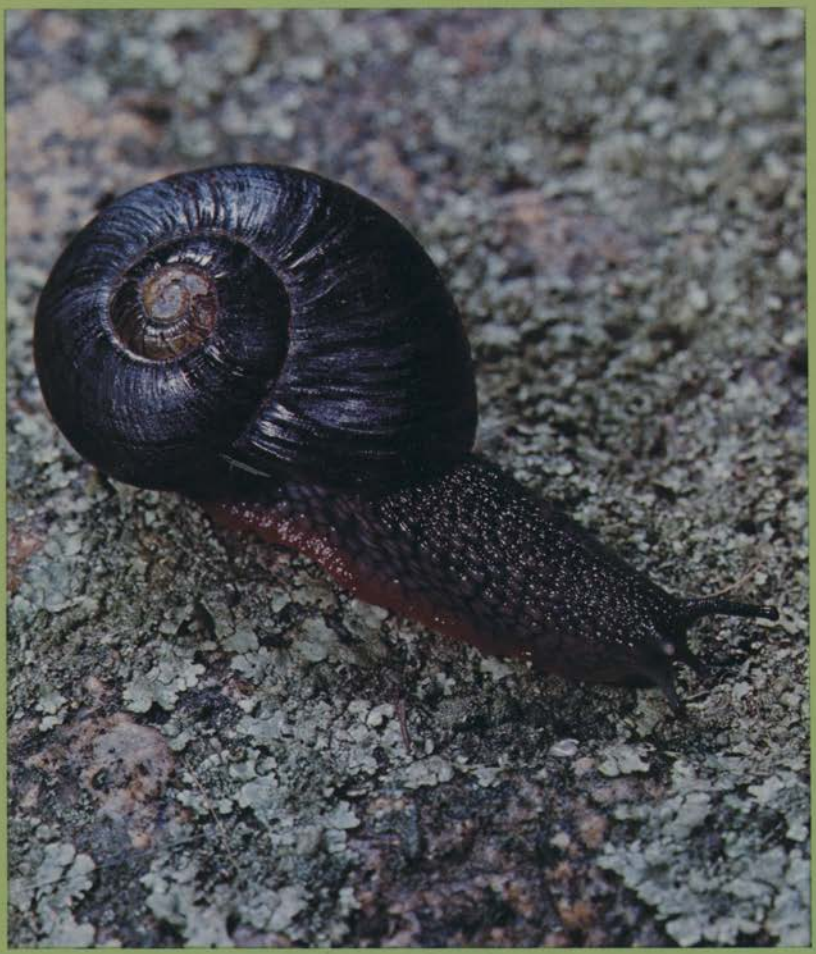
Field Guide to the Non-Marine Molluscs of South Eastern Australia



Brian J. Smith and Ron C. Kershaw

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We dedicate this work to the memory of Charles J. Gabriel (1879-1963), pioneer in the study of non-marine molluscs of south-eastern Australia

Contents

Preface

The purpose of this volume is to provide a handbook for the identification of non-marine molluscs of south-eastern Australia, and to make more readily available the descriptions and figures of this fauna. The area covered is the south-eastern Australian faunal region which consists of Victoria, Tasmania and the southern parts of New South Wales and South Australia. Until now there has been no comprehensive text available to enable either the amateur naturalist or the professional researcher to identify members of this group. In many cases the only figures available of the species are either in the original descriptions or in such early work as Cox (1864, 1868) listing Australian land snails, the work of Petterd (1879) for Tasmania or that of Cox & Hedley (1912) and Gabriel (1930, 1939) for Victoria, while others have never been figured. Iredale's notes (1933) and basic lists (1937, 1938, 1943), while being invaluable as a comprehensive list of nominal species, are of little use to the identity seeker as they contain few descriptions and few useful figures.

This book is intended to stand in an intermediate position between Iredale's Basic Lists and a fully authoritative revision which should ultimately be prepared. It is intended here to outline what is known of the non-marine molluscan fauna of the region, to bring up to date some of the systematics used by Iredale in the Basic Lists, to point out where the many serious gaps occur in our knowledge and understanding of the various groups, and most importantly to provide short descriptions, keys and figures to all recognised species in the area.

The area covered by this work is the region south of the 33 degree line of southern latitude running from Newcastle, N.S.W. in the east to just north of Port Pirie on Spencer Gulf, South Australia, in the west. This area forms a natural faunal region with a high percentage of endemic species with little overlap and interchange with other regions of Australia. This will be discussed more fully below.

This field guide is heavily orientated towards the practical function of identifying molluscs in the field. To this end, of primary importance is the quality of the illustrations. A special

word of thanks is expressed here to the artist, Ms Rhyllis Plant of the Invertebrate Department of the National Museum. With skill and persistence she has provided the superb drawings which illustrate and describe the species far better than many thousands of words of text. Any mistakes or shortcomings of either the illustrations or text are solely the responsibility of the authors. The idea for the format was based on a similar guide to the land snails of the eastern United States of America by Burch (1962).

Our thanks are due to the Director and Council of the National Museum of Victoria, Melbourne for their considerable help in this work. For financial assistance in both production of the text and illustrations our thanks to the Australian Biological Resources Study who also financed the employment of Mrs Elaine Johns to handle the mass of distributional data and to whom thanks are also due. Our thanks are due to the Science and Industry Endowment Fund for the support of one of us (R.C.K.) and also to Mrs Lyn Anderson for typing the manuscript. For information on the many taxonomic and distributional points and problems our thanks go to the staffs of the Mollusc Departments of all the State Museums in Australia, and to the many other professional biologists and amateur naturalists too numerous to mention individually.

Last but not least we would like to thank our wives, Beryl Smith and Win Kershaw, for their help and understanding during the preparation of this work.

National Museum of Victoria
November 1978

Brian J. Smith
Ron C. Kershaw.

Molluscs

The phylum Mollusca is the second largest phylum of the animal kingdom, forming a major part of the world fauna. Molluscs are typically soft-bodied coelomate animals without body segmentation, which bear a hard external calcareous shell for protection. The body pattern of the molluscs is based on a single archetype, the structures of the six classes being a series of variations on this basic theme. The six classes of the Mollusca are: the *Monoplacophora*—primitive, abyssal pseudosegmented molluscs; the *Amphineura*—chitons with eight shell plates, and aplacophorans; the *Gastropoda*—snails, typically with a single external shell and well developed head, the only group to have successfully invaded the land; the *Bivalvia*—with two hinged shells and no head development; the *Scaphopoda*—tusk shells, a minor marine group; the *Cephalopoda*—nautiloids, squid and octopods—active molluscs with high sensory development and prehensile arms (Fig. 1). The main features and characteristics of these classes have been described many times (Morton, 1967; Burch, 1962; Solem, 1974). It is considered sufficient to say that only members of the Gastropoda and the Bivalvia have successfully left the marine habit. Gastropods are the only molluscs to have conquered the land.

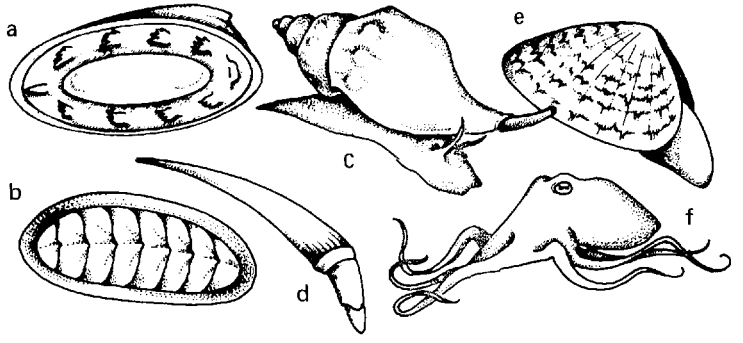


Fig. 1. The six classes of Mollusca are (a) monoplacophora, (b) amphineura, (c) gastropoda, (d) scaphopoda, (e) bivalvia, (f) cephalopoda

Before considering the specific groups of molluscs that have left the marine environment, some attention should be given to the new problems which such a radical change in habitat imposes on the animals. In the sea the animals are bathed in a weak salt solution which provides support for heavy shells, lubrication for such functions as locomotion, feeding and reproduction and a means of species dispersal by free-floating planktonic larvae. Freshwater animals also have some of these advantages, though because of the fluctuations in water level and salt concentration in most freshwater habitats, from flood to drought, the aquatic animals must have special adaptations to combat these changes. The low salt levels of most freshwaters pose osmotic problems. The animal has to possess some mechanism for maintaining the salt balance of its internal fluids at a level different from that of the outside medium.

When animals leave the aquatic medium and emerge into the air a wide array of new physiological and environmental problems assail them. They lose the support and lubrication benefits of the water as well as its transport properties. Instead of taking dissolved oxygen from the water they are faced with the necessity of extracting gaseous oxygen from the air. They must also evolve a method of internal fertilisation to replace the system of liberating their gametes into the water to be fertilised externally. However, their greatest problem is one of desiccation—the loss of water from the body either via the various life processes or by direct evaporation from the skin. Every phase of their life and every structure in their bodies has to be modified to enable the animals to conserve water.

With these factors in mind let us now consider the characteristics of the main groups of non-marine molluscs.

Freshwater bivalves These are the least modified from their marine ancestral type of the three main groups of non-marine molluscs. The reason for this is that, by their mode of life, they have remained wholly aquatic throughout their evolutionary development from the marine to the non-marine habitat. Bivalves have two shells or valves joined by a hinge and a flexible ligament (Fig. 2b). They are almost sedentary and are burrowing in habit. Their complex gills create feeding and respiratory water currents from which they extract oxygen and filter their food of microscopic plankton. Many marine bivalves have external fertilisation

and a long planktonic larval stage; however, a number do modify this by having fertilisation and early larval development in the gill cavities of the adult. Freshwater bivalves mostly show this latter mode of reproduction. However, many species (Australian freshwater mussels—family Hyriidae) have a special larval stage, the glochidium larva, which is temporarily parasitic on the gills of freshwater fish. This ensures both larval feeding and wide dispersal for the species. In other groups, families Corbiculidae and Sphaeriidae, the larval stage is contained within the mantle chamber of the adult, the young emerging as miniature adults.

Freshwater bivalves can be found in almost any permanent or semi-permanent freshwater habitats, from lakes and ponds to fast-flowing rivers and swamps.

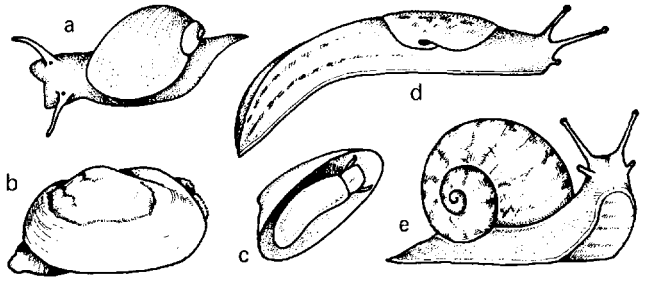


Fig. 2. The non-marine molluscs include (a) freshwater snails, (b) freshwater bivalves, (c) freshwater limpets, (d) land slugs (e) land snails

Aquatic snails and limpets The gastropods found in non-marine waters could have evolved to this habitat from the marine situation by two different routes, and their form and life style is governed by which of these routes their ancestors took. These two ways are either totally aquatic via an estuarine situation or via a terrestrial or semi-terrestrial route such as a swamp or salt-marsh, with a secondary return to an aquatic mode of life (Fig. 2a).

One or two primitive groups, with operculae and related to primitive marine gastropods, are found in freshwater habitats. Many of these forms still show a wide salt tolerance and some are found only in saline waters.

The majority of freshwater gastropods are, however, more closely related to the terrestrial forms, both being grouped under

the Order Pulmonata. The mantle cavity, which is richly lined with blood vessels, is devoid of gills. This can either extract oxygen from the water or can be filled with air and act as a lung. This group is hermaphrodite, having male and female organs in the one individual. The male part of the reproductive tract matures first, and copulation takes place with a reciprocal exchange of sperm packets. This is followed by a sex change with the female tract maturing and eggs are laid (Smith, 1976a). In most freshwater pulmonates the eggs are laid in characteristic jelly masses.

Most freshwater gastropods are herbivorous or detrital feeders. Almost every type of fresh and saline non-marine water is inhabited. A specialised snail found on the stems of leaves of aquatic plants in still water or on the surface of smooth stones in fast flowing streams is the freshwater limpet. This is small with a patelliform shell in which the shell coiling is absent (Fig. 2c). It is not related to the primitive marine limpet but is a modified pulmonate snail. This modification of structure in similar ways to solve similar environmental problems is termed convergence.

Land snails and slugs Land snails are shelled gastropods modified for an existence entirely in air (Fig. 2e). They inhabit a wide variety of terrestrial environments from suburban gardens to open scrub country, dense rainforest or desert. Most land snails belong to the Order Pulmonata and show many common structures. They all have a pallial cavity with its lining richly supplied with blood vessels functioning as a lung. They are hermaphrodite, the male part of the reproductive tract maturing first. Shelled eggs are laid in clutches in the soil or in litter.

A wide variety of life styles and food preferences are seen in the land snails. These are reflected in the details of their shell form and in the structure of their internal organs. The structure of the radula appears to be closely correlated with the type of food taken (Smith, 1976). Vegetable feeders have a radula with large numbers of small multicuspid teeth used like a rasp or file (Fig. 3). These snails also have short buccal masses, long intestines and prominent jaws. Carnivorous species, on the other hand, have short intestines, no jaws and a few, long, lance-shaped teeth for catching and holding their prey and large buccal masses to enable them to ingest large live prey.

Some groups of terrestrial gastropods have sacrificed the protection offered by possession of a shell for the mobility, fast

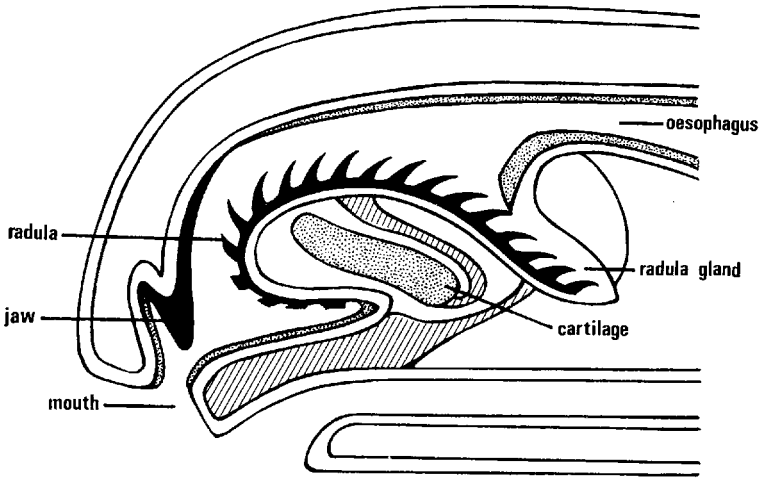


Fig. 3. Diagram of a longitudinal section of a snail's head showing the position of the radula (after Runham and Hunter, 1970)

body movements and ability to occupy very small spaces by reducing or eliminating the shell (Fig. 2d). Slugs are terrestrial gastropods in which the shell has been reduced to a small vestige or lost altogether (Burch, 1976). There are eight families of slugs in Australia, five of which were introduced into the country in comparatively recent times. A number of other groups have travelled some way down the evolutionary road towards the slug state. Solem (1974) has termed these semi-slugs and the Australian fauna contains a number of these.

Methods of Collection and Preservation

In order to enable taxonomic and distributional research work on non-marine mollusc fauna to be carried out, comprehensive collections of all species must be made from as many different localities and as many different habitats as possible. The specimens collected must be preserved in as lifelike a condition as possible and must be accompanied by all the relevant locality and habitat data. The rarest and most beautifully preserved specimens collected from the most inaccessible and exotic areas are useless for scientific study unless they are accompanied by locality and collecting data. They are made even more valuable if habitat notes on the specimens are added to the label.

Labelling A field label should be written at the time of collecting and put into the container with the specimens. Sticky labels on the outside of containers can rub or wash off and collections be mixed up. However, collectors should be aware that many species of molluscs will eat labels if they are left in tubes without food for long periods before preparation. Also certain species should be kept separate as they will eat each other. Labels should be clearly written on good paper in dark pencil or in Indian ink. Do not use ballpoint pens as the label cannot then be used in preservative because the ink is soluble in alcohol. As well as individual labels it is also a good idea to keep a field note-book so that additional habitat and trip data can be kept in chronological sequence. Some collectors use the field note-book to keep all locality data and use only field numbers with the specimens. This method, while being simpler and less time-consuming in the field, is fraught with dangers as the loss of the note-book can render a large, important collection totally useless even though every specimen may be intact.

Ideally a label should contain the following information:

Locality: Distance and direction to nearest recognisable point, usually a town or settlement, a six-figure map grid reference or latitude and longitude co-ordinates and the name of the map and map series to which that reference refers.

Collector's name: Initials and surname—not just initials.
Date of collection: Day, month, year, e.g. 17 vi 1977.
Habitat notes: Brief description of where specimens found including type and/or species of related vegetation where known.

Collecting The successful collector of non-marine molluscs is one with some knowledge of the habitat preferences of the species he is seeking plus a knowledge and general awareness of possible places favourable for snails in the locality he is searching. In effect the collector asks himself 'If I were a snail in this situation where would be the most favourable place for me to live and hide?' In answering this question in the light of his ecological knowledge he has solved his problem.

There are a variety of aids to collecting and tricks-of-the-trade in collecting non-marine molluscs. As a general rule if you see a dead shell lying around then live specimens of the same species will not be far away.

Freshwater habitats are easily sampled using a fine hand net or a fine plastic kitchen strainer. Sweep the net through aquatic vegetation several times with vigorous strokes to dislodge specimens. Leaves and stems of aquatic vegetation should be examined thoroughly for freshwater limpets. Take samples of the top 5-10 mm of the mud or sand and pass through a fine sieve for snails and freshwater bivalves. In rivers with many large stones examine the under surface of the stones carefully for limpets and small snails (usually the same colour as the stone). Finally, if minute freshwater gastropods are suspected from the area, take samples of the bottom debris for examination later by lens. Bottom dredges and rakes can be constructed for deep lakes or rivers for sampling for freshwater mussels (Williams, 1968).

During daylight hours terrestrial snails and slugs are mainly cryptic in habit, hiding under some suitable cover in damp, dark places. The undersides of logs, rocks, bark and other large pieces of cover should be searched. When rolling a log always pull it towards you so that any snake under it is forced to move away from you. A good place to examine, particularly in small bush settlement areas where there is a chance for native species too, is the local rubbish tip. As the dominant component of the fauna of south-eastern Australia consists of small to minute species, less than 4 mm maximum diameter, special searches of leaf litter and clumps of moss and similar dense plants should be made. Samples

of these can be collected in plastic bags which should then be labelled, sealed and taken back for detailed examination under a good light and lens or microscope. Large collections of many species of minute snails may be obtained using this technique.

Preservation All specimens collected have to be preserved before storage to await study and identification. This preservation should be carried out as soon as practicable after collection, as, especially in hot weather, animals can quickly die in small vials. However, before preservation it is desirable, where possible, to relax the specimens so they can be fixed in an expanded, lifelike condition. Relaxation makes for more complete penetration of the preserving fluid and easier dissecting and study of the anatomy.

Dead shell material should simply be washed and dried before storage.

Live taken specimens are relaxed mainly by drowning. The best general relaxing agent is menthol. Place the specimens into a vial filled with freshwater, add a few menthol crystals (half a little finger nail to 20 ml of water), seal the vial and leave to stand over night (12 hours). Carefully decant the water and replace with preservative (Kershaw, 1976).

Freshwater limpets should be preserved immediately without relaxing, as they fall out of their shells. Large and medium freshwater bivalves should be placed in clean water, taken from where they were collected, in a shallow dish. When the valves open, carefully insert match-sticks or small twigs into the gape. With the valves thus propped open the specimen is then preserved.

Some operculate gastropods are difficult to relax. An alternative method is a 1 per cent solution of propylene phenoxetol (Owen, 1955), though this is expensive and difficult to obtain.

All material should be preserved in 5 per cent neutral formalin. It is essential to ensure the solution is non-acidic and cannot show acid drift (the generation of acids over time), as this will damage the fine sculpture of the shell.

Two alternative formulae for a successful preserving solution are:

Concentrated formaldehyde solution	—	1 part
Water	—	8 parts
Sodium bicarbonate powder	—	5 gm/litre

or a double buffered solution—

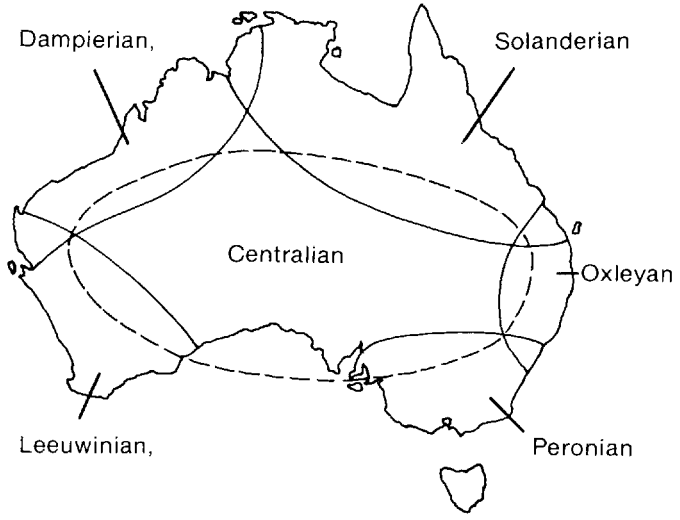
Potassium dihydrogen orthophosphate	—	6.6 gm

Di-sodium hydrogen orthophosphate	—	31.0 gm
Concentrated formaldehyde solution	—	400 ml
Water	—	3600 ml

Specimens should be preserved in this solution for three to seven days, after which the material should be washed in water and transferred to 70 per cent alcohol (with 1-3 per cent glycerine added as an option to help keep tissue soft) for permanent storage.

Faunal Regions of Australia

Australia is a continent of over 7½ million square kilometres in area stretching from the cool temperate regions of southern Tasmania to the tropics. It has many varied habitats from the alpine snow and forest regions of the Great Divide, to the hot dry desert regions, to the monsoon regions of the Top End. It is therefore not surprising that the animal and plant life found in this continent



Map 1:
The six major faunal regions of Australia, with their transition zones

should also show great variation and regionality. Many authors have put forward maps of the various faunal regions of Australia, one of the most recent for non-marine molluscs being given by McMichael and Iredale (1959). A modification of that map is given in Map 1.

There are six faunal regions identifiable in Australia, each with its own non-marine mollusc fauna. Each differs in character and species composition from every other fauna with a high proportion of endemic species, i.e. species native to that region. However, the most interesting feature of these faunas is that each is dominated by a different group of snails. This group is called *dominant* because there is a relatively large number of species present indicating a possible centre of evolution.

The six major faunal regions are as follows:

Leeuwinian Region: South-western Australia—dominant group, genus *Bothriembryon*, family Orthalicidae.

Dampierian Region: North-western Australia—dominant group, genus *Rhagada* and allied forms, family Camaenidae.

Solanderian Region: Northern part of the Northern Territory and eastern Queensland—dominant group, genera *Varohadra, Xanthomelon* and allied forms, family Camaenidae.

Centralian Region: Central Australia—dominant group, genera *Sinumelon, Pleuroxia, Semotrachia* and allied forms, family Camaenidae.

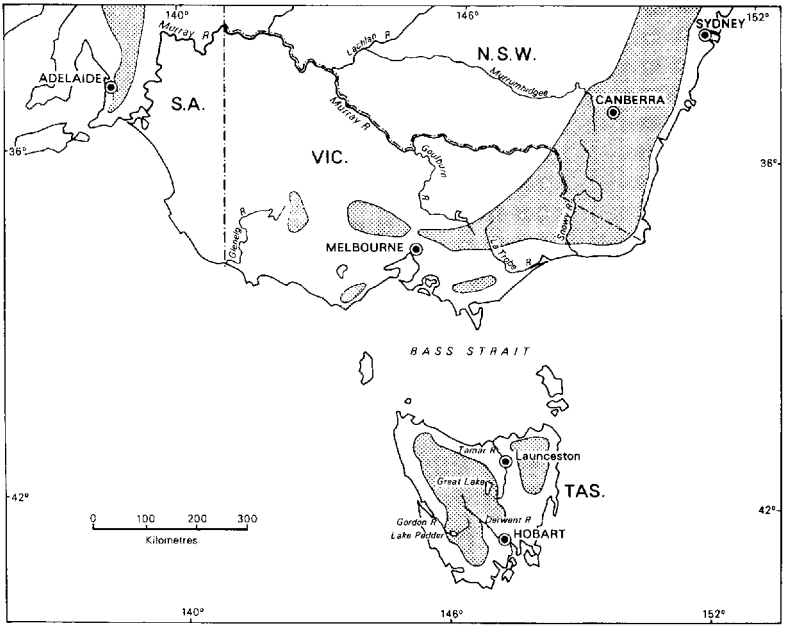
Oxleyan Region: South-eastern Queensland and north-eastern New South Wales—co-dominant groups, genus *Meridolum* and allied forms, family Camaenidae and genera *Hedleyella* and *Pedinogyra*, family Caryodidae.

Peronian Region: South-eastern Australia—dominant group, family Charopidae.

The transition from one faunal region to another is not abrupt but is related to the climatic and vegetation changes. There is a transition zone between adjacent regions where a gradual change takes place. More will be said about the distributional implications of the concept of faunal regions and about the relationships between the mollusc faunas of Australia, Asia and Oceania in the section on zoogeography.

South-eastern Australian Faunal Region

The Peronian or South-eastern Australian faunal region, with its two transition zones, is here considered as New South Wales and South Australia south of the 33 degree parallel, Victoria and Tasmania (Map 2). The region is cool temperate, naturally forested, giving way in the north-western part to savannah woodland, and with large areas of high mountains. This area is considered a single faunal region because the faunal elements within it form a cohesive unit. However, the region does contain two major natural barriers to species movement, both having significant effects on the distribution and species composition of the mollusc fauna in different parts of the region. These barriers are the Great Dividing Range and Bass Strait. Of these the Great



Map 2:
The main geographical features of south-eastern Australia (shaded areas denote major mountain systems)

Dividing Range has probably had a more significant effect on the fauna in Recent geological time, resulting in the idea of the Bassian Sub-faunal Region being put forward. However, the presence of Bass Strait has caused the emergence of many endemic Tasmanian species. The full zoogeographical implications of the molluscan fauna will be discussed more fully in the next section.

The south-eastern Australian region is perhaps the most man-modified faunal region in Australia. It consists of only about 20 per cent of the land mass of Australia but contains over 80 per cent of the human population and most of the intensive agriculture and manufacturing effort of the nation. Most of the major rivers in the region have some form of flow control measures applied to them, as dams, barrages or irrigation empoundments. Large areas of forest have been cleared and irrigation, monoculture, agriculture, forestry or urbanisation has drastically changed the nature of the environment. Though the native mollusc fauna is still present in surprisingly large numbers, the major molluscs present throughout the area as a whole are the introduced species spread by the activities of European man.

Zoogeography of Non-marine Molluscs of south-eastern Australia

Zoogeography is the study of the past and present distribution of animals. It includes the relationships of major animal groups and the effects such geological events as continental drift and sea-level change have on the evolution and present ranges of animals.

Geographically the region consists of the Great Dividing Range, the plateaux and mountains of Tasmania, Bass Strait and the islands, the coastal and inland plains of from medium to very low rainfall, the Murray Valley and the other river systems. This series of differing environmental systems both controls the nature of the fauna and probably restricts its ability to migrate. Most significant in this respect is Bass Strait, which effectively divides the region in two.

The history of the Bass Basin began more than 100 million years ago with the breaking up of the super-continent Gondwanaland (Robinson, 1974). This continent broke into 'plates' that drifted, carrying Australia, New Zealand, India, South America, Africa and Antarctica into their present positions. These plates broke away at different times.

In the Bass Basin the first non-marine sediments formed an alluvial plain between the King and Flinders Islands Ridges. The Gondwanaland fauna continued to exist in Australia across the future Bass Strait. Extensive faulting in Tasmania which affected the Bass Basin resulted in mountain building and basin formation in Tasmania. By 40 million years ago the sea had encroached on the Bass, Murray and Gippsland Basins, isolating Tasmania. Thus a very extensive barrier existed between Victoria and Tasmania, also affecting the Victorian connection with South Australia and New South Wales.

Consequently the Tasmanian snail fauna followed its own evolutionary path to distinct genera and species. The effect on the Victorian fauna was probably less significant. The degree of existing relationships within and beyond Australia has been discussed by authors including McMichael and Iredale (1959) and Solem (1959). The complex situation arises not only because of isolation but also because the land bridge, called the 'Bassian Rise', may have been restored more than two million years ago. The land rose and the sea retreated from the Murray Valley and Gippsland during the Kosciusko Epoch of mountain building.

The movement of Australia northwards brought it into contact with Asia, allowing an inflow of migrating Asian snail families which reached Tasmania. The present fauna has two ancestral sources, Gondwanaland and Asia. The Gondwana fauna includes such groups as the freshwater Hydrobiidae and Hydriidae, and the land Endodontoidea and Rhytididae and possibly Caryodidae. Varying affinity in these groups exists with New Zealand, South America and South Africa in order of significance. The Endodontoidea with world-wide distribution would appear to stem from an older association of all the continents called Pangaea. The Asian element in the fauna includes the freshwater Lymnaeidae, Planorbidae, and Viviparidae, and the land Helicarionidae and Camaenidae.

The land snails *Caryodes* and *Anoglypta* were able to adapt to Tasmania and survive. The super-humid Tasmanian rain forest may have been a factor in this. Bass Strait as a barrier allowed these snails to evolve as distinct genera. But curiously, when the Bassian Rise was restored, they did not migrate north, nor apparently did the Victorian *Pygmipanda* migrate south. The Ice Age climate may have had some effect, but the bridge was present before the cold climate took effect. Some snails did resume a continuous distribution across the Bassian Rise, as traces remain on the islands. The Helicarionidae are an example of a family with continuous distribution from southern Tasmania to Asia but not New Zealand. There are apparent anomalies such as *Bothriembryon* in eastern Tasmania and *Chloritobadistes* on King Island. How did this happen?

Habitats and Habits

When considering animal distribution it is vital to remember that there is always a very close and direct relationship between the animal and the habitat in which it is found. Aquatic species distribution is affected either directly by water quality and current speed or indirectly by its effect on vegetation growth. On land, soil type and base geology together with vegetation type are often dominant factors in determining animal distribution. One extreme example in the non-marine mollusc distribution in south-eastern Australia is the close association of the fauna with the temperate rain forest with its high moisture component and deep litter. Thus a program of land clearing, of regular burning-off and of opening up the forests can dramatically affect many species by removing or reducing their particular habitat niche. Thus life is rendered virtually impossible for the species. Conversely the spread of introduced plants, as weeds, crops or in suburban gardens, and the corresponding reduction of native vegetation, reduce the areas available to native molluscs and facilitates the spread of the many introduced species.

Terrestrial molluscs are susceptible to different degrees to the

desiccating effects of hot dry periods. They overcome this by a series of behavioural and physiological adaptations. Most molluscs are nocturnal in habit as this minimises the desiccation effects of the air. At night there is usually a surface film of condensed or transpired water on most foliage, providing favourable conditions for snails to move and feed. During the day they are mainly cryptic in habit, hiding under logs, leaves, stones and in litter or other shelter. In prolonged dry periods they have the power to aestivate—to withdraw and slow down their body activities until favourable conditions return. Some species secrete a calcareous epiphragm or cover over the aperture of the shell. Desert species secrete several epiphragms and can remain in aestivation for prolonged periods. Some freshwater species living in streams or billabongs which dry out periodically also possess this ability to aestivate, either sealed to hard surfaces or in 'cocoons' in the mud.

Identification

In order to use this field guide successfully it is necessary for us to describe the main features of the shell and animal used in the characterisation of the species. Where possible, external features visible with a X10 hand lens on a live collected, preserved animal are used. Some of the features, however, particularly microsculpture, are visible only by using a stereo-binocular microscope. In several groups, verification of the identities given in this book are possible only by using radula and anatomical characters. These techniques are outside the scope of this book and where such groupings are necessary, or where the taxonomic status is unclear, the group will be referred to as a genus and/or species complex.

The main features used in mollusc classification are shell and aperture shape and form, nature of the operculum where present, shell and particularly protoconch sculpture, shell colour and pattern and animal external form and texture (Fig. 4). All these features will be described with the aid of brief descriptions and drawings.

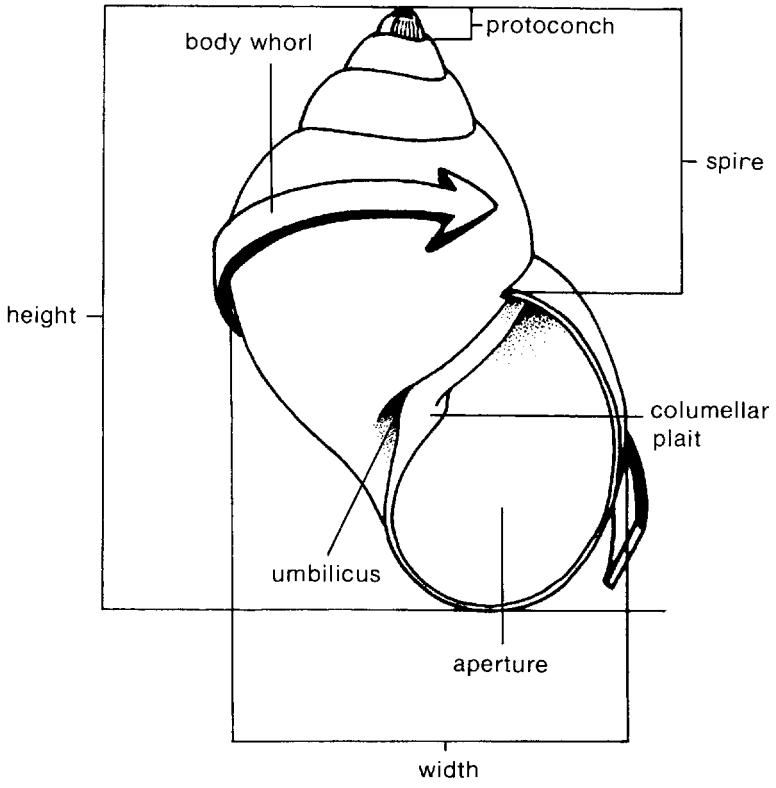


Fig. 4. Diagram of a generalised gastropod showing the main features (after Burch, 1962)

Shell shape Shells will either be coiled (Fig. 5a), patelliform (limpet-shaped) (Fig. 5b), or bivalved (Fig. 5c) and may be thick and heavy or fragile and/or transparent. Coiling may be either to the left (sinistral) (Fig. 5e) or to the right (dextral) (Fig. 5d). To determine coiling, hold the shell vertically with the aperture facing; sinistral shells have the aperture to the left of the median axis, dextral shells to the right. Shells can be elongate (Fig. 5h) with a high spire to globose (Fig. 5f), subglobose (Fig. 5g) to planispiral (Fig. 5i) with a sunken spire. The presence or absence and the relative size of an opening at the base of the shell, the umbilicus, is another important feature (Fig. 6a-c).

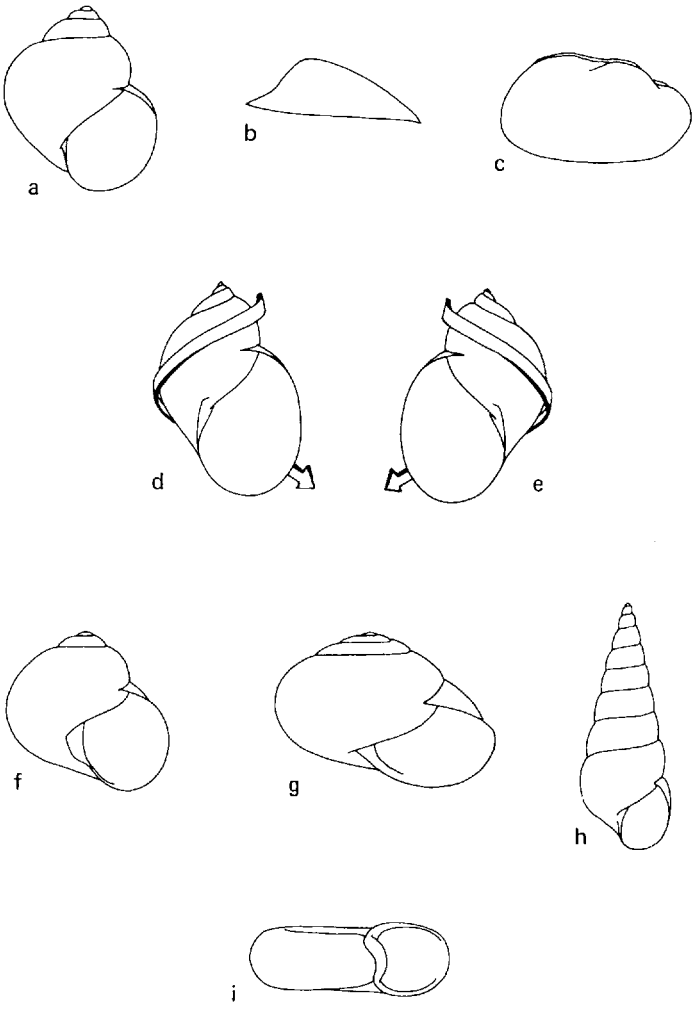


Fig. 5. Shell shape terminology showing (a) coiled or helical, (b) patelliform, (c) bivalve, (d) dextral (right-handed), (e) sinistral (left-handed), (f) globose, (g) subglobose, (h) elongate, (i) planispiral

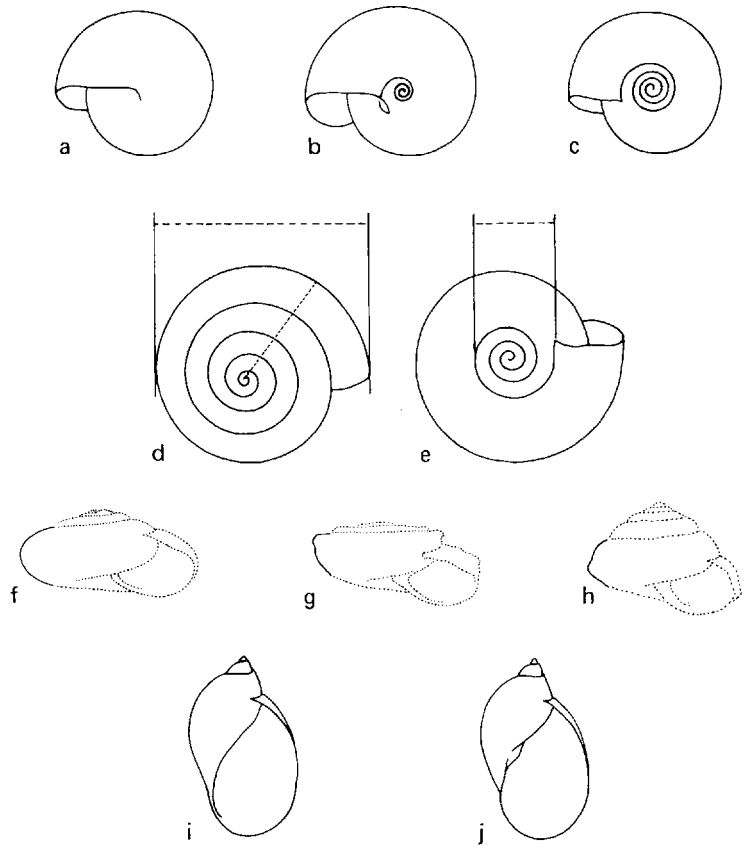


Fig. 6. Shell shape terminology showing (a) closed umbilicus, (b) narrow umbilicus, (c) wide umbilicus, (d) method of counting number of whorls and measuring shell width (after Solem, 1976), (e) method of measuring umbilicus width, (f) rounded whorl, (g) shouldered whorl, (h) keeled whorl, (i) straight columella, (j) folded columella

The number of whorls on the shell is important in determining whether the shell is fully grown. The whorls are counted from the centre (Fig. 6d-e). The whorls may be rounded (Fig. 6f) or with a shoulder (Fig. 6g) or keel (Fig. 6h). The aperture may be in the plane of the shell (Fig. 7f) or depressed (Fig. 7g), the inner lip or

columella may be straight or folded, the outer lip may be thin and straight (Fig. 6i), or reflected (Fig. 6j), and both lips can be thickened and bear teeth or calluses (Fig. 7h-i). The shape of the aperture too is important; it may be round, oval, elongate or lunate (Fig. 7a-e).

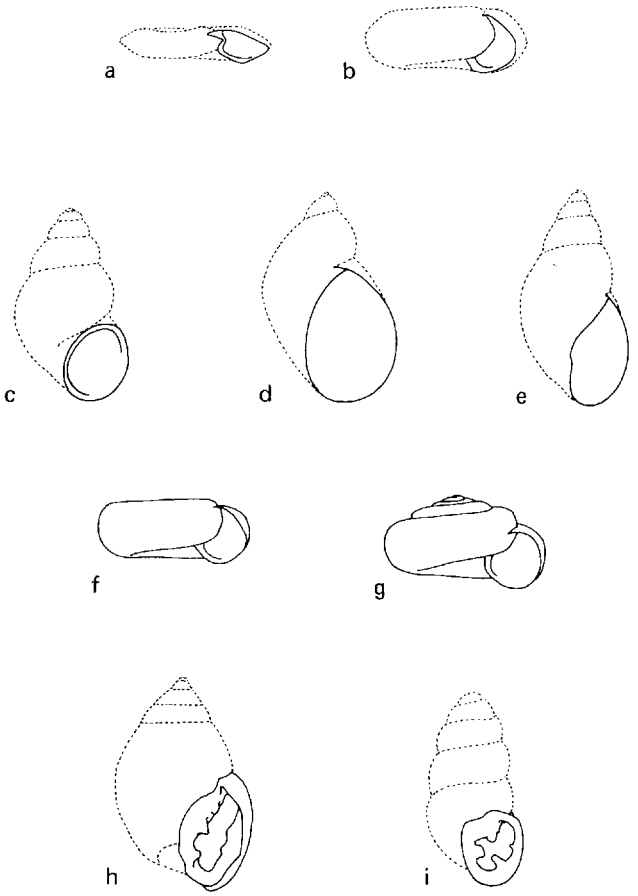


Fig. 7. Aperture terminology showing (a) elongate keeled aperture, (b) narrowly lunate aperture, (c) round aperture, (d) oval aperture, (e) ovate-lunate aperture, (f) aperture in plane of shell, (g) depressed aperture, (h) aperture calluses, (i) aperture teeth

Sculpture The sculpture on the shell is a particularly important aid to identification (Fig. 8). The sculpture on the protoconch, i.e. the first whorl or so of the shell formed while still in the egg, can be especially significant as it may give a key to relationships which can be masked by the adult or teleoconch sculpture. Sculpture can be of ribs, riblets, striae or lines and can be transverse, radial or axial, concentric or spiral. It can be simple, made up of a single repeated unit, or complex, of major ribs and finer riblets or reticulation or decussation in the inter-rib spaces. Some species show sculpture only on the dorsal surface while in others it is uniform over the shell.

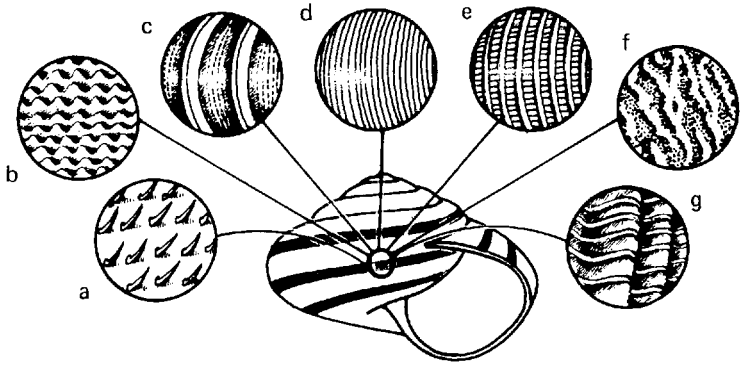


Fig. 8. Shell sculpture terminology showing (a) hairs or bristles, (b) raised cords, (c) complex ribs, (d) simple fine ribs or riblets, (e) decussate sculpture, (f) rugose sculpture, (g) longitudinal ribbed shoulders

It is important to note that sculpture, and particularly the fine protoconch sculpture, can easily be worn or corroded from shells. This process can be more pronounced on dead shells. Acidic preservative solutions can also cause extensive damage to shell sculpture.

Colour Like sculpture, the colour and pattern of a shell can be a major aid to identification. Colour is mainly carried in the shell epidermis or periostracum of the shell, the shell itself, in most cases, being white. The colour and pattern of the shell can be more variable than sculpture and may reflect the habitat in which the species is found. Colours and patterns can be used by the mollusc

for camouflage or warning purposes. Some shells are a uniform colour while others have various bands, blotches or flames in contrasting colours. In some species the shells are transparent and the visible pattern is that of the underlying mantle.

The colour and pattern of the animal is also important, as is the colour or nature of the mucus secreted by the foot and body surface.

Operculum Some primitive non-marine molluscs have the aperture closed by an operculum. This is a horny or calcareous structure carried on the dorsal side of the tail that seals the aperture of the shell when the animal withdraws. The presence of an operculum can be a major identification character and the shape and form of the operculum can further assist recognition (Fig. 9a-d).

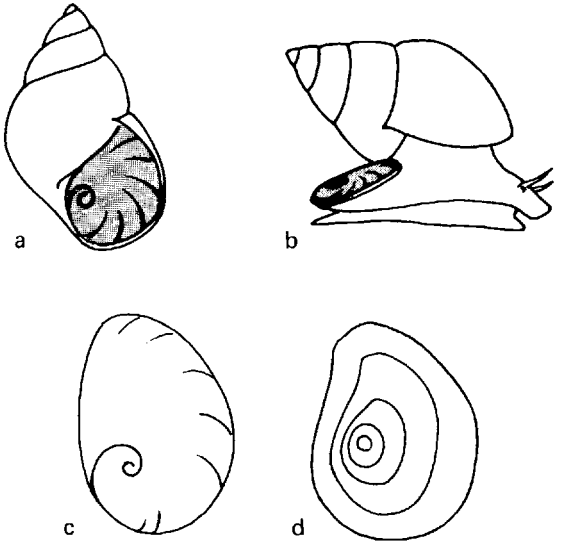


Fig. 9. Animal showing position of operculum with animal (a) withdrawn and (b) extended; operculae terminology (c) paucispiral, (d) concentric

The operculum must not be confused with an epiphragm or mucous plug used to seal the aperture of many land snails when aestivating. This is not a structural part of the animal.

Slug Slugs are terrestrial gastropods in which the shell is lost or reduced to an internal or external vestige. The seven families of slugs found in south-eastern Australia are easily separated by gross external features. These are the presence or absence and position of the mantle and breathing pore and the presence of a dorsal keel (Fig. 10). Species are mainly separated by body and mucous colours and patterns and by internal anatomical features.

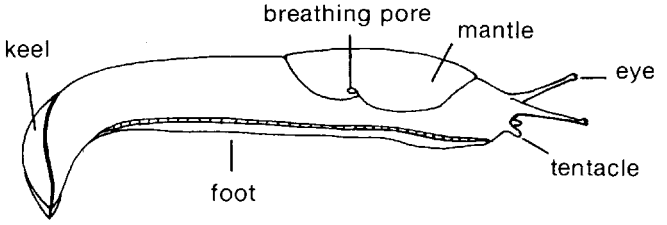


Fig. 10. Diagram of a generalised slug showing main features

Bivalves These are aquatic molluscs with two valves joined along the dorsal edge by a hinge. The shape of the valves, the external sculpture of the shells and particularly the larval shell of the umbo, and the nature of the hinge teeth are used for family, genus and species recognition. The hinge is composed of central, lateral and cardinal teeth and these can be large or small, strong or weak. Internal shell features such as position of adductor muscle and beak muscle scars are also important (Fig. 11).

In identification it must be remembered that any one species shows a level of individual variation. It is the task of the taxonomist or the identifier to establish in his or her own mind the level of individual variation within any particular group which comprises a species in that group. Though a biological definition of a species is a group of interbreeding individuals which produce viable offspring and will not interbreed with other groups, this has no practical significance to the field taxonomist.

Each state museum holds an identified reference collection of species of animals from its area of interest. These museums are public institutions to which the serious worker can turn for assistance. The curatorial staff are keen to aid the interested student provided the aid is sought in a way that respects the curators' other commitments.

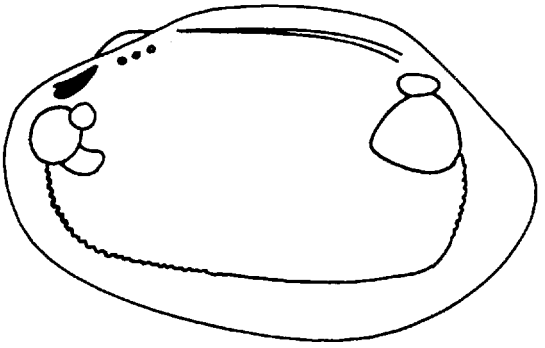


Fig. 11. Diagram of a generalised bivalve shell interior showing main features (after McMichael and Hiscock, 1958)

Molluscs in the Ecosystem

Non-marine molluscs form a significant part of the ecosystem and are important in maintaining the balance of nature in an environment. Any ecosystem is in dynamic equilibrium with all the animals and plants living within it having some effect on the stability of the whole. Although the molluscs in any habitat may not appear to be significant members of the biota, they perform a variety of roles. Many feed on living and dead vegetable material, thus aiding the process of breakdown and decay. Land snails have a special significance in this process since they are one of very few higher animals which produce a special enzyme for the breakdown of the main structural substance of plants, cellulose—a cellulase. A few species of snails are carnivorous in habit, feeding on earthworms, insect larvae and other snails. Most snails are prey to a variety of vertebrate and invertebrate animals and so are important members of many food-chains. Molluscs have the facility to concentrate calcium from the environment in the construction of their shells. After death these discarded shells form a readily available source of concentrated calcium carbonate for other animals and plants.

Since the coming of European man to Australia and his modification and destruction of native bush areas, several species of introduced molluscs have become major components of our fauna. The significance of these species as pests of crops will be dealt with elsewhere but they also have an important role in the balance of nature. Most of these introduced species feed on living plants, have a high fecundity and are able to tolerate a wide variation of environmental conditions, all attributes necessary in a successful world traveller. These species are mainly confined to areas dominated by introduced plants. Because of the ready availability of food and water they often reach very large population densities.

Economic Importance

Molluscs become economically important when they are put to some beneficial use by man or, either directly or indirectly, adversely affect any of man's activities. Non-marine molluscs have very few beneficial uses to man. Certain freshwater mussels, particularly *Velesunio ambiguus*, were used for food and utensils by Aboriginal people, especially along the River Murray. Certain of the introduced molluscs, *Oxychilus* spp. and *Testacella haliotidea*, can be said to be beneficial as they feed on garden and crop pests. However, the bulk of the introduced species can be classed as pests of crops, pasture or gardens or as vectors for human and stock diseases.

Most of the introduced snails and slugs feed on living plants and can be found attacking a wide variety of food and produce crops. The damage caused by these species is both direct, as in vegetables where young plants can be eaten, or indirect as in the contamination of wheat crops with *Cernuella virgata*. The presence of this snail in the wheat at harvest time raises the water content of the grain samples and thus lowers the return to the grower.

Control measures against terrestrial molluscs are based mainly on metaldehyde. This is applied with baits and depends on the moisture level being kept up to ensure that the molluscs are active

at night to take the baits. Metaldehyde upsets the water balance mechanism of the molluscs causing death by desiccation. It follows from this that the effectiveness of metaldehyde is diminished in the presence of excess moisture when affected snails can recover. The use of carnivorous snails or other biological control methods have been suggested. However, no native species are known which can achieve such control and the risks inherent in introducing exotic species are not justifiable due to the probable damage.

A native freshwater snail, *Austropeplea tomentosa*, is the main intermediate host for the sheep liver fluke, *Fasciola hepatica*, a major problem in the sheep industry. Recently a snail with a higher infective rate, *Pseudosuccinea columella*, was recorded as an introduction into Australia with reports of its occurrence in Perth, Sydney and Melbourne. It is possible that other snail-borne parasitic diseases, such as schistosomiasis, could be introduced with new exotic snails.

Another type of adverse effect of molluscs occurs when their physical presence affects man's affairs. For example the bivalve *Corbiculina australis* has been recorded growing in water reticulation systems both in domestic water supplies and in orchard irrigation systems. If the water is not for human consumption the easiest way to combat this growth is to flush the system with a dilute solution of copper sulphate.

In all a total of twenty species of non-marine molluscs can be described as having economic importance in south-eastern Australia.

Beneficial species:

Oxychilus alliarius
Oxychilus cellarius
Oxychilus draparnaldi
Testacella haliotidea
Velesunio ambiguus

Pest and parasite species:

Austropeplea tomentosa
Pseudosuccinea columella
Deroceras reticulatum
Deroceras caruanae
Limax maximus
Lehmannia (Lehmannia) nyctelia
Lehmannia (Limacus) flava
Milax gagates
Helix (Cryptomphalus) aspersa
Theba pisana
Candidula intersecta
Cernuella (Cernuella) virgata
Cochlicella ventrosa
Cochlicella acuta
Corbiculina australis

Key to the Families of Non-Marine Molluscs of South-eastern Australia

Introduction

The main objective of this field guide is to facilitate the ready identification of any non-marine mollusc found in south-eastern Australia. It is essentially a practical text based on a two-tier key system that will work only for south-eastern Australia, i.e. molluscs from elsewhere may key to incorrect family placements. The first stage of identification is the **family key**. This is intended to guide the reader to the correct section of the book where specific identification can be made.

The family key is based on a series of shell and animal characters and on major habitat details. In most cases it is essential to use a live animal which can be observed crawling and for which the habitat is known. Shell sculpture and colour may have worn off dead shells. Because many of the characters used in identification are minute, the use of at least a X10 hand lens is necessary and a stereo-binocular microscope would greatly facilitate the identification of the smaller specimens. The key is written for adult shells of at least four whorls. Juvenile shells may show some variation in characteristics which might be misleading. Simple drawings are given with many of the entries in the family key, to illustrate the various terms used. Full details of the various characteristics and the terminology of shell form used in identification are given in the section called 'Identification' on page 15.

In most cases the key will lead the reader to one family and the page reference to that family is given. On reaching that point, turn to the page indicated to complete the identification. Small families with easily recognisable species will simply have the species set out with illustrations, so identification can be accomplished by direct comparison. Large or complex families have the species grouped and a second key to the major groupings is given. In a few cases, however, the family key will lead the reader to two or more alternative families. This is because the characteristics used in separating these families or parts of families are so minute that their inclusion would add unnecessary complexity to the first stage

key. In this case secondary keys will enable the correct identification to be achieved. Before a final decision on the identification of the specimen is made, the full description of the species should be checked, together with the habitat and distributional data.

The family key is written as a series of couplets. To use the key commence at number 1. Decide which alternative most closely describes the specimen under study and go to the number indicated at the right hand end of the line. Numbers in brackets after the couplet number indicate the previous step in case you wish to retrace your steps.

In the description of each species, the text and figure are meant to be considered together. The text is limited to that needed to characterise the species. The size is given as a size range of most specimens in this region, the measurement is the greatest measurement, whether height, width or diameter. The range given with each species is the known general range in South-eastern Australia, a more detailed picture being given by the distribution map. It should be noted that the species will be found inhabiting only the correct habitat within the given range.

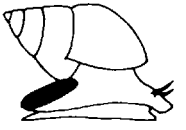
Key to Families etc.

1. Shell of one valve or absent (**Class Gastropoda**) **2**

gastropod

bivalve

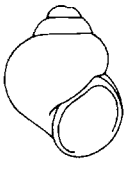
1. Shell of two valves (**Class Bivalvia**) **40**
2(1) Shell with operculum **3**



operculum

2(1) Shell without operculum or shell absent **9**

3(2) Shell large to medium, globose **4**

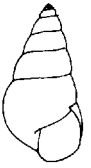


globose

elongate

fusiform

pyriform



conical

planispiral

3(2) Shell small to large, elongate, fusiform, pyriform, subglobose, conical to planispiral **6**

4(3) Shell large to medium, thick, opaque, operculum horny **5**

4(3) Shell medium, thin transparent, operculum calcareous—**Family Bithyniidae** (page 54)

5(4) Shell large, operculum sub-spiral, inhabits fresh water—**Family Viviparidae** (page 37)

subspiral

concentric

5(4) Shell large to medium, operculum concentric, inhabits areas under marine influence—**Family Amphibolidae** (page 66)

6(3) Shell large to medium, elongated to fusiform **7**

6(3) Shell small, pyriform, subglobose, elongate to conical to planispiral **8**

7(6) Shell medium, elongated, smooth or with longitudinal grooves—**Family Hydrobiidae** (part) (page 38) or **Family Truncatellidae**

Hydrobiidae or Truncatellidae

Thiaridae

7(6) Shell large, fusiform, each whorl carinate and bearing longitudinal knobbed ribs—**Family Thiaridae** (page 57)

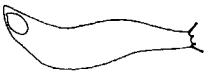
8(6) Shell small, subglobose, inhabits marine salt-marshes, semi-terrestrial in habit—**Family Hydrococcidae** (page 55)

8(6) Shell small pyriform, elongate to conical to planispiral, inhabits fresh to estuarine aquatic habitats—**Family Hydrobiidae** (part) (page 38)

9(2) Shell absent or reduced to vestige with no possibility of the animal withdrawing into it, animal slug-like **10**

9(2) Shell small to large, capable of containing the animal or nearly so **16**

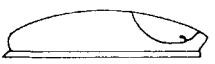
10(9) Shell absent or totally internal, vestigial **11**



Testacellidae

10(9) Shell small, external, situated on posterior end of the body—**Family Testacellidae** (page 215)

11(10) Body entire, foot and visceral mass united **12**



entire

Cystopeltidae

11(10) Body separated posteriorly into separate foot and visceral mass units—**Family Cystopeltidae** (page 206)

12(11) Animal with separate external mantle area and pneumopore, body surface soft, truly terrestrial in habit **13**

Limacidae

Onchidiidae

12(11) Animal without separate external mantle area and pneumopore, body surface leathery dorsally, under marine influence—**Family Onchidiidae** (page 91)

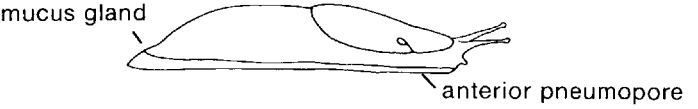
13(12) Mantle area a 'saddle' over anterior part of body with pneumopore situated on right flank **14**

Limacidae

Athoracophoridae

13(12) Mantle area confined to small triangle in centre of back associated with central pneumopore—**Family Athoracophoridae** (page 97)

14(13) Body with posterior keel, no mucus gland on posterior tip, pneumopore towards posterior right side of mantle **15**



14(13) Body without posterior keel, with mucus gland on posterior tip, pneumopore towards anterior right side of mantle—**Family Arionidae** (page 193)

15(14) Body with keel extending from posterior tip to posterior mantle edge—**Family Milacidae** (page 205)

15(14) Body with keel confined to posterior end only, not extending to mantle—**Family Limacidae** (page 202)

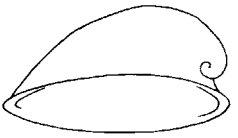
16(9) Shell not coiled but patelliform **17**

patelliform

helical

16(9) Shell helical, coiled **18**

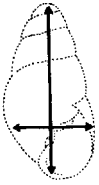
17(16) Shell medium, with vestige of coiling on spire—**Family Planorbidae** (part) (page 76)



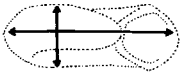
vestige of coiling

17(16) Shell small to minute, with no vestige of coiling—**Family Ancylidae** (page 72)

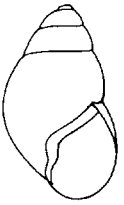
18(16) Shell much higher than wide, conical, pyriform, fusiform, bulimuliform, pupilliform, succiniform, large to small **19**



higher than wide

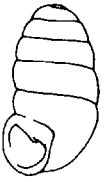


wider than high



bulimuliform

succiniform



pupilliform

18(16) Shell wider than high or dimensions almost equal, helicoid, globose to planispiral **26**

19(18) Shell with one or more pronounced apertural teeth **20**

apertural teeth

19(18) Shell without apertural teeth **21**

20(19) Shell dextral, pyriform, small to medium, confined to areas under periodic tidal influence—**Family Ellobiidae** (page 58)

20(19) Shell dextral or sinistral, pupilliform to fusiform, found in areas beyond tidal influence—**Family Achatinellidae** (page 100 or **Family Pupillidae**

21(19) Shell dextral, terrestrial or aquatic **22**

sinistral

dextral

21(19) Shell sinistral, aquatic only—**Family Planorbidae** (part) (page 76) or **Family Physidae**

22(21) Shell small to medium fusiform to conical **23**

22(21) Shell small to large, pyriform, bulimuliform or succiniform **24**

23(22) Shell fusiform, dark brown, smooth, horny—**Family Cionellidae** (page 101) or **Family Ferussaciidae**

Cionellidae or Ferussacidae

Helicidae

23(22) Shell conical, tall to short, with dark bands—**Family Helicidae** (part) (page 231)

24(22) Shell small to medium, thin, fragile, without colour pattern, with body whorl wide, confined to aquatic or damp cryptic habitat, animal does not protrude its head far out of shell **25**

24(22) Shell medium to large, thin to thick with colour pattern, truly terrestrial in habit, animal with prominent head

region when crawling—**Family Caryodidae** (part) (page 124) or **Family Orthalicidae**

25(24) Shell succiniform with short spire and swollen body whorl, not aquatic, eyes at tip of tentacles—**Family Succineidae** (page 95)

Succineidae

Lymnaeidae

25(24) Shell bulimuliform, medium to long spire and swollen body whorl, aquatic, eyes at the base of triangular tentacles—**Family Lymnaeidae** (page 69)

26(18) Shell small to minute (four whorls with diameter less than 8 mm) **27**

26(18) Shell medium to large (four whorls with diameter more than 8 mm) **30**

27(26) Shell planispiral, thin, horn-coloured, aquatic only—**Family Planorbidae** (part) (page 76)

planispiral

27(26) Not as above **28**

28(27) Shell with pronounced regular sculpture of simple or complex ribs and riblets or concentric lines or striae (other than growth lines), either on the protoconch only or on entire shell **29**

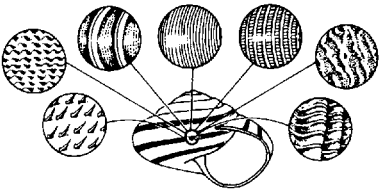
28(27) Shell and protoconch smooth, the only lines being growth lines—**Family Rhytididae** (part) (page 113) or **Family Zonitidae** (part).

29(28) Shell with thickened lip on aperture, wide ribs, confined to gardens and other man-modified areas—**Family Valloniidae** (page 110)

Vallonidae

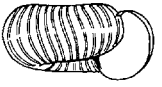
29(28) Shell without thickened lip on aperture, sculpture usually fine and complex—**Endodont Snails (Families Punctidae** and **Charopidae** (part)) (page 130)

30(26) Shell with sculpture of ribs or concentric ridges or with periostracal hairs **31**

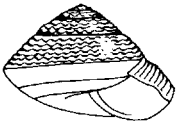


30(26) Shell smooth except for growth lines **35**

31(30) Shell with regular transverse or radial ribs, either complex or simple **32**



transverse



concentric

31(30) Shell with complex concentric or spiral ridges or with periostracal hairs **34**

32(31) Shell thin, fragile with little calcareous material **33**

32(31) Shell thick, heavy, calcareous with coarse ribbing—**Family Camaenidae** (part) (page 218) or **Family Helicidae** (part)

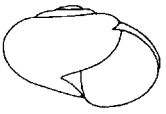
33(32) Shell medium to large with coarse to fine regular transverse simple ribs, yellow to dark horn—**Family Rhytididae** (part) (page 113)

turbinate

33(32) Shell medium, flat to turbinate with complex sculpture, yellow to dark green—**Family Charopidae** (part) (page 153)

34(32) Shell turbinate to sub-conical, keeled, with pronounced granulate concentric ridges—**Family Caryodidae** (part) (page 124)

Caryodidae



Camaenidae

34(32) Shell helicoid with fine periostracal hairs (or pustules of hair bases on eroded shell)—**Family Camaenidae** (part) (page 218)

35(30) Shell large, thin, black to dark brown with small or closed umbilicus—**Family Rhytididae** (part) (page 113)

35(30) Not as above **36**

36(35) Shell helicoid, globose to flat, with body whorl not greatly enlarged **37**

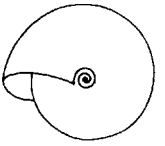
Helicarionidae

36(35) Shell convex to flat, very thin and fragile with body whorl greatly enlarged, with open aperture, small compared to body size and covered by mantle flaps in crawling animal—**Family Helicarionidae** (part) (page 210)

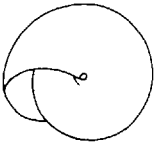
37(36) Shell medium, convex to flat, depressed, thin, smooth, of a single colour **38**

37(36) Shell medium to large, subglobose, globose to conical, thin to thick with or without pattern **39**

38(37) Shell light horn colour, with small to medium umbilicus—**Family Zonitidae** (page 196)



Zonitidae



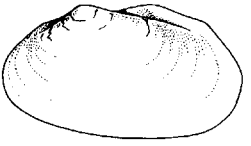
Euconulidae or Helicarionidae

38(37) Shell light yellow to pink to dark brown, with narrow to closed umbilicus—**Family Euconulidae** (part) (page 208) or **Family Helicarionidae** (part)

39(37) Shell medium, subglobose to conical, thin, without colour pattern—**Family Euconulidae** (part) (page 208)

39(37) Shell medium to large subglobose to globose, thick, with various colours and patterns—**Family Camaenidae** (part) (page 218) or **Family Bradybaenidae** or **Family Helicidae** (part)

40(1) Valves small to medium, greeny purple or transparent, umbos central or nearly so **41**



Hyriidae

Corbiculidae or Sphaeriidae

40(1) Valves large, black to dark horny brown, umbos not central—**Family Hyriidae** (page 241)

41(40) Valves medium, solid, with obvious concentric sculpture—**Family Corbiculidae** (page 253)

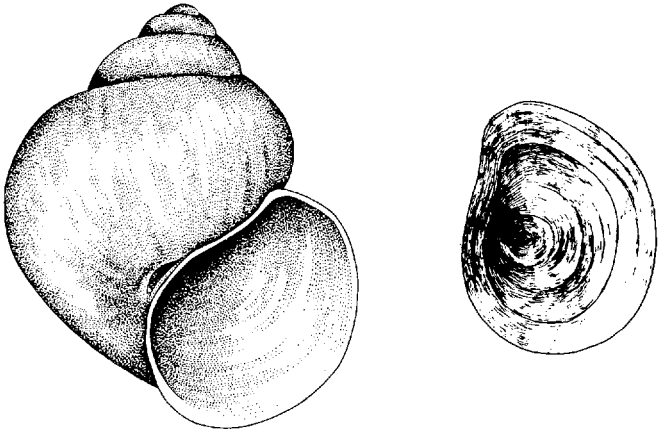
41(40) Valves small, fragile semi-transparent with weak sculpture—**Family Sphaeriidae** (page 255)

Viviparidae

This family of large freshwater operculates has a worldwide distribution. It gets its name from the ability of its members to bear living young (viviparous) rather than the more usual method of reproduction, laying eggs. Only three or four species occur in Australia and these are found in the large drainage basins of the central eastern region and the north.

***Vivipara (Notopala) sublineata* (Conrad, 1850)**
Paludina sublineata Conrad, 1850. *Proc. Acad. nat. Sci. Philad.*, 5: 11

Shell with 5-6 whorls, globose, solid, yellowy-green to brown with a narrow dark brown band towards the base of the last whorl. Thin periostracum, dark green to brownish. Outline square due to tendency to angulation. Aperture ovate, spire moderately high. Operculum horny, nucleus sub-spiral.



Size 20-25 mm
Range Murray-Darling River system
Habitat Running water
Remarks Here considered the senior name in the species group referred to as *Vivipara hanleyi* by Gabriel 1947.

Map 3:
Distribution of Viviparidae:
Vivipara (Notopala) sublineata

Separation of the families Truncatellidae and Hydrobiidae
From family key:

7(6) Shell elongate, smooth or with longitudinal grooves—**Family Truncatellidae** or **Family Hydrobiidae** (part)

7a Shell (5 to 8 whorls) more than 6 mm long, tapered spire, aquatic, often away from tidal influence, operculum horny, without calcareous element—**Family Hydrobiidae** (part)

7b Shell (4 to 6 whorls) less than 6 mm long, spire not tapered, semi-terrestrial found in tidal salt marshes, operculum horny with calcareous plate—**Family Truncatellidae** (page 52).

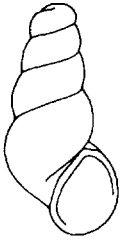
Hydrobiidae

This is the dominant aquatic non-marine mollusc family in south-eastern Australia having the greatest number of species. It shows the widest habitat tolerance, occurring from estuarine creeks to acidic alpine bogs to hypersaline lakes. The family has a worldwide distribution, the Australian species showing close affinities to those of New Zealand and South America. The Australian species are currently the subject of a taxonomic revision hence the generic and specific placements given here should be considered as tentative.

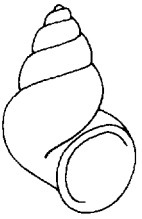
As the Hydrobiidae is made up of a number of different forms, an intermediate key to the various groupings follows below. This is to take the reader to the relevant section of the guide, from which the final species identification is made by direct comparison.

Key to main groups of the Hydrobiidae

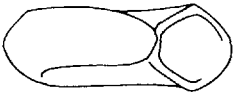
1 Shell large to small, with elevated spire, elongate to conical **2**



Elongate



Conical



Planispiral

1 Shell small, planispiral—genus *Glacidorbis*

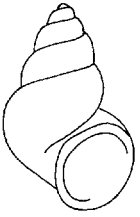
2(1) Shell medium to large, elongate, height more than three times width (when not decollate) **3**

2(1) Shell medium to small, fusiform to conical, height less than three times width **4**

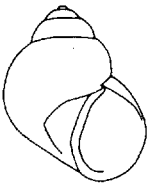
3(2) Shell with pointed spire, estuarine flowing water—genus *Tatea*

3(2) Shell with slightly tapered spire, usually decollate, saline non-flowing water or semi-aquatic—genus *Coxiella*

4(2) Shell with elevated spire body whorl no more than half height of shell..... **5**



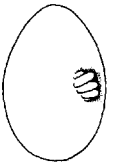
Potomopyrgus



Beddomeia

4(2) Shell small, squat, globose to conical with enlarged body whorl, Tasmania only—*Beddomeia* complex

5(4) Shell small, with short spire, with prominent pegs on inside of operculum, usually found in fast flowing freshwater creeks—genera *Pupiphryx*, *Rivisessor* and *Angrobia*

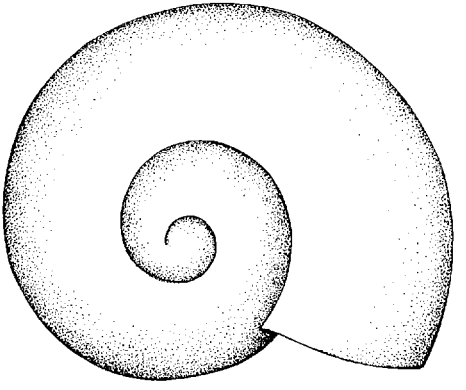


Operculum with pegs

5(4) Shell medium, spire short to long, with no peg on operculum, found in fresh to saline creeks—genera *Potomopyrgus* and *Hydrobia*

***Glacidorbis hedleyi* Iredale, 1943**
Glacidorbis hedleyi Iredale, 1943. *Aust. Zool.*, 10(2): 227

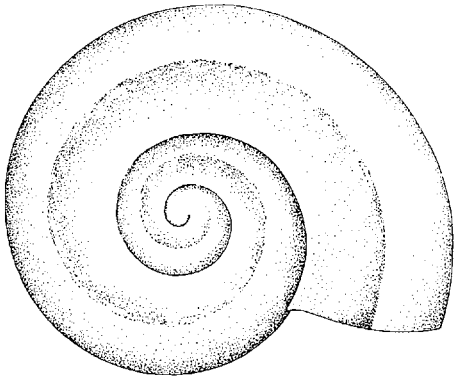
Shell 3 whorls, planispiral, with wide umbilicus, sunken spire, with rounded outer whorl. Sculpture of fine growth lines, with fine brown periostracum. Operculum thin, horny, paucispiral with central nucleus. Colour light brown.



Size 1.5-2 mm
Range Great Dividing Range of eastern Victoria and southern N.S.W.
Habitat Acid waters of mountain streams, bogs or lakes
Remarks This genus was recently revised by Meier-Brook and Smith (1975). It possesses a very characteristic radula and is viviparous in habit.

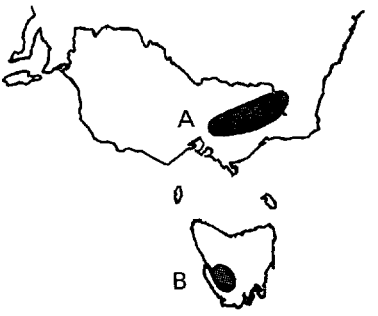
***Glacidorbis pedderi* (Smith, 1973).**
Valvata (?) *pedderi* Smith, 1973. *J. malac. Soc. Aust.*, 2(4): 429

Shell 3 whorls, planispiral with sunken spire, whorls strongly keeled dorsally and ventrally. Faint growth lines visible and fine periostracum. Operculum thin, horny, paucispiral with central nucleus. Colour light brown.



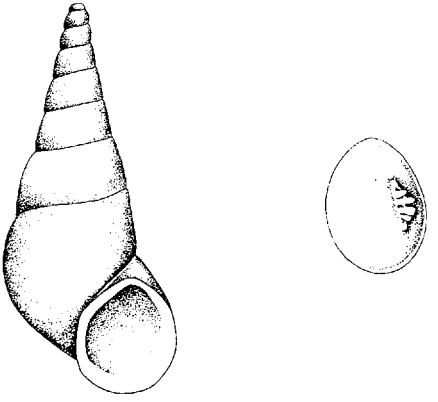
Size 1-2 mm
Range South-western Tasmania
Habitat Acid waters of mountain streams and lakes
Remarks Only known from Lake Pedder and lower Gordon River area

Map 4:
Distribution of Hydrobiidae:
A. *Glacidorbis hedleyi*
B. *Glacidorbis pedderi*



***Tatea rufilabris* (Adams, 1862).**
Diala rufilabris A. Adams, 1862. *Ann. Mag. nat. Hist.*, 3(10): 298

Shell 6-8 whorls, tapered to high, pointed spire, aperture ovoid, entire. Shell smooth, without spines or knobs. Colour black or dark brown frequently with hard encrustacan. Operculum thin, horn coloured, paucispiral with nucleus towards ventral side, with prominent three-pronged peg on inside for muscle insertion.

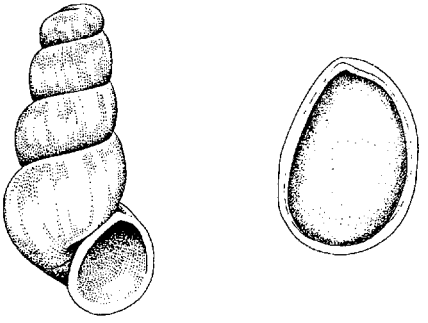


Size 4-6 mm
Range Throughout S.E. Australia
Habitat Estuarine section of rivers and creeks, flowing water with variable salinity and tidal influence

Map 5:
Distribution of Hydrobiidae:
Tatea rufilabris

***Coxiella striata* (Reeve, 1842)**
Truncatella striata Reeve, 1842. *Conch. Syst.*, 2: 94

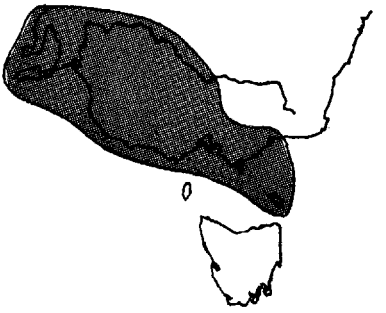
Shell 4-7 whorls, usually decollate, with slightly tapered spire, large, thick, heavy shell, deeply impressed sutures, aperture elliptical, lip thickened and expanded. Sculpture of fine concentric lirae, covered by thin periostracum. Colour salmon pink to brown, with an olive green periostracum. Operculum thin horny with flat raised central section, practically no structure pattern visible, often with external black deposit.



Size 10-15 mm
Range Western Victoria, eastern South Australia, eastern Bass Strait islands, southern and eastern Tasmania
Habitat Saline lakes usually away from direct marine influence

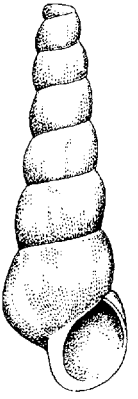
Remarks The genus was revised by Macpherson (1957). *Coxiella* dunes of dead shells of this species occur at the north end of Lake Corangamite, western Victoria. *Coxiella badgerensis* is here considered a synonym of this species.

Map 6:
Distribution of Hydrobiidae:
Coxiella striata



***Coxiella molesta* Iredale, 1943**
Coxiella molesta Iredale, 1943. *Aust. Zool.*, 10: 211

Shell 6-10 whorls, small, narrow, with tapered spire. Texture shagreen with faint longitudinal growth lines. Aperture with reflected lip. Colour flesh-coloured with olive green periostracum. Operculum thin, horny, paucispiral.



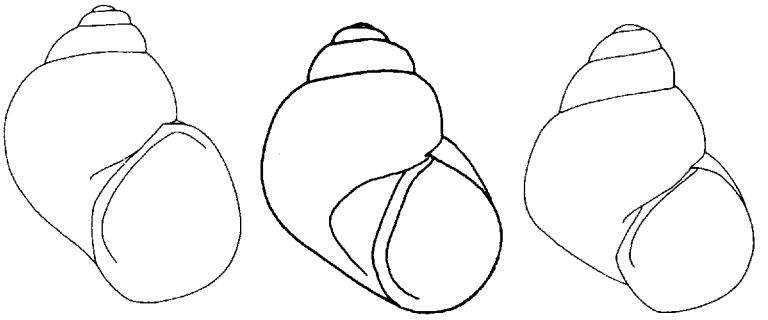
Size 6-8 mm
Range Only known from Port Phillip, Victoria

Habitat Not known
Remarks This species is only known from the type locality and its status remains doubtful till more specimens are discovered.

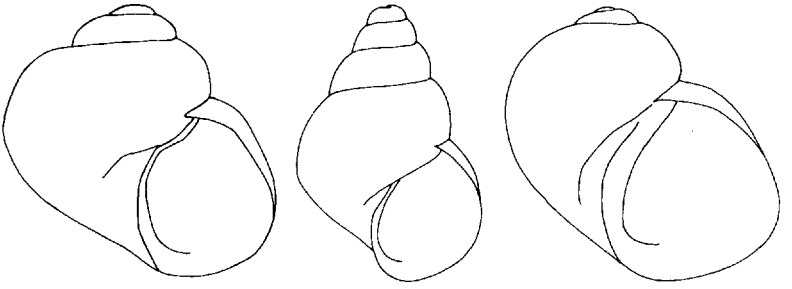
Map 7:
Distribution of Hydrobiidae:
Coxiella molesta

***Beddomeia* complex**
This is a group of small globose to conical hydrobiids found in streams throughout Tasmania. The exact status of this group and how many of the available names correspond to valid species are not known. The names referred to this group are:

Beddomeia launcestonensis (Johnston, 1872)
Beddomeia lodderi (Petterd, 1889)
Beddomeia belli (Petterd, 1889)
Petterdiana paludinella (Reeve, 1857)
Valvatasma tasmanica (Tenison-Woods, 1876)
Phrantela marginata (Petterd, 1889)



B. launcestonensis *B. bellii* *B. lodderae*

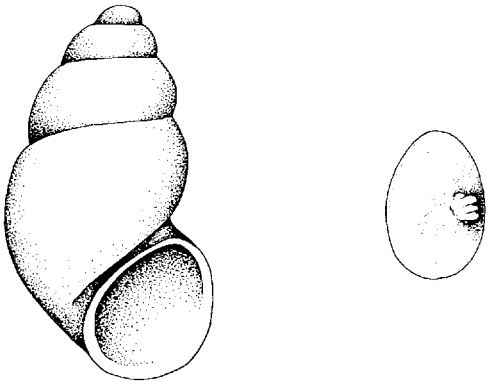


P. paludinella *P. marginata* *V. tasmanica*

Size 1-3 mm

***Pupiphryx grampianensis* (Gabriel, 1939)**
Bythinella grampianensis Gabriel, 1939. *Mem. natn. Mus. Melb.*, 1: 106

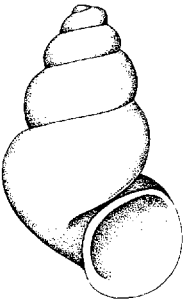
Shell small, 4 whorls, elongate turbinate with rounded base of body whorl, impressed sutures, aperture free, entire. Colour dark brown. Operculum thin, horny, paucispiral with nucleus near centre, prominent three-pronged peg-like process on inside.



Size 2 mm
Range Grampians, Otways and Great Divide of Victoria and southern N.S.W.
Habitat Under stones in fast flowing freshwater creeks and rivers

***Pupiphryx dunrobinensis* (Tenison-Woods, 1876)**
Bythinia dunrobinensis Tenison-Woods, 1876. *Pap. Proc. R. Soc. Tasm.*, 1875: 77

Shell small, 5 to 6 whorls, high spire with rounded body whorl. Aperture entire and free. Colour light brown but often with black deposit on shell. Operculum thin, horny, paucispiral with central nucleus, prominent peg-like process on inside.



Size 2-3 mm
Range Streams of central Tasmania
Habitat Under stones in swiftly flowing streams
Remarks Poorly known species

Map 8:
Distribution of Hydrobiidae:
A. *Pupiphryx grampianensis*
B. *Pupiphryx dunrobinensis*

***Rivisessor gunnii* (Frauenfeld, 1863)**
Hydrobia gunnii Frauenfeld, 1863. *Verh. zool.-bot. Ges. Wien.*, 13: 1025

Shell 4 to 6 whorls, small, turbinate to conical with small free oval aperture. Sculpture of weak radial furrows to fine lines. Colour pale yellowish horn to deep yellow spotted with black. Operculum thin, horny with paucispiral subcentral nucleus and peg-like process on the inside.

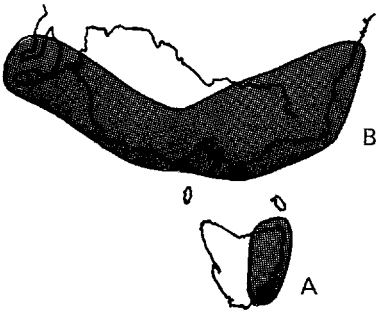
Size 2-4 mm
Range Streams of eastern Tasmania
Habitat Under stones and on weed, freshwater creeks
Remarks A thorough revision of the group is needed before weight can be given to any statement on species name

***Angrobia angasi* (Smith, 1882)**
Hydrobia angasi Smith, 1882. *J. Linn. Soc. Zool.*, 16: 271

Shell 5 whorls, small, conical with large, slightly inflated body whorl and fairly high spire. Aperture small, entire, attached to body whorl. Shell smooth or with fine granulations but usually with black deposit. Colour pale yellow to horn to brown with black deposits. Operculum thin, pale horn with paucispiral, subcentral nucleus and small peg-like process on the inside.

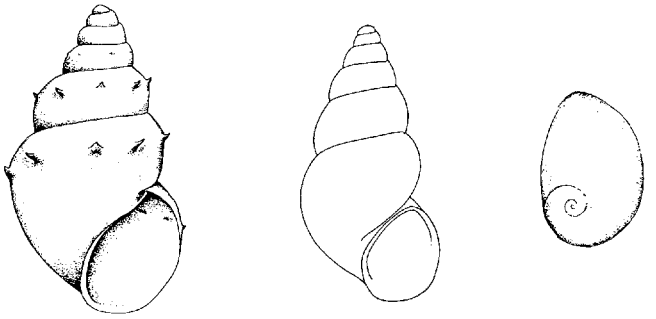
Size 2-3 mm
Range Victoria, southern South Australia and southern N.S.W.
Habitat Under rocks and in weed in freshwater streams

Map 9:
Distribution of Hydrobiidae:
A. *Rivisessor gunnii*
B. *Angrobia angasi*



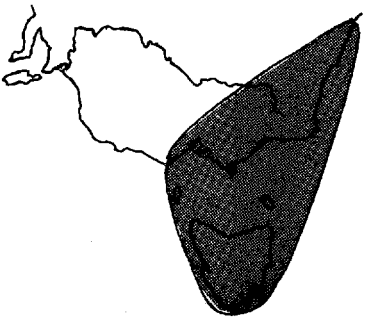
***Potomopyrgus niger* (Quoy & Gaimard, 1835)**
Paludina niger Quoy & Gaimard, 1835. *Voy. Astrolabe Zool.*, 3: 174

Shell 5 whorls, small to medium, high spire and wide body whorl. Shells vary from smooth with no ornamentation to carinated forms to those with a series of large spines on each whorl. Sculpture of very fine radial riblets but shell often covered with black deposit. Aperture oval, peaked above, and attached to body whorl. Colour usually black but can be pale yellow or reddish. Operculum yellow horn, paucispiral with submarginal nucleus without internal peg.



Size 3-5 mm
Range Southern Victoria, Tasmania, southern N.S.W.
Habitat Freshwater streams, usually just above region of tidal influence in coastal streams
Remarks Recent work (Wallace, 1978) has revealed that most populations of this species have less than 5 per cent males, the species probably being parthenogenic

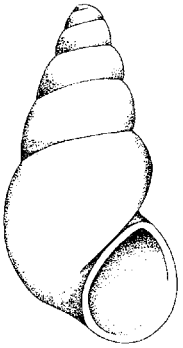
Map 10:
Distribution of Hydrobiidae:
Potamopyrgus niger



***Hydrobia buccinoides* (Quoy & Gaimard, 1835)**
Paludina buccinoides Quoy & Gaimard, 1835. *Voy. Astrolabe Zool.*, 3: 175

Shell 5 whorls, small, with high spire, impressed sutures and convex whorls with body whorl large. Aperture small, entire and attached to body whorl. Sculpture of indistinct radial lirae. Colour

yellow to brownish green sometimes with black deposit. Operculum yellow horn, paucispiral with no internal process.



Size 2-3 mm
Range Coastal streams of Victoria and Tasmania
Habitat Estuarine sections of tidal creeks and in associated lagoons.
Remarks This species has a wide salinity tolerance from almost full sea water to fresh.

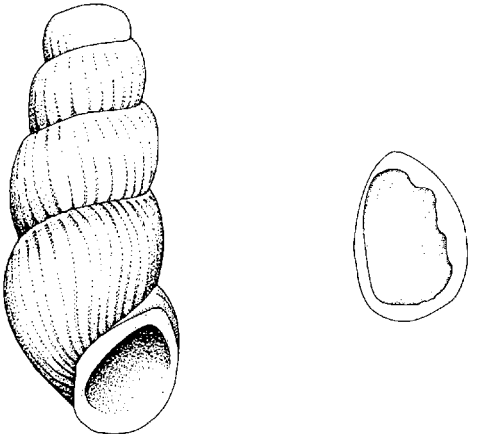
Map 11:
Distribution of Hydrobiidae:
Hydrobia buccinoides

Truncatellidae

This is a worldwide family of operculates found mainly in marginal supra-littoral habitats. It is more commonly thought of as a tropical or subtropical group but is found around almost the entire Australian coast except for southern Tasmania. The family is characterised by the small cylindrical shells, usually decollate and often heavily ribbed. The operculum usually has a calcareous layer or element on top of the horny layer. A good review of the family was published by Clench and Turner (1948). For separation from Hydrobiidae see page 38.

***Truncatella scalarina* Cox, 1867**
Truncatella scalarina Cox, 1867. *Proc. zool. Soc. Lond.*, 1867: 40

Shell 4 to 5 whorls, small, elongate shining white with strong rounded regular longitudinal ribs. Aperture entire, oblique, ovate with subspiral horny operculum bearing irregular calcareous plate.

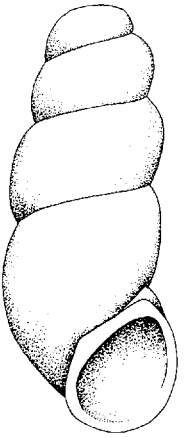


Size 4-6 mm
Range Coast of South Australia, Victoria, N.S.W., and north coast of Tasmania
Habitat Terrestrial, supra-littoral, marginal marine, under litter

Map 12:
Distribution of Truncatellidae:
Truncatella scalarina

***Truncatella vincentiana* (Cotton, 1942)**
Acmea vincentiana Cotton, 1942. *Trans. R. Soc. S. Aust.*, 66(2): 128

Shell 4 to 5 whorls, small, decollate, elongate shining amber to translucent, smooth with fine longitudinal striae. Aperture entire ovate with subspiral horny operculum bearing irregular calcareous plate.



Size 4-6 mm
Range Coast of South Australia and Bass Strait
Habitat Terrestrial, supra-littoral, marginal marine, under litter

Map 13:
Distribution of Truncatellidae:
Truncatella vicentiana

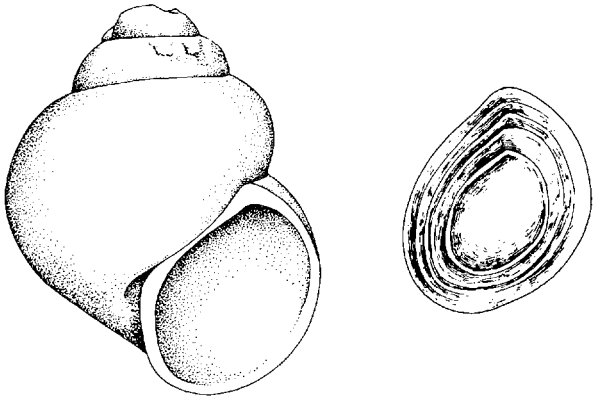
Bithyniidae

This is a family of operculate gastropods found in fresh or slightly saline waters of most of the world. In Australia it is found mainly in the inland and the northern region where it prefers backwaters and billabongs of the drainage systems.

The relationships are obscure and several names have been applied to this group. The name used here is established in Opinion 475 from the International Commission for Zoological Nomenclature. Members of the family are characterised by the calcareous nature of the operculum.

***Gabbia australis* Tryon, 1865**
Gabbia australis Tryon, 1865. *Am. J. Conch.*, 1: 220

Shell small to medium, 4 whorls, globose with high spire. Shell thin, almost transparent with narrow umbilicus. Operculum thick, calcareous with central nucleus. Colour light horn sometimes with greenish tinge, dark pigment on the animal visible through the shell.



Size 8-12 mm
Range Occasionally around central Murray-Darling system
Habitat Shallow fresh to slightly saline water, still or slow flow, in weed
Remarks Occurs over a wide area of Central Australia

Map 14:
Distribution of Bithyniidae:
Gabbia australis

Hydrococcidae

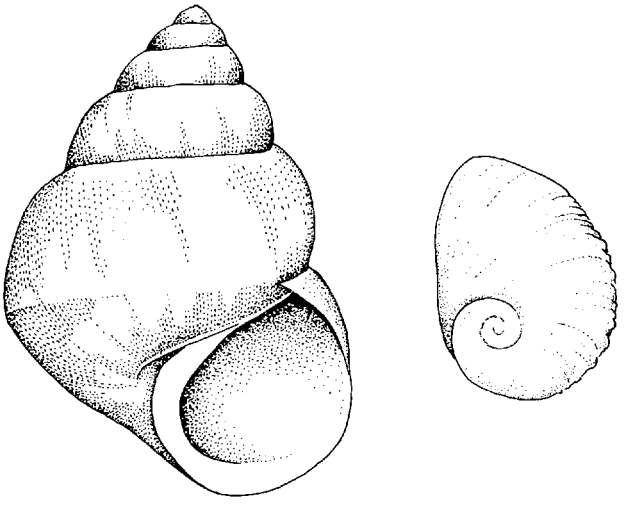
This is another of the semi-marine families included in this guide because the species belonging to it can be found in what appears

to be a non-marine situation. The southern Australian species was referred to the largely northern hemisphere family Assimineidae until they were separated into this Australian family by Thiele (1928). The precise relationships of this group of small operculates await a wide-ranging revision before they can be positively stated.

This group is found in the salt-marsh areas of southern Australia in large numbers associated with the other mollusc families of this zone, the ellobiids, amphibolids and truncatellids. They require coverage by sea water at intervals, but are found well above the high neap tide mark. They live on the surface of the mud between the stems of the saltbush and are detrital feeders.

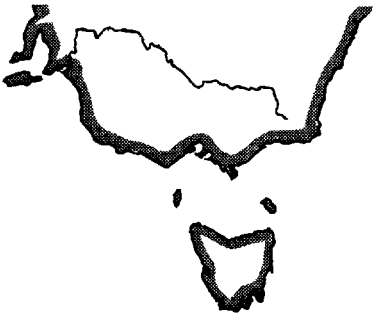
***Hydrococcus tasmanicus* (Tenison-Woods, 1876)**
Assiminea tasmanica Tenison-Woods, 1876. *Pap. Proc. R. Soc. Tasm,* 1876: 117

Shell small, 4-5 whorls, subglobose, turbinate with square sub-keeled body whorl, elevated spire with rounded shoulders and impressed sutures, almost closed umbilicus by reflected columella fold, round aperture. Operculum horny, paucispiral. Colour white to cream to buff, sometimes one or two broad dark brown concentric bands.



Size 2-4 mm
Range Coastal region throughout S.E. Australia
Habitat On mud between plant roots in tidal saltmarsh areas in sheltered bays and inlets
Remarks A second species is quoted in literature, *Hydrococcus brazieri* (Tenison-Woods, 1876). This is said to be slightly larger, usually has brown bands and occurs in lower tide area. However, we consider that this could be a variety of this species.

Map 15:
Distribution of Hydrococcidae:
Hydrococcus tasmanicus

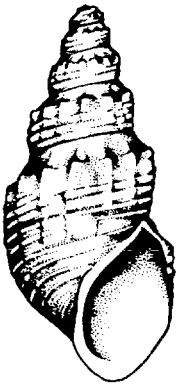


Thiaridae

This family of fresh and brackish water operculates is confined mainly to tropical areas of the Indo-Pacific. Australia has three or four very similar species occurring in the large inland drainage basins of the central eastern region of the north. It is also found in small bodies of water, such as dams and irrigation storages, fed from the rivers where it survives and multiplies readily.

***Plotiopsis balonnensis* (Conrad, 1850)**
Melania balonnensis, Conrad, 1850. *Proc. Acad. nat. Sci. Philad.*, 5: 11

Shell with 6-7 whorls, fusiform, with carinated whorls, thin, olive green to browny-yellow. Aperture ovate-lunate, whorls with longitudinal ridges. Operculum horny with central nucleus.



Size 20-30 mm
Range Murray-Darling River system
Habitat Mainly running water with soft bottom

Map 16:
Distribution of Thiaridae:
Plotiopsis balonnensis

Ellobiidae

This is the largest of the littoral fringe families included in this work. It has a wide distribution in tropical and sub-tropical areas with only a few species occurring in temperate latitudes. Members of the family are found from about neap high tide level to spring

high tide level in mangrove and saltmarsh areas. They live on the surface of the mud and around the roots of the saltmarsh plants, in association with members of the Hydrococcidae, Amphibolidae and Truncatellidae.

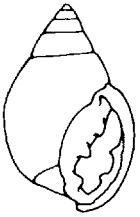
The family is characterised by the presence of one or several apertural teeth. Many species, particularly the larger tropical ones, bear a complex series of apertural columellar teeth and lip callosities. Many local species have been described within the group and several genera proposed. A basic revision of the Australian species is needed to clarify the status of these names. The species recognised here, and the names used, must therefore be considered as tentative until such a revision is carried out.

The Victorian species are well described by Macpherson and Gabriel (1962).

Key to the genera of the Ellobiidae

1 Shell without teeth or thickening on outer lip of the aperture **2**

no teeth on outer lip



teeth on outer lip

1 Shell with teeth and thickened callosity on outer lip of the aperture **4**

2(1) Shell medium, black to brown with several light encircling bands—genus *Ophicardelus*

2(1) Shell small to medium, uniform light colour **3**

3(2) Shell medium to small, two or three prominent columellar teeth, usually found in saltmarshes—genus *Marinula*

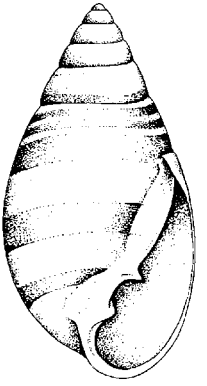
3(2) Shell small, only one prominent columellar tooth present, usually found at neap high tide level—genus *Leuconopsis*

4(1) Shell medium, without obvious sculpture—genus *Melosidula*

4(1) Shell small, with sculpture of heavy ribs—genus *Plecotrema*

***Ophicardelus ornatus* (Ferussac, 1821)**
Auricula ornatus Ferussac, 1821. *Tabl. Syst. Anim. Moll.*: 103

Shell medium, 5-6 whorls, elongately ovate, body whorl large, convex, spire high, aperture elongate-ovate, outer lip sharp, inner lip with two prominent columellar teeth. Sculpture of fine growth lines, shell with thin brown periostracum. Colour brown to dark brown with several wide to narrow encircling light brown to yellow bands.

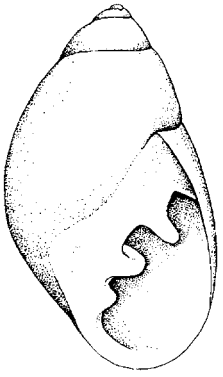


Size 10-12 mm
Range Coastal area throughout S.E. Australia, except southern Tasmania
Habitat Mangrove and saltmarsh areas, between neap and spring high-tide levels in sheltered inlets, on mud
Remarks Two species listed separately by Macpherson and Gabriel (1962), *O. quoyi* (H. & A. Adams, 1855) and *O. sulcatus* (H. & A. Adams, 1855) are here considered synonyms.

Map 17:
Distribution of Ellobiidae:
Ophicardelus ornatus

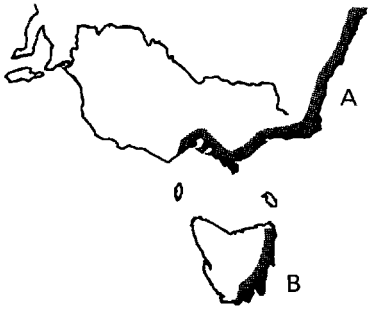
***Marinula xanthostoma* H. & A. Adams, 1855**
Marinula xanthostoma H. & A. Adams, 1855. *Proc. zool. Soc. Lond.*, 1854: 35

Shell medium, 4-5 whorls, oblong-ovate, solid, spire short, whorls flatly rounded, aperture elongate-ovate, outer lip sharp, inner lip bearing three prominent teeth on columella, posterior one largest. Shell smooth. Colour white, cream or pinkish.



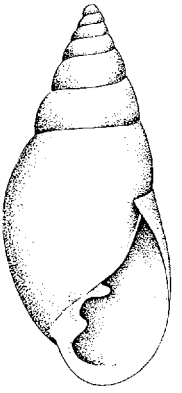
Size 7-9 mm
Range Coastal region of New South Wales and east and central Victoria.
Habitat Mangrove and saltmarsh areas in sheltered inlets, on mud between plant roots.

Map 18:
Distribution of Ellobiidae:
A. *Marinula xanthostoma*
B. *Marinula parva*



***Marinula meridionalis* (Brazier, 1877)**
Alexia meridionalis Brazier, 1877. *Proc. Linn. Soc. N.S.W.*, 2: 26

Shell small, 6 whorls, elongate, with high spire, whorls flatly convex, aperture short, elongate-ovate with outer lip sharp, inner lip with two teeth on columella, shell smooth with fine growth lines. Colour light horn.

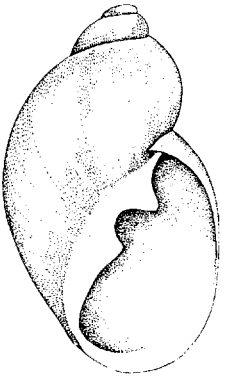


Size 3-4 mm
Range Coastal region of Victoria, south-eastern South Australia and Tasmania
Habitat Mangrove and saltmarsh areas in sheltered inlets, on mud between plant roots

Map 19:
Distribution of Ellobiidae:
Marinula meridionalis

***Marinula parva* (Swainson, 1856)**
Cremnobates parva Swainson, 1856. *Pap. Proc. R. Soc. Tasm.*, 1856: 44.

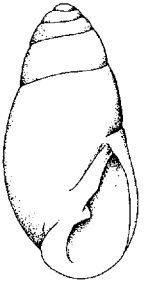
Shell small, 4 whorls, elongate-ovate, spire low, body whorl rounded, impressed sutures, large ovate aperture with two or three irregular prominent teeth on columella, outer lip sharp, sculpture of fine growth lines. Colour pale buff with white teeth.



Size 2-4 mm
Range Southern and eastern Tasminia
Habitat Saltmarsh and tidal flats in sheltered inlets between roots of plants on mud

***Leuconopsis pellucidus* (Cooper, 1841)**
Auricula pellucidus Cooper, 1841. *Microscopic J.*, 1841: 16.

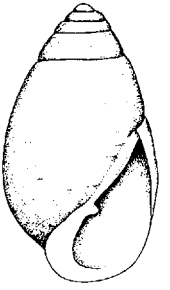
Shell small, 4-5 whorls, low rounded spire, flattish whorls, elongate-ovate aperture with outer lip sharp, one tooth on columella, sculpture of fine growth lines or smooth. Colour white.



Size 2-3 mm
Range Coastal region of Victoria, south-eastern South Australia and northern Tasmania
Habitat Littoral fringe in sheltered bays in crevices in rocks on mud flats

***Leuconopsis inermis* Hedley, 1901**
Leuconopsis inermis Hedley, 1901. *Proc. Linn. Soc. N.S.W.*, 15: 722

Shell small, 4-5 whorls, low rounded spire, large body whorl, elongate-ovate aperture with outer lip sharp, one tooth on columella. Sculpture of fine spiral lines. Colour white to light brown.

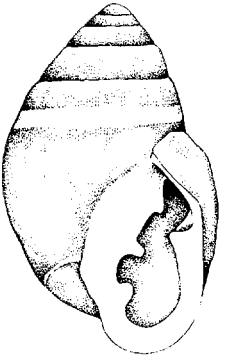


Size 2-3 mm
Range Coastal region of central N.S.W.
Habitat Littoral fringe in sheltered bays in crevices in rocks on mud flats

Map 20:
Distribution of Ellobiidae:
A. *Leuconopsis pellucidus*
B. *Leuconopsis inermis*
Melosidula zonata
Plecotrema octanfracta

***Melosidula zonata* (H. & A. Adams, 1855)**
Cassidula zonata H. & A. Adams, 1855. *Proc. zool. Soc. Lond.*, 1854: 32

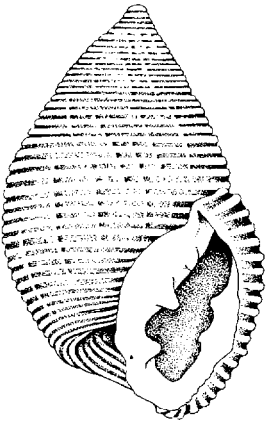
Shell medium, 4-5 whorls, high spire, thick, heavy, spire rounded, open umbilicus with reflected columellar callus, aperture elongate-ovate, depressed posterior margin, thickened outer lip. Three prominent teeth on the columella and one on the outer lip. Sculpture of fine growth lines. Colour light brown with white band on body whorl, aperture white.



Size 8-12 mm
Range Coastal region of central N.S.W.
Habitat On mud between roots of plants in supra littoral fringe in sheltered inlets and estuaries

***Plecotrema octanfracta* (Jonas, 1845)**
Pedipes octanfracta Jonas, 1845. *Z. Malakozool.*, 1: 169

Shell small, 4-5 whorls, high rounded spire, thick, heavy, open umbilicus, aperture elongate-ovate with heavy columellar callus and thickened lip. Three prominent teeth on the columellar and two on the outer lip. Sculpture of prominent coarse concentric ribs. Colour dark brown with white aperture.



Size 6-8 mm
Range Coastal region of central N.S.W.
Habitat On mud between roots of plants in supra littoral fringe in sheltered inlets and estuaries.
Remarks Species occurs widely in south-western Pacific Ocean.

Amphibolidae

The species of this family inhabit the supra-littoral zone and are included here because, despite their need for regular immersion in sea water, they do spend most of their lives in an essentially

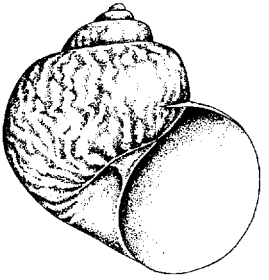
non-marine environment. The family is a small one confined to the southern Indo-Pacific area. It inhabits the region between the mid-littoral and the lower supra-littoral zones in muddy sea-grass flats, mangrove and saltmarsh localities, in sheltered areas. The family is unique in that it is the only pulmonate family with an operculum. It is not known whether the operculum is homologous to those seen in archaeogastropods but it is entirely functional in the family.

Two species are found in the sheltered marine environments of southern Australia where they occupy different tidal zones and occur in very large numbers. They lay sausage-shaped jelly egg-masses which appear to give rise to a veliger stage.

The Australian species were revised by Woolacott (1945) and described by Macpherson and Gabriel (1962).

***Salinator fragilis* (Lamarck, 1822)**
Ampullaria fragilis Lamarck, 1822. *Hist. nat. Anim. sans Vert.*, 6(2): 179

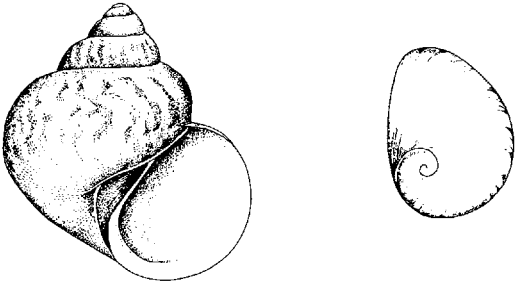
Shell 5-6 whorls, small to medium thin, globose, with fairly wide umbilicus, sutures deeply impressed. Colour light brown typically with one or more dark brown horizontal bands. Operculum thin paucispiral, light horn colour, without internal claw.



Size 6-12 mm
Range S.E. Australian coasts generally.
Habitat Mid to upper littoral zone in sheltered marine inlets, on mud and sea-grass flats

***Salinator solida* (von Martens, 1878)**
Amphibola solida, von Martens, 1878. *Jb. dt. malakozool. Ges.*, 1878: 2

Shell 5-6 whorls, medium to large, thick, globose, with fairly wide umbilicus, sutures deeply impressed, occasionally with concentric ridge around centre of last whorl. Colour light brown with dark brown zig-zag markings. Operculum thin paucispiral, light horn colour, with prominent internal claw.



Size 10-20 mm
Range S.E. Australian coasts generally
Habitat Supra-littoral zone in saltmarsh and saline marshy areas, on soft mud
Remarks Found associated with Hydrococcidae and Ellobiidae

Map 21:
Distribution of Amphibolidae:
Salinator fragilis
Salinator solida

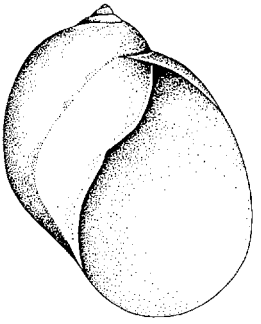
Lymnaeidae

This is a worldwide family of dextrally coiled freshwater pulmonates characterised by a large fleshy foot and wide, triangular tentacles. They prefer mainly slow or non-flowing waters and thrive in eutrophic conditions. A recent revision of the family by Hubendick (1951) reduced the Australian fauna to three species. This was later restricted to two by Boray and McMichael (1961), both species occurring in South-eastern Australia. Hubendick referred most of the species in the family to one genus, *Lymnaea*. We prefer to follow Inaba (1969) in recognising several genera for the family, characterised by distinct shell and anatomical differences and different chromosome numbers and mitotic figures.

Some species of this family are the vectors for the sheep liver fluke, *Fasciola hepatica*, making the family of major economic importance. Besides the two native species, two introduced species are included here as they have been found released in the 'wild' situation.

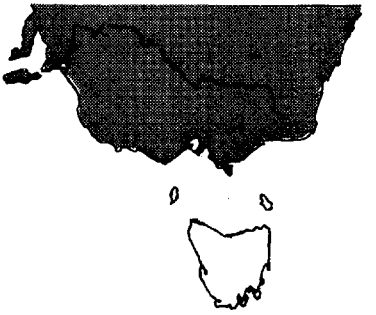
***Austropeplea lessoni* (Deshayes, 1830)**
Limnea lessoni Deshayes, 1830. *Mag. de Zool.*, 2: 16

Shell 4-5 whorls, large, with short spire and bulbous last whorl. Shell smooth, thin, fragile, almost transparent. Animal with very



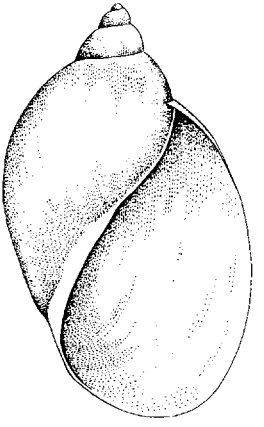
fleshy foot, head and tentacles. Colour usually pale to almost white with shell very pale yellow.
Size 15-20 mm
Range Throughout S.E. Australia except Tasmania
Habitat Mainly pools and billabongs with weed
Remarks Discontinuous distribution. Not a vector for sheep liver fluke.

Map 22:
Distribution of Lymnaeidae:
Austropeplea lessoni



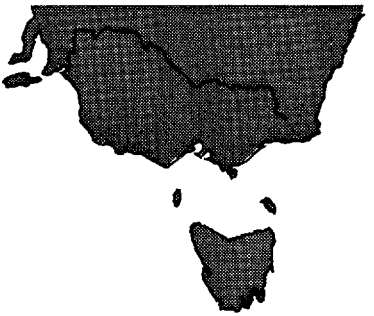
***Austropeplea tomentosa* (Pfeiffer, 1855)**
Succinea tomentosa Pfeiffer, 1855. *Proc. zool. Soc. Lond.*, 1854: 297

Shell 4 whorls, small to medium, spire third of shell length, last whorl not bulbous. Shell smooth or with very faint spiral lines, thin, fragile. Animal fleshy, dark grey. Colour black to bluey-grey, rarely light.



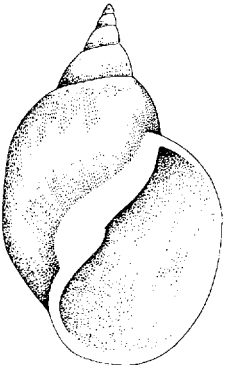
Size 5-15 mm
Range S.E. Australia generally
Habitat Creeks, dams and billabongs in weed in shallow water
Remarks Main vector of the sheep liver fluke

Map 23:
Distribution of Lymnaeidae:
Austropeplea tomentosa



***Lymnaea stagnalis* (Linne, 1758).** (Introduced)
Helix stagnalis Linne, 1758. *Syst. Nat.*, 10: 774

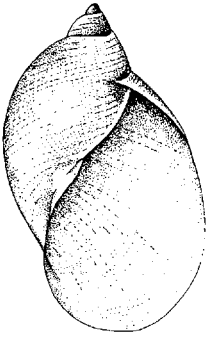
Shell 5 whorls, large with high spire and bulbous last whorl, occasionally with 'winged' aperture. Shell smooth, thin. Animal fleshy, light to dark colour. Colour bluey-grey to light horn.



Size 25-35 mm
Range Widespread patchy distribution
Habitat Ponds
Remarks Native of the Palaeoarctic and introduced as an aquarium snail into many countries

***Pseudosuccinea columella* (Say, 1817).** (Introduced)
Lymnaea columella Say, 1817. *J. Acad. nat. Sci. Philad.*, 1: 14

Shell 4 whorls, small with low spire fairly narrow with wide aperture. Sculpture of fine spiral lines, shell thin. Animal fleshy, grey. Colour light horn.



Size 5-10 mm
Range Few areas in Melbourne and Sydney
Habitat Creeks
Remarks Native of North America, but introduced into several countries. Recent introduction into Australia, probably from New Zealand. Recorded in aquarium suppliers in Melbourne, Sydney and Perth. This species is known to be a potent vector of sheep liver fluke. (Ponder, 1975).

Ancylidae

This family of freshwater limpets has a worldwide distribution and forms a significant part of the freshwater fauna of Australia. The species are confined to non-saline waters but are found in a wide range of habitats from stagnant pools to fast flowing creeks and rivers. The family is characterised by the small patelliform shell

without coiling and a backward pointing apex. The head is reduced and the foot enlarged to enable the limpet to cling to the substratum and withdraw completely under the shell. Variation is seen in shell form by septation—the growth of a septum or shelf as a horizontal outgrowth from the posterior portion of the shell margin. Subsequent growth after septation may form a cap on the shell (Fig. 12) and such unusual shell forms have been named in the past. The growth of septae has been shown to be connected with changing ecological factors (Richardot, 1977).

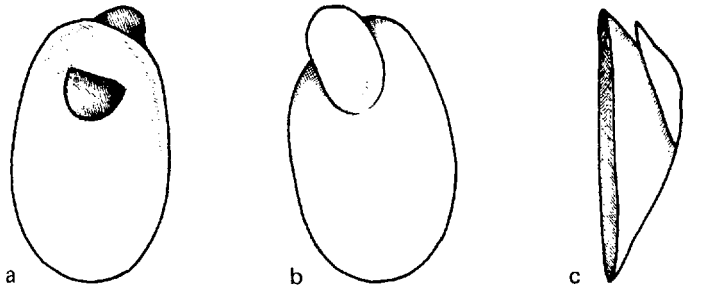
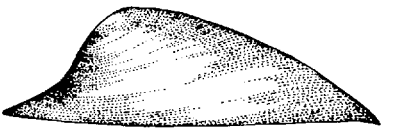


Fig. 12. Diagrams showing septation in ancylids, (a) ventral view showing restricted aperture, (b) dorsal view showing small central cap, (c) lateral view showing off-set cap (after Hubendick, 1967)

The Australian members of the family were revised by Hubendick (1967) and this revision is followed here. We are not following Zilch (1959) in his placement of these species in the family Ferrissiidae.

***Ferrissia (Pettancylus) petterdi* (Johnston, 1879)**
Gundlachia petterdi Johnston, 1879. *Pap. Proc. R. Soc. Tasm.*, 1878: 23

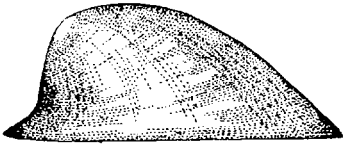
Shell small, thin and fragile, elongate with low apex, between centre and posterior end and displaced to the right side, anterior end rounded, posterior end tapering. Sculpture on apex of very fine radial lines. Colour very pale yellowish-brown to colourless. Animal unpigmented except for eyes.



Size 4-5 mm
Range Throughout S.E. Australia
Habitat Attached to surfaces, either dead or living plant material or rocks or pebbles, freshwater, from pools to creeks and rivers

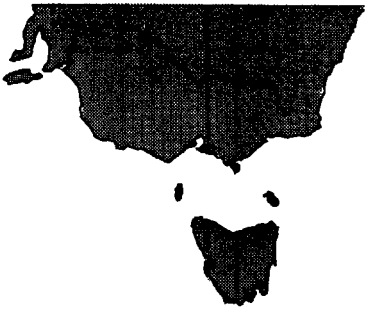
Ferrissia (Pettancylus) tasmanica **(Tenison-Woods, 1876)**
Ancylus tasmanicus Tenison-Woods, 1876. *Pap. Proc. R. Soc. Tasm.*, 1875: 70

Shell small, thin and fragile, elliptical, with fairly high apex situated posteriorly and displaced to the right, anterior end rounded, posterior tapering. Sculpture of fine radial lines, particularly on apex. Colour pale yellowish-brown to colourless. Animal pigmented dorsally, arranged as a black ring just inside mantle collar.



Size 3-4 mm
Range Throughout S.E. Australia
Habitat Attached to surfaces in freshwater pools or creeks

Map 24:
Distribution of Ancylidae:
Ferrissia (Pettancylus) petterdi
Ferrissia (Pettancylus) tasmanica



Separation of the families Planorbidae and Physidae
From the family key:

21(19) Shell sinistral, aquatic only—**Family Physidae** or **Family Planorbidae** (part)

Nearly all sinistral helicoid aquatic snails in Australia belong to the family Planorbidae. The family Physidae is generally regarded as a northern hemisphere, Holarctic and Neotropical group. Fairly recently specimens of the family Physidae have been recorded from several localities in south-eastern Australia (Thatcher, 1972—pers. comm.; C. Meier-Brook, 1977—pers. comm.; J. B. Burch, 1978—pers. comm.). It is thought that all records of Physidae in Australia are introduced species.

Species of these two families are difficult to separate by shell and external features. Planorbids possess a pseudobranch which can often be seen protruding from the mantle. They also have red blood. Physids do not show these features. The physids have mantle digitations while the planorbids have straight mantle edges.

A reasonably simple method to differentiate the two families is by means of a radula preparation. The radula is the ribbon of teeth used by the snail for feeding. Examination of a radula requires a microscope capable of at least 80 magnifications.

Radula Preparation:

1. Cut off the head-foot region or dissect out the buccal mass.
2. Boil in 10 per cent solution of caustic soda (sodium hydroxide) in a test tube until the tissues disintegrate on shaking.
3. Pour into small dish of water and search for the radula (small, transparent structure—shines under oblique light).
4. Transfer to water drop on microscope slide with mounted needle. Arrange, cover and observe on dark field.

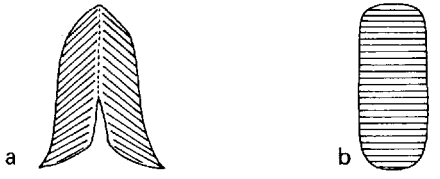


Fig. 13. Diagrams showing (a) physid radula shape (divergent posteriorly), (b) planorbid radula shape (entire)

Differentiation between Physidae and Planorbidae

Physidae— radula with divided, divergent posterior end, rows arranged obliquely along the radula with the half rows at 90° to each other (see figure). Central tooth (rhachidian) denticulate, lateral multicuspid.

Planorbidae—radula oblong, entire, rows horizontal, not divided. Central tooth bicuspid, laterals with 3 or 4 cusps.

Planorbidae

This is the largest and most diverse family of freshwater snails and has a worldwide distribution. In Australia it is represented by a wide variety of forms and is the dominant group of freshwater molluscs in many areas. Members of the family have either planispiral shells, sinistrally or dextrally coiled or have sinistral helicoid shells. They are confined to waters of low salinity and are usually associated with water weed or algal growth on which they feed.

Many names have been given to members of this family in the different states, largely based on shell shape and form. More comprehensive collecting has shown many of the shell forms are ecomorphs—local variations associated with particular environmental conditions. A taxonomic revision using comparative anatomy as well as the more sophisticated techniques of protein matching is long overdue. The groups described below must be considered as tentative only. No correct assignment of species can be made with any certainty without revision.

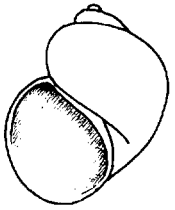
One of the common forms of high-spired planorbids in Australia was referred to the genus *Bulinus* by Hubendick (1955b) and others. We are following recent unpublished work by Burch and Walker (pers. comm.) in believing that these species should not be referred to *Bulinus* but to *Isidorella*.

Constant confusion occurs over the differentiation of the two main helicoid planorbid genera, *Isidorella* and *Physastra*. The shells and many external features are very similar. The differences listed in the key below apply to most specimens found in south-

eastern Australia. However the only satisfactory criteria for differentiating these two genera is by dissection of the penis and male genitalia (Hubendick, 1955b).

Key to the genera of the Planorbidae

1 Shell sinistral, helicoid **2**



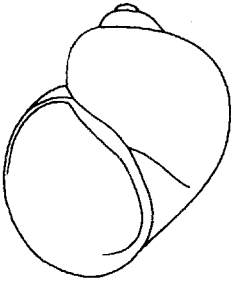
helicoid

planispiral

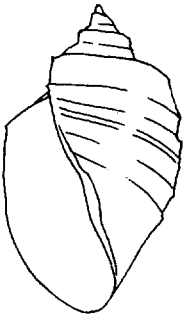
patelliform

1 Shell sinistral of dextral, planispiral or patelliform **4**

2(1) Shell with fine ridges and periostracal hairs to smooth without ornament, with rounded spire **3**



rounded spire



pointed spire

2(1) Shell with obvious ridges or carinations, spire tapering to sharp point at the apex—genus *Glyptophysa.*

3(2) Shell usually smooth, without ornament, sculpture of fine threads and growth lines usually with long spire, columella twisted—genus *Physastra.*

3(2) Shell usually with fine periostracal hairs in spiral rows, columella not twisted—genus *Isidorella.*

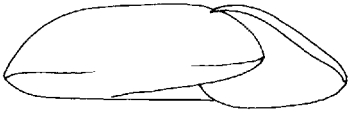
4(1) Shell minute to large, planispiral **5**

4(1) Shell medium, patelliform with spiral apex and ridges—genus *Ancylastrum*

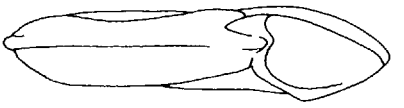
5(4) Shell small to minute, thin, fragile, often with peripheral keel **6**

5(4) Shell large, thick, heavy, without peripheral keel—genus *Planorbarius*

6(5) Shell glossy, dark horn-coloured with ventrally situated peripheral keel, narrow umbilicus, ventral surface flat—genus *Segnitila*



ventral keel



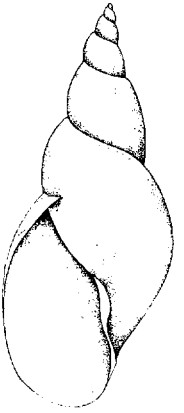
lateral keel

6(5) Shell not glossy, brown with mid-lateral keel or no keel, wide umbilicus—genus *Gyraulus*

***Physastra gibbosa* (Gould, 1847)**

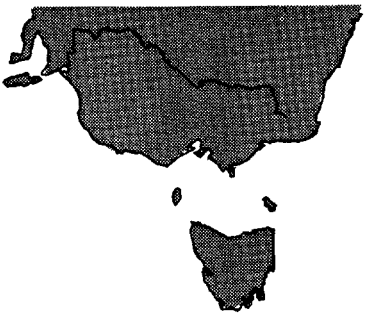
Physa gibbosa Gould, 1847. *Proc. Boston. Soc. nat. Hist.*, 2: 214

Shell medium to large, 5-6 whorls, usually with high spire, pointed apex and impressed sutures, aperture oval with columella twisted or folded. Colour light brown sometimes glossy.



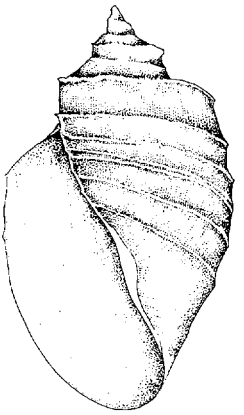
Size 7-14 mm
Range Throughout S.E. Australia
Habitat Freshwater in slow-flowing rivers, billabongs and lakes in weed and algae
Remarks There is probably more than one species of this genus in the area. Shell shape, particularly spire height and width, is very variable in this group. A useful field character is the presence of the columellar twist.

Map 25:
Distribution of Planorbidae:
Physastra gibbosa



***Glyptophysa aliciae* (Reeve, 1862)**
Physa (*Ameria*) *aliciae* Reeve, 1862. *Proc. zool. Soc. Lond.*, 1862: 106

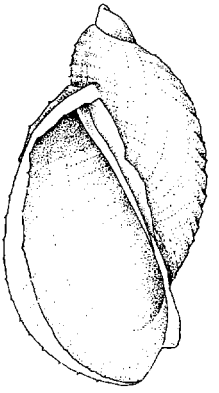
Shell small to medium, thin, 4 whorls, body whorl large, aperture long, oval, columella folded, spire short, to a sharp point. Shell carinate with angular shoulders, and a series of strong spiral ridges, no axial ribs and no periostracal fringe. Colour dark brown to pale yellow.



Size 8-15 mm
Range Northern Victoria and southern N.S.W.
Habitat Slow flowing rivers and creeks, in dead leaves and debris

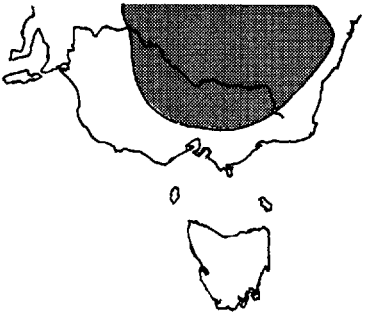
***Glyptophysa cosmeta* (Iredale, 1943)**
Glyptomoda cosmeta Iredale, 1943. *Aust. Zool.*, 10: 220

Shell small, thin, 3-4 whorls, large body whorl, aperture large, oval, columella folded, spire short, to a sharp point. Sculpture of numerous (17-18) strong spiral ridges on body whorl with fine axial ribs in the inter-spaces, rounded shoulder, wide periostracal fringe. Colour brown.



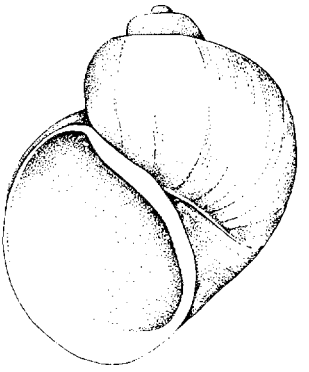
Size 6-8 mm
Range Central and northern Victoria to central N.S.W.
Habitat Backwaters or slow flowing rivers, in leaves and debris
Remarks This species was reported in aestivation to survive dry seasons by Smith & Burn (1976). Burch (pers. comm.) indicates that this species should probably be referred to the genus *Camptoceras*.

Map 26:
Distribution of Planorbidae:
Glyptophysa aliciae
Glyptophysa cosmeta



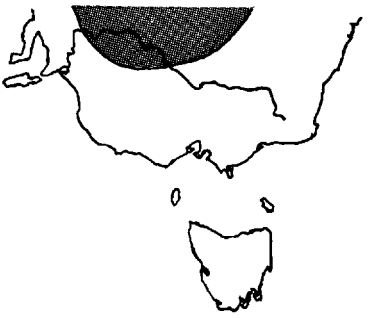
***Isidorella newcombi* (Adams & Angas, 1864)**
Physa newcombi Adams & Angas, 1864. *Proc. zool. Soc. Lond.*, 1863: 416

Shell medium, thin, 4 whorls, almost globose, with broad body whorl, large oval aperture, very short impressed spire, open umbilicus. Sculpture of fine striae and spiral rows of fine periostracal hairs. Colour dark to mid brown periostracum, sometimes to olive-green by algal deposits, shell light horn.



Size 12-20 mm
Range Northern Victoria to central South Australia and N.S.W.
Habitat Billabongs and creeks of little flow and ponds and dams, in mud, often subject to dry periods
Remarks This species was originally described from Central Australia and appears to be able to survive dry periods buried in mud

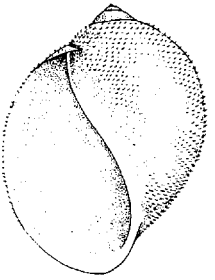
Map 27:
Distribution of Planorbidae:
Isidorella newcombi



***Isidorella hainesii* (Tryon, 1866)**
Physa (Isidora) hainesii Tryon, 1866. *Am. J. Conch.*, 2: 9

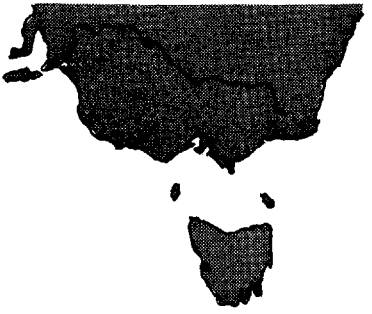
Shell small, thin, 4-5 whorls, large rounded body whorl, ovate aperture, high spire rising to a sharp apex, rounded shoulders. Sculpture of fine spiral striae and fine axial lines forming a lattice,

with spiral rows of fine periostracal hairs, in some specimens enlarged to form a series of fine periostracal fringes, in others reduced to single short hairs or almost absent. Colour light horn to dark brown, sometimes with dark apex.



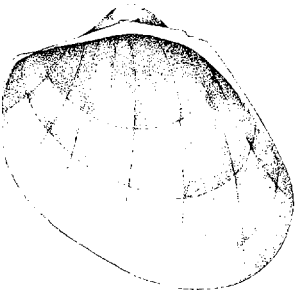
Size 10-16 mm
Range Throughout S.E. Australia
Habitat Freshwater rivers, creeks, billabongs, lakes and dams, in weed or bottom debris
Remarks A very variable species which has carried a large number of names. There is probably more than one species represented by this generalised description but the true status of this group will have to await a comprehensive revision. A useful field character to separate this species from *Physastra gibbosa* is the presence of a columellar twist in *Physastra.*

Map 28:
Distribution of Planorbidae:
Isidorella hainesii



***Ancylastrum cumingianus* (Bourguignat, 1854)**
Ancylus cumingianus Bourguignat, 1854. *Proc. zool. Soc. Lond.*, 1853: 91

Shell medium, patelliform, asymmetrical with coiled spire over the right posterior quarter, apex of one whorl of vestigal spire projecting over right margin. Sculpture of spire is fine spiral striae, on main part of shell, few (7-10) strong longitudinal angular ribs. Colour pale yellow.

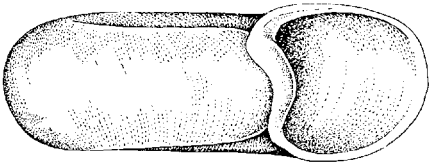


Size 8-12 mm
Range Lakes of mountain region of central Tasmania
Habitat Under stones in cold mountain lakes
Remarks This was originally thought to belong to the family of freshwater limpets, Ancylidae. It was recognised as an unusual member of the family Planorbidae by Hubendick (1964) on anatomical grounds. Only one specimen is known to have been collected since 1960. This was a specimen taken from Great Lake by V. Spencer 1978 (W. Fulton—pers. comm.). The populations are thought to have been severely affected by the introduction of trout.

Map 29:
Distribution of Planorbidae:
Ancylastrum cumingianus

***Planorbarius corneus* (Linnaeus, 1758).** (Introduced)
Helix cornea Linnaeus, 1758. *Syst. Nat.*, 10: 770

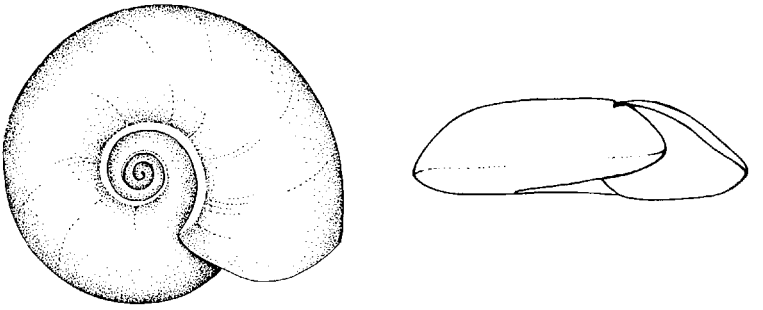
Shell large, discoidal, 4-5 whorls, thick, heavy with sunken spire, rounded periphery and lunate aperture with thickened lip. Sculpture of fine radial striae. Colour dark brown with white lip.



Size 15-25 mm
Range Ponds in Melbourne area and irrigation channel in north-western Victoria
Habitat Freshwater, in weeds
Remarks An introduced species from Europe, imported for aquaria, has been collected in ponds in the Melbourne area and in an irrigation channel in north-western Victoria (Smith, 1969a). Presumably liberated from aquaria.

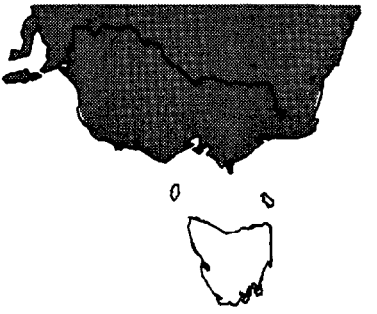
***Segnitila victoriae* (Smith, 1882)**
Segmentina victoriae Smith, 1882. *J. Linn. Soc. Zool.*, 16: 296

Shell planispiral small, thin, 4-5 whorls, smooth, glossy,with tight coiling overlapping sutures, sunken spire, periphery keeled, sharply angular with keel on ventral margin of whorl, ventral side of shell flat, dorsal side of whorl convex. Shell smooth except for fine growth lines. Colour dark brown, transparent.



Size 2-4 mm
Range Throughout Victoria and southern South Australia and N.S.W.
Habitat Slow flowing streams and ponds, billabongs and dams in muddy freshwater on water weed particularly duck-weed

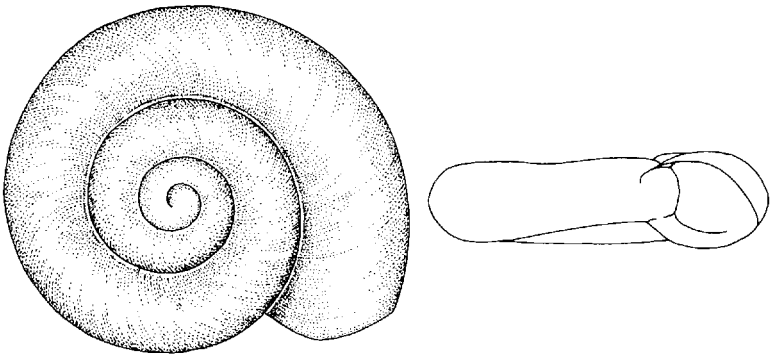
Map 30:
Distribution of Planorbidae:
Segnitila victoriae



Three species of the genus *Gyraulus* are recognised here. They are tentatively related to this genus following some general discussions with Dr Claus Meier-Brook. When a comprehensive revision is carried out on this group they may not follow this generic placement and there will probably be more than three species finally recognised. These three species approximately follow the three genera erected by Iredale (1943). These were:
Pygmanisus—smallest, with rounded mouth, no keel
Plananisus—middle size, with rounded oblique mouth but with a keel structure
Glyptanisus—largest, with angled mouth and strongly keeled periphery

***Gyraulus scottianus* (Johnston, 1879)**
Planorbis scottiana Johnston, 1879. *Pap. Proc. R. Soc. Tasm.*, 1878: 26

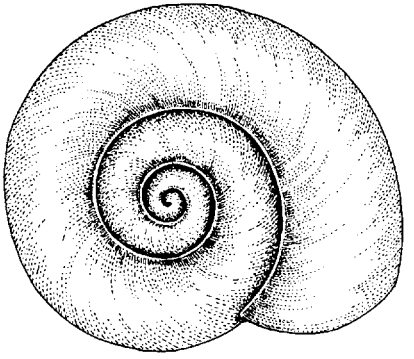
Shell planspiral, small to minute, 4 whorls, thin and fragile with sunken spire, peripheral coiling, roundly lunate aperture, no keel and rounded whorls, impressed sutures. Sculpture of fine transverse striae. Colour dark brown to light horn.

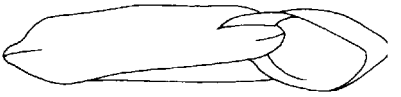


Size 1.5-2.5 mm
Range Tasmania generally and Great Dividing Range of central and eastern Victoria and southern N.S.W.
Habitat Under stones, in crevices and on weed in backwaters of flowing rivers and creeks
Remarks This was placed in *Pygmanisus* by Iredale (1943)

***Gyraulus tasmanicus* (Tenison-Woods, 1876)**
Planorbis tasmanicus Tenison-Woods, 1876. *Pap. Proc. R. Soc. Tasm.*, 1875: 79

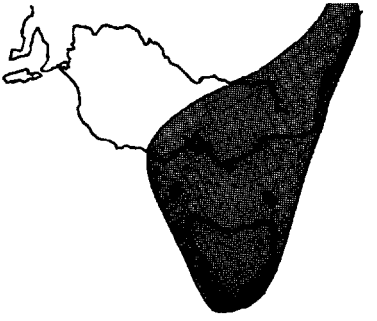
Shell planispiral, small, thin, 4-5 whorls, sunken spire, aperture depressed, periphery with keel, rounded, not sharply keeled, keel between mid-lateral and ventral, dorsal and ventral sides of whorls, roundly convex, sutures impressed. Sculpture of axial striae. Colour light brown.





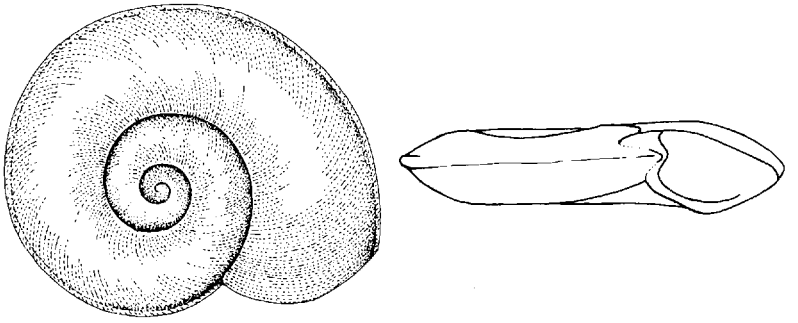
Size 2-4 mm
Range Tasmania and central and eastern Victoria and southern N.S.W.
Habitat In backwaters of rivers, billabongs, creeks and ponds, on weed and stones
Remarks This was placed in *Plananisus* by Iredale (1943)

Map 31:
Distribution of Planorbidae:
Gyraulus scottianus
Gyraulus tasmanicus



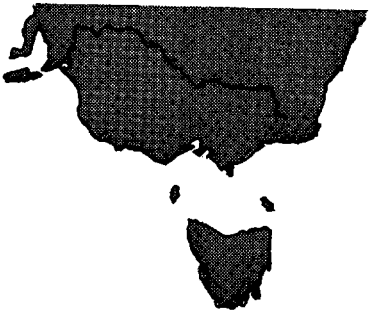
***Gyraulus meridionalis* (Brazier, 1875)**
Planorbis meridionalis Brazier, 1875. Proc. Linn. Soc. N.S.W., 1: 20

Shell planispiral, small to medium, 4 whorls, thin, fragile, sunken spire, peripherally coiled with oblique, elongate angular aperture, strong mid-lateral, peripheral keel, upper and lower surfaces of whorls rounded, convex. Sculpture of fine transverse striae. Colour brown to pale horn.



Size 4-6 mm
Range Throughout S.E. Australia
Habitat In backwaters of rivers, billabongs, creeks and ponds, on weed
Remarks This was placed in *Glyptanisus* by Iredale (1943)

Map 32:
Distribution of Planorbidae:
Gyraulus meridionalis



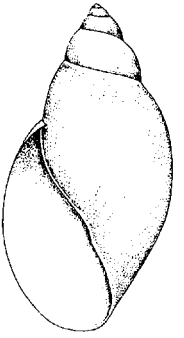
Physidae

This is a family of freshwater snails native to the Holarctic and Neotropical regions of Europe and North America about which there has been a great deal of confusion over the years. In Britain and Europe all sinistral, helicoid, aquatic snails were placed in the genus *Physa* and the family Planorbidae consisted solely of planispiral shells. It was therefore natural for all such snails brought back from Australia by the early explorers for description by British and European workers to be placed into the genus *Physa*. It was subsequently shown that all of the Australian species belonged to the Planorbidae and were related to the genera *Isidorella* or *Physastra*.

Recently, however, it has been shown (Hubendick, 1955a; A. Thatcher, 1972—pers. comm.; Meier-Brook, 1977—pers. comm.; J. B. Burch, 1978—pers. comm.) that some specimens of true *Physa* do occur in Australia. Field observers should therefore be aware of the possibility of any sinistral aquatic snail belonging to the family Physidae. For separation from Planorbidae see page 75.

***Physa acuta* Draparnaud, 1805.** (Introduced)
Physa acuta Draparnaud, 1805. *Hist. Nat. Moll. terr. fluv. France*: 55

Shell medium to small, 4 whorls, sinistral, with fairly high spire, aperture ovate-lunate, shell smooth. Colour light brown.



Size 12-15 mm.
Range Recorded from near Adelaide, central Victoria and N.S.W.
Habitat Freshwater ponds, on weed
Remarks We consider the physid found in S.E. Australia to be introduced, probably from western Europe and tentatively refer it to this species. Hubendick (1955a) recorded *Physa concinna* from Western Australia. We consider that insufficient evidence was produced to associate the *Physa* species from south-western Australia with the species name *concinna* Adams & Angas 1864 which was described from Arnhem Land, northern Australia. This latter species we tentatively refer to the genus *Physastra.*

Map 33:
Distribution of Physidae:
Physa acuta

Onchidiidae

This is really a marine family which is found in the littoral zone and immediately above the tidal zone in sheltered situations. It is included because occasionally specimens can be found in non-marine situations, under shelter just above high-tide level. The Onchidiidae is a family of air-breathing slugs with no mantle cavity, a leathery dorsal surface and a single pair of tentacles. They are Indo-Pacific tropical or subtropical species, with a few being found in the temperate zones. They live right around the coasts of Australia. An early revision of the Australian species is

given by Bretnall (1919) and a good description of the Victorian species by Macpherson & Gabriel (1962). The species listed below follow Bretnall (1919).

***Onchidium verruculatum* Cuvier, 1830**
Onchidium verruculatum Cuvier, 1830. *Le Regne Animal*, 2nd ed., 3: 46

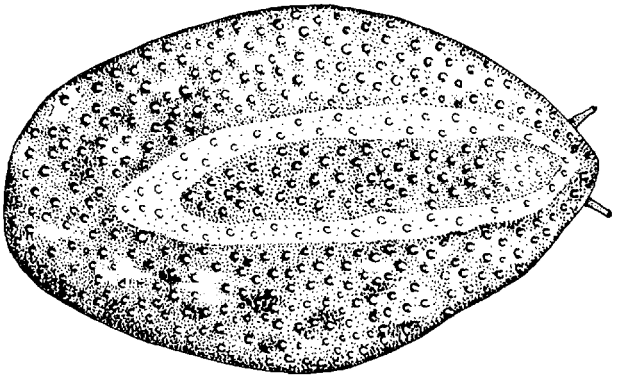
Animal large, oval, flattened with large head and long cylindrical tentacles, foot large. Mantle covered by simple and compound tubercles, a few tubercles bearing groups of dorsal eyes. Colour olive with brown flecks, head dark.
Size 30-35 mm
Range Central coast of N.S.W.
Habitat Intertidal on mud in upper littoral zone in sheltered areas

***Onchidium damelii* Semper, 1882**
Onchidium damelii Semper, 1882. *Reis. im. Arch. Phil.*, 3, *Landmoll.*, 6: 270

Animal oval, strongly arched, head large, tentacles short and conical, foot large. Mantle finely granular with small scattered papillae, especially around mantle periphery, many papillae bear dorsal eyes. Colour olive to dark green with irregular dark blotches, head yellowish.
Size 20-25 mm
Range Central coast of N.S.W.
Habitat Intertidal on mud in upper littoral zone in sheltered areas

***Oncis chameleon* (Brazier, 1886)**
Onchidium chameleon Brazier, 1886. *Proc. Linn. Soc. N.S.W.*, 10: 729

Animal elongately oval, flattened, foot and head small, tentacles short, conical and ringed. Mantle regularly finely granular with no dorsal eyes. Colour olive with two prominent yellow longitudinal bands, sometimes forming V-shape or oval, head yellowish.

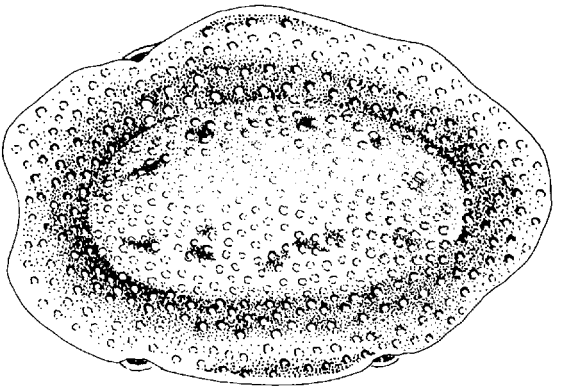


Size 35-45 mm
Range Sydney area and central coast of N.S.W.
Habitat Upper littoral zone on mud in sheltered areas

Map 34:
Distribution of Onchidiidae:
Onchidium verruculatum
Onchidium damelii
Oncis chameleon

***Onchidina australis* Semper, 1882**
Onchidina australis Semper, 1882. *Reis. im. Arch. Phil.*, 3, *Landmoll.*, 6: 287

Animal oval, elongate, strongly arched with head small, tentacles short, anterior margins of foot expanded. Mantle finely granular with irregularly placed papillae. Colour olive with dark green blotches, papillae whitish, head grey.

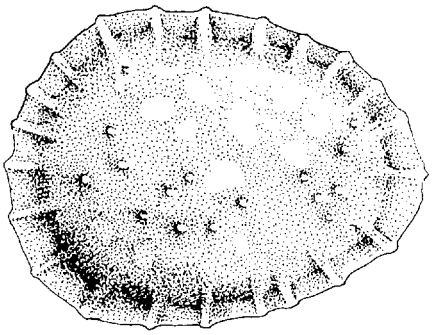


Size 25-35 mm
Range Coast of N.S.W. and eastern Victoria
Habitat Supra littoral fringe under logs or on mud in sheltered areas
Remarks This species was recorded from a non-marine habitat by Macpherson (1947)

Map 35:
Distribution of Onchidiidae:
Onchidina australis

***Onchidella patelloides* (Quoy & Gaimard, 1832)**
Onchidium patelloides Quoy & Gaimard, 1832. *Voy. Astrolabe Zool.*, 2: 212

Animal oval, elevated, with mantle border notched, head small, tentacles short and conical. Mantle finely granular with a few to many large papillae, prominent marginal glands. Colour yellowish-brown to dark green often with radiating black streaks, head black.



Size 20-30 mm
Range Coasts of S.E. Australia
Habitat On rocks or tree trunks in upper to mid-littoral zone, may be associated with *Galeolaria* on rock platforms

Map 36:
Distribution of Onchidiidae:
Onchidella patelloides

Succineidae

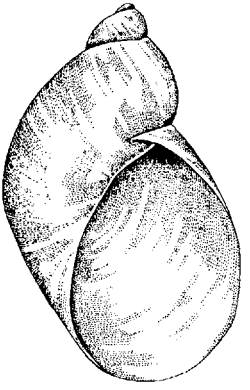
This is a worldwide family, sometimes called 'amber snails', because of the delicate light yellow to horn-coloured shells. The family is characterised by the greatly enlarged body whorl and the low spire. Found mainly in damp, even semi-aquatic, situations,

they are sometimes confused with the dextral freshwater snails, the Lymnaeidae, as the shells bear a strong superficial resemblance. However, the animals show several basic differences which enable these groups to be distinguished. The lymnaeid snail has a large fleshy head with wide, triangular, non-retractile tentacles with the eyes situated at their bases. The succineid snail, on the other hand, has a small head with cylindrical, retractile tentacles with the eyes situated at their tips.

In Australia members of this family are found in widely differing habitats throughout the country. No detailed taxonomic study has been carried out on this family and it may be that many undescribed species exist. However, as specimens collected from the many habitats bear a close resemblance to one another, it may take quite sophisticated research techniques to elucidate this problem. The higher organisation of the family was described by Patterson (1971).

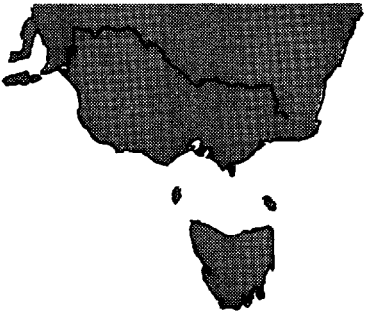
***Succinea (Austrosuccinea) australis* (Ferussac, 1821)**
Helix australis Ferussac, 1821. *Tabl. Syst. Anim. moll.*, 2: 31

Shell 4 whorls, small, thin, delicate, spire short, body whorl inflated, aperture wide. Fine growth lines on shell. Colour light yellow, horn to dark green, sometimes with pigment blotches on animal visible through shell. Animal grey-green, sometimes with white or yellow reticulations on body and mantle



Size 6-15 mm
Range Throughout S.E. Australia
Habitat Damp situations (see remarks)
Remarks There may be more than one species represented under this name as specimens have been found on the land edge of tidal saltmarsh, in wet patches in semi-desert country and in damp situations near mountain tops.

Map 37:
Distribution of Succineidae:
Succinea (Austrosuccinea) australis



Note A small species of succineid was described as living under bark of gum trees near Adelaide. This is called *Succinea (Arborcinea) arborea.* It was described as shorter and with a more swollen body whorl. We consider this could be a juvenile of *australis* but include it here to alert collectors to the possibility of finding succineids on trees.

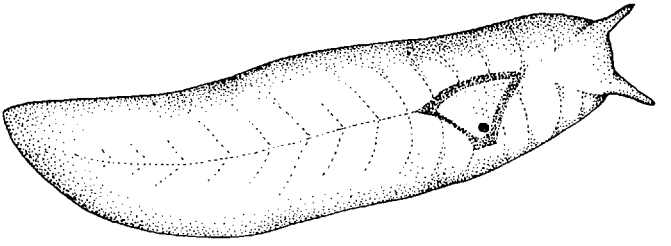
Athoracophoridae

This is a family of slugs found only in eastern Australia, New Zealand and the islands of the south-west Pacific. The family is described as tracheopulmonate and shows two unique characteristics amongst land molluscs. One is the possession of trachea-like diverticulae arising from the small pulmonary cavity or lung which appears to have a respiratory function. The other is the possession of a single pair of eye-bearing tentacles, which are

retracted and not inverted as in most land molluscs (Burch, 1968). Besides the single pair of tentacles the Athoracophoridae is characterised by the small triangular mantle area with the pneumopore placed almost mid-dorsally (see Arionidae, page 193). In Australia the family extends from central New South Wales up the east coast to north Queensland in forest areas. The animals feed mainly on fungi.

***Triboniophorus graeffei* Humbert, 1863.**
Triboniophorus graeffei Humbert, 1863. *Mem. Soc. Phys. Hist. nat. Geneve*, 17(1): 116

Large flattened slug with single pair of thin, retractile tentacles, mantle a small triangle in the mid-dorsal region with pneumopore at apex of the triangle. Body divided by a series of segment creases. No obvious caudal gland. Colour apple green to light olive green, rarely pink, with foot margin and mantle triangle edge bright red.



Size 100-140 mm
Range Occurs naturally in Blue Mountains, central N.S.W. (see remarks below)
Habitat In ferns and under foliage and bark in wet forest, occasionally on trees on wet evenings, also dry sclerophyll woodland

Remarks Several live specimens recorded in Melbourne on ferns transported from northern New South Wales

Map 38:
Distribution of Athoracophoridae:
Triboniophorus graeffei

Separation of the families Pupillidae and Achatinellidae
From the family key:

20(19) Shell dextral or sinistral, pupilliform to fusiform, found in areas beyond tidal influence—**Family Pupillidae** or **Family Achatinellidae**

20a Shell small (less than 5 mm), dextral, fusiform with single, long parietal lamella—**Family Achatinellidae**

Achatinellidae Pupillidae

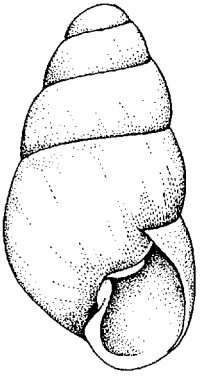
20b Shell sinistral or dextral, small to medium, pupilliform with either many apertural teeth or single parietal knob—**Family Pupillidae** (page 102).

Achatinellidae

This family of snails with small conical shells is restricted to the islands of the Pacific Ocean and some of the continents bordering it. The main distribution is the island groups of the central east Pacific with only a small number of genera being widespread. The family was comprehensively revised by Cooke and Kondo (1960), who suggest that the few species known from Australia were probably carried here by human agency (but probably not European man). The shells of the family show characteristic aperture armature to restrict the aperture opening as a defence mechanism.

***Tornatellinops jacksonensis* (Cox, 1864)**
Bulimus jacksonensis Cox, 1864. *Cat. Aust. Land Shells*: 25

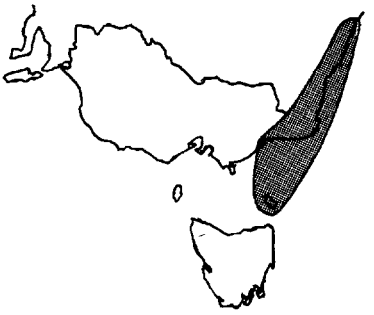
Shell small, 5 whorls, conical, very thin with high spire and blunt apex. Sculpture of few faint longitudinal striae. Aperture ovate with twisted columella and thin central parietal lamella. Colour light yellow to horn.



Size 2 mm
Range Sydney, Wollongong area of N.S.W., eastern Victoria and eastern Bass Strait islands.
Habitats In litter under low vegetation in woodland scrub

Remarks This is a rare species, having been recorded from only a few localities. It is not known whether this is true rarity or a collection artifact because of its small size.

Map 39:
Distribution of Achatinellidae:
Tornatellinops jacksonensis



Separation of the families Ferussaciidae and Cionellidae
From the family key:

23(22) Shell fusiform, dark brown, smooth, horny—**Family Cionellidae** or **Family Ferussaciidae**.

Both these families are introduced and represented by a single species and have been recorded only a few times. It is simpler to differentiate between them at specific rather than family level.

Family Cionellidae
Cionella lubrica—small (less than 6 mm), 5-6 whorls, outer lip with thickened callus, columella straight

Family Ferussaciidae
Ferussacia folliculus—larger (6-10 mm), 4 whorls, outer lip thin, columella with well defined basal fold

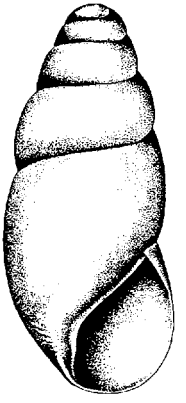
Cionellidae

This is a small family of elongate glossy snails native to northern Europe and North America. One species has been recorded as an

introduction in several temperate parts of the world and was recently recorded from southern Western Australia by Kendrick & Sedgwick (1973). The few records from Australia are all from gardens in very damp situations under plant cover. We have followed Burch (1976) after Pilsbry (1948) for the family and generic name.

***Cionella lubrica* (Muller, 1774).** (Introduced)
Helix lubricus Muller, 1774. *Verm. terr.*, 2: 104

Shell small, 5-6 whorls, oblong elongate with high, rounded spire, thin smooth glossy, with convex whorls, small ovate aperture with thickened callus on outer lip and straight columella. Colour dark brown.



Size 4-6 mm
Range Central Victoria
Habitat Damp situations under plant cover in well established gardens

Pupillidae

This large family of small, usually pupa-shaped land snails has a worldwide distribution. The family is characterised by its shell

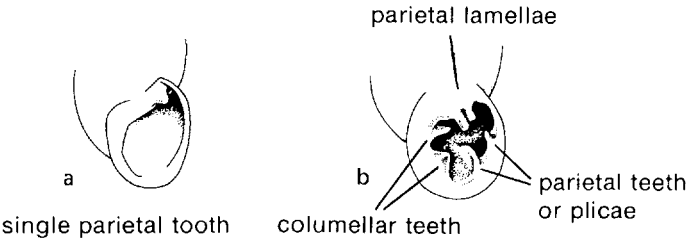


Fig. 14. Diagrams of pupillid apertures showing (a) single parietal knob, (b) complex apertural teeth consisting of palatal folds and parietal and columellar lamellae

shape, and by the possession of one, several, or many apertural teeth or barriers. Classification of the major groupings within the family is largely in terms of these apertural teeth (Fig. 14).

In Australia the family is a major component of the land snail fauna being found mainly in drier areas, either in desert and semi-desert to mallee scrub areas to exposed coastal heath environments. The classification used here follows Pilsbry as set out by Burch (1976). Iredale, in several publications, erected five families and many species to contain the Australian pupillids due to the diversity of the forms found. Of interest is this group's apparent facility to have sinistral and dextral morphs of a species in the same population. Some generic groups appear to possess equal numbers of sinistral and dextral species. For separation from Achatinellidae see page 100.

Key to the genera of the Pupillidae

1	Single apertural tooth—a parietal or angular lamella or callus	**2**
1	Many apertural teeth present	**3**
2(1)	Shell sinistral cylindrical—genus *Pupilla*	
2(1)	Shell dextral or sinistral, elongate-conic—genus *Pupoides*	
3(1)	Shell small (2-4 mm length), elongate-cylindrical with four or more pronounced apertural teeth—genus *Gastrocopta*	
3(1)	Shell minute (less than 2 mm length), cylindrical with strong parietal lamella and several aperture folds or thickenings—genus *Cylindrovertilla*	

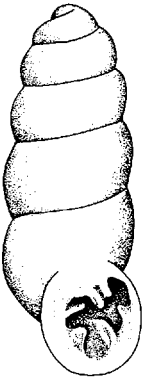
Each of the main groups of pupillids has a variety of species names in literature, based on minute differences in shell morphology coupled with a different geographical region. They are listed here as species complexes under the various genera and subgenera to highlight the need for a basic revision of the group. Some names are obvious synonyms and have been omitted, others that have been included may subsequently also be shown to be synonyms. In each case the earliest species name is used as the example, other names given only in brief.

Gastrocopta (Australbinula) complex

Small, elongate-cylindrical, sinistral or dextral shells with many, pronounced apertural teeth.
Size 2-3 mm
Range Northern part of S.E. Australian region—not Tasmania

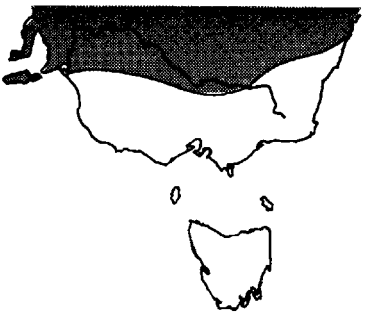
***Gastrocopta (Australbinula) margaretae* (Cox, 1868)**
Pupa margaretae Cox, 1868. *Mon. Aust. Land Shells*: 80

Shell small, 5 whorls, dextral, elongate-cylindrical with squarely-oval aperture with thickened callused reflected lip and five pronounced apertural teeth. Apertural teeth—large bifid parietal lamella, two columellar teeth and two palatal teeth. Sculpture of fine longitudinal striae. Colour yellowish-brown.

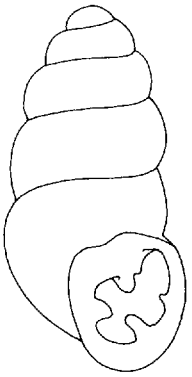


Size 2-3 mm
Range Central eastern South Australia
Habitat Under rocks, in crevices, in dry semi-desert areas

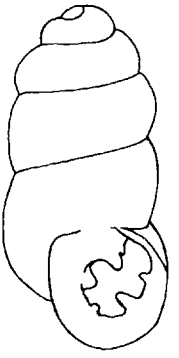
Map 40:
Distribution of Pupillidae:
Gastrocopta (Australbinula)
complex



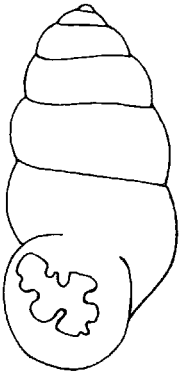
Other members of the complex:
Gastrocopta (Australbinula) rossiteri (Brazier, 1875)
Type locality—Picton, N.S.W.



G.(A) rossiteri



G.(A) bannertonensis



G.(A) strangeana

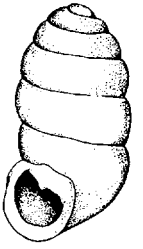
Gastrocopta (Australbinula) bannertonensis (Gabriel, 1930)
Type locality—Bannerton, Victoria
Gastrocopta (Australbinula) strangeana (Iredale, 1937).
Type locality—Garden Island, Port Jackson, N.S.W.

Pupilla complex

Small, sinistral, cylindrical, with single parietal lamella or callus.
Size 4-5 mm
Range Throughout S.E. Australia

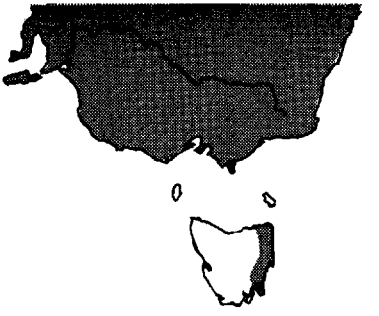
***Pupilla australis* (Angas, 1864)**
Vertigo australis Angas, 1864. *Proc. zool. Soc. Lond.*, 1863: 522

Shell small, sinistral, 5-7 whorls, cylindrical with roundly lunate aperture, with thickened reflected lip and a parietal lamella or callus. Sculpture of oblique striae. Colour pale brown.

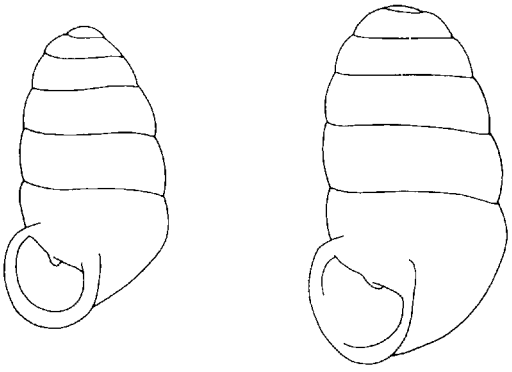


Size 4-5 mm
Range Central and southern South Australia and western Victoria
Habitat Under rocks, in crevices in dry habitats, either along the coast or in semi-desert, mallee areas

Map 41:
Distribution of Pupillidae:
Pupilla complex



Other members of the complex
Pupilla nelsoni (Cox, 1864)
Type locality—Nelsons Bay, Sydney, N.S.W.



P. nelsoni *P. tasmanica*

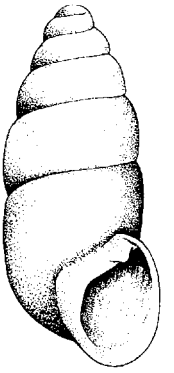
Pupilla tasmanica (Johnston, 1883)
Type locality—Eastern Tasmania

***Pupoides* complex**

Small to medium, dextral or sinistral, elongate-conic with elongate body whorl, ovate aperture and single angular lamella or callus.
Size 5-8 mm
Range Central eastern South Australia, north-west Victoria and south-west N.S.W.

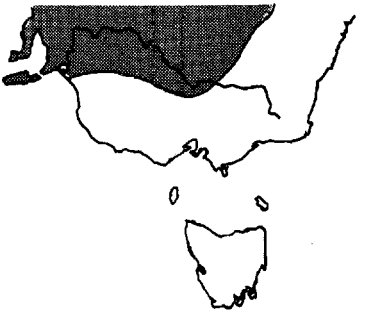
***Pupoides adelaidae* (Angas, 1864)**
Bulimus (Chondrula) adelaidae Angas, 1864. *Proc. zool. Soc. Lond.*, 1863: 522

Shell small to medium, 6 whorls, dextral, elongate-conic, convex, solid, with rounded apex, aperture oval with thickened reflected lip and single angular lamella or callus, columella margin callused. Sculpture of fine longitudinal striae. Colour pale brown to white.

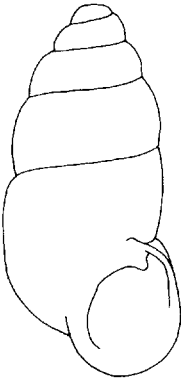


Size 5-8 mm
Range Central eastern South Australia into western Victoria
Habitat Under rocks, in crevices, particularly limestone habitat in dry semi-desert areas

Map 42:
Distribution of Pupillidae:
Pupoides complex



Other members of the complex:
Pupoides beltiana (Tate, 1894)
Type locality—Central Australia
Pupoides ischna (Tate, 1894)
Type locality—Central Australia



P. beltiana

P. ischna

***Cylindrovertilla kingi* (Cox, 1864)**
Pupa kingi Cox, 1864. *Cat. Aust. Land Shells*: 28

Shell small, 4 whorls, sinistral, thin, fragile, cylindrical with rounded spire. Aperture large, square with large parietal lamella, thickened calluses on outer and inner lips, deep set palatal plica and twisted lip. Sculpture of fine oblique striae. Colour chestnut-horn.

Size 1-2 mm
Range Central eastern N.S.W.
Habitat Under rocks and ground vegetation in woodland scrub

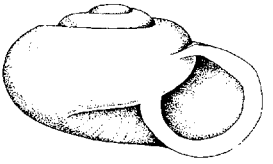
Map 43:
Distribution of Pupillidae:
Cylindrovertilla kingi

Valloniidae

This family of small land snails with fragile, often depressed shells is native to Eurasia and North America, but several species are noted world travellers. Being so small and feeding on decaying vegetable matter, the species are not considered pests. They are usually confined to old gardens, long established with exotic plants. In Australia they are confined to the south-eastern region where a single species is known. It is easily separable from the small native forms, when adult, by the well developed reflected apertural lip.

***Vallonia pulchella* (Muller 1774).** (Introduced)
Helix pulchella Muller, 1774, *Verm. terr.*, 2: 30

Shell small, thin, fragile, 3-4 whorls, depressed with narrow umbilicus, large rounded body whorl, aperture round to lunate with well developed reflected lip. Shell smooth or with fine radial striae. Colour creamy-white, semi-transparent.



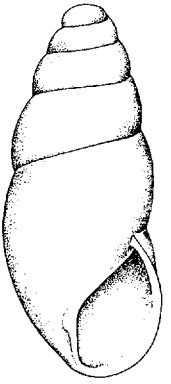
Size 2-3 mm
Range Known from isolated localities throughout S.E. Australia
Habitat Under ground cover plants in established gardens
Remarks A second species, *V. costata* (Muller, 1774), was recorded from N.S.W. and Tasmania (Cotton, 1954) but this is not now thought to be the case

Ferussaciidae

This is a small family of elongate glossy snails native to Europe and Asia. A species of this family was recorded from South Australia by Cotton (1954), and though the species appears to be established in some suburban gardens in Adelaide it has not been found anywhere else in Australia. Further information concerning this introduction was given by Venmans (1957). For separation from Cionellidae see page

***Ferussacia folliculus* (Gmelin, 1790)**
Helix folliculus Gmelin, 1790. in *Linn. Syst. Nat.* 13: 3654.

Shell small, 4 whorls, glossy, elongate with very large body whorl, impressed sutures, rounded apex, small ovate lunate aperture with thin lip and well developed basal fold on columella. Colour dark brown.



Size 6-10 mm
Range Suburbs of Adelaide
Habitat Damp situations under plant cover or debris in suburban gardens

Separation of the families Zonitidae and Rhytididae
From the family key:

28(27) Shell and protoconch smooth, the only lines being growth lines—**Family Rhytididae** (part) or **Family Zonitidae** (part).

This key item, coming from 'shell small to minute . . . less than 8 mm diameter', leads to two species of rhytidid and four species of zonitid. These are most easily separated by a combination of shell morphology and habitat.

Family Zonitidae
Oxychilus alliarius—shell dark horn, 5-8 mm diameter, wide umbilicus, animal black; gardens and open scrub
Vitrea crystalina and *Vitrea contracta*—shell white or colourless, 2-3 mm diameter, narrow umbilicus; gardens
Zonitoides arboreus—shell olive-buff, 5-6 mm diameter, wide umbilicus; gardens, New South Wales

Family Rhytididae
Tasmadelos nelsonensis—shell horn coloured, 2-3 mm diameter, wide umbilicus; forest litter
Prolesophanta dyeri—shell light horn to colourless, 2-3 mm diameter, no umbilicus; rain forest litter

Rhytididae

This large family of carnivorous land snails is found in New Zealand, Australia, islands of the western Pacific, Indonesia, the Seychelles and South Africa. The animal has no jaw and possesses long curved radula teeth, a specialisation for the carnivorous habit. In Australia the family is confined to the eastern and south-eastern regions except for two species in the south-west of Western Australia. The greatest radiation of species occurs in the south-eastern faunal region where many endemic species and genera are found.

The Australian species of the family are currently being revised by one of us (BJS). The generic placement and the valid species recognised here must be considered as tentative only, awaiting the completion of work on the group. A general review of the family was published by Smith (1971) including a description of feeding. Most species appear to be active predators feeding on earthworms, other molluscs and insect larvae.

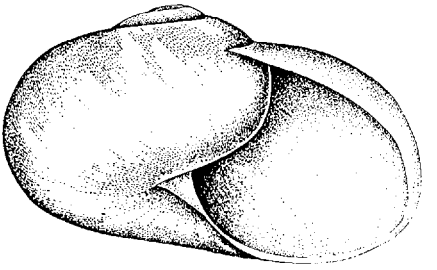
Key to the genera of Rhytididae

1	Shell medium to large, diameter greater than 6 mm	**2**
1	Shell small to minute, diameter less than 6 mm	**5**
2(1)	Shell large, globose or subglobose, black to dark brown with little calcareous material in the shell—genus *Victaphanta*	
2(1)	Shell medium to large, subglobose to flattened, dark honey to pale yellow with some calcareous material in the shell	**3**
3(2)	Shell with flattened spire, light to dark yellow, with sculpture of coarse, deep, irregular, radial ribs—genus *Tasmaphena*	
3(2)	Shell subglobose to flattened, light to dark yellow, with sculpture of fine, regular, radial ribs	**4**
4(3)	Shell flattened, light yellow, N.S.W., Victoria, Great Divide to the Grampians—genus *Rhytida*	
4(3)	Shell subglobose, dark yellow, South Australia and south-western Victoria to Otway Ranges—genus *Strangesta*	

5(1) Shell small, without umbilicus—genus *Prolesophanta*
5(1) Shell small, with wide umbilicus—genus *Tasmadelos*

***Victaphanta atramentaria* (Shuttleworth, 1853)**
Nanina atramentaria Shuttleworth, 1853. *Mittheil. Natwf. Gesell. Bern.*, 1852: 194

Shell large, 4-5 whorls, depressedly globose, thin, glossy with little or no calcareous material, composed largely of conchin, narrow umbilicus and wide body whorl. Sculpture of few, fine, concentric lines on upper surface, lower surface smooth. Aperture ovate-lunate. Colour of shell black grading through yellow to almost white at protoconch. Animal black with orange frill around foot and orange viscous mucus.

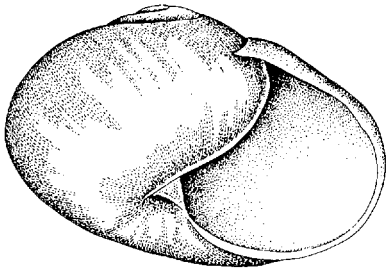


Size 30-34 mm
Range Great Dividing Range in central Victoria
Habitat Deep litter in temperate rain forest
Remarks Descriptions of the two Victorian species of this genus were given by Smith (1969b, 1970)

***Victaphanta compacta* (Cox & Hedley, 1912)**
Paryphanta compacta Cox & Hedley, 1912. *Mem. natn. Mus. Melb.*, 4: 8

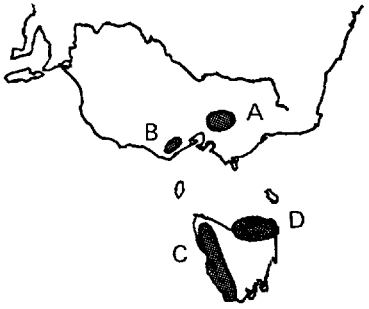
Shell large, 4-5 whorls, globose, thin glossy with little or no calcareous material, composed largely of conchin, umbilicus almost closed. Sculpture of few concentric lines on upper surface only. Aperture ovate-lunate. Colour dark brown to almost black

grading to yellow on protoconch. Animal black with no orange pigment on body or in mucus.



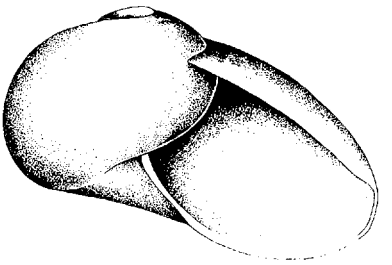
Size 20-25 mm
Range Otway Ranges, Victoria
Habitat Deep litter in temperate rain forest
Remarks Details of distribution are given in Smith (1977)

Map 44:
Distribution of Rhytididae
A. *Victaphanta atramentaria*
B. *Victaphanta compacta*
C. *Victaphanta milligani*
D. *Victaphanta lampra*



***Victaphanta milligani* (Pfeiffer, 1853)**
Vitrina milligani Pfeiffer, 1853. *Mon. Helic. Vivert.*, 3: 4

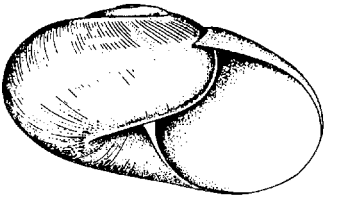
Shell large, 4 whorls, depressedly globose, thin, glossy, composed mainly of conchin, spire nearly flat, suture deeply impressed, last whorl wide, aperture large, ovate-lunate, umbilicus closed. Sculpture of few fine concentric lines on upper surface. Colour dark brown grading to white at protoconch. Animal black with orange foot and mantle edge.



Size 18-24 mm
Range Western half of Tasmania
Habitat Litter in wet sclerophyll and temperate rain forest
Remarks This species was redescribed by Smith and Kershaw (1972).

***Victaphanta lampra* (Reeve, 1854)**
Helix lampra Reeve, 1854. *Conch. Icon.*, 7, sp. 1295

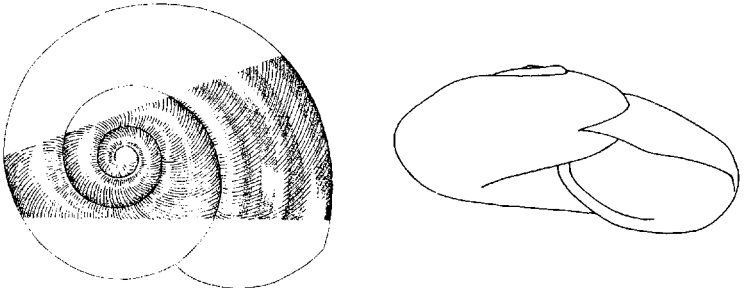
Shell medium, 4-5 whorls, globose, thin, glossy, composed largely of conchin with some calcareous material, sutures deeply impressed, umbilicus narrow, aperture large ovate-lunate. Sculpture of few fine radial lines on upper surface. Colour dark brown to dark greeny-brown grading to yellow at protoconch. Animal black with orange foot frill and orange mucus.



Size 18-22 mm
Range North-eastern Tasmania
Habitat Deep litter in wet sclerophyll and temperate rain forest
Remarks This species has not been referred to this genus before as some dead shells appear to have significant calcareous elements and a dark yellow colour

***Tasmaphena sinclairi* (Pfeiffer, 1845)**
Helix sinclairi Pfeiffer, 1845. *Z. malakozool.*, 2: 154

Shell medium, 4 whorls, flattened, calcareous with thin conchin periostracum, low spire, wide aperture and wide umbilicus. Sculpture of pronounced coarse irregular, radial smooth riblets, deep on upper surface, less pronounced on under surface, only smooth round umbilicus. Upper edge of aperture often indented. Colour dark to light yellow with several dark brown concentric bands on upper surface.

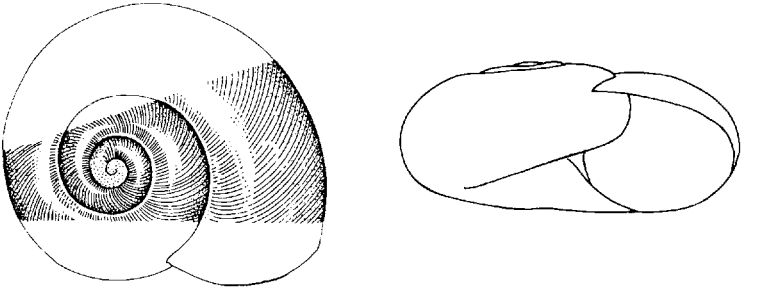


Size 12-16 mm
Range Throughout Tasmania
Habitat Damp situation in forest and woodland scrub

Map 45:
Distribution of Rhytididae:
A. *Tasmaphena sinclairi*
B. *Tasmaphena helmsiana*

***Tasmaphena ruga* (Legrand, 1871)**
Helix (Videna) ruga Legrand, 1871. *Coll. Mon. Tasm. Land Shells*, no. 24

Shell small, 4 whorls, flattened with slightly raised spire, large body whorl, rounded periphery, umbilicus wide. Sculpture of pronounced coarse, irregular, radial smooth riblets on upper and lower surfaces. Colour dark yellow.



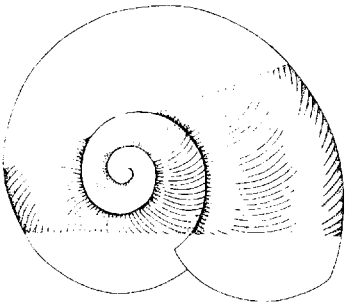
Size 6-10 mm
Range Throughout Tasmania and southern Victoria
Habitat Damp situations in forest and woodland scrub
Remarks This species has not been referred to this genus before

Map 46:
Distribution of Rhytididae:
Tasmaphena ruga

***Tasmaphena helmsiana* (Iredale, 1938)**
Saladelos helmsiana Iredale, 1938. *Aust. Zool.*, 11: 117

Shell small, thin, 4 whorls, flat with large body whorl and narrow umbilicus. Sculpture of coarse radial riblets on upper surface,

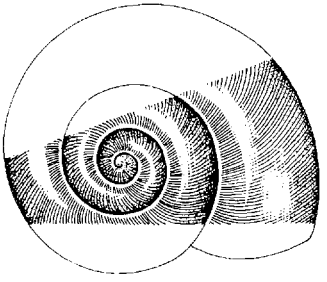
lower surface smooth. Colour light yellow to pale honey.

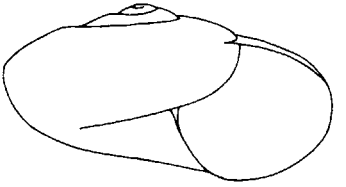


Size 5-6 mm
Range Great Dividing Range of southern N.S.W.
Habitat In litter in forest areas
Remarks This species has not been referred to this genus before

***Tasmaphena lamproides* (Cox, 1868)**
Helix lamproides Cox, 1868. *Proc. zool. Soc. Lond.*, 1867: 722

Shell medium, 4 whorls, low spire, periphery bluntly angular, narrow umbilicus, aperture large, ovate-lunate with angular margin. Sculpture of coarse irregular radial ribs on upper surface, almost smooth below. Colour dark reddish-honey to dark yellow.



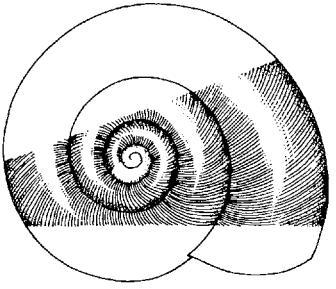


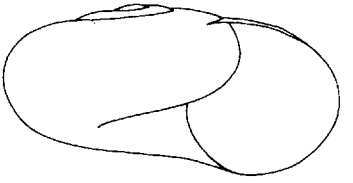
Size 12-15 mm
Range North-west Tasmania and possibly southern Victoria
Habitat Damp situation in litter in forest and woodland scrub
Remarks This species has not been referred to this genus before

Map 47:
Distribution of Rhytididae:
Tasmaphena lamproides

***Rhytida capillacea* (Ferussac, 1832)**
Helix (Helicella) capillacea Ferussac, 1832. *Hist. nat. moll. terr. fluv.*, 27: 82

Shell medium, thin, 4-5 whorls, flattened with slightly elevated spire, convex, rounded with fairly wide umbilicus, aperture ovate-lunate. Sculpture of fine regular radial striae above, smooth below. Colour light yellow, glossy.

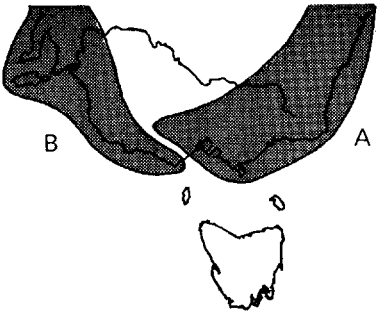




Size 12-18 mm
Range Eastern N.S.W. through eastern and central Victoria
Habitat Damp situations in forest and woodland scrub, sometimes in gardens in Sydney

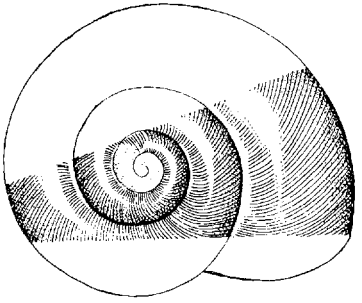
Remarks This is a New Zealand genus and the placement of this species here is tentative, awaiting the completion of a revision of the family

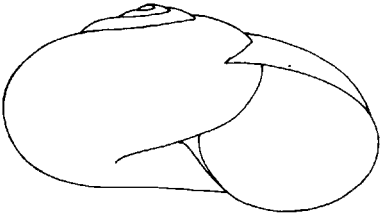
Map 48:
Distribution of Rhytididae:
A. *Rhytida capillacea*
B. *Strangesta gawleri*



***Strangesta gawleri* (Brazier, 1872)**
Helix (Zonites) gawleri Brazier, 1872. *Proc. zool. Soc. Lond.*, 1872: 618

Shell medium, 4-5 whorls, thin, depressed spire, impressed sutures, deep, wide ovate-lunate aperture, narrow umbilicus. Sculpture of fine to medium regular radial ribs on upper surface, faint ribs to striae on lower surface, shiny. Colour dark honey to reddish-brown.

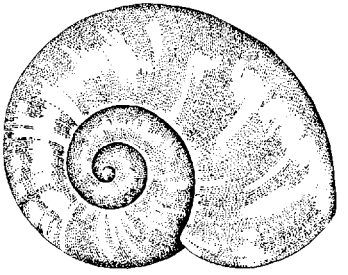


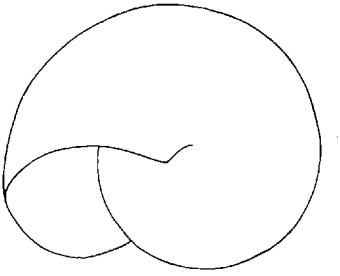


Size 14-18 mm
Range South-eastern South Australia into south-western Victoria
Habitat Under ground cover, dry forest to woodland scrub and coastal heath

***Prolesophanta dyeri* (Petterd, 1879)**
Helix dyeri Petterd, 1879. *Mon. Land Shells Tasm.*: 40

Shell small, 3 whorls, thin, fragile, glossy, large body whorl, depressed spire, no umbilicus. Sculpture of fine growth lines or smooth. Colour very pale horn to colourless transparent, with rays of dark red to chestnut brown.





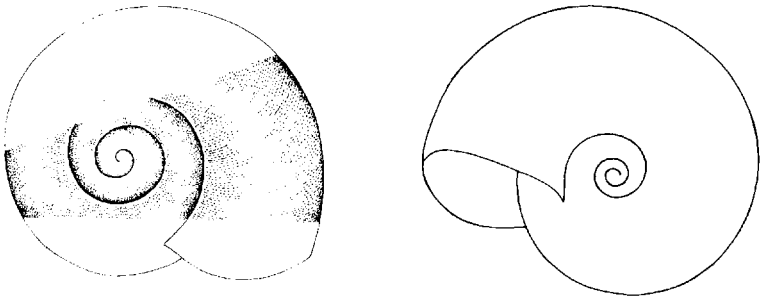
Size 3-4 mm
Range Northern Tasmania and southern Victoria
Habitat Leaf litter in damp situations in rain forest and wet sclerophyll forest

Map 49:
Distribution of Rhytididae:
Prolesophanta dyeri

***Tasmadelos nelsonensis* (Brazier, 1871)**
Helix (Hyalina) nelsonensis Brazier, 1871. *Proc. zool. Soc. Lond.*, 1870: 661

Shell small, 4 whorls, thin, fragile, almost transparent, depressed spire, with wide umbilicus. Shell smooth or with fine growth lines.

Colour pale horn to colourless.



Size 2-4 mm
Range Throughout Tasmania
Habitat Leaf litter in wet sclerophyll forests
Remarks This has been recorded from Victoria but more material is required to confirm this

Map 50:
Distribution of Rhytididae:
Tasmadelos nelsonensis

Separation of the families Orthalicidae and Caryodidae
From the family key:

24(22) Shell medium to large, thin to thick with colour pattern, truly terrestrial in habit, animal with prominent head region when crawling—**Family Caryodidae** (part) or **Family Orthalicidae**

This key entry leads to either two species in the family Caryodidae or two species in the family Orthalicidae. These can easily be differentiated with reference to a combination of gross shell form and the locality.

Family Caryodidae
Caryodes dufresnii—shell medium to large, rounded spire, black to dark brown—Tasmania
Pygmipanda atomata—shell large, elevated spire, red-brown—eastern Great Divide

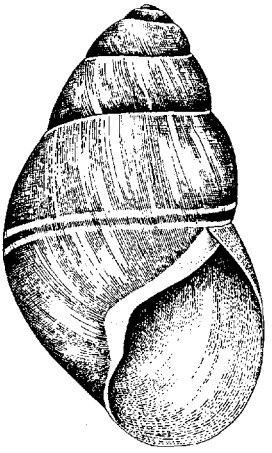
Family Orthalicidae (page 128)
Bothriembryon tasmanica—shell medium, short pointed spire, yellow with light brown flecks—eastern Tasmania
Bothriembryon mastersi—shell medium, short rounded spire, light fawn with white and brown flecks—central southern South Australia

Caryodidae

This family is endemic to eastern Australia and consists of a series of medium to large land snails found mainly in forest litter. This group of snails is treated as a subfamily of the family Acavidae so widespread in Asia and South America, by many workers (Zilch, 1959; Burch, 1976) but is here treated as a separate family. The family consists of a small number of large, distinct genera and species, each occupying a circumscribed area with little overlap. These groups were so distinct to Iredale (1937c) that he divided them into four families.

***Caryodes dufresnii* (Leach, 1815)**
Bulimus dufresnii Leach, 1815. *Zool. Misc.*, 2: 153

Shell 5 whorls, medium to large, solid, wide, rounded base, oval aperture and low rounded spire. Almost smooth with faint longitudinal striae and granulations. Colour very dark to dark brown with encircling yellow and brown bands, blue in aperture.

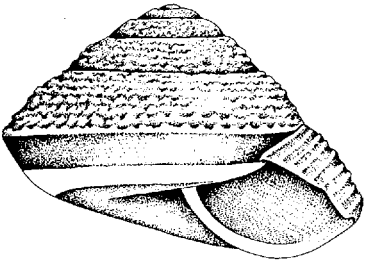


Size 30-50 mm
Range Throughout Tasmania but not Bass Strait islands
Habitat In litter and under logs in forest areas
Remarks This is a widespread snail in Tasmania being found in a wide variety of habitats from wet sclerophyll forest to open woodland. There appear to be a number of ecological variants present in various parts of the state, some of which have been given subspecific names (Kershaw & Dartnall, 1972 and 1975). Much more research is needed on this interesting Tasmanian endemic species, that work being undertaken by one of us (RCK).

Map 51:
Distribution of Caryodidae:
Caryodes dufresnii

***Anoglypta launcestonensis* (Reeve, 1853)**
Helix launcestonensis Reeve, 1853. *Conch. Icon.*, 7 pl.149, sp.968

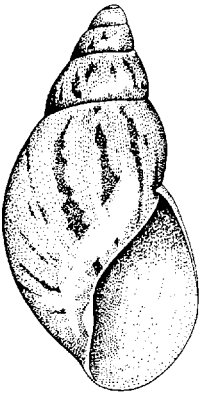
Shell large, 5 whorls, solid, with deep, fairly wide umbilicus and conical shape, spire low with series of granular ridges and spiral lines, acute peripheral keel, base convex, smooth. Aperture oblique, elliptical. Colour, upper surface yellowish-green, brown and black with narrow yellow line near periphery, base chocolate brown with broad, bright yellow band.



Size 25-35 mm
Range North-east corner of Tasmania
Habitat In deep litter in temperate rain forest
Remarks Fairly rare species with very restricted range. Only a few live taken specimens known

***Pygmipanda atomata* (Gray, 1834)**
Bulimus atomatus Gray, 1834. *Proc. zool. Soc. Lond.*, 1834: 64

Shell large, 5 whorls, thin, with fairly high spire, long rounded body whorl with narrow oval aperture. Sculpture of longitudinal striae and faint spiral lines. Colour light yellowy-brown with large dark brown to black longitudinal zigzag streaks and blotches, interior of aperture bluish.



Size 40-65 mm
Range Eastern Victoria and ranges of southern N.S.W.
Habitat In litter in dry sclerophyll forest and woodland
Remarks A case could be made for separating this species into a central N.S.W. form under this name and a smaller form in eastern Victoria under the name *P. kershawi.* A relationship appears to be evident between shell shape and locality, particularly height above sea level. Details of the reproductive anatomy of this group were published by Dartnall & Dartnall (1972).

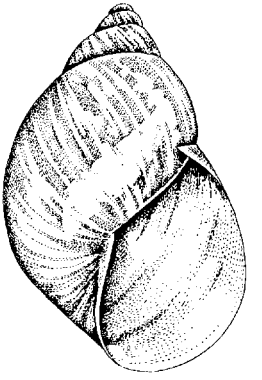
Map 52:
Distribution of Caryodidae:
A. *Anoglypta launcestonensis*
B. *Pygmipanda atomata*

Orthalicidae (Bulimulidae)

This family has its principal centre of distribution in south and central America, with some members in New Zealand, Australia and the Pacific islands. It was known for many years as the Bulimulidae and in using the name Orthalicidae we are following Burch (1976). In Australia most species of this family are found in the Leeuwinian faunal region of southern Western Australia where it forms the dominant group in the fauna. Two species of this group occur in south-eastern Australia, with one or two more in central southern Australia and up into the Centre.

***Bothriembryon tasmanicus* (Pfeiffer, 1853)**
Bulimus tasmanicus Pfeiffer, 1853. *Proc. zool. Soc. Lond.*, 1851: 260

Shell 5 whorls, thin, squat with inflated body whorl, short spire rising to sharp apex. Aperture wide, simple ovoid. Sculpture of fine growth lines. Colour pale yellow with longitudinal irregular streaks of white and darker yellow, often with thin brown periostracum.



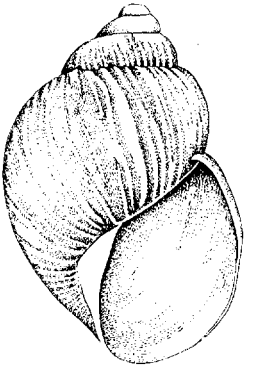
Size 25-30 mm
Range Eastern Tasmania
Habitat Usually found on the trunks of trees, often several metres off the ground, also in litter, particularly at night

Remarks Ecological information was published by Dartnall (1972). Recently (G. Davis 1978—pers. comm.) populations of large individuals have been found on outlying islands off southern Tasmania.

Map 53:
Distribution of Orthalicidae:
A. *Bothriembryon tasmanicus*
B. *Bothriembryon mastersi*

***Bothriembryon mastersi* (Cox, 1867)**
Bulimus mastersi Cox, 1867. *Proc. zool. Soc. Lond.*, 1867: 39

Shell 4 whorls, thick with inflated body whorl with rounded base, wide, oval, oblique aperture, short rounded spire and deeply impressed sutures. Sculpture of rough longitudinal ridges and spiral furrows. Colour white with yellow and brown longitudinal bands and streaks.



Size 20-25 mm
Range York Peninsula and Kangaroo Is., South Australia
Habitat Under vegetation in dry woodland

Endodont Snails

The dominant group of land snails in the South-eastern Australian faunal region is the group of small to minute snails known as endodonts. Recent work by Solem (1973) and Climo (1975) has shown that these snails formally placed in the family Endodontidae should be placed in the families Punctidae and Charopidae. Details of these families will be given below. For identification purposes they are here considered together.

The endodonts are small snails with mainly complex shell sculpture showing a wide variety of pattern, colour and shell form, resulting in a bewildering variety of names in literature. Iredale, in his papers on this group (1933, 1937a, b, c, 1941a) erected four new families, over thirty new genera and dozens of new species and sub species. This array of names, most without adequate diagnoses or differentiation from related forms, is in urgent need of revision. Until this is done, the name used here must be considered tentative. In several cases we have used a single name for what may prove to be a group of related species.

To facilitate identification, the endodonts are treated as a single group for keying purposes. To eliminate some of the complexities in these keys the initial breakdown of this large group of twenty-eight genera will be on a state basis. This is purely for convenience since it will always be known in which of the four states the specimens were collected. This is in no way meant to imply that these purely political boundaries bear any relationship to the distribution of snail species.

Numbers of genera and species of endodonts in the states of south-eastern Australia

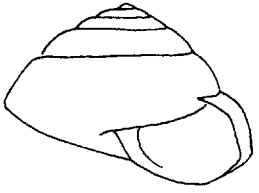
	Punctidae		**Charopidae**	
	Genera	Species	Genera	Species
Tasmania	6	7	14	24
Victoria	6	7	14	26
Southern N.S.W.	3	3	8	9
S.E. South Australia	4	4	2	2
Total for S.E. Australia	8	9	20	51

Keys are now given to the genera of endodont snails found in each of the four states in the S.E. Australian region. The families and species will be treated in a similar manner to the other families in the book. In order to identify an endodont from S.E. Australia follow the appropriate key of the state in which the specimen was collected. Then turn to the page indicated by that key and compare the descriptions and figures of the species in that genus found in the correct state with your specimen. If difficulties are encountered and your specimen 'doesn't fit' it should be referred to the authors or to one of the state museums in the area, where it may be of value in any revisionary work carried out on this complex group.

The following keys are to shells of 4 or 5 whorls or more which are not corroded or damaged. Juvenile shells will give incorrect answers.

Key to the genera of endodonts in Tasmania

1	Shell over 7 mm in diameter	**2**
1	Shell under 7 mm in diameter	**4**
2(1)	Shell flat or slightly convex	**3**



turbinate

flat

2(1) Shell turbinate to conical—genus *Mulathena* (*M. fordei*—page 190)

3(2) Shell with wide angled umbilicus and bold sharp radial ribs—genus *Thryasona* (*T. diemenensis*—page 188)

3(2) Shell with small umbilicus and fine radial ribs, variable—genus *Stenacapha* (*S. hamiltoni*—page 192)

4(1) Shell with small, minute or closed umbilicus (up to a quarter of diameter of shell) **5**

4(1) Shell with medium or wide umbilicus (more than a quarter of diameter of the shell) **13**

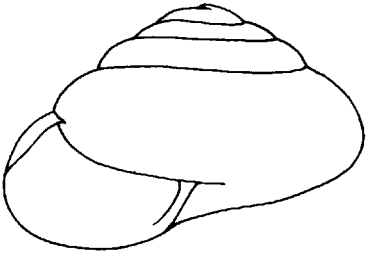
5(4) Shell low-turbinate to turbinate to conical **6**

5(4) Shell flat to slightly concave or convex **9**

6(5) Shell with microscopic to low rounded radial ribs, without spines **7**

6(5) Shell with sharp radial ribs, often with short spines—genus *Magilaoma* (*M. penolensis*—page 150)

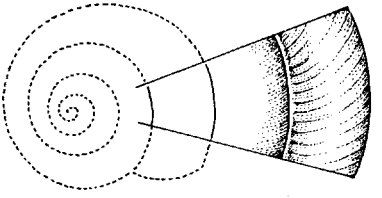
7(6) Shell dextral, with squat, rounded turbinate spire and brown in colour **8**



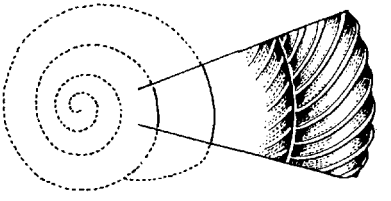
Miselaoma

7(6) Shell sinistral or dextral, with turbinate to conical spire and yellow horn in colour—genus *Miselaoma* (*M. weldii* and *M. parvissima*—page 148, 149)

8(7) Shell with low rounded radial riblets—genus *Pedicamista* (*P. coesa*—page 146)



Pedicamista



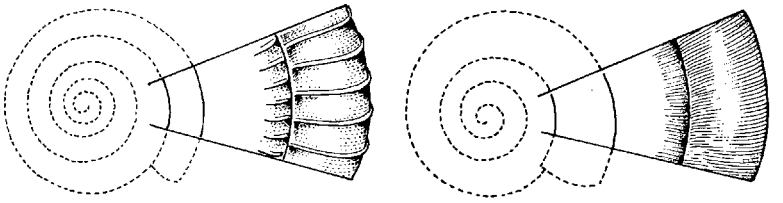
Paralaoma

8(7) Shell with bold, widely spaced oblique ribs—genus *Paralaoma* (*P. caputspinulae*—page 144)

9(5) Shell less than 4 mm in diameter **10**

9(5) Shell greater than 4 mm in diameter—genus *Elsothera* (part) (*E. limula* and *E. ricei*—page 157, 158)

10(9) Sculpture of very low radial riblets or beaded radial lirae, colour brown to bronze **12**



strong ribs low riblets

10(9) Sculpture of strong radial ribs, colour reddish-yellow to white **11**

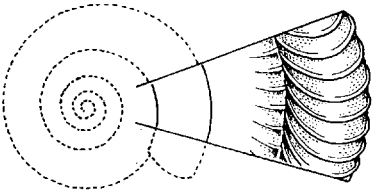
11(10) Sculpture of close strong radial ribs, colour pale yellow—genus *Oreomava* (*O. johnstoni*—page 183)

11(10) Sculpture of widely spaced radial ribs, colour reddish-yellow to white—genus *Dentherona* (part) (*D. dispar* —page 183)

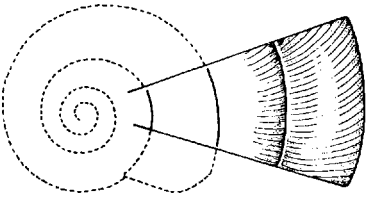
12(10) Sculpture of very low close riblets with faint spiral striae between—genus *Pasmaditta* (*P. jungermanniae*—page 146)

12(10) Sculpture of close clear rounded radial lirae, aperture with two lamellae—genus *Bischoffena* (*B. bischoffensis*—page 181)

13(4) Sculpture of bold prominent primary radial ribs, either widely spaced or close **14**



bold ribs



fine ribs

13(4) Sculpture of fine ribs, riblets, broad to narrow lirae, or smooth **18**

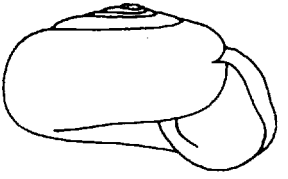
14(13) Shell less than 6 mm in diameter **15**

14(13) Shell more than 6 mm in diameter, deep body whorl and bold curved radial ribs, colour shining horn—genus *Roblinella* (part) (*R. mathinnae*—page 179)

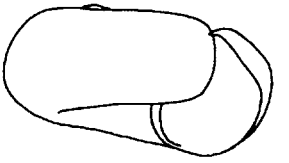
15(14) Colour of shell uniform brown, yellow or white **16**

15(14) Colour pale horn to yellow with red to chestnut rays or flames—genus *Pernagera* (part) (*P. tasmaniae* and *P. officeri*—page 166, 168)

16(15) Shell discoid with flat to concave sunken spire; in wet forest in northern and eastern Tasmania **17**



elevated spire



sunken spire

16(15) Shell with slightly elevated convex spire, in forest throughout Tasmania—genus *Dentherona* (part) (*D. subrogosa*—page 170)

17(16) Shell 4-5 mm in diameter, yellow to brown; eastern Tasmania—genus *Elsothera* (part) (*E. ricei*—page 158)

17(16) Shell 2-3 mm in diameter, yellow often with dark ribs; northern Tasmania—genus *Allocharopa* (part) (*A. kershawi*—page 164)

18(13) Shell with flat to concave sunken spire **19**

18(13) Shell with slightly elevated, convex spire to turbinate **25**

19(18) Shell of 4-5 whorls less than 4 mm in diameter **20**

19(18) Shell of 4-5 whorls more than 4 mm in diameter ... **24**

20(19) Shell unicolour, red, brown, yellow or white **21**

20(19) Shell brown to white with prominent contrasting red to brown segments, rays or blotches **23**

21(19) Shell with roundly lunate aperture, without apertural lamellae; from the mainland of Tasmania **22**

21(19) Shell with narrow semi-lunate aperture with small apertural lamellae; from the islands of the Furneaux Group, eastern Bass Strait only—genus *Letomola* (*L. barrenense*—page 187)

22(21) Sculpture of irregular, slightly spaced fine radial riblets red-brown, yellow or white; in wet sclerophyll forest, from southern Tasmania only—genus *Allocharopa* (part) (*A. legrandi*—page 163)

22(21) Sculpture of regular sharp fine radial riblets pale yellow horn; in forest throughout Tasmania—genus *Discocharopa* (part) (*D. vigens*—page 155)

23(20) Shell with roundly lunate aperture, regular radial riblets with close lirae between, reddish horn with irregular rays and blotches of white—genus *Discocharopa* (part) (*D. mimosa*—page 155)

23(20) Shell with narrow lunate aperture, fine close radial ribs with reticulate interstices, white to light brown, with red to brown rays—genus *Geminoropa* (*G. hookeriana*—page 175)

24(19) Shell light brown with dark rays, very wide umbilicus—genus *Pernagera* (part) (*P. tamarensis*—page 167)

24(19) Shell unicolour, white, cream to reddish-brown, medium umbilicus—genus *Roblinella* (part) (*R. curacoae*—page 000)

25(18) Shell unicolour, white, yellow to brown. **26**

25(18) Shell with red or chestnut rays or flames on white to light brown background **27**

26(25) Shell with medium to wide umbilicus, 2-5 mm in diameter—genus *Roblinella* (part) (*R. gadensis* or *R. agnewi*—page 177, 178)

26(25) Shell with very wide umbilicus, 1-2 mm in diameter—genus *Laomavix* (*L. collisi*—page 147)

27(25) Shell with whorls angled below suture, with fine close sharp ribs, yellow to white with broad chestnut rays; southern Tasmania—genus *Pernagera* (part) (*P. kingstonensis*—page 165)

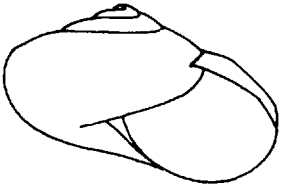
27(25) Shell with rounded whorls, with fine, spaced radial ribs, with close radial riblets and spiral striae, light brown with red segments (dorsal surface only); scattered localities—rare—genus *Planilaoma* (*P. luckmanii*—page 154)

Key to the genera of endodonts in Victoria

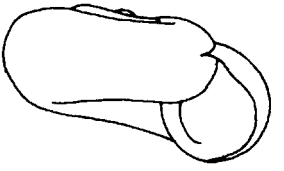
1 Shell over 6 mm in diameter **2**

1 Shell under 6 mm in diameter **6**

2(1) Shell with minute or closed umbilicus, turbinate spire **3**



turbinate



flat

2(1) Shell with small, medium to wide umbilicus, flat to slightly convex spire **4**

3(2) Shell horny brown with no flames; from southern central Victoria—genus *Mulathena* (*M. fordei*—page 190)

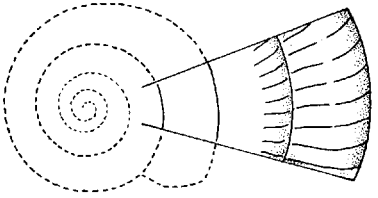
3(2) Shell pale horn with brown flames; from eastern Victoria—genus *Flammulops* (*F. excelsior*—page 191)

4(2) Shell unicolour or with few faint streaks, buff to

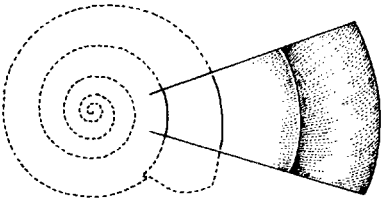
blackish-grey without rays **5**

4(2) Shell light brown with dark rays, spaced, curved radial ribs, interstices of dense radial lirae—genus *Pernagera* (part) (*P. tamarensis*—page 167)

5(4) Shell with bold close radial ribs to riblets, brown to blackish-grey—genus *Elsothera* (part) (*E. murrayana* and *E. funerea*—page 159, 160)



Thryasona



Elsothera

5(4) Shell with low widely spaced ribs, sometimes fading to smooth on body whorl, ochraceous-buff occasionally with faint brown radial streaks—genus *Thryasona* (*T. elenescens*—page 189)

6(1) Shell with closed, minute to small umbilicus (less than a quarter of the shell diameter) **7**

6(1) Shell with medium to wide umbilicus (a quarter or more of the shell diameter) **16**

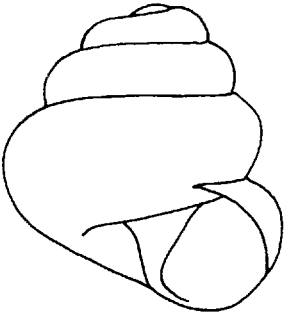
7(6) Shell with markedly elevated spire, turbinate **8**

7(6) Shell with concave, flat, slightly elevated or convex spire **10**

8(7) Shell of 4-7 whorls 1-2 mm in diameter, with high spire and subkeeled periphery **9**

8(7) Shell of 5 whorls 3-4 mm in diameter with peripheral keel and peripheral spines (easily lost)—genus *Magilaoma* (*M. penolensis*—page 000)

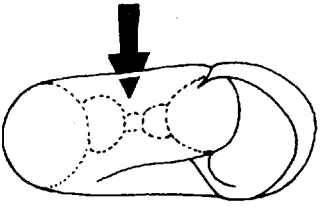
9(8) Shell dextral or sinistral, pale yellow horn; southern central Victoria—genus *Miselaoma* (*M. weldii* and *M. parvissima*—page 148, 149)



Turbolaoma

9(8) Shell dextral, chocolate brown; Bairnsdale area only—genus *Turbolaoma* (*T. turbinuloidea*—page 152)

10(7) Shell with concave, sunken spire **11**



sunken spire

10(7) Shell with convex to flat spire **12**

11(10) Shell 3-4 mm in diameter, deep body whorl, white; Great Divide of far eastern Victoria—genus *Pillomena* (part) (*P. nivea*—page 185)

11(10) Shell 1-2 mm in diameter, cream with pale streaks; Otway Ranges—genus *Geminoropa* (*G. scindocataracta*—page 176)

12(10) Shell of 4-5 whorls, 2-3 mm in diameter **13**

12(10) Shell of 4-5 whorls, 4-6 mm in diameter **14**

13(12) Shell with sculpture of bold curved radial ribs, interstices of spiral striae—genus *Cralopa* (*C. colliveri*—page 173)

13(12) Shell with fine close to spaced clear radial ribs, interstices of radial lirae or reticulate—genus *Oreomava* (*O. otwayensis* and *O. cannfluviatilus*—page 183)

14(12) Shell red-brown to grey **15**

14(12) Shell white—genus *Pillomena* (part) (*P. meraca*—page 184)

15(14) Shell grey with dark brown to black rays; wet forest of eastern Victoria—genus *Elsothera* (part) (*E. sericatula*—page 157)

15(14) Shell red-brown; dry scrub area of western Victoria—genus *Excellaoma* (*E. retipora*—page 000)

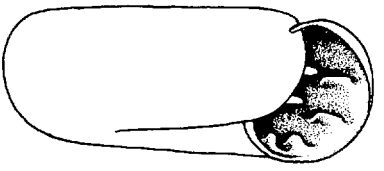
16(6) Shell of two distinct colours, white to light brown with rays or bands or zigzags of contrasting colour, red, chestnut or dark brown **17**

16(6) Shell unicolour, white, horn to brown or black, without prominent rays of contrasting colour **19**

17(16) Shell discoid with concave, sunken spire, sculpture of fine radial ribs **18**

17(16) Shell with flat to slightly elevated, convex spire, sculpture of from close to spaced ribs—genus *Pernagera* (*P. tamarensis, P. officeri* and *P. gatliffi*—page 167, 168, 169)

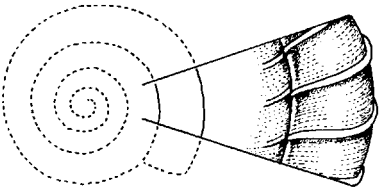
18(17) Shell bearing apertural lamellae; from wet sclerophyll forest of central southern Victoria—genus *Rhophodon* (*R. problematica*—page 175)



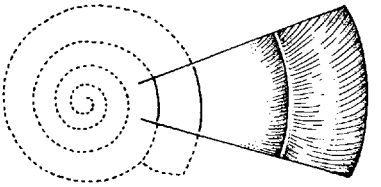
apertural lamellae

18(17) Shell without apertural lamellae; from alpine woodland of eastern Victoria—genus *Allocharopa* (part) (*A. okeana*—page 161)

19(16) Shell with bold prominent primary ribs, either wide spaced or close **20**



bold ribs



fine ribs

19(16) Shell with fine primary ribs, not prominent or bold **23**

20(19) Shell with flat spire, convex or concave, not markedly elevated **21**

20(19) Shell turbinate with markedly elevated spire—genus *Paralaoma* (*P. caputspinulae*—page 000)

21(20) Shell more than 2 mm diameter, with wide spaced to close bold ribs and no apertural lamellae **22**

21(20) Shell less than 2 mm diameter with few widely spaced very bold ribs, interstices of radial riblets and spiral striae, aperture bearing parietal and basal lamellae—genus *Egilodonta* (*E. bairnsdalensis*—page 174)

22(21) Shell flat to slightly convex, medium umbilicus, confined to wet sclerophyll forest of south Gippsland area of eastern Victoria—genus *Allocharopa* (part) (*A. tarravillensis*—page 162)

22(21) Shell discoid, spire concave sunken, medium to wide umbilicus, dry to moist woodland of eastern Victoria—genus *Dentherona* (*D. illustra, D. jemmysensis* and *D. saturni*—page 171, 172, 173)

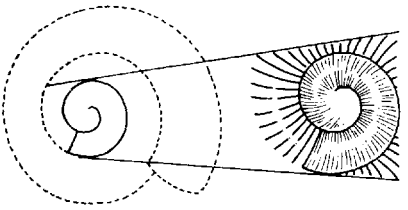
23(19) Shell with flat to concave sunken spire, white to cream; found in wet sclerophyll forest areas **24**

23(19) Shell with elevated convex spire, pale horn in colour; found in dry forest and woodland scrub—genus *Laomavix* (*L. collisi*—page 000)

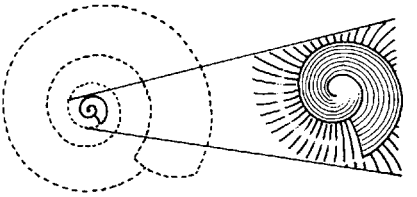
24(23) Shell white; found in forests of the Great Dividing Range of eastern Victoria **25**

24(23) Shell cream, glossy; found in forest of the Otway Ranges of south-western Victoria only—genus *Allocharopa* (part) (*A. erskinensis*—page 163)

25(24) Shell of 4 whorls, 1-1.5 mm in diameter, protoconch of fine radial lines to smooth—genus *Discocharopa* (*D. inexpectata*—page 000)



radial protonconch

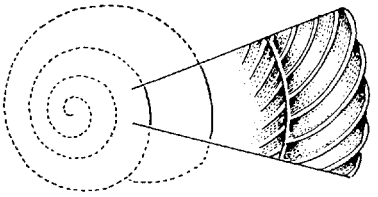


spiral protoconch

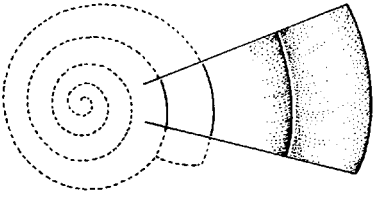
25(24) Shell of 4 whorls, 2-4 mm in diameter, protoconch of obvious spiral grooves—genus *Pillomena* (part) (*P. dandenongensis* and *P. marysvillensis*—page 185, 186)

Keys to the genera of endodonts in south-eastern South Australia

1 Shell less than 3 mm in diameter **2**
1 Shell greater than 3 mm in diameter **4**
2(1) Shell pale yellow to brown in colour **3**
2(1) Shell cream in colour—genus *Roblinella* (*R. speranda*—page 181)
3(2) Shell with very wide umbilicus and low radial riblets—genus *Laomavix* (*L. collisi*—page 147)



Paralaoma



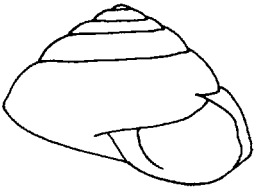
Laomavix

3(2) Shell with medium umbilicus and bold wide radial ribs—genus *Paralaoma* (*P. caputspinulae*—page 000)

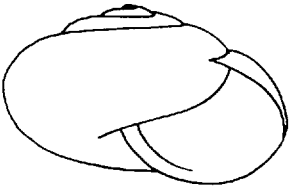
4(1) Shell with small, minute to closed umbilicus **5**

4(1) Shell with medium umbilicus—genus *Elsothera* (*E. murrayana*—page 159)

5(4) Shell turbinate to conical with sharp radial ribs often with small spines—genus *Magilaoma* (*M. penolensis*—page 150)



Magilaoma



Excellaoma

5(4) Shell with flat to slightly convex spire with close bold radial ribs—genus *Excellaoma* (*E. retipora*—page 150)

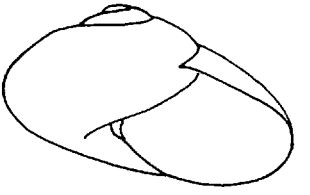
Key to the genera of endodonts in southern New South Wales

1 Shell with closed to minute umbilicus **2**

1 Shell with small to wide umbilicus **3**

2(1) Shell flat, black to grey, 5-7 mm—genus *Elsothera* (part) (*E. sericatula*—page 157)

Elsothera



Flammulops

2(1) Shell turbinate, pale horn with brown flames, 8-10 mm—genus *Flammulops* (*F. excelsior*—page 000)

3(1) Shell with small umbilicus (less than a quarter of the shell diameter) **4**

3(1) Shell with medium to wide umbilicus (greater than a quarter or more of the shell diameter) **5**

4(3) Shell turbinate to conic, colour horn to brown to green—genus *Magilaoma* (*M. penolensis*—page 150)

4(3) Shell flat to subglobose, colour white—genus *Pillomena* (*P. nivea*—page 000)

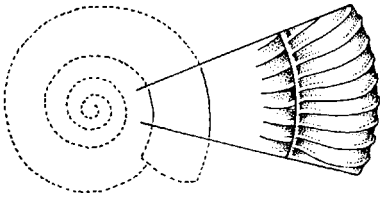
5(3) Shell less than 5 mm in diameter **6**

5(3) Shell 5 mm or more in diameter **10**

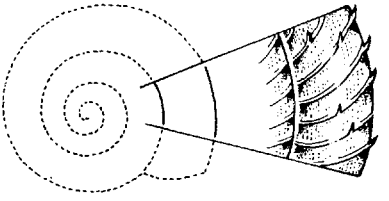
6(5) Shell flat, discoid often with sunken spire **7**

6(5) Shell low turbinate with slightly raised spire **11**

7(6) Shell with fine, close to widely spaced low ribs or riblets, wide umbilicus, colour horn, reddish-brown to ash grey with dark lines **8**



Dentherona



Setomedea

7(6) Shell with bold fine, medium spaced ribs, medium umbilicus, colour reddish-brown to white—genus *Dentherona* (*D. saturni*—page 173)

8(7) Shell with fine close riblets to lirae with no slender points on the riblets **9**

8(7) Shell with series of slender points on widely spaced radial ribs, interstices of clear spiral lirae, colour light brown—genus *Setomedea* (*S. aculeata*—page 000)

9(8) Shell 2 mm in diameter, colour pale horn to reddish—genus *Roblinella* (*R. belli*—page 180)

9(8) Shell 3-4 mm in diameter, colour ash grey with occasional dark lines or streaks—genus *Allocharopa* (*A. brazieri*—page 161)

10(5) Shell with very wide umbilicus, close, slightly curved radial ribs, colour light brown with dark rays—genus *Pernagera* (*P. tamarensis*—page 167)

10(5) Shell with medium umbilicus, bold close radial ribs, colour blackish to grey—genus *Elsothera* (*E. funerea*—page 000)

11(6) Shell with very wide umbilicus and low radial riblets—genus *Laomavix* (*L. collisi*—page 147)

11(6) Shell with medium umbilicus and bold wide radial ribs—genus *Paraloama* (*P. caputspinulae*—page 000)

Punctidae

This is a family of small to minute land snails with a worldwide distribution. The species typically have a shell with a glassy to somewhat frosted, translucent appearance, usually with spiral sculpture on the protoconch or one where it appears smooth. Colour patterns are uncommon and the shell may bear irregular ribs and show peripheral keeling.

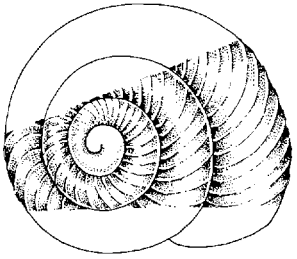
The family is found throughout Australia, though it appears to have its major centre of radiation in the south-eastern region. The species are usually found in fairly dry conditions in the micro-shelter habitats in litter and under stones, logs or other ground cover.

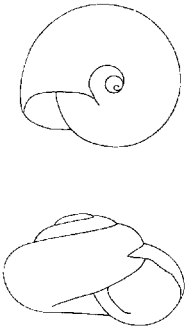
The species placed in this family in Australia are largely those put in the family Laomidae by Iredale (1937a). Recent work by Solem (1973) has placed this group in the family Punctidae. There are many species names available in literature, the status of which will have to await a comprehensive revision. This group is being revised by F. Climo.

***Paralaoma caputspinulae* (Reeve, 1854)**
Helix caputspinulae Reeve, 1854. *Conch. Icon.*, 7, *Helix*, sp.818

Shell small, 4-5 whorls, turbinate with low, rounded spire, medium

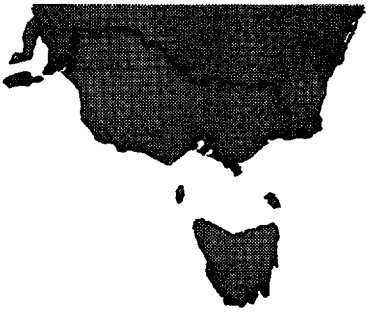
umbilicus and roundly lunate slightly depressed aperture. Sculpture of bold, widely spaced, oblique ribs with interstices of radial lirae and spiral striae or granulations. Protoconch of faint spiral lines to smooth. Colour pale yellow to brown.





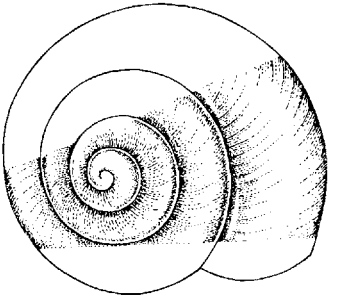
Size 1.5-2.5 mm
Range Throughout S.E. Australia
Habitat Under bark litter or rocks in dry woodland or scrub areas. A common habitat is the litter at the base of large river red gums, *Eucalyptus camaldulensis* (F.W. & J. Aslin, pers. comm.).
Remarks This species is commonly referred to in literature as *Paralaoma morti* (Cox, 1864). However, this was shown to be a synonym of this species by Climo (1975). The status of the genus *Paralaoma* is under review by Climo. There is a wide variability in shell form and sculpture with other species probably present.

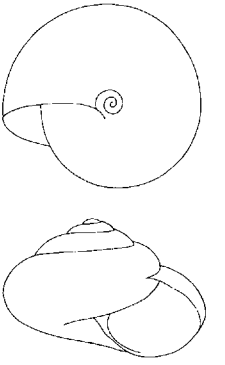
Map 54:
Distribution of Punctidae:
Paralaoma caputspinulae



***Pedicamista coesa* (Legrand, 1871)**
Helix (Charopa) coesus Legrand, 1871. *Coll. Mon. Tasm. Land Shells*, 1st. ed. sp. 21: 3

Shell small, 5 whorls, turbinate with low convex spire, small umbilicus, depressed ovate lunate aperture. Sculpture of low rounded radial riblets crossed by spiral lirae. Protoconch smooth. Colour light reddish-brown to yellow.





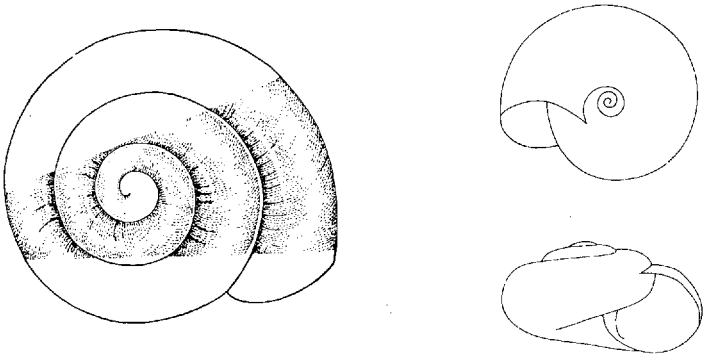
Size 3-5 mm
Range Widespread in coastal regions of Tasmania
Habitat In litter amongst rocks, mainly in coastal regions

Map 55:
Distribution of Punctidae:
Pedicamista coesa

***Pasmaditta jungermanniae* (Petterd, 1879)**
Helix jungermanniae Petterd, 1879. *Mon. Land Shells Tasm.*: 17

Shell small, 4-5 whorls, discoid with rounded body whorl, flattened spire, narrow umbilicus, depressed roundly lunate aperture.

Sculpture of fine close riblets with faint spiral striae between. Protoconch of weak spiral striae or smooth. Colour bronze.

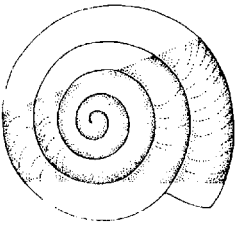


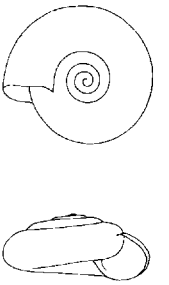
Size 3 mm
Range Around Launceston area, northern Tasmania
Habitat Under moss on rocks on the banks of streams

Map 56:
Distribution of Punctidae:
Pasmaditta jungermanniae

***Laomavix collisi* (Brazier, 1877)**
Helix (Pitys) collisi Brazier, 1877. *Pap. Proc. R. Soc. Tasm.*, 1876: 168

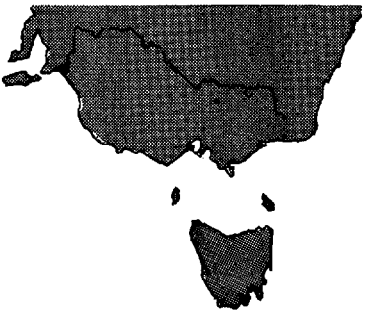
Shell small, 4-5 whorls, with almost flat, convex spire, whorls slightly depressed, very wide umbilicus, aperture roundly lunate. Sculpture of close, broad, irregular radial lirae. Protoconch smooth. Colour pale horn.





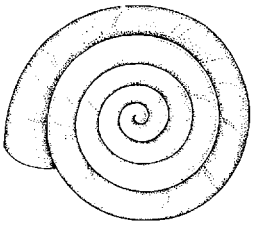
Size 1.5-2 mm
Range Throughout S.E. Australia
Habitat In litter and on low vegetation in forest or open woodland scrub
Remarks This may represent a complex of forms. Variation in spire height is a common feature in some areas.

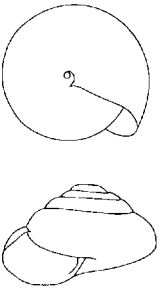
Map 57:
Distribution of Punctidae:
Laomavix collisi



***Miselaoma weldii* (Tenison-Woods, 1877)**
Helix weldii Tenison-Woods, 1877. *Pap. Proc. R. Soc. Tasm.*, 1876: 33

Shell small, 6-7 whorls, sinistral, turbinate with a tightly coiled, elevated spire, wide deep body whorl with a squared, subkeeled periphery, minute umbilicus and elongate, oval-lunate depressed aperture. Sculpture of microscopic radial lirae, protoconch with faint spiral lines. Colour pale horn.





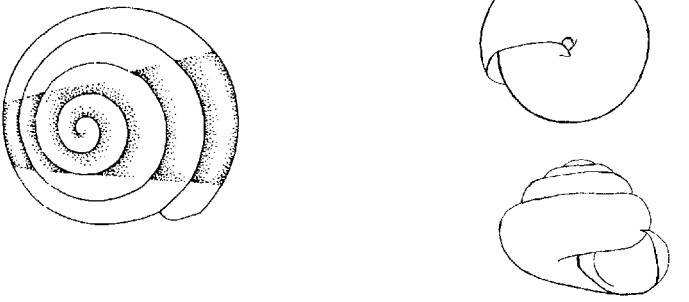
Size 1-2 mm
Range Few scattered localities in northern Tasmania and southern Victoria
Habitat In moss and litter in wet sclerophyll forests
Remarks These small snails are rare in collections due to their small size. A complex of species may occur. The main difference between this and the following species is that one is sinistral the other dextral. With more collecting these may prove to be a variation of one species.

Map 58:
Distribution of Punctidae:
Miselaoma weldii

***Miselaoma parvissima* (Legrand, 1871)**
Helix (Conulus) parvissima Legrand, 1871. *Coll. Mon. Tasm. Land Shells*, 1st ed., sp. 39: 6

Shell small, 5-6 whorls, dextral, turbinate with rounded elevated spire, tightly coiled with deep body whorl, faint keeling, minute

umbilicus and roundly lunate depressed aperture. Sculpture of close faint radial riblets, protoconch with faint spiral lines. Colour shining yellow horn.



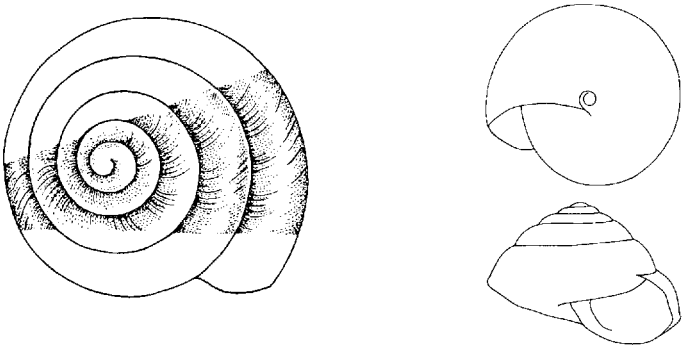
Size 1-2 mm
Range Throughout Tasmania and possibly southern Victoria
Habitat In moss and litter in wet sclerophyll forest and gorges
Remarks This was placed in his genus *Trocholaoma* by Iredale (1937a) but the only difference between the genera appears to be the direction of coiling of the shell

Map 59:
Distribution of Punctidae:
Miselaoma parvissima

***Magilaoma penolensis* (Cox, 1868)**
Helix penolensis Cox, 1868. *Proc. zool. Soc. Lond.*, 1867: 724

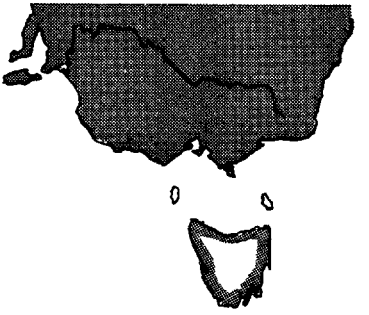
Shell small, 5 whorls, turbinate with elevated convex spire and peripheral keel with widely spaced peripheral spines (easily lost) on each whorl, umbilicus narrow, aperture depressed, ovate-

lunate. Sculpture of irregular sharp radial ribs with interstices of radial lirae. Protoconch of spiral lines to smooth. Colour pale yellow to dark horn.



Size 3-4 mm
Range Throughout S.E. Australia
Habitat Litter and ground vegetation in drier and coastal areas
Remarks This is a variable species, widespread on mainland south-eastern Australia and mainly coastal dunes in Tasmania. It has been tentatively referred to the New Zealand genus *Phrixgnathus* by Climo (pers. comm.).

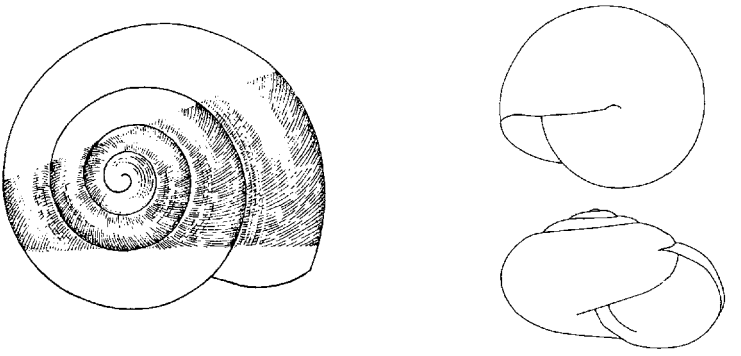
Map 60:
Distribution of Punctidae:
Magilaoma penolensis



***Excellaoma retipora* (Cox, 1867)**
Helix retipora Cox, 1867. *Proc. zool. Soc. Lond.*, 1867: 39

Shell small, 4-5 whorls, deep with flat to slightly convex spire, closed to minute umbilicus and oblique ovate lunate aperture.

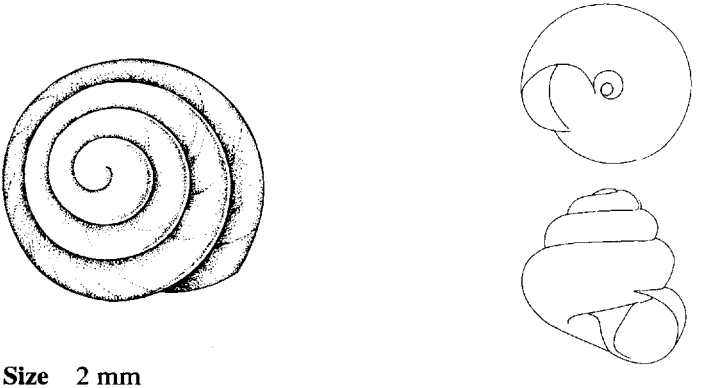
Sculpture of very close bold radial ribs. Protoconch of faint spiral lines to smooth. Colour dull red-brown.



Size 4-6 mm
Range South-eastern South Australia and western Victoria
Habitat In litter in dry scrub areas

***Turbolaoma turbinuloidea* (Gabriel, 1930)**
Laoma turbinuloidea Gabriel, 1930. *Proc. R. Soc. Vict.*, ns. 43: 81

Shell small, 4-5 whorls, high turbinate, with rounded whorls and deeply impressed sutures, small umbilicus, aperture depressed, oblique, round with wide columella. Sculpture of low rounded riblets, protoconch with radial lines. Colour chocolate brown.



Size 2 mm
Range Bairnsdale area of eastern Victoria

Habitat In litter in wet sclerophyll forest
Remarks The relationships of this species are uncertain and it is doubtful whether it belongs to this family

Map 61:
Distribution of Punctidae:
A. *Excellaoma retipora*
B. *Turbolaoma turbinuloidea*

Charopidae

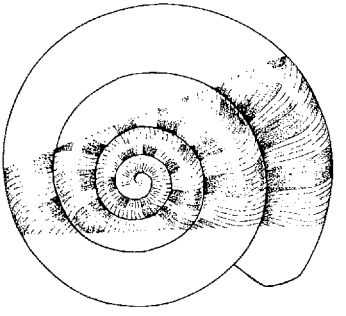
This is a large family of small to medium sized snails centred on New Zealand, Australia and the islands of the southern Pacific. These are typically flattened to turbinate shells with radial protoconch sculpture and often with complex adult sculpture of intricate patterns of ribs and riblets with reticulated cross ribbing. They are usually found in litter, under logs or in shelter in damp situations and probably feed mainly on decaying vegetable matter or fungi.

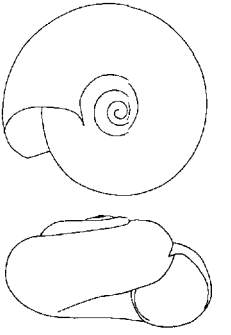
Two main divisions of the family are recognised in south-eastern Australia. These are the subfamilies Charopinae and Phenacohelicinae. The Charopinae are small tightly coiled shells, usually with a depressed spire and complex adult sculpture. The Phenacohelicinae are larger with looser coiling and often turbinate shells. Peripheral keeling also occurs. Early revisionary work on Australian charopids was carried out by Hedley (1892) and Kershaw (1954, 1955, 1956a, b). A revision of the New Zealand species is being undertaken by Climo, who has already published some findings of his work (Climo 1969, 1970, 1975). A very large array of names occurs in Australian literature and the proper status of all the species will have to await a full revision of the family.

A key to the genera in the various states is given in the section on endodont snails. This key directs the reader to a genus group and the species can then be determined by direct comparison having regard to shell form, habitat and distribution range.

***Planilaoma luckmanii* (Brazier, 1877)**
Helix (Pitys) luckmanii Brazier, 1877. *Pap. Proc. R. Soc. Tasm.*, 1876:168

Shell small, 4-5 whorls, with almost flat spire, medium umbilicus, roundly lunate oblique aperture. Sculpture of fine, spaced radial ribs with close radial riblets and spiral striae in interstices. Protoconch with radial lines to smooth. Colour light brown with red segments (dorsal surface only).



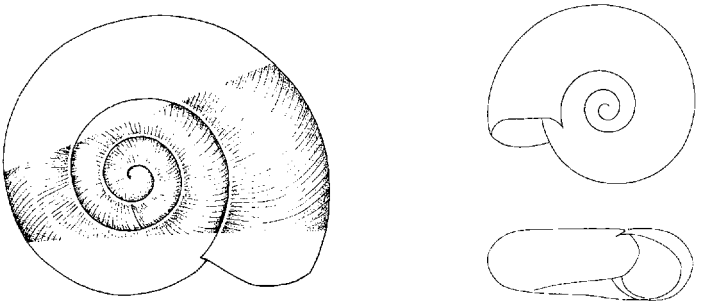


Size 2.5-3 mm
Range Throughout Tasmania (scattered localities)
Habitat In litter in dry forest areas
Remarks Though the name suggests an affinity with the laomids (now all punctids), it is placed in the Charopidae (Solem, 1976)

Map 62:
Distribution of Charopidae:
Planilaoma luckmanii

***Discocharopa vigens* (Legrand, 1871)**
Helix (Discus) vigens Legrand, 1871. *Coll. Mon. Tasm. Land Shells*, 1st ed., sp. 30: 2

Shell small, 4-5 whorls, discoid with wide umbilicus and roundly lunate aperture. Sculpture of regular sharp fine radial riblets. Protoconch of radial riblets. Colour pale yellow horn.

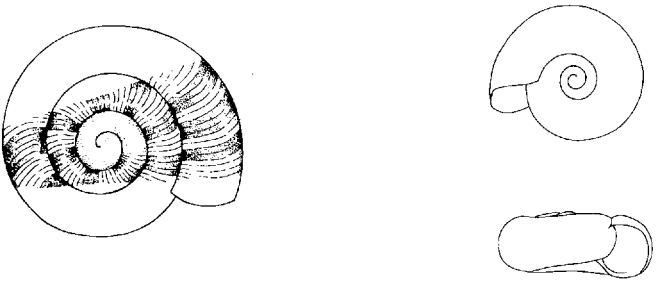


Size 3.0-3.5 mm
Range Throughout Tasmania
Habitat In litter in mainly dry forest areas

Map 63:
Distribution of Charopidae:
Discocharopa vigens

***Discocharopa mimosa* (Petterd, 1879)**
Helix mimosa Petterd, 1879. *Mon. Land Shells Tasm.*: 33

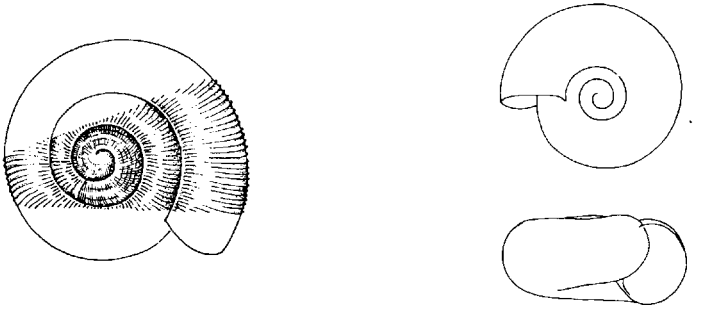
Shell small, 4-5 whorls, discoid with medium umbilicus and roundly lunate aperture. Sculpture of regular radial riblets with close lirae between. Protoconch of radial riblets to smooth. Colour reddish-horn with irregular rays and blotches of white.



Size 2 mm
Range Northern Tasmania
Habitat In litter in wet forest

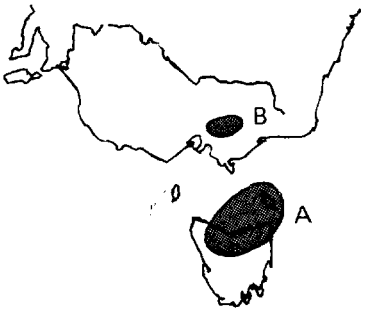
***Discocharopa inexpectata* (Gabriel, 1947)**
Charopa inexpectata Gabriel, 1947. *Mem. natn. Mus. Vict.*, 15: 118

Shell minute, 4 whorls, discoidal with wide umbilicus and narrow oblique lunate aperture. Sculpture of fine radial ribs, interstices reticulate. Protoconch of fine radial lines to smooth. Colour silky white.



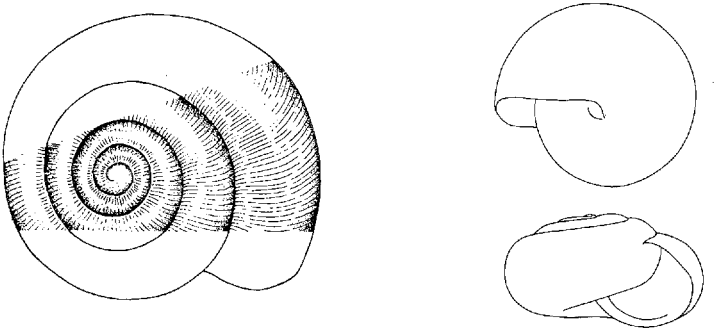
Size 1-1.5 mm
Range Marysville area of central Victoria only
Habitat Under decaying timber in wet sclerophyll forest

Map 64:
Distribution of Charopidae:
A. *Discocharopa mimosa*
B. *Discocharopa inexpectata*



***Elsothera sericatula* (Pfeiffer, 1850)**
Helix sericatula Pfeiffer, 1850. *Proc. zool. Soc. Lond.*, 1849: 127

Shell small, 4-5 whorls, with flat spire, deep rounded body whorl, closed umbilicus and slightly depressed ovate-lunate aperture. Sculpture of fine close radial ribs, protoconch of fine radial lines. Colour grey with dark brown to black rays.

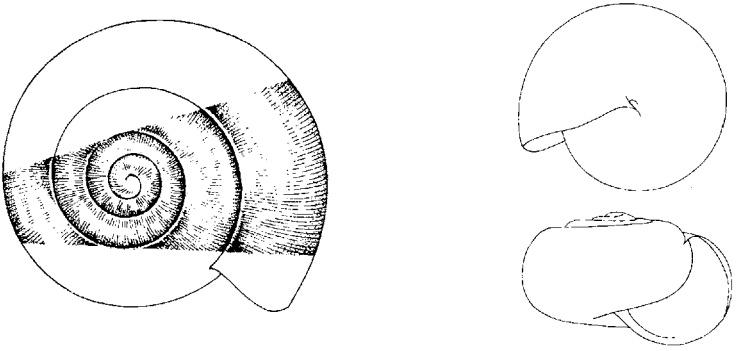


Size 5 mm
Range South-eastern N.S.W. and eastern Victoria
Habitat In litter and under decaying logs in wet forest in hilly country

***Elsothera limula* (Legrand, 1871)**
Helix (Charopa) limula Legrand, 1871. *Coll. Mon. Tasm. Land Shells*, 2nd ed., sp. 72

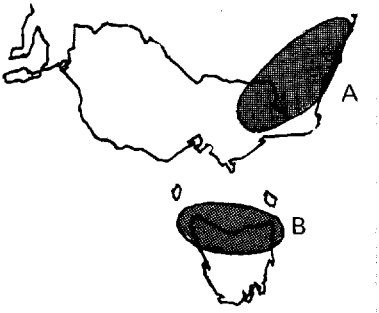
Shell small, 4-5 whorls, with low spire and deep rounded body whorls, umbilicus closed, ovate-lunate aperture. Sculpture of fine

close radial ribs, protoconch of fine radial lines. Colour metallic light brown.



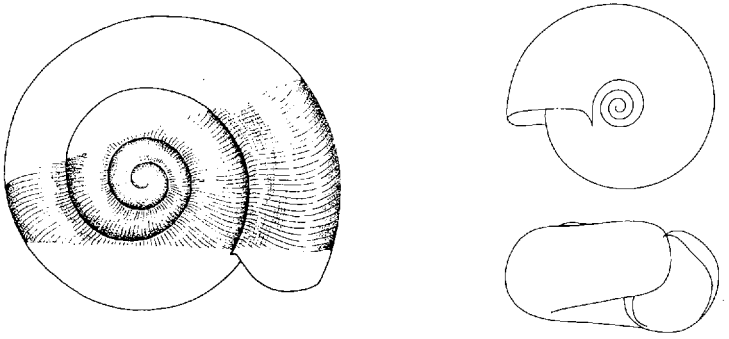
Size 4-5 mm
Range Northern Tasmania
Habitat In litter and under logs in wet forest

Map 65:
Distribution of Charopidae:
A. *Elsothera sericatula*
B. *Elsothera limula*



***Elsothera ricei* (Brazier, 1871)**
Helix (Charopa) ricei Brazier, 1871. *Proc. zool. Soc. Lond.*, 1870: 660

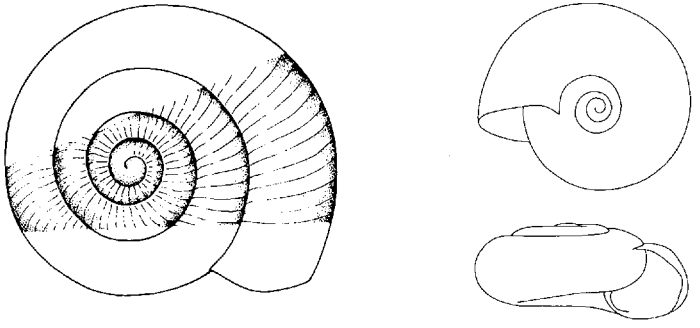
Shell small, 4 whorls, flat or slightly depressed spire, small to wide umbilicus, aperture broadly ovate-lunate. Sculpture of regular close to spaced ribs or riblets, interstices reticulate. Protoconch of faint radial striae. Colour yellow to brown.



Size 4-5 mm
Range Eastern Tasmania
Habitat In litter and under logs in wet forest
Remarks This represents a complex of shell forms which may prove to be several species

***Elsothera murrayana* (Pfeiffer, 1864)**
Helix murrayana Pfeiffer, 1864. *Proc. zool. Soc. Lond.*, 1863: 527

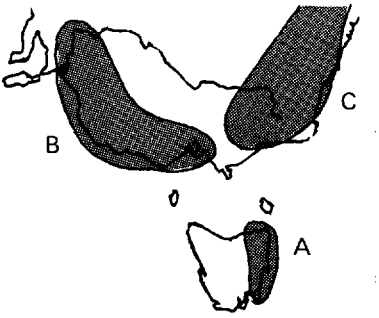
Shell medium, 5 whorls, with almost flat spire and narrow to medium, slightly depressed whorls, medium umbilicus and oblique, roundly lunate aperture. Sculpture of close radial riblets, protoconch of radial lines to smooth. Colour brown.



Size 7-8 mm
Range Eastern central South Australia and western Victoria
Habitat Under rocks, particularly on the limestone cliffs of the Lower Murray, in drier areas

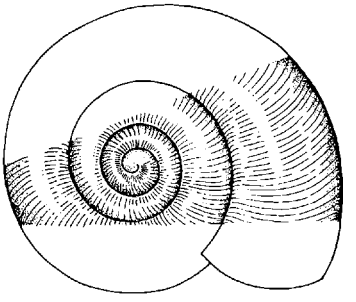
Remarks More than one form of this species probably occurs

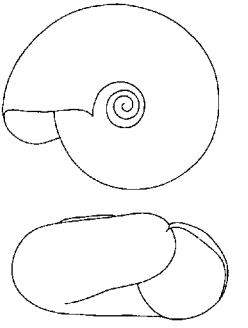
Map 66:
Distribution of Charopidae:
A. *Elsothera ricei*
B. *Elsothera murrayana*
C. *Elsothera funerea*



***Elsothera funerea* (Cox, 1868)**
Helix funerea Cox, 1868. *Mon. Aust. Land Shells*: 13

Shell medium, 4 whorls, with deep rounded body whorl, flat spire, medium umbilicus and oblique roundly lunate aperture. Sculpture of bold close radial ribs, protoconch of radial lines. Colour blackish to grey.

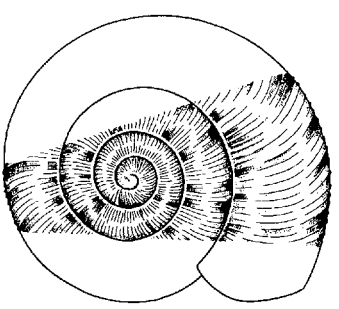


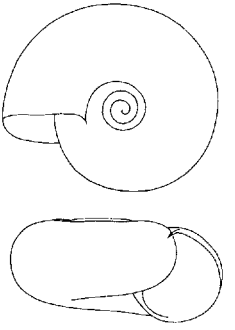


Size 6-7 mm
Range Great Dividing Range of eastern Victoria and southern and central N.S.W.
Habitat In litter and under logs in wet forest

***Allocharopa brazieri* (Cox, 1868)**
Helix brazieri Cox, 1868. *Mon. Aust. Land Shells*: 14

Shell small, 5 whorls, discoid with slightly concave sunken spire, sutures deeply impressed, very wide umbilicus, broadly lunate, oblique depressed aperture. Sculpture of very fine close riblets, interstices of faint radial striae. Protoconch of faint radial lirae. Colour ash grey with occasional dark lines or streaks.

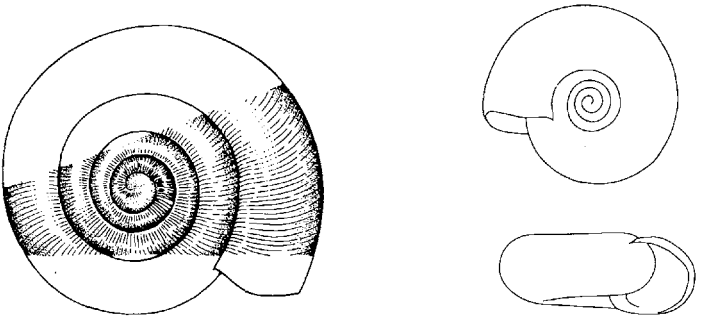




Size 3-4 mm
Range Central eastern N.S.W.
Habitat Under stones in dry places

***Allocharopa okeana* (Gabriel, 1947)**
Charopa okeana Gabriel, 1947. *Mem. natn. Mus. Vict.*, 15: 117

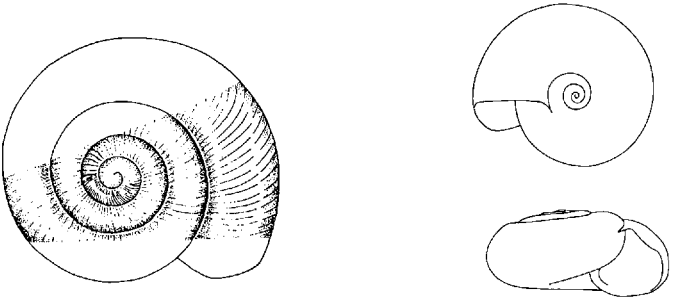
Shell small, 5 whorls, thin, discoid with sunken spire, narrow rounded body whorl, wide umbilicus and roundly lunate descending aperture. Sculpture of very close fine radial riblets. Protoconch of fine radial lines. Colour light brown with reddish-brown bands.



Size 4-5 mm
Range Mountains of eastern Victoria
Habitat Under litter near mountain peaks in alpine woodland

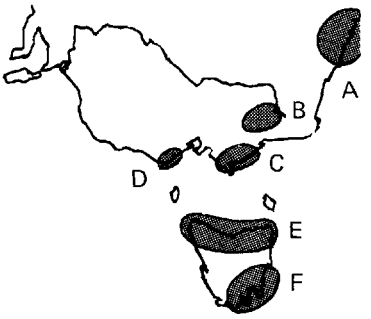
***Allocharopa tarravillensis* (Gabriel, 1930)**
Charopa tarravillensis Gabriel, 1930. *Proc. R. Soc. Vict.*, n.s. 43: 77

Shell small, 4-5 whorls, flat spire with rounded body whorl, medium umbilicus and oblique roundly lunate aperture sometimes with slightly impressed outer margin. Sculpture of bold radial ribs with interstices with fine radial riblets and minute spiral striae. Protoconch of fine radial riblets. Colour light brown.



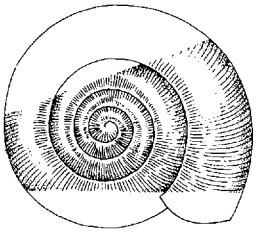
Size 2-3 mm
Range South Gippsland area of eastern Victoria
Habitat In litter and under decaying logs in wet sclerophyll forest

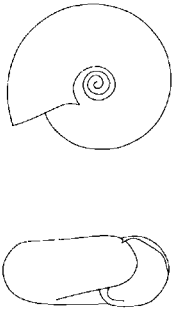
Map 67:
Distribution of Charopidae:
A. *Allocharopa brazieri*
B. *Allocharopa okeana*
C. *Allocharopa tarravillensis*
D. *Allocharopa erskinensis*
E. *Allocharopa legrandi*
F. *Allocharopa kershawi*



***Allocharopa erskinensis* (Gabriel, 1930)**
Charopa erskinensis Gabriel, 1930. *Proc. R. Soc. Vict.*, n.s. 43: 76

Shell small, 4-5 whorls, discoid with sunken spire, tight coiling, rounded, fairly deep body whorl, medium umbilicus, aperture narrowly lunate. Sculpture of fine close radial riblets, protoconch of radial riblets. Colour cream and of glossy appearance.



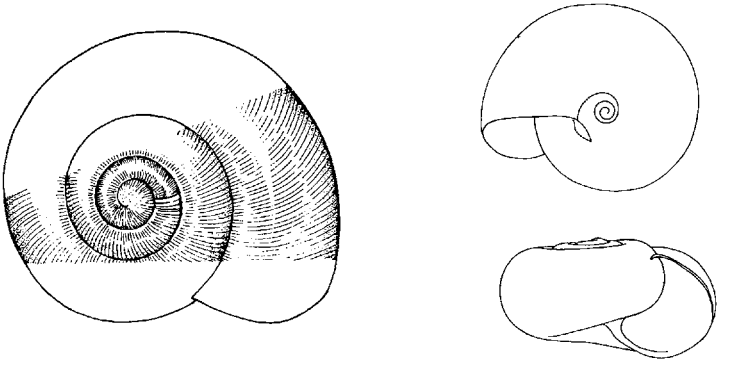


Size 2-3 mm
Range Otway Ranges south-western Victoria
Habitat In litter and under decaying logs in wet sclerophyll forest

***Allocharopa legrandi* (Cox, 1868)**
Helix legrandi Cox, 1868. *Mon. Aust. Land Shells*: 14

Shell small, 4-5 whorls, flat spire and deep rounded body whorl, umbilicus wide, aperture oblique, roundly lunate. Sculpture of irregular, slightly spaced fine radial riblets with densely reticulate

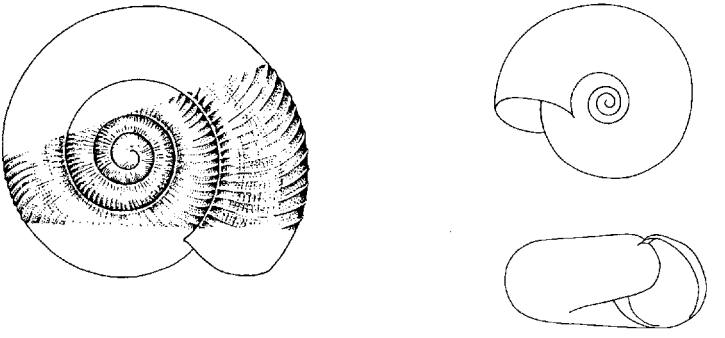
interstices. Protoconch of fine radial lines to smooth. Colour red-brown, yellow or white.



Size 2-3 mm
Range Southern Tasmania
Habitat In litter and under decaying logs in wet sclerophyll forest

***Allocharopa kershawi* (Petterd, 1879)**
Helix kershawi Petterd, 1879. *Mon. Land Shells Tasm.*: 28

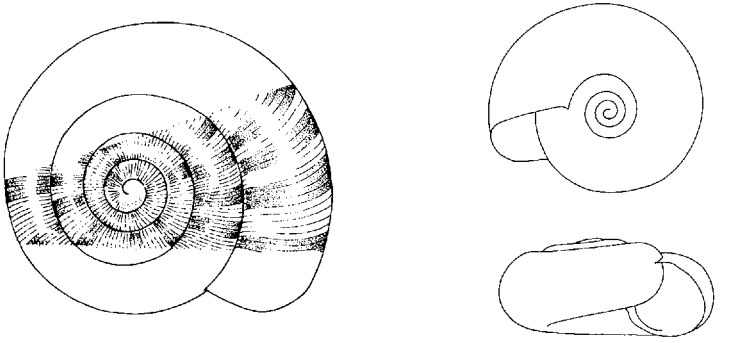
Shell small, 5 whorls, with flat or sunken spire, rounded body whorl, wide umbilicus and roundly lunate aperture. Sculpture of fairly widely spaced bold radial ribs and reticulate interstices. Protoconch of fine lines to smooth. Colour pale yellow, translucent with dark ribs in some specimens.



Size 2-3 mm
Range Northern Tasmania
Habitat In litter and under decaying logs in wet forests

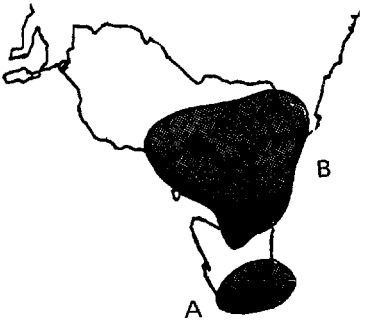
***Pernagera kingstonensis* (Legrand, 1871)**
Helix (*Discus*) *kingstonensis* Legrand, 1871. *Coll. Mon. Tasm. Land Shells*, 1st ed., sp. 40: 3

Shell small, 5 whorls, with flat, slightly convex spire, angled whorls below sutures, medium to wide umbilicus and roundly lunate, slightly depressed aperture. Sculpture of fine close sharp ribs, protoconch of faint radial striae. Colour yellow to white with broad chestnut rays.



Size 2.5-4 mm
Range Southern Tasmania, particularly round the Hobart area
Habitat In litter and under logs in woodland areas
Remarks A complex series of species belonging to this genus appears to occur in Tasmania. Several of the more obvious forms are given here but much more material is required before the proper status of these forms can be established.

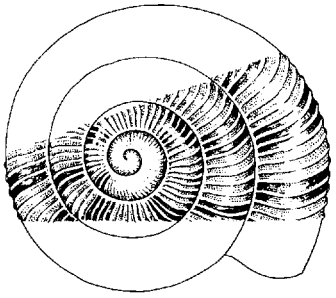
Map 68:
Distribution of Charopidae:
A. *Pernagera kingstonensis*
B. *Pernagera tamarensis*

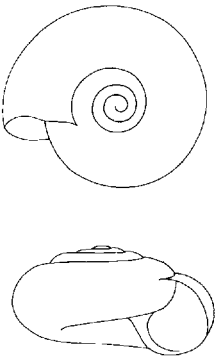


Differentiation of the species of *Pernagera* is as follows:
kingstonensis—shell less than 4 mm, medium to wide umbilicus, angled whorls below sutures, fine close riblets southern Tasmania.
tasmaniae—shell less than 4 mm, wide umbilicus with angled entrance, wide spaced erect curved ribs prominent on ventral surface too, eastern Tasmania.
tamarensis—shell more than 4 mm, very wide umbilicus, spaced ribs, north central Tasmania and Victoria.
officeri—shell size variable, medium umbilicus, sharp bold wide spaced ribs, northern Tasmania and southern Victoria.
gatliffi—shell less than 4 mm, medium umbilicus, close ribs, Otway region of Victoria.

***Pernagera tasmaniae* (Cox, 1868)**
Helix tasmaniae Cox, 1868. *Mon. Aust. Land Shells*: 22

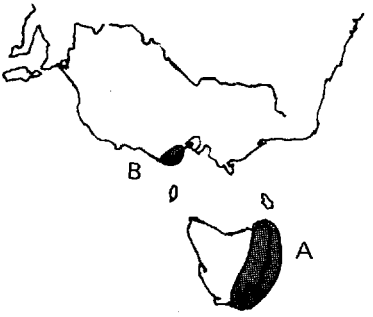
Shell small, 5 whorls, with flat spire, impressed sutures,wide umbilicus and roundly lunate aperture. Sculpture of wide spaced erect, curved radial ribs, prominent on the ventral surface too, interstices reticulate. Protoconch of radial lines. Colour pale horn with red to chestnut rays.





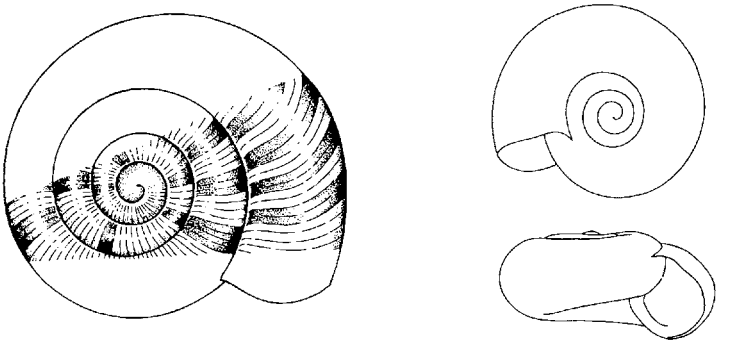
Size 3-4 mm
Range Eastern Tasmania
Habitat In litter in dry woodland
Remarks Listed by Iredale (1937a) in the genus *Paralaoma*. This placement is inexplicable as the animal is totally dissimilar in shell structure from any laomid and is close to other members of the genus *Pernagera*.

Map 69:
Distribution of Charopidae:
A. *Pernagera tasmaniae*
B. *Pernagera gatliffi*



***Pernagera tamarensis* (Petterd, 1879)**
Helix tamarensis Petterd, 1879. *Mon. Land Shells Tasm.*: 30

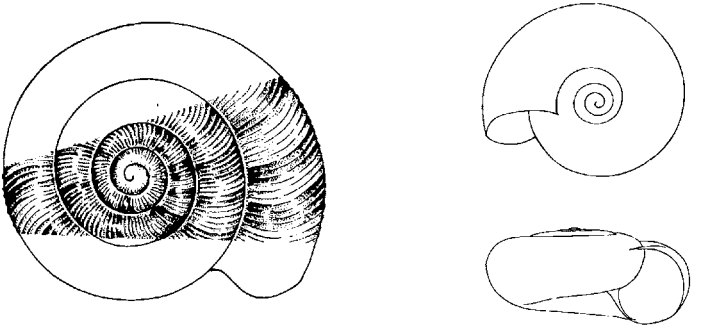
Shell small to medium, 5 whorls, with flat spire, very wide umbilicus and oblique descending ovate-lunate aperture. Sculpture of spaced, slightly curved radial ribs with interstices of dense radial lirae. Protoconch of faint radial lirae. Colour light brown with darker rays.



Size 5-7 mm
Range North central Tasmania and Victoria
Habitat Under logs in moist habitats

***Pernagera officeri* (Legrand, 1871)**
Helix (*Discus*) *officeri* Legrand, 1871. *Coll. Mon. Tasm. Land Shells*, 1st ed., sp. 57

Shell small, 5 whorls, flat to slightly bulging spire, medium umbilicus and oblique roundly lunate aperture. Sculpture of sharp bold wide spaced radial ribs, protoconch of faint radial lines. Colour pale yellow with reddish-brown rays.



Size 2-5.5 mm
Range Northern Tasmania, eastern Bass Strait islands and southern Victoria

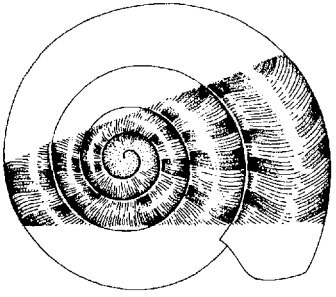
Habitat In litter and under ground vegetation in dry scrub and heath areas

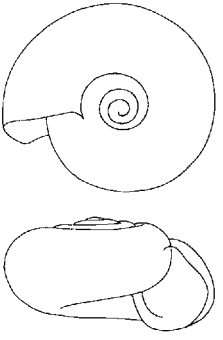
Remarks This species is more widely known under the name *Pernagera stanleyensis* (Petterd, 1879), which is here considered a synonym.

Map 70:
Distribution of Charopidae:
Pernagera officeri

***Pernagera gatliffi* (Gabriel, 1930)**
Charopa gatliffi Gabriel, 1930. *Proc. R. Soc. Vict.*, n.s. 43: 76

Shell small, 4-5 whorls, spire almost flat, body whorl deep, umbilicus medium, aperture depressed, roundly lunate. Sculpture of close ribs, protoconch of faint radial lines. Colour light brown with zigzag rays.



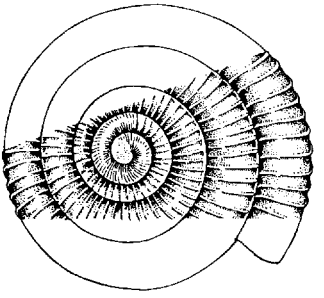


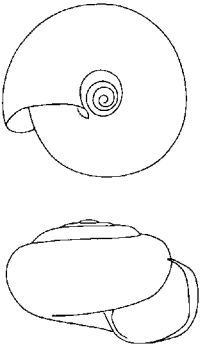
Size 3-4 mm
Range Otway region of south-western Victoria
Habitat Under logs and in litter in wet sclerophyll forest

Remarks Considered endemic to the Otways region by Smith (1977)

***Dentherona dispar* (Brazier, 1871)**
Helix (?*Charopa*) *dispar* Brazier, 1871. *Proc. zool. Soc. Lond.*, 1870: 661

Shell small, 5-6 whorls, with convex, slightly elevated spire, tightly coiled deep body whorl, deep small umbilicus and descending deeply lunate narrow aperture, basal tooth in the aperture. Sculpture of bold wide radial ribs, interstices of fine radial lirae and spiral striae. Protoconch of fine close radial riblets. Colour reddish-yellow to white.

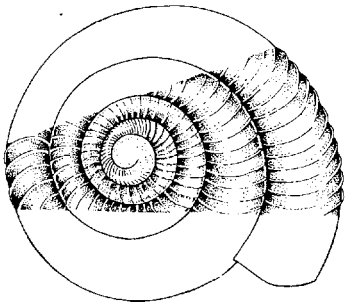


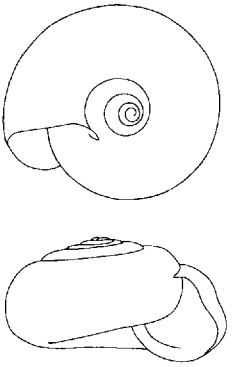


Size 2-3 mm
Range Throughout Tasmania
Habitat In litter in dry woodland

***Dentherona subrugosa* (Legrand, 1871)**
Helix (*Pitys*) *subrugosa* Legrand, 1871. *Coll. Mon. Tasm. Land Shell*, 2nd ed., sp. 68

Shell small, 5-6 whorls, with deep square body whorl and low convex spire, medium, deep umbilicus and lateral wall of body often impressed, aperture oblique narrowly ovate-lunate. Sculpture of wide rounded radial ribs, interstices reticulate. Protoconch of faint radial lirae. Colour brownish to reddish horn.

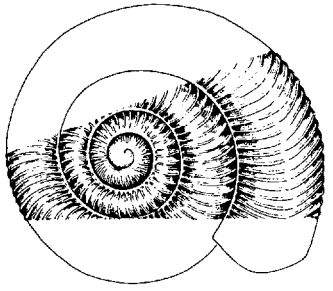


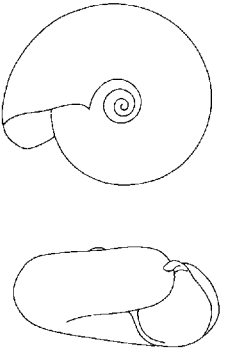


Size 2-4 mm
Range Throughout Tasmania
Habitat In litter in forest
Remarks Iredale (1937a) made this species the type of his genus *Kannaropa*, here considered not distinct from *Dentherona*. There is strong evidence for two forms of this species.

***Dentherona illustra* (Gabriel, 1947)**
Charopa illustra Gabriel, 1947. *Mem. natn. Mus. Vict.*, 15: 117

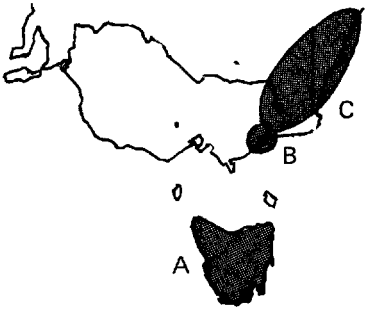
Shell small, 4-5 whorls, discoid with deep rounded body whorl, fairly wide umbilicus and descending oblique roundly lunate aperture. Sculpture of bold slightly spaced ribs with reticulate interstices. Protoconch of faint radial lines. Colour light brown.





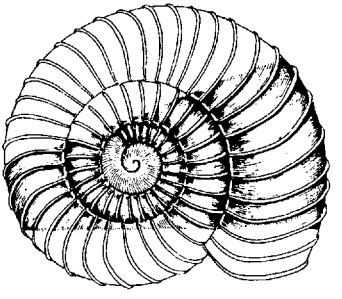
Size 3-4 mm
Range South-eastern Victoria
Habitat In litter in dry woodland
Remarks *D. lakesentranciencia* (Gabriel, 1947) is here included as a synonym of this species

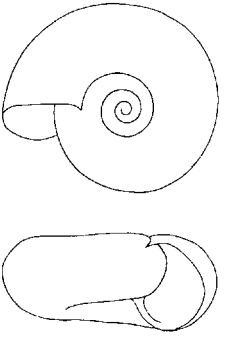
Map 71:
Distribution of Charopidae:
A. *Dentherona dispar*
Dentherona subrugosa
B. *Dentherona illustra*
Dentherona jemmysensis
C. *Dentherona saturni*



***Dentherona jemmysensis* (Gabriel, 1947)**
Charopa jemmysensis Gabriel, 1947. *Mem. natn. Mus. Vict.*, 15: 117

Shell small, 4-5 whorls, discoid with sunken spire, wide umbilicus and oblique ovate-lunate aperture. Sculpture of very bold widely spaced rounded radial ribs, interstices of fine riblets. Protoconch of radial riblets. Colour light horn to brown.

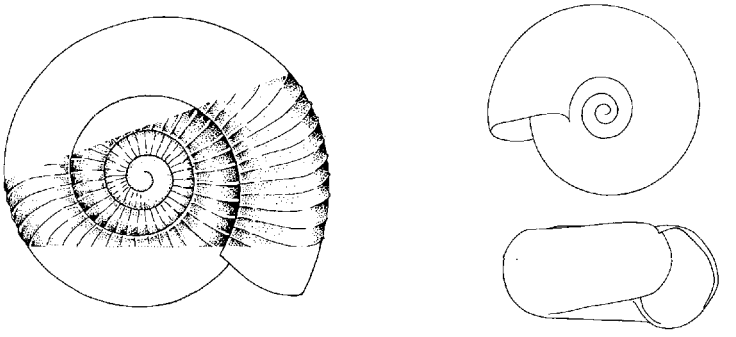




Size 2-3 mm
Range South-eastern Victoria
Habitat In litter and under decaying logs in wet forest and woodland areas

***Dentherona saturni* (Cox, 1864)**
Helix saturni Cox, 1864. *Cat. Aust. Land Shells*: 35

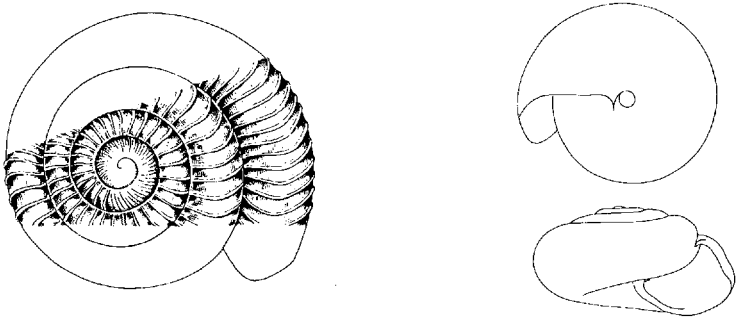
Shell small, 5 whorls, discoid with sunken spire, umbilicus medium to wide, aperture oblique, narrowly lunate. Sculpture of bold medium spaced radial ribs, interstices of radial striae. Protoconch of faint radial lines. Colour reddish-brown to white.



Size 3-4 mm
Range Eastern N.S.W. and eastern Victoria
Habitat In litter and under decaying logs in woodland

***Cralopa colliveri* (Gabriel, 1947)**
Charopa colliveri Gabriel, 1947. *Mem. natn. Mus. Vict.*, 15: 118

Shell small, 4-5 whorls, spire slightly raised, convex, with impressed sutures, umbilicus narrow, aperture descending oblique, roundly lunate with outer margin impressed. Sculpture of bold curved radial ribs, interstices of spiral striae. Protoconch of faint radial riblets. Colour light brown to white.

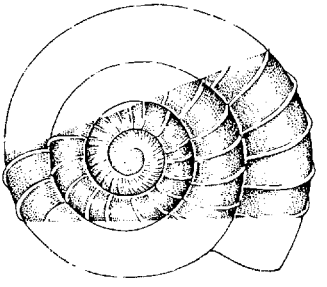


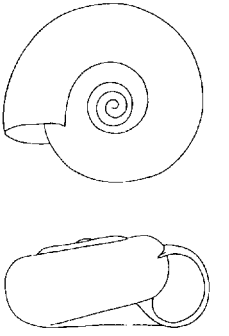
Size 2-3 mm
Range South-eastern Victoria
Habitat Under decaying logs in wet forest area

Map 72:
Distribution of Charopidae:
Cralopa colliveri

***Egilodonta bairnsdalensis* (Gabriel, 1930)**
Charopa bairnsdalensis Gabriel, 1930. *Proc. R. Soc. Vict.*, n.s. 43: 78

Shell small, 4-5 whorls, with flattened spire, wide umbilicus and oblique roundly lunate aperture bearing parietal and basal lamellae. Sculpture of bold very widely spaced sharp ribs, interstices of radial riblets and fine spiral striae. Protoconch of radial riblets on a granular surface. Colour light horn.

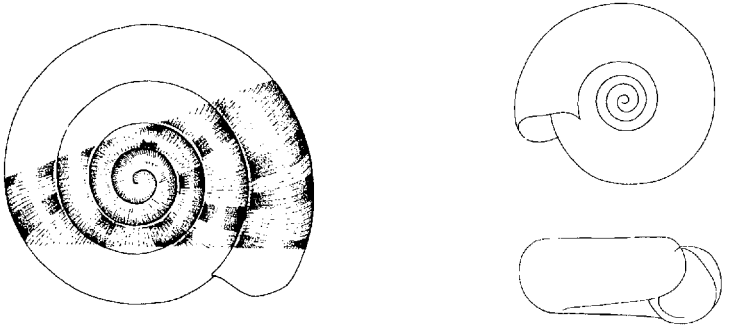




Size 2 mm
Range Bairnsdale area of south-east Victoria
Habitat In litter in wet sclerophyll forest

***Rhophodon problematica* (Gabriel, 1947)**
Charopa problematica Gabriel, 1947. *Mem. natn. Mus. Vict.*, 15: 119

Shell small, 4-5 whorls, discoid with sunken spire and shallow rounded body whorl, wide umbilicus and oblique roundly lunate aperture bearing apertural lamellae. Sculpture of fine radial ribs with interstices of fine riblets. Protoconch of fine radial striae to smooth. Colour white with irregular brown streaks.



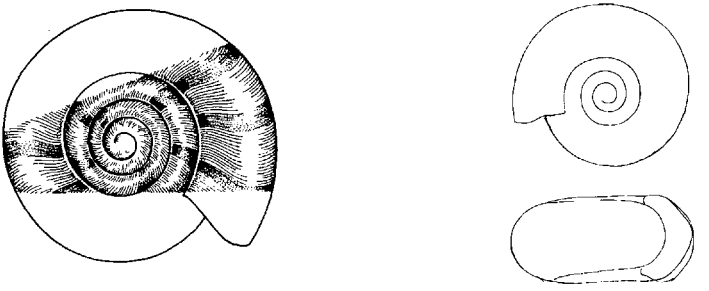
Size 2-3 mm
Range Central southern Victoria
Habitat In litter and under logs in wet sclerophyll forest

Map 73:
Distribution of Charopidae:
A. *Egilodonta bairnsdalensis*
B. *Rhophodon problematica*

***Geminoropa hookeriana* (Petterd, 1879)**
Helix hookeriana Petterd, 1879. *Mon. Land Shells Tasm.*: 38

Shell small to minute, 4-6 whorls, discoid with flat to sunken spire, shallow tightly coiled body whorl with suggestion of lateral keel,

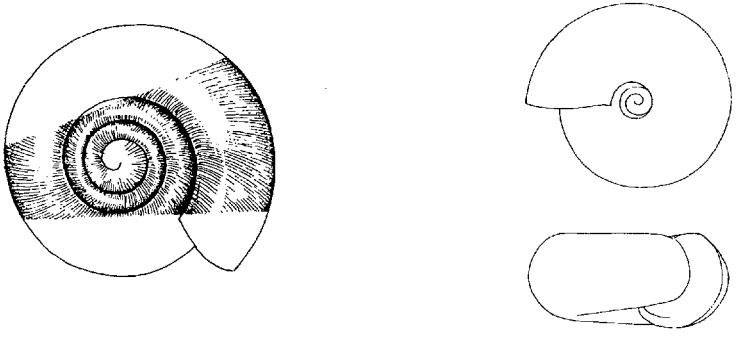
medium to wide umbilicus and narrow lunate aperture. Sculpture of fine close radial ribs, interstices reticulate. Protoconch of fine radial riblets to granular. Colour white or light brown, with red to brown rays.



Size 1-2 mm
Range North-west Tasmania
Habitat In litter and under decaying logs in wet sclerophyll to temperate rainforest

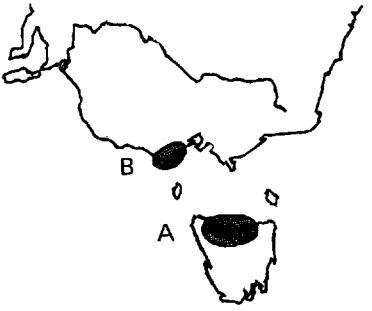
***Geminoropa scindocataracta* (Gabriel, 1930)**
Charopa scindocataracta Gabriel, 1930. *Proc. R. Soc. Vict.*, n.s. 43: 77

Shell minute, 4-5 whorls, discoid with sunken spire and tightly coiled rounded body whorl, umbilicus small, aperture narrowly lunate. Sculpture of fine very close radial ribs, interstices of fine spiral striae. Protoconch of fine radial riblets to granular. Colour cream with pale streaks.



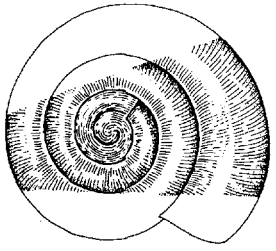
Size 1-2 mm
Range Otway Ranges, south-western Victoria
Habitat In litter and under logs in wet sclerophyll and temperate rainforest
Remarks The name is derived from the type locality, Splitters Falls. This species is endemic to the Otway Ranges (Smith, 1977).

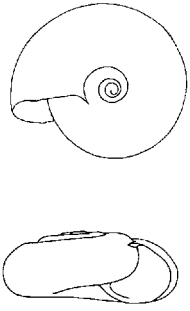
Map 74:
Distribution of Charopidae:
A. *Geminoropa hookeriana*
B. *Geminoropa scindocataracta*



***Roblinella gadensis* (Petterd, 1879)**
Helix gadensis Petterd, 1879. *Mon. Land Shells Tasm.*: 29

Shell small, 4-5 whorls, with flattened to slightly convex spire, impressed sutures, umbilicus medium, aperture ovate-lunate. Sculpture of close radial riblets, interstices of fine radial striae. Protoconch of spiral grooves. Colour white to light horn.

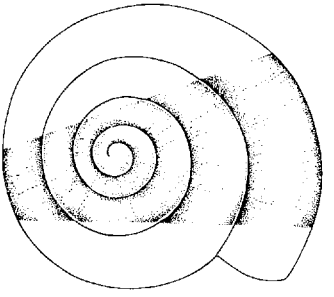


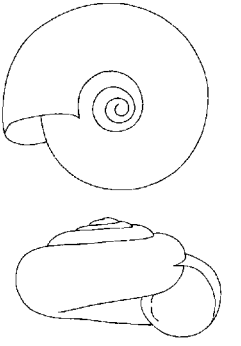


Size 2-3 nm
Range Northern Tasmania
Habitat In litter and under decaying logs in wet sclerophyll forest

***Roblinella agnewi* (Legrand, 1871)**
Helix (*Discus*) *agnewi* Legrand, 1871. *Coll. Mon. Tasm. Land Shells*, 1st ed. sp. 27: 5

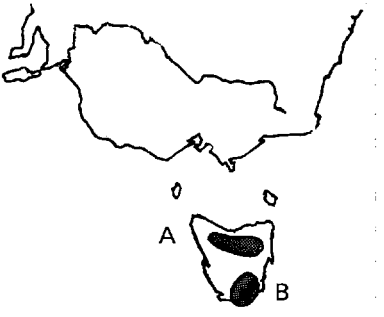
Shell small, 4-5 whorls, with slightly elevated, convex spire, rounded body whorl, wide umbilicus and depressed, round lunate aperture. Sculpture of fine, minute radial lirae, protoconch smooth, granular. Colour brownish-yellow.





Size 4-5 mm
Range South central Tasmania
Habitat In litter in woodland
Remarks The generic placement of this species is considered questionable as some shell characters do not appear to conform well

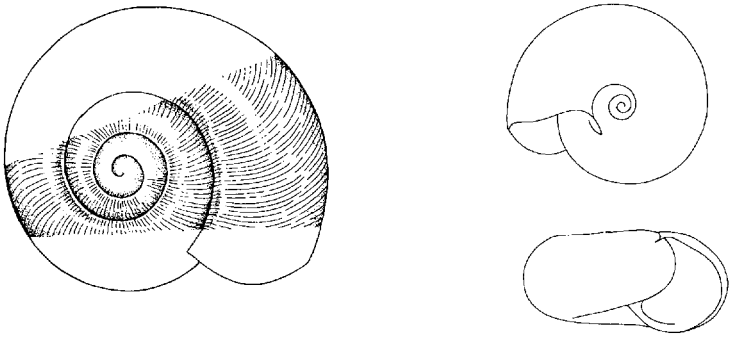
Map 75:
Distribution of Charopidae:
A.. *Roblinella gadensis*
B. *Roblinella agnewi*
Roblinella curacoae



***Roblinella curacoae* (Brazier, 1871)**
Helix (*Charopa*) *curacoae* Brazier, 1871. *Proc. zool. Soc. Lond.*, 1870: 659

Shell medium, 4-5 whorls, spire flat to slightly concave, body

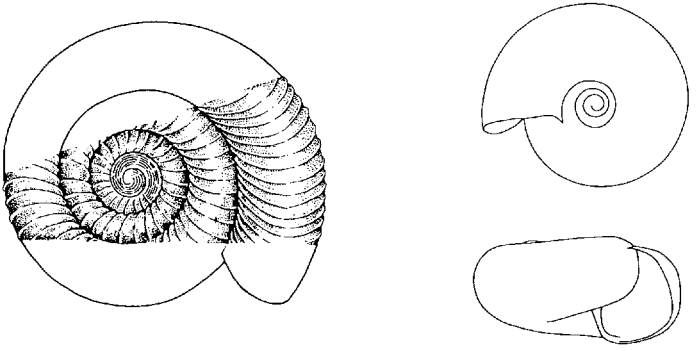
whorl deep rounded, umbilicus medium, aperture deep, roundly lunate. Sculpture of fine elevated clear radial ribs, interstices of weak radial lirae. Protoconch of faint spiral lines to granular. Colour white, cream to reddish.



Size 6-7 mm
Range South central Tasmania
Habitat In litter in woodland

***Roblinella mathinnae* (Petterd, 1879)**
Helix mathinnae Petterd, 1879. *Mon. Land Shells Tasm.*: 26

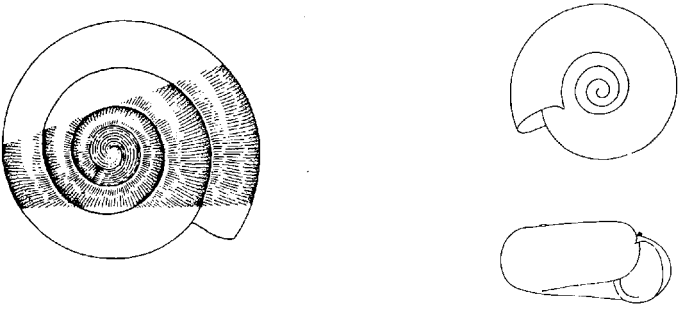
Shell medium, 4-5 whorls, spire slightly sunken, concave, body whorl deep rounded, umbilicus medium to wide, aperture deep, roundly lunate. Sculpture of bold wide curved radial ribs, interstices of radial lirae and spiral striae. Protoconch of spiral grooves. Colour shining horn.



Size 6-7 mm
Range Launceston area of northern Tasmania
Habitat In litter in wet forests and gorges
Remarks The generic placement of this species may be in doubt

***Roblinella belli* (Cox, 1864)**
Helix belli Cox, 1864. *Cat. Aust. Land Shells*: 22

Shell small to minute, 5-6 whorls, discoid with sunken spire, round narrow body whorl, wide umbilicus and depressed roundly lunate aperture. Sculpture of fine close radial lirae, protoconch of fine spiral grooves. Colour pale horn to reddish.

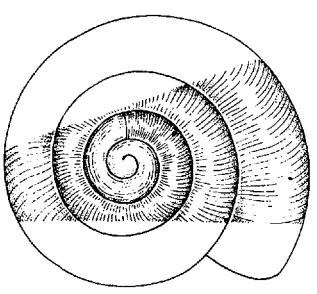


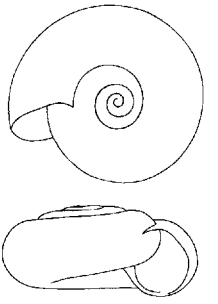
Size 2 mm
Range Eastern central N.S.W.
Habitat In litter in wet forest
Remarks This species was placed in *Allocharopa* by Iredale (1937a) but we consider it is better placed in *Roblinella* because of the spiral protoconch sculpture.

Map 76:
Distribution of Charopidae:
A. *Roblinella mathinnae*
B. *Roblinella belli*
C. *Roblinella speranda*

***Roblinella speranda* Iredale, 1937**
Roblinella speranda Iredale, 1937. *S. Aust. Nat.*, 18: 25

Shell small to minute, 4-5 whorls, spire flat to slightly elevated, convex, umbilicus very wide, aperture depressed roundly lunate. Sculpture of fine close radial ribs, interstices of fine radial striae. Protoconch of spiral grooves. Colour cream.

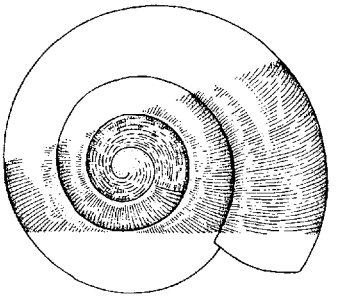


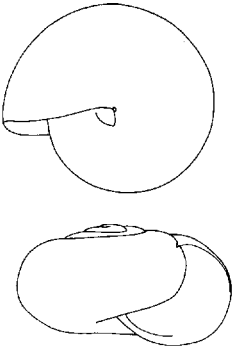


Size 2 mm
Range Central eastern South Australia
Habitat In litter in woodland

***Bischoffena bischoffensis* (Petterd, 1879)**
Helix bischoffensis Petterd, 1879. *Mon. Land Shells Tasm.*: 39

Shell small, 4-6 whorls, flattened to slightly convex spire, very deep rounded body whorl giving shell an almost subglobose appearance, umbilicus minute to closed, aperture oblique ovate-lunate with two lamellae on the outer lip. Sculpture of close clear radial lirae with interstices of spiral striae. Protoconch of fine spiral striae. Colour brown.



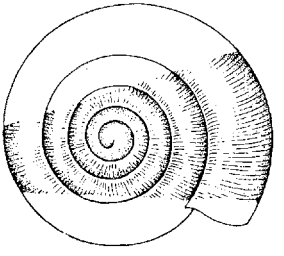


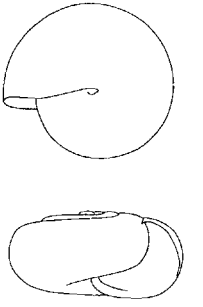
Size 2-3 mm
Range North-west Tasmania
Habitat In litter in wet sclerophyll forest

Map 77:
Distribution of Charopidae:
Bischoffena bischoffensis

***Oreomava otwayensis* (Petterd, 1879)**
Helix otwayensis Petterd, 1879. *Mon. Land Shells Tasm.*: 39

Shell small, 4-5 whorls, flat to slightly convex spire, rounded, tightly coiled body whorl, closed umbilicus, aperture narrowly ovate-lunate. Sculpture of fine clear radial ribs, interstices of radial lirae. Protoconch of fine spiral lines to granular. Colour pale chestnut.

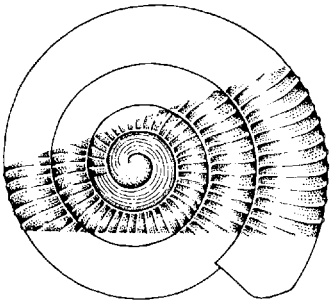


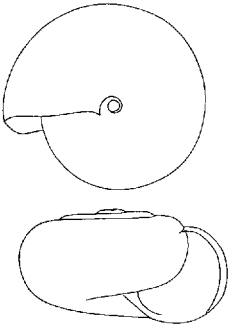


Size 2-3 mm
Range South-western Victoria
Habitat In litter in woodland scrub

***Oreomava cannfluviatilus* (Gabriel, 1929)**
Allodiscus cannfluviatilus Gabriel, 1929. *Victorian Nat.*, 46: 133

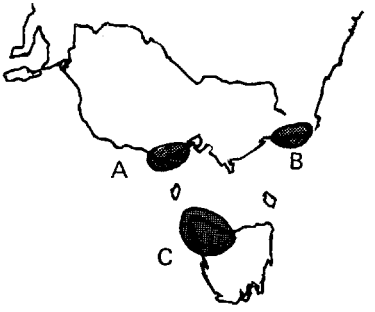
Shell small, 4-5 whorls, with flat to slightly convex spire, fairly deep, rounded body whorl, umbilicus small to minute, aperture ovate-lunate. Sculpture of clear radial ribs, interstices reticulate. Protoconch of spiral grooves. Colour light brown.





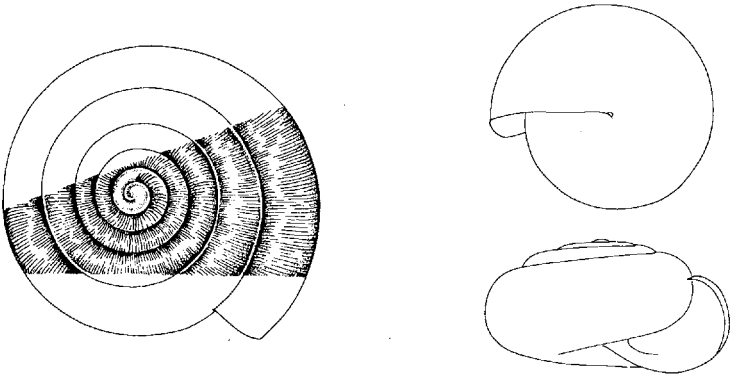
Size 2-3 mm
Range South-eastern Victoria
Habitat In litter and under logs in wet forest

Map 78:
Distribution of Charopidae:
A. *Oreomava otwayensis*
B. *Oreomava cannfluviatilus*
C. *Oreomava johnstoni*



***Oreomava johnstoni* Iredale, 1933**
Oreomava johnstoni Iredale, 1933. *Rec. Aust. Mus.*, 19: 54

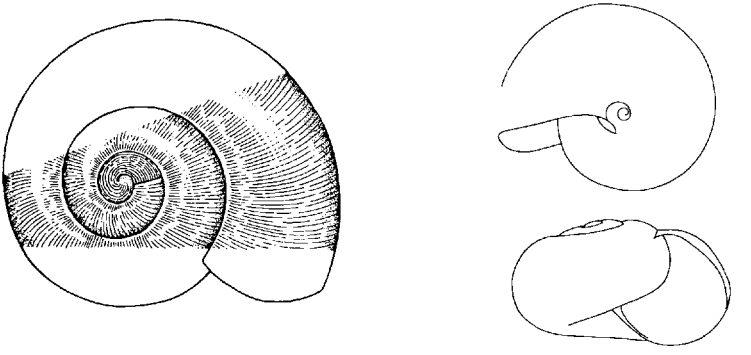
Shell small, 5-6 whorls, with slightly elevated convex spire, body whorl with a slight keel, umbilicus minute to closed, aperture narrow lunate. Sculpture of close strong radial ribs, interstices reticulate. Protoconch of spiral grooves. Colour pale yellow.



Size 3 mm
Range North-west Tasmania
Habitat In litter and under logs in wet forests

***Pillomena meraca* (Cox & Hedley, 1912)**
Flammulina meraca Cox & Hedley, 1912. *Mem. natn. Mus. Melb.*, 4: 13.

Shell small, 4 whorls, with deep, round body whorl and convex spire giving the shell a subglobose appearance, umbilicus small, aperture wide, oblique ovate-lunate. Sculpture of fine close radial riblets, interstices of radial lirae. Protoconch of fine spiral striae. Colour white.

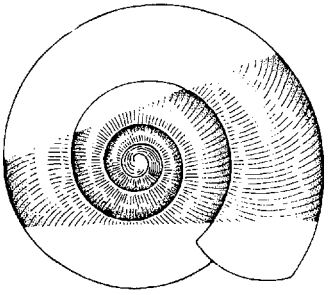


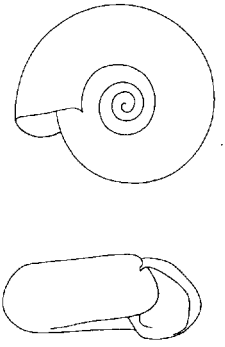
Size 4-5 mm
Range Great Divide of eastern Victoria
Habitat In litter and under decaying logs in wet sclerophyll forest

Map 79:
Distribution of Charopidae:
Pillomena meraca
Pillomena dandenongensis

***Pillomena dandenongensis* (Petterd, 1879)**
Helix dandenongensis Petterd, 1879. *J. Conch.* (*Leeds*), 2: 355

Shell small, 4-5 whorls, flat to sunken spire, narrow rounded body whorl, impressed sutures, wide umbilicus and narrow depressed lunate aperture. Sculpture of sharp close radial ribs, protoconch of spiral grooves. Colour white.



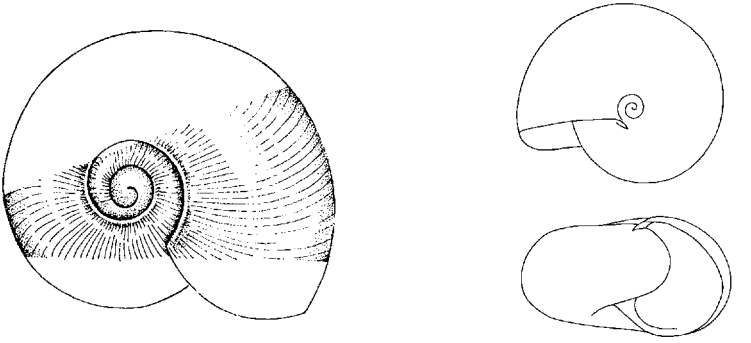


Size 3-4 mm
Range Great Divide of eastern Victoria
Habitat In litter and under decaying logs in wet sclerophyll forest

***Pillomena nivea* (Hedley, 1896)**
Endodonta nivea Hedley, 1896. *Rec. Aust. Mus.*, 2: 102

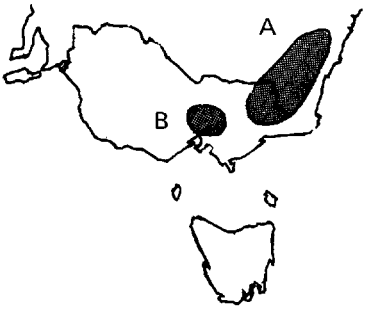
Shell small, 3-4 whorls, with flat to sunken spire, with deep body whorl, small umbilicus, aperture wide deeply lunate with lip incurved at the suture. Sculpture of sharp radial ribs converging

at the suture, interstices of sparse radial lines. Protoconch of faint spiral lines to granular. Colour white.



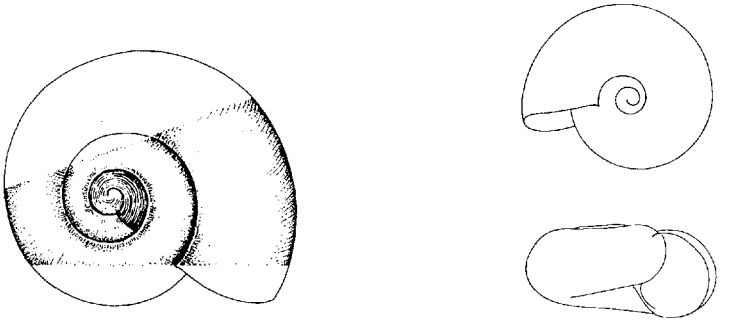
Size 3-4 mm
Range Great Divide of far eastern Victoria and southern N.S.W.
Habitat In litter in wet forest areas of mountains

Map 80:
Distribution of Charopidae:
A. *Pillomena nivea*
B. *Pillomena marysvillensis*



***Pillomena marysvillensis* (Gabriel, 1947)**
Allodiscus marysvillensis Gabriel, 1947. *Mem. natn. Mus. Vict.*, 15: 122

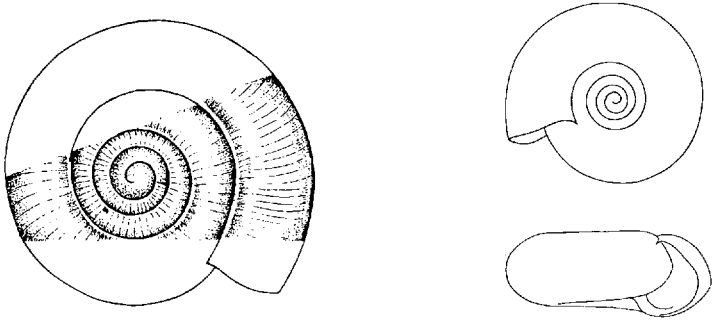
Shell small, 4 whorls, flat to sunken spire, narrow rounded body whorl, medium to wide umbilicus and oblique roundly lunate aperture. Sculpture of fine close radial ribs, interstices reticulate. Protoconch of spiral grooves and striae. Colour white.



Size 2-3 mm
Range Central part of Great Divide, Victoria
Habitat In litter and under decaying logs in wet sclerophyll forest

***Letomola barrenense* (Petterd, 1879)**
Helix barrenensis Petterd, 1879. *Mon. Land Shells Tasm.*: 38

Shell small to minute, 4-5 whorls, discoid with sunken spire, narrow rounded body whorl, wide umbilicus and narrow semi-lunate aperture with small lamellae. Sculpture of radial ribs with striae on apices, interstices faintly granular. Protoconch very faint radial lines to smooth. Colour horn to brown.

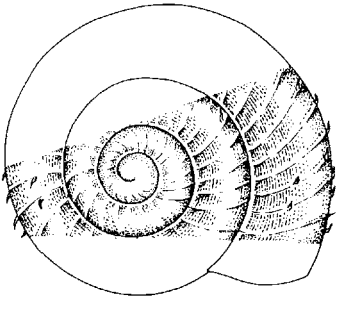


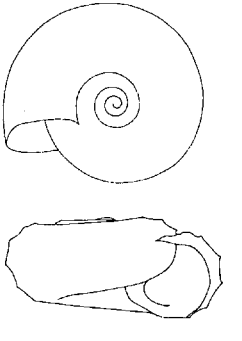
Size 2 mm
Range Bass Strait islands
Habitat In litter in dry woodland scrub

Map 81:
Distribution of Charopidae:
A. *Letomola barrenense*
B. *Setomedea aculeata*

***Setomedea aculeata* (Hedley, 1899)**
Endodonta aculeata Hedley, 1899. *Rec. Aust. Mus.*, 3: 151

Shell small, 3-4 whorls, discoid with narrow many-faceted body whorl, wide umbilicus and round lunate oblique aperture. Sculpture of oblique, widely spaced slightly recurved radial ribs produced to a series of points, interstices of clear spiral lirae, reticulate. Protoconch of very fine radial lirae to smooth. Colour light brown.



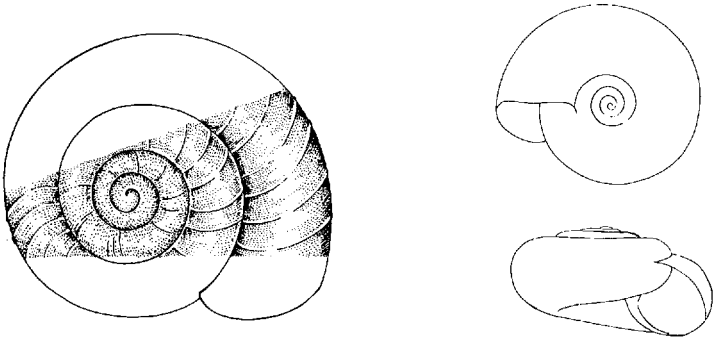


Size 2-3 mm
Range Central eastern N.S.W.
Habitat In litter in woodland

***Thryasona diemenensis* (Cox, 1868)**
Helix diemenensis Cox, 1868. *Proc. zool. Soc. Lond.*, 1867: 723

Shell medium, 4-5 whorls, slightly convex, with narrow rounded body whorl, wide umbilicus, angled at the entrance, aperture

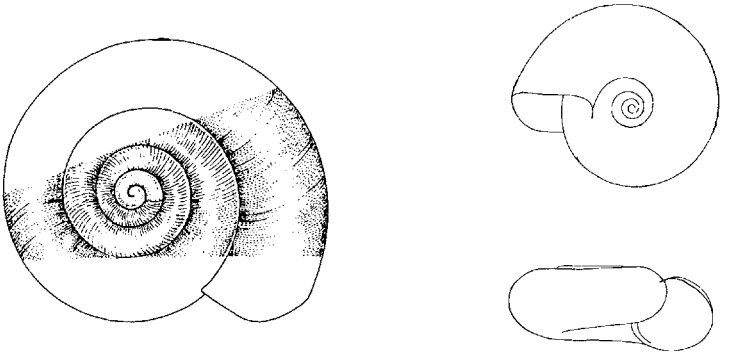
ovate-lunate. Sculpture of bold sharp radial ribs, interstices of radial riblets or reticulate. Protoconch smooth to faintly radial. Colour translucent horn with pale reddish ray.



Size 7-8 mm
Range Throughout Tasmania
Habitat In litter in forest and woodland
Remarks There are a number of forms in this species group which may prove to be separate species when more collecting and a revisionary study have been carried out. Gabriel (1930) recorded this species from Victoria, but we consider this doubtful.

***Thryasona elenescens* (Cox & Hedley, 1912)**
Flammulina elenescens Cox & Hedley, 1912. *Mem. natn. Mus. Melb.*, 4: 12

Shell medium, 5 whorls, spire slightly convex with deeply impressed sutures, small to medium umbilicus, aperture ovate-lunate. Sculpture of low widely spaced ribs with interstices of fine riblets, sometimes fading to smooth on body whorl. Protoconch of very fine radial lines to smooth. Colour ochraceous-buff occasionally with few faint brown radial streaks.

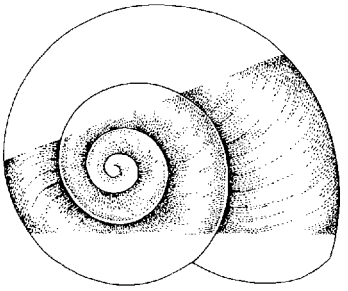


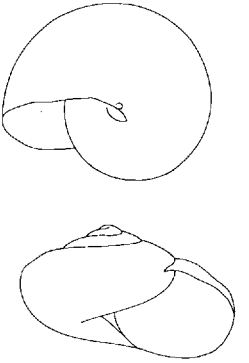
Size 6-7 mm
Range Central southern Victoria
Habitat In litter and under logs in forest and woodland areas
Remarks We consider the placement of this species in the genus *Thryasona* doubtful

Map 82:
Distribution of Charopidae:
A. *Thryasona diemenensis*
B. *Thryasona elenescens*

***Mulathena fordei* (Brazier, 1871)**
Helix (*Hemiplecta*) *fordei* Brazier, 1871. *Proc. zool. Soc. Lond.*, 1870: 662

Shell medium, 5 whorls, turbinate to conoid with rounded keel, elevated spire and wide deep body whorl, umbilicus minute, aperture oblique ovate-lunate. Sculpture fine, spaced radial riblets to rugose, protoconch of radial lirae or smooth. Colour horny brown.



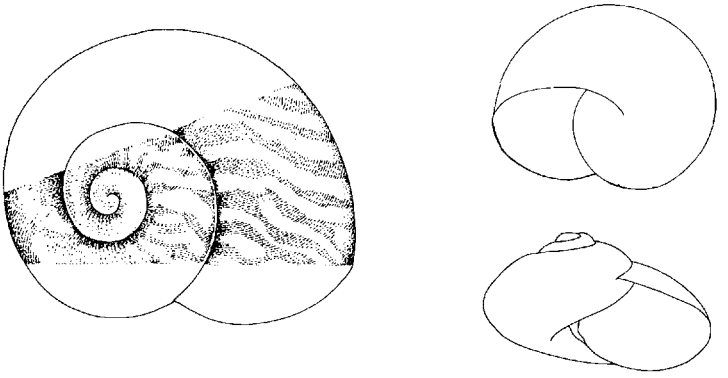


Size 7-8 mm
Range Western and southern Tasmania and south central Victoria
Habitat Under logs or on moss in wet conditions in wet sclerophyll forest

Map 83:
Distribution of Charopidae:
Mulathena fordei

***Flammulops excelsior* (Hedley, 1896)**
Flammulina excelsior Hedley, 1896. *Rec. Aust. Mus.*, 2: 108

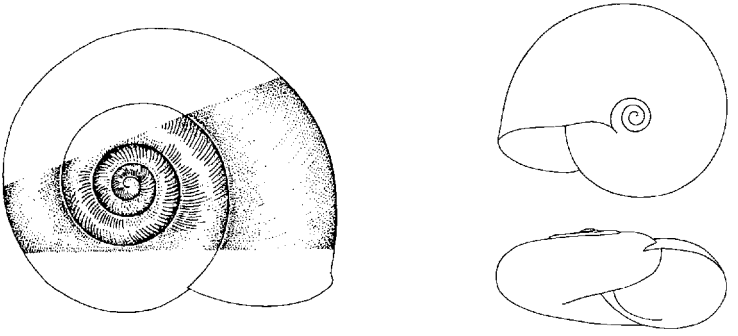
Shell medium, 3 whorls, turbinate with elevated spire, sub-keeled periphery and wide deep body whorl, umbilicus closed, aperture oblique broadly ovate-lunate. Sculpture of close radial riblets, interstices of spiral striae. Protoconch of faint spiral striae. Colour pale horn with brown flames.



Size 8-10 mm
Range Great Divide of eastern Victoria and southern N.S.W.
Habitat Under logs and on moss in wet forest

***Stenacapha hamiltoni* (Cox, 1868)**
Helix hamiltoni Cox, 1868. *Proc. zool. Soc. Lond.*, 1867: 722

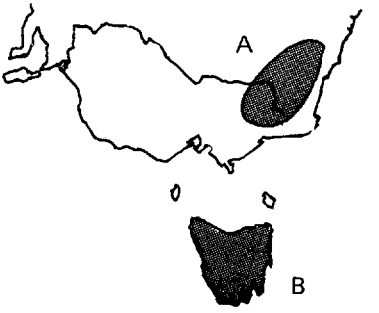
Shell medium to large, 5-6 whorls, spire flat to slightly convex, sutures impressed, body whorl rounded, umbilicus small, abruptly rounded, aperture widely ovate-lunate. Sculpture of fine radial ribs, interstices reticulate. Protoconch of radial and spiral lines. Colour yellow to pale reddish to brown.



Size 14-18 mm
Range Throughout Tasmania
Habitat Under logs in woodland to forest

Remarks A number of different forms have been described and these may prove to be separate species when more information becomes available on the group. This species can be confused with rhytidid snails because of the superficial resemblance of the shells.

Map 84:
Distribution of Charopidae:
A. *Flammulops excelsior*
B. *Stenacapha hamiltoni*



Arionidae

This family of slugs is native to western and central Europe but some species have been introduced to many countries in the temperate zones of the world by modern man. However, the arionid slugs do not appear to be such successful world travellers as the limacid slugs. Only a few have the necessary adaptability for successful colonisation.

The arionids are easily separated from the other families of slugs in Australia by the position of the pneumopore (Fig. 15). In Arionidae the pneumopore is close to the anterior margin of the right-hand side of the mantle. The family is also characterised by the presence of a prominent caudal gland, the absence of a dorsal keel, and the presence of prominent tubercles on the body.

The anatomy of all the introduced slugs is given in Quick (1960) and details of general biology by Runham and Hunter (1970).

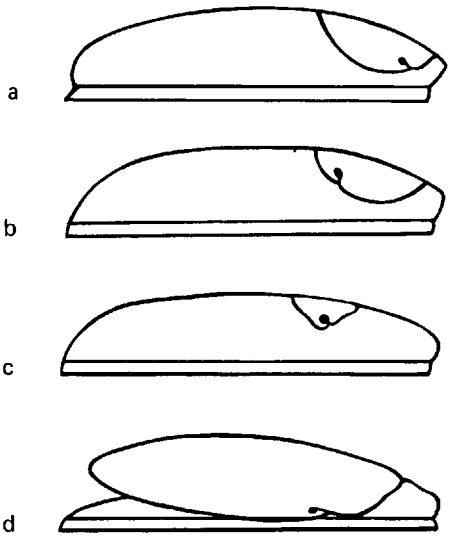
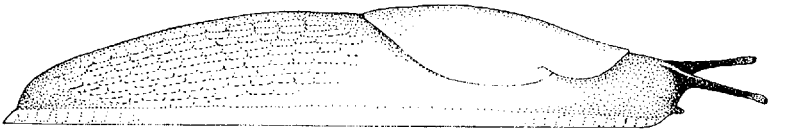


Fig. 15. Diagrams of slug body forms (a) Arionidae, (b) Limacidae and Milacidae, (c) Athoracophoridae, (d) Cystopeltidae

***Arion intermedius* Normand, 1852.** (Introduced)
Arion intermedius, Normand, 1852. *Desc. de six limaces nouvelles Valenciennes*: 6

Slug small, rounded, with prominent caudal gland. Body colour yellow to grey with dark grey to black head and tentacles and occasionally dark bands along the lateral wings of the mantle. Mucus yellow and viscous.



Size 12-20 mm
Range Southern Victoria and Tasmania

Habitat Damp situation under logs and litter in marginal bush areas

Remarks A small, insignificant slug, not a pest. First recorded in the Australian fauna by Long (1970). Called the Hedgehog Slug because of the characteristic form of the dorsal tubercles which stand up as small conical eminences with translucent tips when the animal contracts. A widespread, well established species.

Map 85:
Distribution of Arionidae:
Arion intermedius

The other two species of arionid are not well established and there are probably no breeding colonies present in Australia. However, they have been recorded several times and are included here for this reason. More material is needed.

***Arion hortensis* Ferussac, 1819.** (Introduced)
Arion hortensis, Ferussac, 1819. *Hist. nat. moll. terr. fluv.*, 2: 65

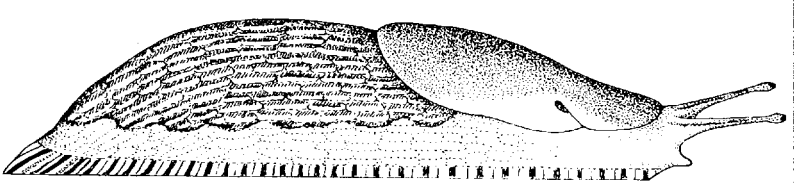
Slug medium, round to flattened, body slender, without foot fringe. Colour grey to black, sometimes with darker lateral bands. Foot yellow and mucus orange to yellow.

Size 25-40 mm
Range Reported from several localities in central Tasmania

Habitat Damp situations in cleared land in cooler areas
Remarks Does not show the characteristic 'hedgehog' behaviour of the previous species

***Arion ater* (Linnaeus, 1758).** (Introduced)
Limax ater Linnaeus, 1758. *Syst. Nat.*, 10: 652

Slug large, fat body with rows of prominent tubercles, a large caudal gland and wide foot fringe. Body colour usually dark brown to black but some varieties have a mottled to variegated pattern, rarely white. Foot fringe alternating vertical black and orange or yellow stripes. Mucus viscous, white to colourless.



Size 100-150 mm
Range Few old records from Sydney area
Remarks A large slug which is not a good world traveller and Australia appears too hot. No breeding recorded in Australia. In Britain and Europe it is a garden pest.

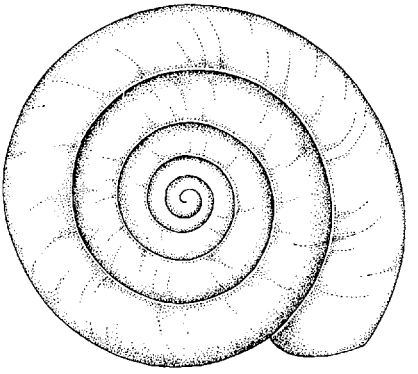
Zonitidae (Vitrinidae)

This family of small to medium land snails is almost worldwide in its distribution but does not occur native in Australia. Typically, the species have thin, low spired, transparent to translucent shells and are often collectively called 'glass snails'. Several species have been introduced into the temperate to sub-tropical parts of Australia where they occur in gardens and other damp sheltered situations. They are classed as beneficial introductions since they feed on non-green vegetable matter and on small animals such as insect larvae and pest species of molluscs.

A review of the species known from Victoria was published by Long (1972). He included *Euconulus fulvus* in this family, a placement we are not following as we consider it to belong to the Euconulidae. Burch (1976) gave the name of this family as Vitrinidae, but we are following Zilch (1959) in this matter.

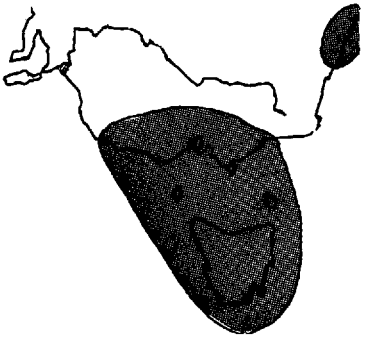
***Oxychilus cellarius* (Muller, 1774).** (Introduced)
Helix cellarius Muller, 1774. *Verm. terr.*, 28: 230

Shell 5 whorls, medium, with low spire and narrow umbilicus, smooth, polished with faint growth lines and channelled sutures. Aperture elliptical. Colour greyish-yellow to light horn. Animal pale grey, mantle edge speckled with brown spots in life.



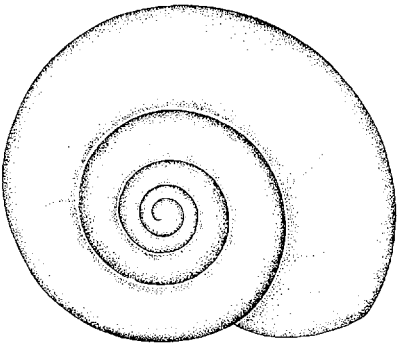
Size 8-10 mm
Range Tasmania generally, Melbourne and central Victoria and Sydney area
Habitat Under groundcover plants in damp situations in gardens and road sides

Map 86:
Distribution of Zonitidae:
Oxychilus cellarius



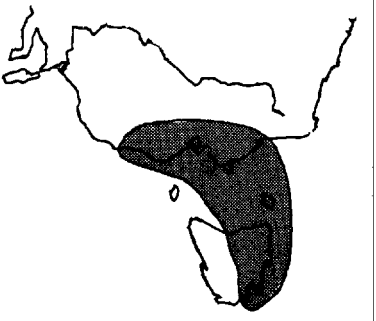
***Oxychilus draparnaldi* (Beck, 1837)** (Introduced)
Helicella draparnaldi Beck, 1837. *Index Moll.*: 6

Shell medium, 6-7 whorls, last whorl enlarged, small umbilicus, aperture elongate elliptical, slightly raised spire, smooth polished with irregular growth lines. Colour pale to dark horn. Animal blue-grey, mantle edge dark grey, unspotted.



Size 12-16 mm
Range Southern Victoria and Tasmania
Habitat Under groundcover vegetation in gardens

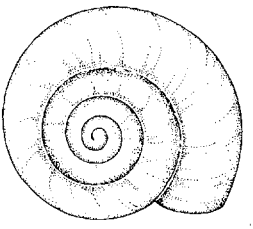
Map 87:
Distribution of Zonitidae:
Oxychilus draparnaldi



***Oxychilus alliarius* (Miller, 1822).** (Introduced)
Helix alliaria Miller, 1822. *Ann. Phil.*, n.s. 3: 379

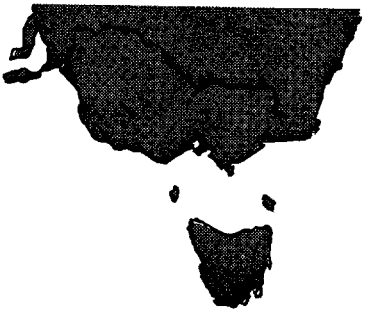
Shell small, 4-5 whorls, flat with wide umbilicus, convex above, aperture slightly elliptical, smooth glossy or with regular weak striations. Colour dark horn. Animal slatey blue-black, mantle

grey edged with dark grey. Emits distinct garlic odour when alarmed or crushed.



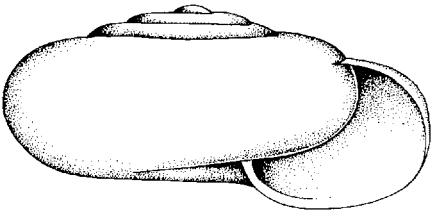
Size 5-6 mm
Range Throughout S.E. Australia
Habitat Under groundcover plants in gardens and other cultivated and marginal land
Remarks The three *Oxychilus* spp. are closely similar, particularly in the juvenile stages. They are easily distinguished as follows:
O. alliarius—smallest, dark shell, nearly black animal and garlic smell
O. cellarius—medium-sized, shell greyish-yellow, brown speckles on mantle edge
O. draparnaldi—largest, light shell, animal blue-grey without mantle spots

Map 88:
Distribution of Zonitidae:
Oxychilus alliarius



***Vitrea contracta* (Westerlund, 1873).** (Introduced)
Zonites crystallina var. *contracta* Westerlund, 1873. *Faun. Moll. terr. fluv. Svec., Norveg, Dan.*: 56

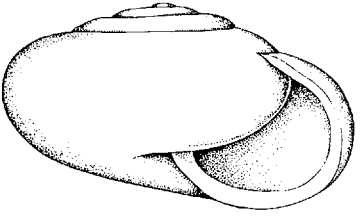
Shell small, 4-5 whorls, thin, transparent flat spire, umbilicus small, regular, smooth wide very faint growth lines. Colour white to very pale yellow to colourless. Animal greyish-white.



Size 2-3 mm
Range Geelong area, Victoria
Habitat Under groundcover plants in damp situation, gardens

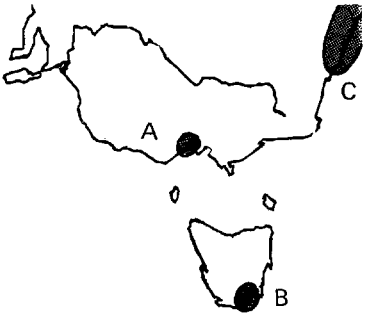
***Vitrea crystallina* (Muller, 1774).** (Introduced)
Helix crystallina Muller 1774. *Verm. terr.*, 2: 23

Shell small, 4-5 whorls, thin transparent, rounded body whorl and narrow umbilicus, with irregular spiral and elliptical aperture, aperture usually with apertural rib. Colour greenish-white to colourless.



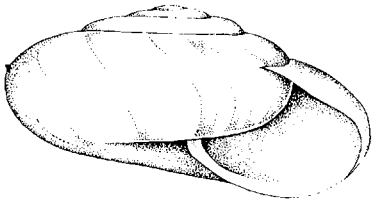
Size 2-3 mm
Range Hobart area, Tasmania
Habitat Under groundcover plants in damp situations, gardens

Map 89:
Distribution of Zonitidae:
A. *Vitrea contracta*
B. *Vitrea crystallina*
C. *Zonitoides arboreus*



***Zonitoides arboreus* (Say, 1816).** (Introduced)
Helix arboreus Say, 1816. in *Nicholson's Encyclop.*, ed. 32. *Conch.*, sp. 2

Shell medium, 4-5 whorls, convex, translucent, glossy, with wide umbilicus and deeply lunate aperture. Sculpture of irregular growth wrinkles and faint fine spiral striae. Colour olive-buff.



Size 5-6 mm
Range Sydney area, New South Wales
Habitat Under groundcover plants in gardens
Remarks This species is native to the United States of America; all the other species listed here in this family are native to Europe. Recorded for Australia by Bishop (1978).

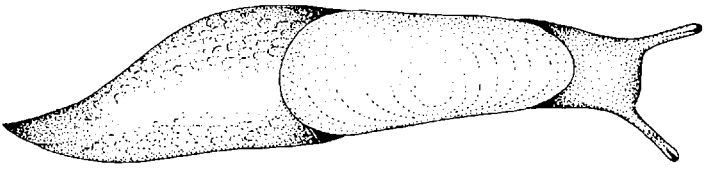
Limacidae

This is a family of slugs, native to the Palaearctic, many species of which have been recorded as successful world travellers. They mainly feed on live plants and are classed as pest species. They have been accidentally introduced into most temperate regions of the world, including Australia, by European man, probably on farm machinery and stock plants brought in by the new settlers. The slugs are surprisingly resistant to adverse environmental conditions and have the ability to hide in very small crevices.

Recent work was carried out on the Australian species of this family by Altena and Smith (1975). The family is typified by the respiratory orifice well behind the middle of the right margin (see Arionidae page 194), and the keel confined to the posterior end of the body. Shell is small and internal.

***Deroceras reticulatum* (Muller, 1774).** (Introduced)
Limax reticulatus Muller, 1774. *Verm. terr.*, 2: 10

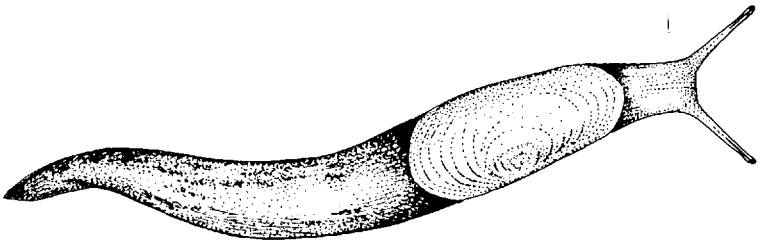
Animal swollen, flaccid, slow moving, not active. Colour pale fawn with dark brown to grey reticulations, sometimes so dense as to give body dark appearance. White milky, sticky mucus secretion exudes over body when disturbed.



Size 40-50 mm
Range Throughout S.E. Australia
Habitat Areas of introduced plants in damp situations, such as base of stems or under rocks and logs

***Deroceras caruanae* (Pollonera, 1891).** (Introduced)
Agriolimax caruanae Pollonera, 1891. *Boll. Musei Zool. Anat. comp. R. Univ. Torino*, 6(99): 3

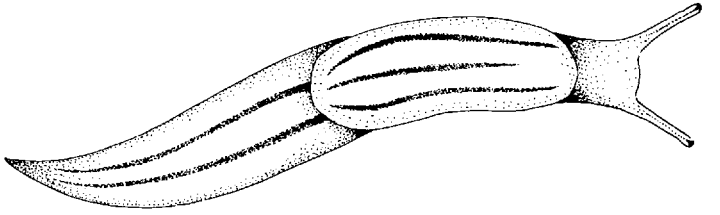
Animal small, slim, fast moving, active. Colour uniform light brown to grey. Body secretion colourless, non-viscous.



Size 25-35 mm
Range Throughout S.E. Australia
Habitat Areas of introduced plants in damp situation both in pasture and gardens, at base of plant stems

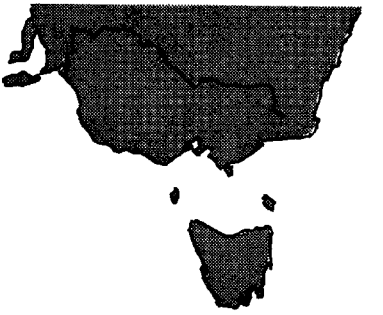
***Lehmannia (Lehmannia) nyctelia* (Bourguignat, 1861)** (Introduced)
Limax nyctelia Bourguignat, 1861. *Spec. malac.*: 41

Animal swollen, flaccid, not active. Colour of light brown with two lateral dark stripes on the mantle and body and occasionally a median stripe also. Body mucus colourless, non-viscous.



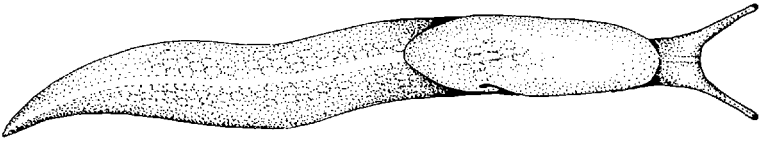
Size 40-60 mm
Range Throughout S.E. Australia
Habitat In cleared country, under rocks or around plant roots, occasionally in gardens

Map 90:
Distribution of Limacidae:
Deroceras reticulatum
Deroceras caruanae
Lehmannia (Lehmannia) nyctelia
Lehmannia (Limacus) flava
Limax maximus



***Lehmannia (Limacus) flava* (Linnaeus, 1758)** (Introduced)
Limax flavus Linnaeus, 1758. *Syst. Nat.*, 10: 652

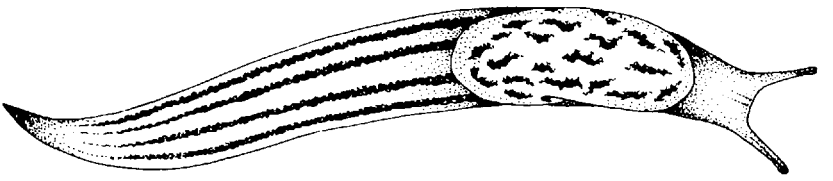
Animal large, with no bands. Colour olive-greeny-grey with light grey spots. Body mucus viscous yellow-orange, particularly from the pedal gland



Size 130-160 mm
Range Throughout S.E. Australia
Habitat With decaying vegetation in damp situations around human dwellings

***Limax maximus* Linnaeus, 1758** (Introduced)
Limax maximus Linnaeus, 1758. *Syst. Nat.*, 10: 652

Animal large, with longitudinal bands on body. Colour light brown with dark brown to black bands and dark spotting or marbling on the mantle. Body mucus fairly non-viscous and colourless



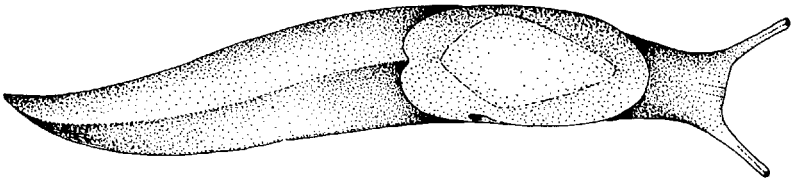
Size 150-200 mm
Range Throughout S.E.Australia
Habitat With decaying vegetation in damp situations but not necessarily close to human dwellings

Milacidae

This family of introduced slugs is closely related to the Limacidae, some authorities including it in that family with sub-family status. It is closely similar to the Limacidae in origin, life style and pest potential of crops and gardens. Species are most easily separated from limacid slugs by the tail keel which in this family extends along the dorsum to the posterior edge of the mantle.

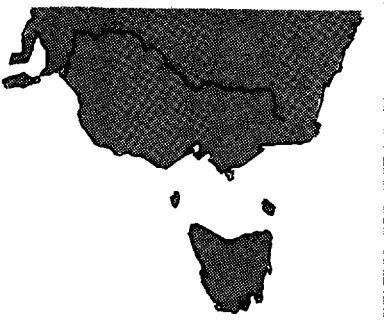
***Milax gagates* (Draparnaud, 1801)** (Introduced)
Limax gagates Draparnaud, 1801. *Tabl. Moll. terr. fluv. France*: 100

Animal medium, with obvious dorsal keel extending from tail to posterior mantle edge. Median area of foot crossed by >-shaped groove. Colour uniform black to grey, without body bands.



Size 40-50 mm
Range Throughout S.E. Australia
Habitat Associated with introduced plants in damp situations in pasture, crops and gardens

Map 91:
Distribution of Milacidae:
Milax gagates



Cystopeltidae

This is a small family of native slugs endemic to eastern and south-eastern Australia. They are distinguished from all other slugs by their general body form as they appear to be midway between a snail and a 'classical' slug. In Cystopeltidae the visceral mass is separate from the foot at the posterior end (see Arionidae, page 194). The mantle covers the entire visceral mass.

The relationships of this family to other groups of land molluscs is still not known, though several workers have suggested various relationships. A great deal more material is needed before a revision of the species can be undertaken. Various colour forms are known and the colour, size and body form appears to be related to habitat and to geographical distribution.

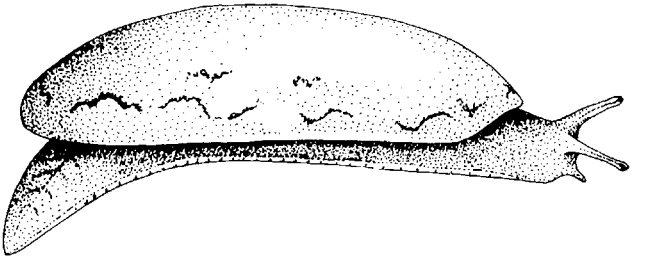
Cystopeltids are found sheltering under logs or in litter, but on wet cool days they are often seen crawling on tree trunks, sometimes quite high above the ground. In forest areas they have also commonly been found resting inside the rolled up loose bark hangings on the large gum trees, in some cases many metres above the ground.

As no accurate revision of the species is available, a representative name is given here. Several other names are available in literature. Outside South-eastern Australia the family is known along the Great Dividing Range of northern New South Wales and into southern Queensland. This group is currently the subject of study by the present authors.

***Cystopelta petterdi* Tate 1881**

Cystopelta petterdi Tate, 1881. *Pap. Proc. R. Soc. Tasm.*, 1880: 17

Slug small to medium, with large visceral mass, flat tail with central venation, pneumopore on right anterior margin of visceral mass. Colour grey-brown to dark brown to light greeny-grey, sometimes with black, white and brown flecks and blotches. Mucus thin, non-viscous, colourless.



Size 10-40 mm

Range Tasmania, southern Victoria and N.S.W. in the Great Dividing Range and coastal strip. Most westerly record, Glenelg region of S.W. Victoria

Habitat Forest and woodland scrub, in litter, under logs and bark

Map 92:
Distribution of Cystopeltidae:
Cystopelta petterdi

Separation of the families Helicarionidae and Euconulidae
From the family key:

38(37) Shell light yellow to pink to dark brown, with small to closed umbilicus—**Family Euconulidae** (part) or **Family Helicarionidae** (part)

38a Shell medium (more than 10 mm), eastern-central N.S.W. only—**Family Helicarionidae** (part) (page)

38b Shell small (less than 10 mm), eastern-southern N.S.W. or South Australia—**Family Euconulidae** (part)

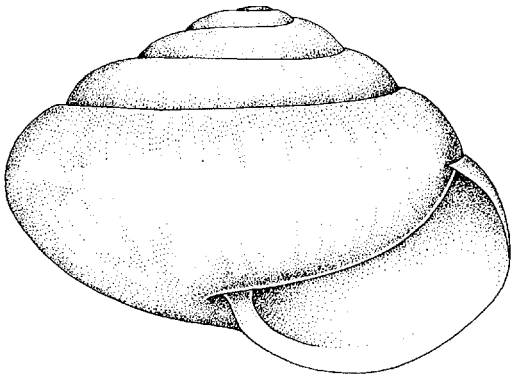
Euconulidae

This is a family with small to medium thin, fairly featureless shells, with a world-wide distribution. The exact limits and status of the family is still not agreed upon nor stable in malacological literature. The nature of the dilemma is set out by Burch (1976). The native species referred to this family are very similar to the *Nitor* group of the family Helicarionidae and much more work is needed to elucidate the exact relationships between these various small, smooth flat shells.

In Australia the family is found in the tropical and warm temperature regions with sufficient rainfall to give the damp situations required. Like the helicarionids and cystopeltids this family also possesses a marked caudal process and the animals are very active when disturbed.

***Euconulus fulvus* (Muller, 1774).** (Introduced)
Helix fulva Muller, 1774. *Verm. terr.*, 2: 249

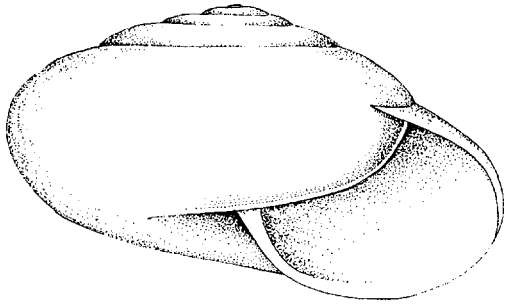
Shell very small, 5-6 whorls, turbinate, semi-transparent, thin and fragile with no umbilicus, rounded peripheral keel, aperture descending, oblong lunate. Shell smooth, with faint growth lines. Colour horn to reddish-brown, animal grey-black.



Size 2-3 mm
Range South-eastern Victoria
Habitat Under plant cover in damp situations in gardens
Remarks This introduced species was recorded by Gabriel (1929) and included by Long (1972) in his review of Zonitidae introduced into Victoria. We place it in this family following Burch (1976).

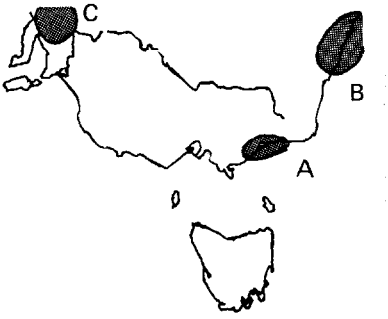
***Melocystis jacksoniensis* (Gray, 1834)**
Helix jacksoniensis Gray, 1834. *Proc. zool. Soc. Lond.*, 1834: 64

Shell small, 5 whorls, thin, depressed spire, umbilicus almost closed, aperture ovate-lunate, shoulder rounded. Sculpture of very fine spiral and transverse lines on smooth, glossy shell. Colour pale horn to reddish-yellow, occasionally with deeper flames.



Size 8-10 mm
Range Central and southern N.S.W.
Habitat Damp situations in litter in forest and woodland

Map 93:
Distribution of Euconulidae:
A. *Euconulus fulvus*
B. *Melocystis jacksoniensis*
C. *Echonitor cyrtochilus*



***Echonitor cyrtochilus* (Gude, 1905)**
Thalassia cyrtochila Gude, 1905. *J. Malac.*, 12: 12

Shell small, 4-5 whorls, thin, depressed spire, narrow umbilicus almost closed, hidden by reflected columella, smooth, shining, whorls rounded, aperture ovate-lunate. Sculpture absent or of fine spiral lines. Colour greenish-yellow to golden brown.
Size 8-10 mm
Range Central-eastern South Australia
Habitat Damp situations, under moss and in litter on shaded sides of gorges
Remarks No figure is given of this species as it would be identical with the preceding species. The species differ only in the colour and locality range.

Helicarionidae

This is a fairly large and diverse family of snails with mainly thin, fragile to reduced shells distributed from Africa through South-east Asia and the western Pacific and Australia. In some Asian

regions it represents a major part of the snail fauna (Solem 1966). In Australia it plays a relatively minor role, being mainly confined to the forest areas of the Great Divide of eastern Australia and of Tasmania.

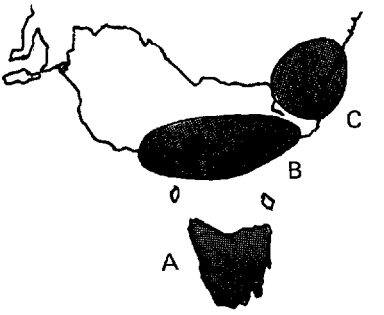
Two main types of helicarionids are encountered in Australia. One has a flattened, glossy, pale coloured helicoid shell and is found in tropical to warm temperate regions of the east coast. The other is what Solem (1974) terms a semi-slug, having a reduced, very fragile, usually transparent shell with a very wide aperture into which the body is usually too large to withdraw completely. The animal is very quick and active and has mantle flaps or lappets which can in some species cover the shell. It can therefore be thought of as being on the evolutionary road to becoming a slug. This group ranges throughout the wet regions of eastern Australia including Tasmania.

The delineation of species in this group is only tentative, as in the past probably undue emphasis has been given to shell features and animal colour. Various groups in the family are currently being revised by one of us (RCK) and Burch.

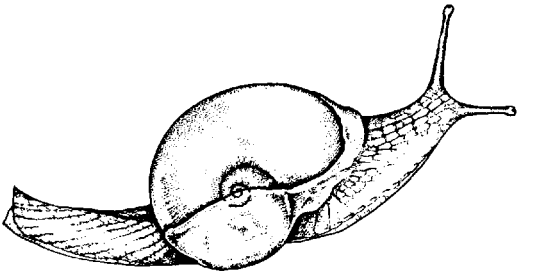
***Helicarion cuvieri* Ferussac, 1821.**
Helicarion cuvieri Ferussac, 1821. *Tabl. Syst. Anim. moll.*: 20

Shell medium, 3 whorls, thin fragile, transparent glossy, flat with wide aperture. Protoconch with very faint radial lirae and spiral striae, adult sculpture of irregular radial lirae and vague spiral striae. Colour pale yellow. Animal slim, elongate, white to grey.
Size 10-16 mm
Range Throughout Tasmania
Habitat Damp situations, under logs in forest and woodland
Remarks This species was previously described from Victoria (Gabriel, 1930) but these are now thought to be pale variations of the next species.

Map 94:
Distribution of Helicarionidae:
A. *Helicarion cuvieri*
B. *Helicarion niger*
C. *Helicarion mastersi*

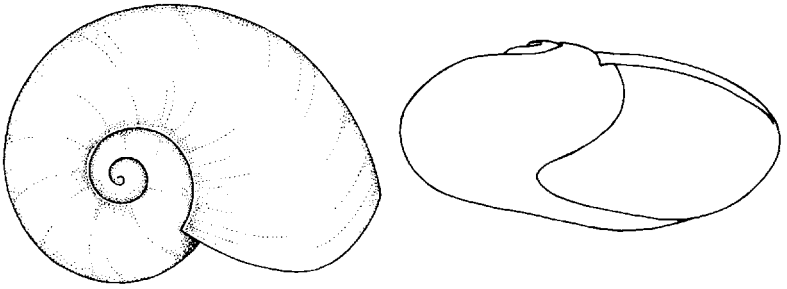


The animal and shell figures given are intended to illustrate all the species of *Helicarion* mentioned here.



***Helicarion niger* (Quoy & Gaimard, 1832)**
Vitrina niger Quoy & Gaimard, 1832. *Voy. Astrolabe. Zool.*, 2: 135

Shell medium, 3 whorls, thin fragile, glossy, transparent to opaque, flat with wide aperture. Protoconch with distinct spiral striae and sometimes weak radial lirae, adult sculpture of radial lirae and very fine spiral striae. Colour orange-yellow. Animal black to grey to pinkish-buff with dark extremities.

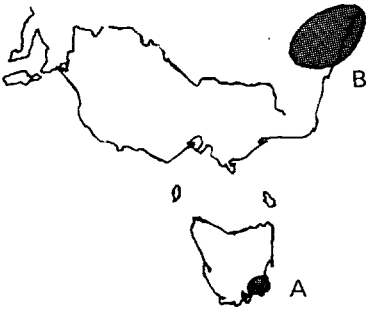


Size 8-13 mm
Range Southern and eastern Victoria
Habitat Damp situation, under logs in forest and woodland

***Helicarion rubicundus* (Dartnall & Kershaw, 1978)**
Helicarion rubicundus Dartnall & Kershaw, 1978. *Rec. Queen Vict. Mus.*, 62: 1-18

Shell large, 3 whorls, thin, fragile, glossy, transparent, flat with very wide aperture. Sculpture of fine irregular radial lirae and spiral striae, particularly on protoconch. Colour greenish-yellow, animal grey with bright red and green pattern, red mucus.
Size 16-22 mm
Range South-eastern Tasmania
Habitat Under logs in wet forest and woodland
Remarks Very rare species

Map 95:
Distribution of Helicarionidae:
A. *Helicarion rubicundus*
B. *Helicarion freycineti*

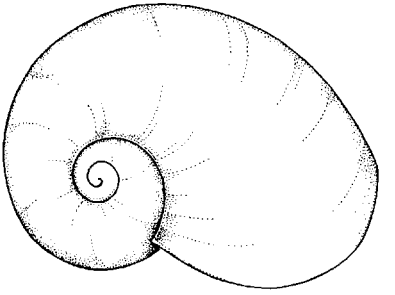


***Helicarion mastersi* (Cox, 1868)**
Vitrina mastersi Cox, 1868. *Mon. Aust. Land Shells*: 86

Shell medium, 3 whorls, thin fragile, transparent glossy, flat with very wide aperture. Protoconch with fine irregular radial lirae and vague spiral striae, adult sculpture of weak radial lirae. Colour yellow to golden. Animal dark greyish-buff to white.
Size 10-13 mm
Range South-eastern N.S.W.
Habitat Damp situations, under logs and litter in forest and woodland

***Helicarion freycineti* (Ferussac, 1821)**
Helicarion freycineti Ferussac, 1821. *Tabl. Syst. Anim. moll.*: 24

Shell large, 3 whorls, thin, glossy transparent to opaque, flat with very wide aperture. Shell with low ridges, smooth with fine spiral striae and few weak radial lirae on protoconch. Colour pale yellow. Animal bulky, buff to yellowish-grey.

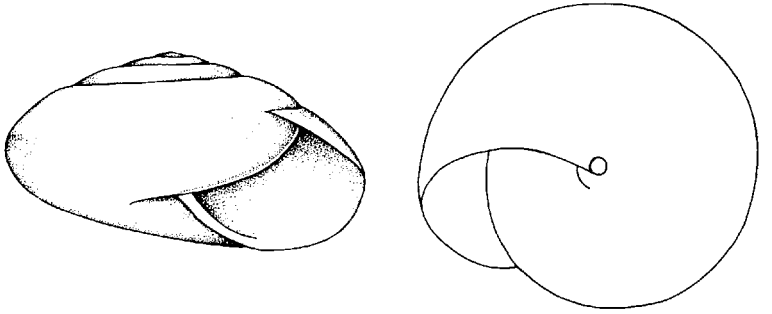


Size 15-20 mm
Range Central N.S.W.
Habitat Damp situations, under logs and litter in wet forests
Remarks Iredale (1941b) notes red colour on side of foot

***Nitor subrugatus* (Reeve, 1852)**
Helix subrugata Reeve, 1852. *Conch. Icon.*, 7, *Helix* pl. 128, sp. 773

Shell medium, 5-6 whorls, thin, semi-transparent, helicoid with tight coiling, depressedly turbinate, smooth whorls rounded to

slightly keeled, base flatly convex with narrow umbilicus, aperture ovate-lunate. Shell glossy with very faint spiral lines. Colour milky white, olive to pale yellow to opal pink.



Size 10-15 mm
Range Central eastern N.S.W.
Habitat Damp situations under logs and in litter in wet forest
Remarks This is the southern extremity of a common group of snails in the forests of much of the east coast of Australia

Map 96:
Distribution of Helicarionidae:
Nitor subrugatus

Testacellidae

This is a small family of unusual slugs which is carnivorous in habit and bears a small vestigial shell on the posterior end of the body.

The family is native to Europe and the Palaearctic region and has been recorded as an introduction into most of the other temperate regions of the world. Because of its habit of burrowing in soil in gardens, feeding mainly on earthworms and insect larvae, it is rarely seen. However, a few specimens have been recorded in various parts of southern Australia.

***Testacella haliotidea* (Draparnaud, 1801)** (Introduced)
Testacella haliotidea Draparnaud, 1801. *Tabl. Moll. terr. fluv. France*: 99

Animal medium to large, slug-like with body tapered towards anterior end, pair of lateral branching grooves run along sides of body. Shell small, ear-shaped, imperforate with subspiral posterior nucleus on posterior end of body. Shell contains and protects the mantle, heart and kidney but impossible for animal to retract into it. Colour of the shell is light yellow to horn and animal a greeny-brown.

Size Shell 6-10 mm; animal 60-90 mm
Range Recorded from Melbourne and Sydney
Habitat Burrowing in cultivated soil in gardens
Remarks Very rare species because of its way of life. Not uncommon around Sydney (Ponder—pers. comm.).

Separation of the families Camaenidae, Bradybaenidae and Helicidae
From the family key:

32(31) Shells thick, heavy, calcareous with coarse ribbing—**Family Camaenidae** (part) or **Family Helicidae** (part)
39(37) Shell medium to large, subglobose to globose, thick, with various colours and patterns—**Family Camaenidae, Family Bradybaenidae** or **Family Helicidae** (part)

Species of the three families Camaenidae, Bradybaenidae and Helicidae found in S.E. Australia are almost impossible to separate at family level by gross shell characteristics. However, they are readily separated at species level if particular shell characteristics are used in conjunction with habitat type and geographical region.

Family Bradybaenidae (page 229)

Bradybaena similaris—shell small to medium (12-16 mm) subglobose, narrow umbilicus, porcellanous, white to buff with single brown band around each whorl, Sydney area and garden areas of towns of central N.S.W. coast only.

Family Caemaenidae (page 218)

In New South Wales—species confined to native bush areas, forest, woodland scrub or semi-desert mallee except for *Meridolum* spp. which could be confused with helicids or bradybaenids.

Meridolum spp.—shell medium to large (15-20 mm) subglobose, depressed spire, yellow to brown, sculpture of fine granulations.

In Victoria—species with periostracal hairs, confined to woodland scrub and forest.

In Tasmania—King Island only.

In South Australia—species found under rocks or vegetation in woodland to semi-desert mallee areas in natural habitats, shells with granulations, yellow to pale brown without dark banding except for *Meracomelon cassandra.* This is a large shell (25-30 mm), larger than any species with which it might be confused.

Family Helicidae (page 231)

Species confined to areas grossly modified by man such as gardens, crops, pastures, etc. The only species likely to be confused with other families are the *Cernuella* spp. These are confined to South Australia and western Victoria and are mainly white, medium sized shells with several dark brown concentric bands.

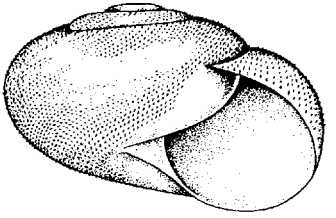
Camaenidae

This is one of the major land snail families of the world showing a wide diversity of form and of habitat preference. Its main centre of distribution is Asia, ranging throughout the Indo-Pacific area. It is the most widespread and diverse family in Australia ranging from deserts to tropical rainforests. The numbers of species in the fauna falls off from north to south in Australia. The family is the dominant group in tropical Australia. While only thirteen species are present in South-eastern Australia, only one occurs in southern Victoria and King Island and none on the Tasmanian mainland.

The family is characterised by medium to large, solid, helicoid shells and the absence of a dart apparatus in the reproductive system. Most species are very variable in shell shape, form and colour, leading to many names in the literature. We consider the species listed below a reasonable assessment of the fauna in the absence of modern revisionary findings. Various sections of the Australian camaenids are being revised by Bishop and Solem. It is probable that there will be changes in the specific and generic groupings given here when this revisionary work is completed.

Key to the genera of the Camaenidae

1 Shell subglobose to flattened with periostracal hairs or pustulate shell sculpture as hair-bases **2**

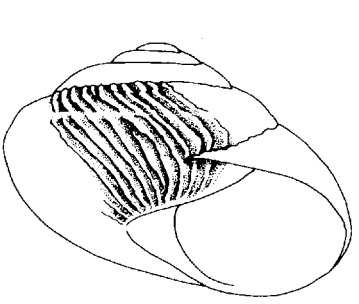


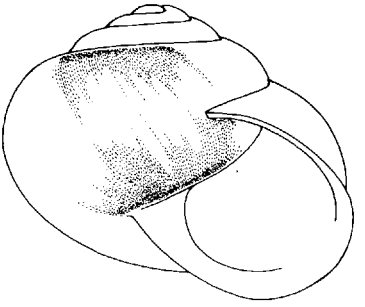
1 Shell globose to flattened without periostracal hairs but with granular to ribbed sculpture **3**

2(1) Shell subglobose, with many periostracal hairs, from woodland areas in Victoria or eastern N.S.W.—genus *Chloritobadistes*

2(1) Shell subglobose to flattened with rounded peripheral keel and few short periostracal hairs or pustulate hair bases, from dry regions of South Australia or western New South Wales—genus *Semotrachia*

3(1) Shell with depressed spire, sometimes keeled, with sculpture of rough irregular ribs **4**





3(1) Shell globose to subglobose, smooth or with sculpture of fine granulations **5**

4(3) Shell large to medium, with peripheral keel and pronounced ribs—genus *Glyptorhagada*

4(3) Shell small to medium, rounded to slightly keeled periphery, ribs fine, rounded—genus *Pleuroxia*

5(3) Shell large to medium, subglobose, with colour banding and fine granular surface **6**

5(3) Shell medium, globose, unicolour with almost smooth surface, desert snail—genus *Sinumelon*

6(5) Shell from New South Wales—genus *Meridolum*

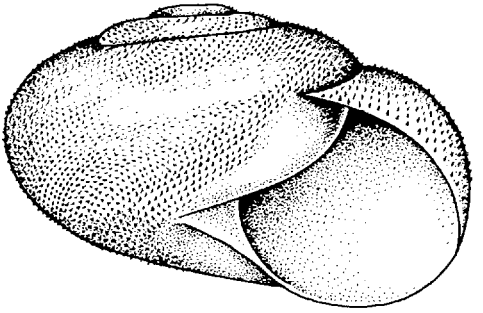
6(5) Shell from South Australia—genus *Meracomelon*

***Chloritobadistes brevipila* (Pfeiffer, 1850)**

Helix brevipila Pfeiffer 1850. *Proc. zool. Soc. Lond.*, 1849: 130

Shell medium, 4-5 whorls, subglobose, with depressed spire, rounded apex, impressed sutures and large, rounded body whorl, narrow umbilicus partially closed by reflected columella, aperture roundly lunate often with slightly reflected outer lip. Periostracum

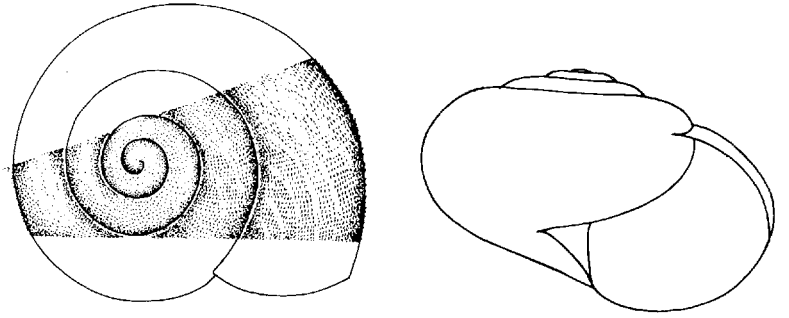
with sparse covering of fairly fine, short, tapered hairs in oblique rows, clean shell with pustules at hair bases. Colour mid to light brown.



Size 12-15 mm
Range Great Dividing Range of southern N.S.W. and far eastern Victoria
Habitat In litter in dry sclerophyll forest

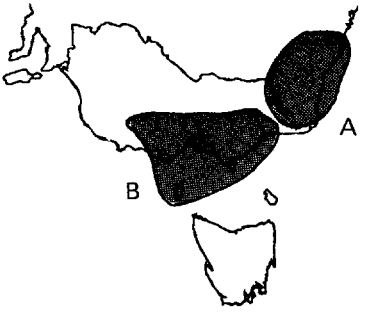
***Chloritobadistes victoriae* (Cox, 1868)**
Helix victoriae Cox, 1868. *Mon. Aust. Land Shells*: 37

Shell medium, 4-5 whorls, subglobose with flattened, depressed spire, rounded apex, impressed sutures and almost closed umbilicus with reflected columella, aperture ovate-lunate. Periostracum with close fine hairs densely covering surface in fine velvet. Colour dark reddish-brown.



Size 12-20 mm
Range Victoria south of the Great Divide and King Island, Bass Strait
Habitat In litter in forest and woodland scub
Remarks A recent opinion by Bishop (pers. comm.) is that this species may be split into two or three separate species by anatomical features

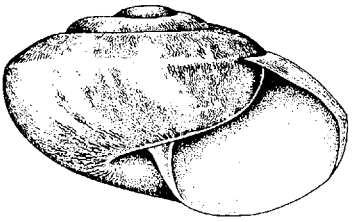
Map 97:
Distribution of Camaenidae:
A. *Chloritobadistes brevipila*
B. *Chloritobadistes victoriae*



Note Species of the following four genera are thought of as 'desert snails' showing special adaptations for life in hot, low rainfall areas. During dry conditions these snails exhibit lowered metabolic activity or aestivation. To assist with their survival the snails use two distinct methods of sealing the shell aperture. Species of the genera *Semotrachia* and *Glyptorhagada* seal themselves onto hard surfaces while species of *Pleuroxia* and *Sinumelon* seal their apertures with a calcareous epiphragm and lie buried free in loose sand under stones.

***Semotrachia subsecta* (Tate, 1879)**
Helix subsecta Tate, 1879. *Trans. R. Soc. S. Aust.* 1878-9: 133

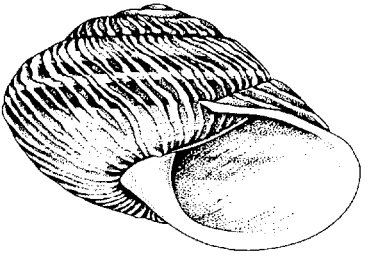
Shell medium to small, 4 whorls, subdiscoidal, with slightly elevated spire, body whorl rounded with slight hint of keeling, wide umbilicus. Aperture roundly lunate, oblique, facing downwards, lip continuous, thickened and reflected. Sculpture granulate with some surface wrinkles and sparse cover of short periostracal hairs arising from pustulate hair bases. Colour dark brown, apex paler and lip yellow to white.



Size 10-14 mm
Range Central eastern South Australia and south-western N.S.W.
Habitat Under rocks, usually in a sheltered, shady area
Remarks This is the most southerly species of a large group of snails widespread in Central Australia

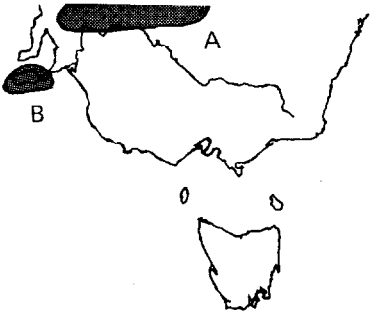
***Glyptorhagada silveri* (Angas, 1868)**
Helix (*Rhagada*) *silveri* Angas, 1868. *Proc. zool. Soc. Lond.*, 1868: 257

Shell medium to large, 4-5 whorls, subglobose with depressed spire, body whorl rounded with sub keel, umbilicus small, almost closed with reflected columella, aperture ovate-lunate with reflected lip. Sculpture of coarse, irregular rounded oblique ribs giving the shell a rugose appearance. Colour light brown.



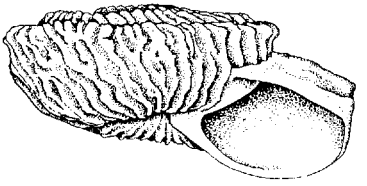
Size 20-25 mm
Range Central eastern South Australia and south-west N.S.W.
Habitat Under rocks and litter in sheltered places

Map 98:
Distribution of Camaenidae:
A. *Semotrachia subsecta*
Glyptorhagada silveri
Pleuroxia hinsbyi
B. *Glyptorhagada bordaensis*
Pleuroxia lemani



***Glyptorhagada bordaensis* (Angas, 1880)**
Helix bordaensis Angas, 1880. *Proc. zool. Soc. Lond.*, 1880: 419

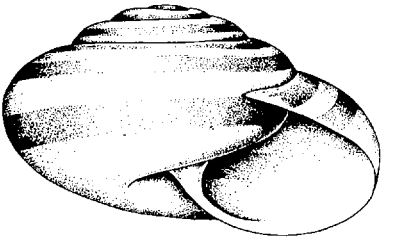
Shell medium, 4 whorls, with flattened spire, keel on shoulder of body whorl, base rounded, umbilicus narrow, aperture oblique, ovate-lunate with thin lip. Sculpture of strong coarse wavy ribs. Colour light brown.



Size 12-18 mm
Range Kangaroo Island, South Australia
Habitat Under rocks and litter in open scrub country

***Pleuroxia lemani* (Gude, 1916)**
Angasella lemani Gude, 1916. *Proc. malac. Soc. Lond.*, 12: 41

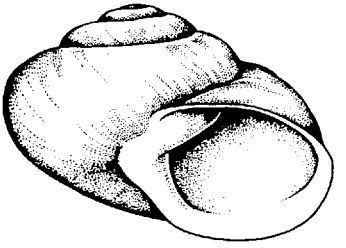
Shell small, 4-5 whorls, subdiscoidal with depressed to flattened spire, body whorl rounded, aperture roundly lunate, umbilicus narrow. Sculpture of coarse regular radial ribs and a fine granular surface. Colour mid to dark brown.



Size 10-16 mm
Range Kangaroo Island, South Australia
Habitat Under rocks and litter in open scrub country

***Pleuroxia hinsbyi* (Gude, 1916)**
Angasella hinsbyi Gude, 1916. *Proc. malac. Soc. Lond.*, 12: 42

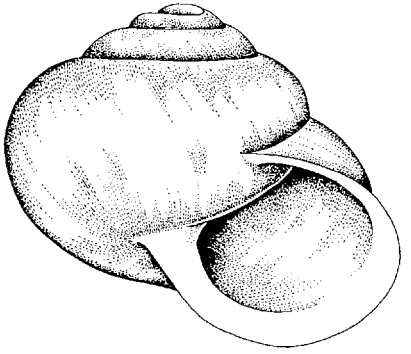
Shell small, 4 whorls, subglobose with slightly elevated spire, deep body whorl and round shoulder, wide umbilicus, aperture oblique, narrowly ovate-lunate with thickened lip. Sculpture of fine ribs and fine surface granulation on early whorls. Colour light to dark brown.



Size 10-15 mm
Range Central eastern South Australia and south-west N.S.W.
Habitat Under rock and litter in sheltered places

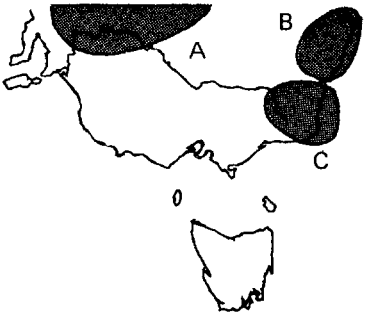
***Sinumelon fodinale* (Bednall, 1892)**
Helix (Hadra) fodinalis Bednall, 1892. *Trans. R. Soc. S. Aust.*, 16: 63

Shell medium, 4 whorls, globose, heavy, with large body whorl, depressed roundly lunate aperture with reflected lip, umbilicus almost closed by reflected columella. Sculpture of very fine granulations over oblique radial growth lines. Colour pale fawn to light brown, occasionally with faint broad reddish-brown band.



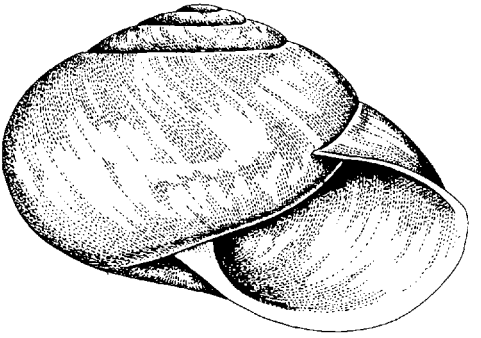
Size 14-18 mm
Range South-western N.S.W. and adjacent areas of South Australia and Victoria
Habitat Found aestivating in coarse sand under groundcover vegetation such as *Triodia*, litter debris or rock piles

Map 99:
Distribution of Camaenidae:
A. *Sinumelon fodinale*
B. *Meridolum jervisensis*
C. *Meridolum mastersi*



***Meridolum jervisensis* (Quoy & Gaimard, 1832)**
Helix jervisensis Quoy & Gaimard, 1832. *Voy. Astrolabe. Zool.*, 2: 126

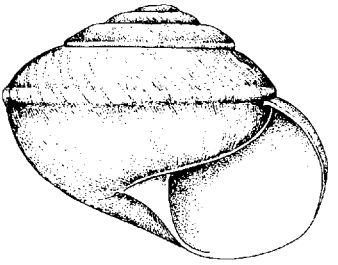
Shell large, 4 whorls, subglobose, strong, with large body whorl, slightly depressed spire, ovate-lunate, slightly depressed aperture with shallow reflected lip, umbilicus narrow, almost covered by reflected columella. Sculpture of very fine zigzag lines and coarser growth lines, suggestion of pustulation on the protoconch. Colour pale brown with, in some, a narrow subsutural red-brown line and a similar coloured patch round the umbilicus.



Size 20-26 mm
Range Coastal and Great Divide region of central N.S.W.
Habitat Under logs and in litter in dry forest and woodland scrub
Remarks This is the earliest species described for this variable group of snails from the coastal and mountain region of eastern N.S.W. Many names occur in literature and there may be more valid species. A second, probably distinct species is included here.

***Meridolum mastersi* (Cox, 1864)**
Helix mastersi Cox, 1864. *Cat. Aust. Land Shells*: 19

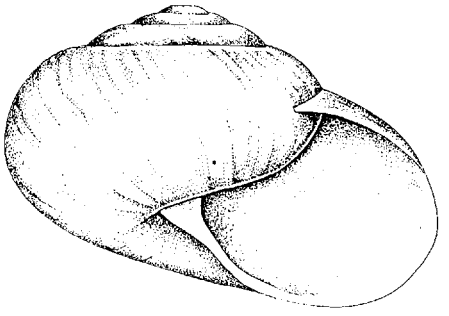
Shell medium, 4 whorls, subglobose with depressed spire and slight peripheral keel on body whorl. Aperture ovate-lunate, depressed, with slightly reflected lip, umbilicus closed by reflected columella. Sculpture of fine granulations and oblique growth lines. Colour mid brown with faint concentric band.



Size 14-18 mm
Range Coastal region of southern N.S.W. and far eastern Victoria
Habitat Under logs and litter in forest

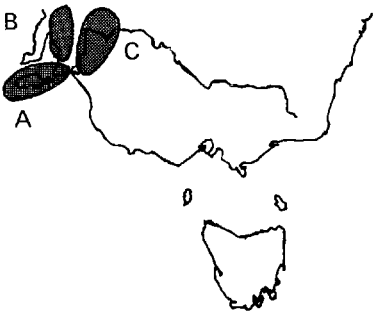
***Meracomelon sutilosa* (Ferussac, 1829)**
Helix sutilosa Ferussac, 1829. *Hist. nat. moll. terr. fluv.* livr. 29

Shell, medium, 4 whorls, subglobose with depressed spire, rounded body whorl, aperture ovate-lunate slightly depressed, lip thin, umbilicus almost closed by reflected columella. Sculpture of fine granulations and oblique lines. Colour buff to light brown.



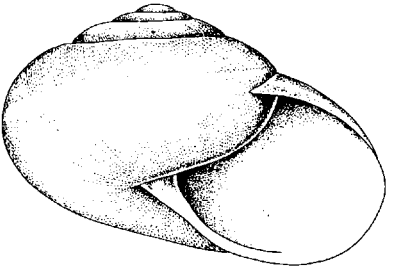
Size 12-18 mm
Range Kangaroo Island and adjacent mainland areas, South Australia
Habitat Under rocks and litter in fairly dry areas

Map 100:
Distribution of Camaenidae:
A. *Meracomelon sutilosa*
B. *Meracomelon stutchburyi*
C. *Meracomelon cassandra*



***Meracomelon stutchburyi* (Pfeiffer, 1857)**
Helix stutchburyi Pfeiffer, 1857. *Proc. zool. Soc. Lond.*, 1856: 386

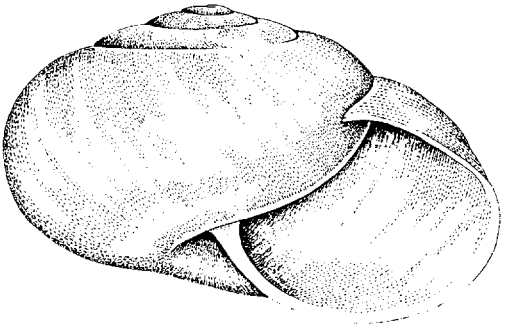
Shell large, 4-5 whorls, solid, subglobose with slightly depressed spire, rounded periphery, aperture ovate-lunate, slightly depressed, umbilicus narrow almost closed by reflected columella. Sculpture of fine granulations on dorsal surface, smooth below. Colour pale yellow with faint brown horizontal band.



Size 18-22 mm
Range Coastal and hill regions north of Adelaide, South Australia
Habitat Under rocks and litter in sheltered places

***Meracomelon cassandra* (Pfeiffer, 1864)**
Helix cassandra Pfeiffer, 1864. *Proc. zool. Soc. Lond.*, 1863: 527

Shell large, 4-5 whorls, solid, subglobose with slightly elevated spire, body whorl rounded, aperture ovate-lunate depressed, umbilicus almost hidden by reflected columella. Sculpture of fairly fine granulation over entire shell. Colour buff to whitish with faint concentric band.



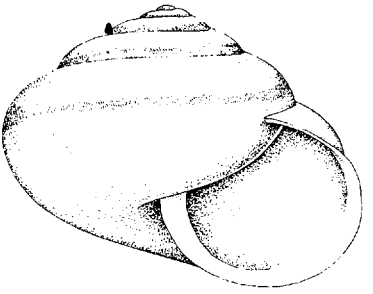
Size 22-28 mm
Range Lower Murray Valley, South Australia
Habitat Under rocks in sheltered places
Remarks There are many names in literature for these medium to large, subglobose shells from southern South Australia. The delineation of the species will have to await a thorough revision of the group.

Bradybaenidae

This family of snails with medium to small, depressed shells is native to eastern Asia. Several species have become world travellers, particularly in tropical areas. Only one species is known as an introduction into Australia. This is originally a native of China but has spread to many tropical and subtropical regions round the world. It is known only from central New South Wales to central Queensland.

***Bradybaena similaris* (Ferussac, 1831).** (Introduced)
Helix similaris Ferussac, 1831. *in Rang., Annls. Sci. nat.*, 24 (93): 15

Shell medium, 5-6 whorls, subglobose with depressed spire, narrow umbilicus and large round lunate aperture with reflected lip and columella. Shell porcellanous with impressed sutures and sculpture of fine irregular growth lines and fine spiral striae. Colour buff to light brown with single chestnut brown spiral band just above the sutures.



Size 12-16 mm
Range Sydney area, N.S.W.
Habitat Gardens and parks, in damp situations

Map 101:
Distribution of Bradybaenidae:
Bradybaena similaris

Helicidae

This large family of snails native to the Palaearctic region of Europe, western Asia and North Africa has many species which are accomplished world travellers, having been introduced by European man into most temperate regions of the world. Many species of this family, introduced around the world, have become serious crop and garden pests as they are living-plant feeders.

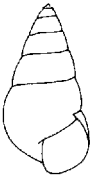
There is a special problem with identifying species of introduced molluscs and referring them to species names in such a complex family as the Helicidae. Snail specialists in Europe have stated that they can only identify their local helicids with certainty when they take the locality into consideration. There is no way to determine from which part of Europe any given introduced species originates. It is therefore possible that more introduced species than have at present been recognised may occur in Australia.

These snails were obviously first introduced accidentally on plants, machinery, etc. and are now spread within Australia by similar means. A map of the distribution of several of these species is identical with a map of the main road, rail and river transport arteries. Incredibly some deliberate introductions also took place (Legrand, 1871).

Key to the genera of the Helicidae

1 Shell helicoid, globose or subglobose **2**

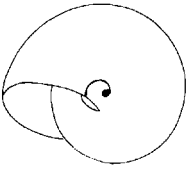
globose



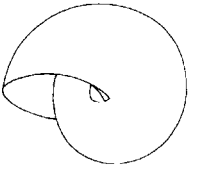
conical

1 Shell conical, with high spire—genus *Cochlicella*

2(1) Shell large to medium with closed or hidden umbilicus **3**



open umbilicus



closed umbilicus

2(1) Shell medium to small with open umbilicus **5**

3(2) Shell large, globose, thin, brown with black bands and blotches—genus *Helix*

3(2) Shell large to medium subglobose with depressed spire, white with brown spiral bands **4**

4(3) Shell medium, thin, white with fine brown bands, aperture rose pink—genus *Theba*

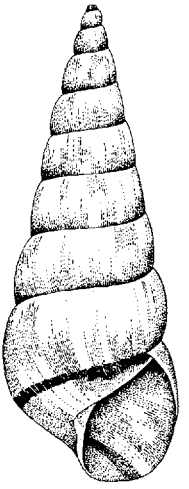
4(3) Shell large, thick, heavy, white with broad brown to black spiral bands, aperture with thick reflected lip, white—genus *Eobania*

5(2) Shell medium (more than 12 mm), white with fine dark bands, sculpture of fine striae or absent—genus *Cernuella*

5(2) Shell small (less than 12 mm), brown with blotches and speckles, rarely unbroken bands, sculpture of coarse striae or granulations—genus *Candidula*

***Cochlicella acuta* (Muller, 1774)** (Introduced)
Helix acuta Muller, 1774. *Verm. terr.*, 2: 100

Shell 7-9 whorls, narrowly acute. Colour white or pale fawn with brown apex and typically a single brown line on ventral surface of last whorl. The aperture is ovate-lunate and the outer lip sharp.



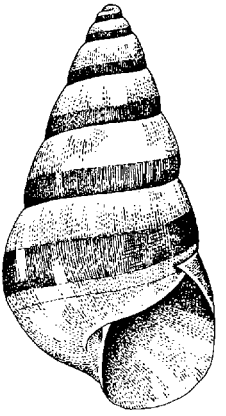
Size 12-18 mm
Range Lower Murray Valley of South Australia and north-western Victoria and Yorke Peninsula, South Australia
Habitat Under groundcover plants in cultivated areas
Remarks This is an uncommon species and is characterised by the extremely high spire. Some specimens of the following species can have a similar colour pattern.

Map 102:
Distribution of Helicidae:
Cochlicella acuta

***Cochlicella ventrosa* (Ferussac, 1821).** (Introduced)
Helix (Cochlicella) ventrosus Ferussac, 1821. *Hist. nat. moll. terr. fluv.*: 56

Shell 7-8 whorls, widely conical with a broad last whorl, usually thin, almost transparent. Colour pale horn with brown bands of

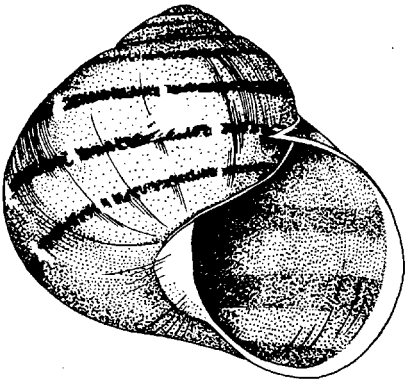
varying width. Aperture ovate-lunate, often fragile, outer lip sharp.



Size 8-12 mm
Range Throughout S.E. Australia
Habitat Under groundcover plants, or on leaves and stems, in gardens, pastures and cultivated areas
Remarks Can be a crop and pasture pest.

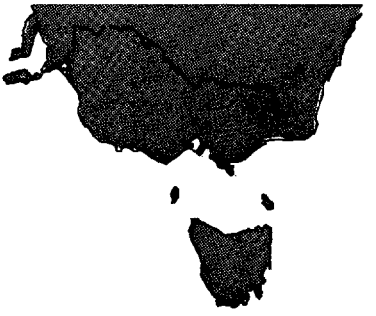
***Helix (Cryptomphalus) aspersa* (Muller, 1774).** (Introduced)
Helix aspersa Muller, 1774. *Verm. terr.*, 2: 59

Shell 4-5 whorls, large, globose, thin, with umbilicus closed or nearly so, fine wrinkles on surface, lip sometimes slightly reflected. Basically horn-coloured but with dark brown or black bands of varying widths on yellow flecks and broken lines and bands.



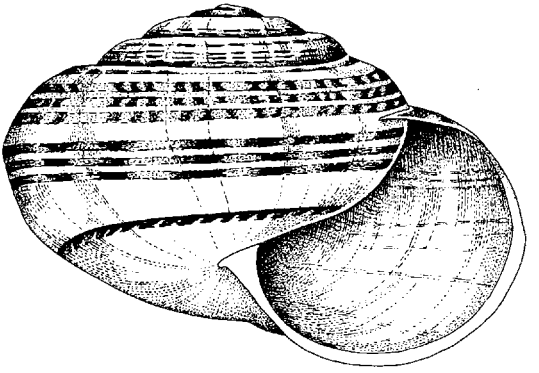
Size 30-40 mm
Range Throughout S.E. Australia
Habitat Under groundcover plants in gardens, in damp situations
Remarks The common garden snail, a severe pest

Map 103:
Distribution of Helicidae:
Cochlicella ventrosa
Helix (Cryptomphalus) aspersa



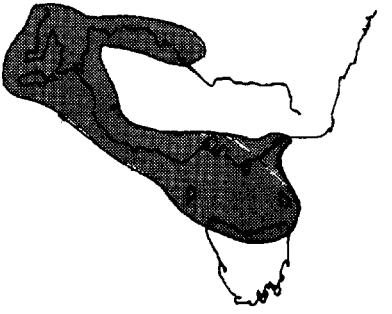
***Theba pisana* (Muller, 1774)** (Introduced)
Helix pisana Muller, 1774. *Verm. terr.*, 2: 60

Shell 4-5 whorls, medium, subglobose with umbilicus almost closed by reflected inner margin of aperture, lip not reflect. Colour white with fine brown concentric bands of varying thickness, often bleached with prolonged exposure to sun, inside aperture a deep rose pink.



Size 18-24 mm
Range Coastal region of South Australia, western Victoria and northern Tasmania and in Murray Valley
Habitat Found sealed onto trees or posts or feeding on foliage
Remarks Is a pest of gardens and crops, particularly vines. Can reach very large population densities (Smith, 1967).

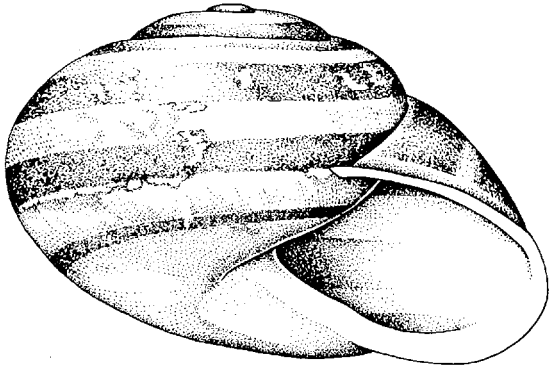
Map 104:
Distribution of Helicidae:
Theba pisana



***Eobania vermiculata* (Muller, 1774).** (Introduced)
Helix vermiculata Muller, 1774. *Verm. terr.*, 2: 20

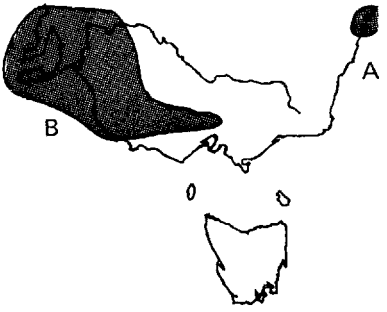
Shell large, 5 whorls, subglobose with elevated spire, periphery of body whorl roundly angular, umbilicus closed by reflected columella, aperture ovate-lunate, descending with thickened lip. Sculpture of interrupted fine spiral wrinkles. Colour white to buff

to light brown with black to dark brown concentric bands and white aperture.



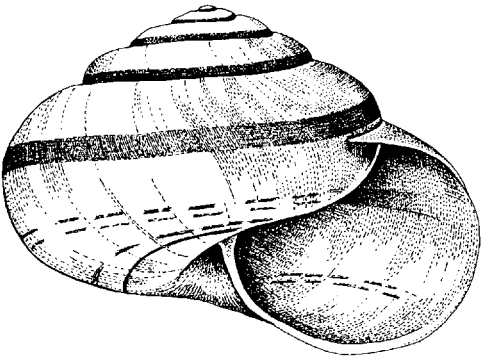
Size 28-34 mm
Range Sydney area, N.S.W.
Habitat Old gardens and parks, under groundcover plants
Remarks Originates from the Mediterranean region

Map 105:
Distribution of Helicidae:
A. *Eobania vermiculata*
B. *Cernuella (Cernuella) virgata*



***Cernuella (Cernuella) virgata* (da Costa, 1778)** (Introduced)
Helix virgata da Costa, 1778. *Brit. Conch.*: 79

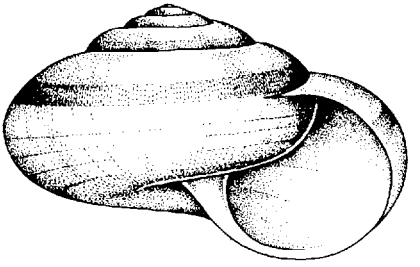
Shell medium, 4-5 whorls, subglobose with spire depressed and small to insignificant from lateral view, last whorl large and rounded. Umbilicus small but open and obvious. Colour variable, mainly white with brown concentric bands, many bleached. Interior of aperture often brown.



Size 16-22 mm
Range Central and south-eastern South Australia and western Victoria
Habitat Sealed onto posts, trees and other vegetation in dry areas close to man-modified environment
Remarks Can reach very large population densities and become a serious contamination pest of cereal crops

***Cernuella (Xerocincta) neglecta* (Draparnaud, 1805)** (Introduced)
Helix neglecta Draparnaud, 1805. *Hist. nat. moll. terr. fluv. France*: 108

Shell medium, 4-5 whorls, subglobose with elevated spire, slight keel on periphery of body whorl, umbilicus narrowly open. Colour white with brown concentric bands, susceptible to bleaching.

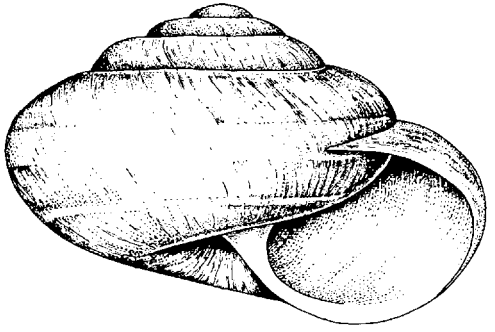


Size 12-18 mm
Range Yorke Peninsula, South Australia
Habitat Sealed to posts and trees in dry situations near coast
Remarks Very difficult to separate by shell characters from *C. (C.) virgata*. Has higher spire and appears to be confined to Yorke Peninsula, South Australia.

Map 106:
Distribution of Helicidae:
Cernuella (Xerocincta) neglecta

***Cernuella (Microxeromagna) vestita* (Rambur, 1868)** (Introduced)
Helix vestita Rambur, 1868. *J. Conchyliol.*, 16: 267

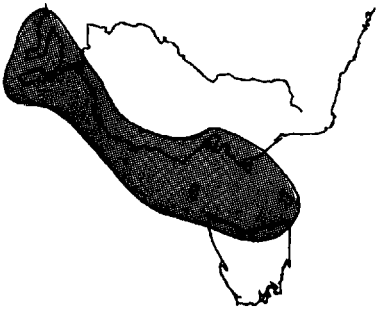
Shell small, 4-5 whorls, with slightly elevated spire, rounded body whorl and wide umbilicus. Aperture ovate-lunate, lip not reflected but often ringed inside with a callused thickening. Colour white with reddish-brown spiral bands.



Size 8-12 mm
Range Coastal region of South Australia, Victoria and northern Tasmania

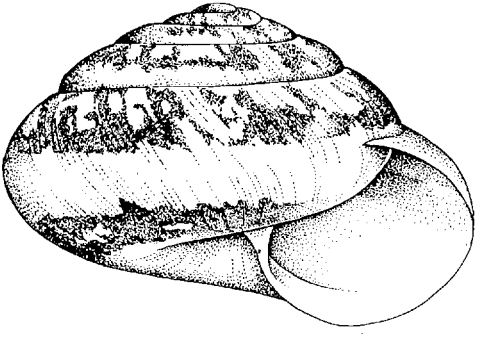
Habitat On coastal scrub or in sparse litter around coast plants in sand dune habitat
Remarks This species was recorded as *Helicella caperata* by Cotton (1954). Found associated with *Theba pisana.*

Map 107:
Distribution of Helicidae:
Cernuella (Microxeromagna) vestita



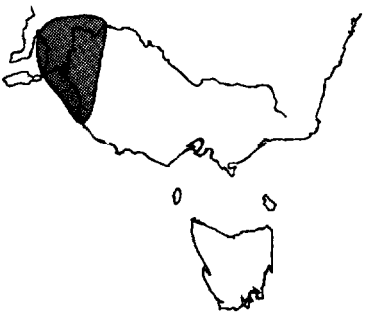
***Candidula intersecta* (Poiret, 1801)** (Introduced)
Helix intersecta Poiret, 1801. *Coq. fluv. terr. Aisne*: 81

Shell small, 5-6 whorls, subglobose, rounded, solid, with descending, ovate-lunate aperture and wide umbilicus, lower lip reflected. Sculpture of coarse radial wrinkles and lines. Colour buff to light brown with dark brown to black irregular blotches.



Size 6-10 mm
Range South-eastern South Australia
Habitat Under stones in crevices, particularly in limestone areas along the lower Murray River

Map 108:
Distribution of Helicidae:
Candidula intersecta



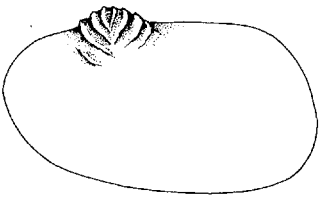
Hyriidae

This is the family of large freshwater mussels found in most river systems in Australia. Some species are endemic to particular catchments while others are widespread in their distribution. The family is confined to Australasia and South America. The Australian species were revised by McMichael and Hiscock (1958) under the family name Mutelidae, later corrected to Hyriidae by Parodiz and Bonetto (1963).

Mussels are found in both running waters of creeks and rivers and in lakes and dams. They can survive periods of drying out, usually buried in a 'cocoon' in the mud. They live buried in firm silty mud bottoms in seasonally shallow water and feed by filtering water through their gills. Fertilisation occurs in the gill chambers of the females where development occurs to a *glochidium* larva which, on release, becomes parasitic on a freshwater fish until it settles as an adult mussel.

Key to the genera of Hyriidae

1 Beak smooth and unsculptured **2**



1 Beak sculptured and with V-shaped ridges **3**

2(1) Shell generally rounded in outline, hinge lamellar—genus *Velesunio*

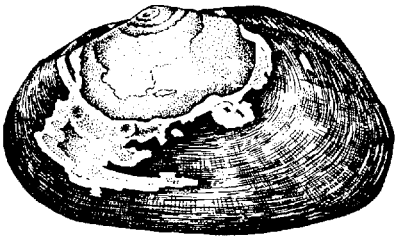
2(1) Shell elongate-ovate in outline and distinctly winged, thick with heavy teeth, hinge unionid—genus *Alathyria*

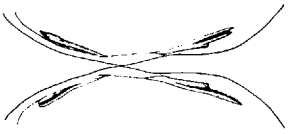
3(1) Shell small to medium, elongate but not winged, sculpture limited to ridges on the beaks, hinge strong with grooved cardinal teeth, eastern and central Victoria, N.S.W. and Tasmania—genus *Hyridella (Hyridella)*

3(1) Shell small, solid, winged posteriorly with prominent ridge, heavily sculptured, hinge strong with heavy grooved cardinal teeth, confined to Glenelg-Wannon catchment of western Victoria—genus *Hyridella (Protohyridella)*

***Velesunio ambiguus* (Philippi, 1847)**
Unio ambiguus Philippi, 1847. *Abbild. Beschreib. Conchyl.*, 3 (*Unio*): 7

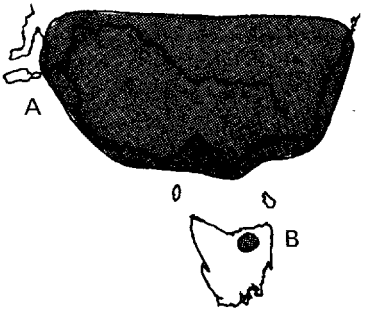
Shell large, variable in shape and form from thin to swollen, fragile to strong, anterior rounded, posterior slightly pointed. Beaks usually strongly eroded, no sculpture present. Shell surface with coarse growth lines. Hinge weak to strong, lamellar. Colour dark brown, nacre flat white with purple, pink, orange or brown spots.





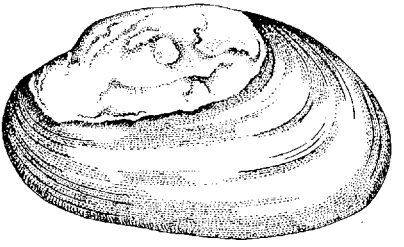
Size 50-95 mm
Range Throughout Murray-Darling system and coastal rivers of Victoria, south-eastern South Australia and central N.S.W.
Habitat In stable silty mud in rivers, creeks and lakes

Map 109:
Distribution of Hyriidae:
A. *Velesunio ambiguus*
B. *Velesunio moretonicus*



***Velesunio moretonicus* (Reeve, 1865)**
Unio moretonicus Reeve, 1865. *Conch. Icon.*, 16, *Unio* sp. 118

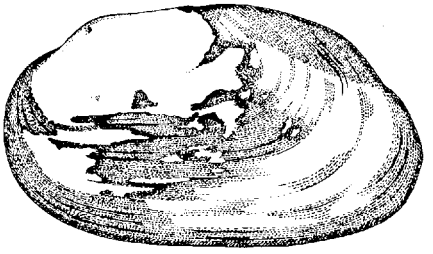
Shell large, slightly swollen, thick and heavy, anterior and posterior margins rounded, hinge strong, lamellar but tending towards unionid, strong growth lines. Colour dark brown to black, nacre purplish-white with copper-coloured blotches usually within the pallial line.



Size 60-95 mm
Range South Esk River system, northern Tasmania
Habitat Mud in rivers
Remarks Referred to as *V. legrandi* by McMichael and Hiscock (1958). Subsequently corrected to this name by Hiscock (1960).

***Alathyria jacksoni* (Iredale, 1934)**
Alathyria jacksoni Iredale, 1934. *Aust. Zool.*, 8: 64

Shell large, swollen, thick, heavy, oval, posterior ridge slightly inflated, beaks smooth, growth lines prominent, hinge strong, unionid with curved lateral teeth erect. Anterior muscle scars deeply impressed. Colour brown to black, nacre bluish to white with copper coloured blotches mainly below beaks in adults.



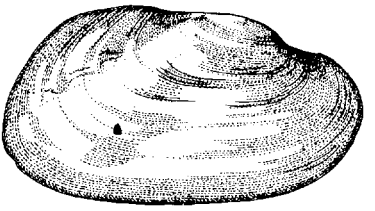
Size 60-150 mm
Range Throughout Murray-Darling system and coastal streams of eastern Victoria
Habitat In silty mud in rivers and creeks

Map 110:
Distribution of Hyriidae:
Alathyria jacksoni

***Alathyria profuga* (Gould, 1851)**
Unio profugus Gould, 1851. *Proc. Boston Soc. nat. Hist.*, 3: 295

Shell large, swollen, moderately thick, rounded anterior and posterior margins, hinge reduced, cardinals simple, laterals reduced, anterior muscle scars moderately impressed, beak muscle scars in a row, periostracum smooth or broken by marked

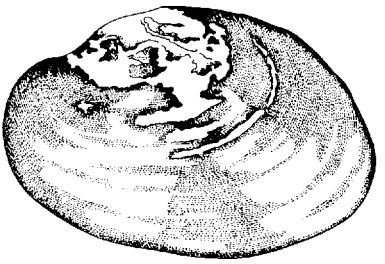
growth lines. Colour dark brown, nacre white with copper or blue spots.



Size 70-120 mm
Range Hunter and Shoalhaven River systems of coastal N.S.W.
Habitat Silty mud in shallow water in creeks and lakes

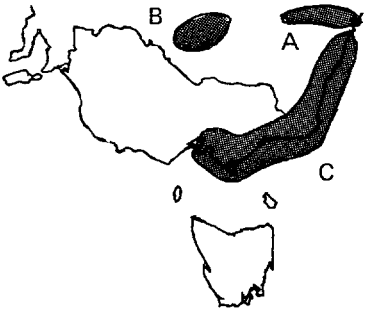
***Alathyria condola* (Iredale, 1943)**
Alathyria condola Iredale, 1943. *Aust. Nat.*, 11: 90

Shell large, uniformly swollen, thick, heavy, anterior rounded, posterior slightly obliquely truncate dorsally, posterior ridge not marked, beaks low swollen, hinge strong, cardinal teeth erect, grooved, lateral teeth elongate, growth lines strong. Colour dark brown, nacre white without spots.



Size 70-110 mm
Range Lachlan and Murrumbidgee River systems in north-eastern section of Murray-Darling system
Habitat Silty mud in creeks and dams
Remarks This species is similar to and is found with *Alathyria jacksoni*. They can be separated by the more rounded shape of *A. jacksoni*, the presence of a prominent posterior ridge and copper blotches on the nacre.

Map 111:
Distribution of Hyriidae:
A. *Alathyria profuga*
B. *Alathyria condola*
C. *Hyridella (Hyridella) australis*



Four species of the subgenus *Hyridella (Hyridella)* occupy the same distribution range in eastern Victoria and three extend

together up the N.S.W. coast. The distinguishing features of these four species are given below:
H. (H.) australis—oblong-ovate, prominent posterior ridge, heavy beak sculpture, height to length ratio 60 per cent.

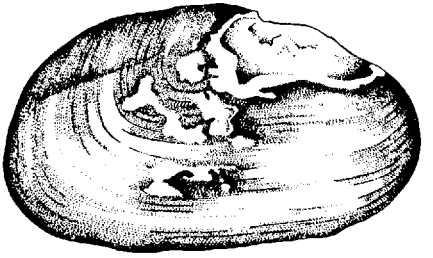
H. (H.) drapeta—elongate-ovate, flattened posterior ridge, slightly winged, delicate beak sculpture, height to length ratio 55 per cent.

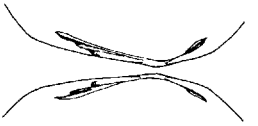
H. (H.) depressa—elongate, dorsal margin anterior to beak slopes away markedly, height to length ratio 50 per cent.

H. (H.) narracanensis—small with beak close to anterior end, posterior ridge prominent, very strong hinge.

***Hyridella (Hyridella) australis* (Lamarck, 1819)**
Unio australis Lamarck, 1819. *Hist. nat. Anim. sans Vert.*, 6: 80

Shell large, oblong-ovate with prominent posterior ridge, anterior margin rounded, swollen, thickened near antero-ventral border, beaks swollen elevated, strongly sculptured with V-shaped ridges. Hinge strong unionid, cardinal teeth, strong, erect, laterals strong, thick. Colour deep purple-brown, shining with faint growth lines and concentric striations, nacre silvery-white with bluish-pink stains below the beaks and copper and yellow blotches.

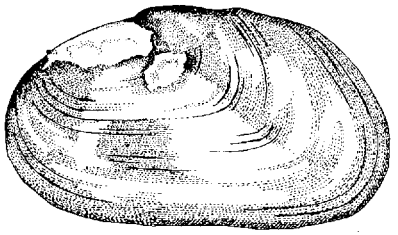




Size 40-90 mm
Range Coastal rivers of N.S.W. and eastern Victoria to the Yarra River
Habitat Silty mud in shallow water of creeks, rivers and dams

***Hyridella (Hyridella) drapeta* (Iredale, 1934)**
Hyridunio australis drapeta Iredale, 1934. *Aust. Zool.*, 8: 68

Shell large, elongate-ovate, heavy and thick at antero-ventral border, with posterior ridge flattened, anterior margin rounded, slightly winged, beaks low not swollen, sculpture weak, of a series of V-shaped ridges, shell marked with fine growth lines. Hinge strong unionid, cardinal teeth heavy erect, lateral teeth long, slightly curved and smooth, nacre bluish-white, stained copper.

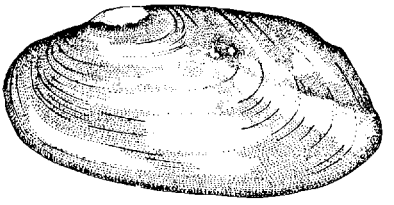


Size 40-90 mm
Range Coastal rivers of N.S.W. and eastern and central Victoria to Cape Otway
Habitat Silty mud in shallow creeks and rivers

Map 112:
Distribution of Hyriidae:
Hyridella (Hyridella) drapeta
Hyridella (Hyridella) depressa

***Hyridella (Hyridella) depressa* (Lamarck, 1819)**
Unio depressa Lamarck, 1819. *Hist. nat. Anim. sans Vert.*, 6: 79

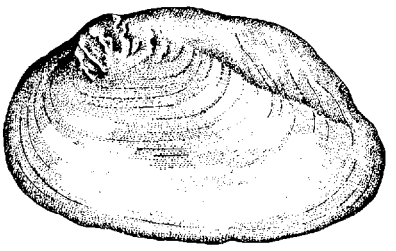
Shell medium, elongate, fairly thick, anterior portion short, rounded, dorsal margin anterior to beak sloping away markedly, posterior winged and rounded. Beaks not swollen, depressed, strongly sculptured with V-shaped ridges, rarely extending on to shell. Shiny with fine growth lines. Hinge strong, unionid, cardinal teeth erect grooved and serrated, laterals, long, curved. Colour dark brown to black, nacre bluish-white, iridescent, posteriorly with copper spots.



Size 35-70 mm
Range Coastal rivers of N.S.W. and eastern and central Victoria to Cape Otway
Habitat Silty mud in shallow creeks and rivers

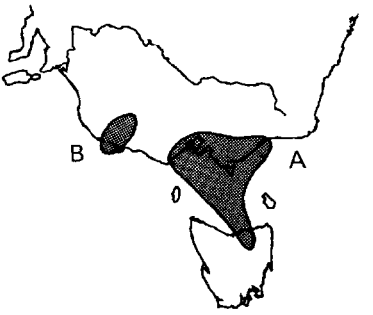
***Hyridella (Hyridella) narracanensis* (Cotton & Gabriel, 1932)**
Propehyridella narracanensis Cotton & Gabriel, 1932. *Proc. R. Soc. Vict.*, n.s. 44: 159

Shell medium to small with beak close to anterior end, thick, swollen, posterior ridge prominent, dorsal margin elevated posterior to beaks, ventral margin convex. Beaks slightly swollen, strongly sculptured with V-shaped ridges, lost in adults, fine growth lines and prominent dark rest marks. Hinge strong, unionid, cardinal teeth large erect, grooved, lateral teeth heavy, short, grooved. Colour deep purple-brown, nacre blue, slightly iridescent, stained coppery-purple



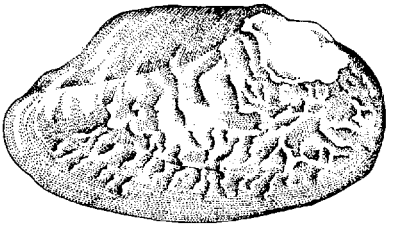
Size 20-60 mm
Range Coastal rivers of central Victoria and South Esk River system, northern Tasmania
Habitat Silty mud in shallow creeks and rivers

Map 113:
Distribution of Hyriidae:
A. *Hyridella (Hyridella) narracanensis*
B. *Hyridella (Protohyridella) glenelgensis*



***Hyridella (Protohyridella) glenelgensis* (Dennant, 1898)**
Unio glenelgensis Dennant, 1898. *Proc. R. Soc. Vict.*, 10: 112

Shell small, heavy, thick, with short anterior end, slightly swollen, surface with strong sculpture of ridges and wrinkles. Beak low slightly swollen, sculptured with strong V-shaped ridges which continue on to the shell surface, also fine growth lines and dark rest marks. Hinge very strong, cardinal teeth solid, peg-like denticulate, lateral teeth long, heavy slightly curved and crenate. Colour olive to dark purple-brown, nacre bluish, iridescent, stained pale brown under the beaks.



Size 30-40 mm
Range Glenelg-Wannon River system of western Victoria
Habitat Silty mud in river

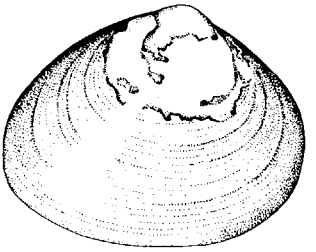
Corbiculidae

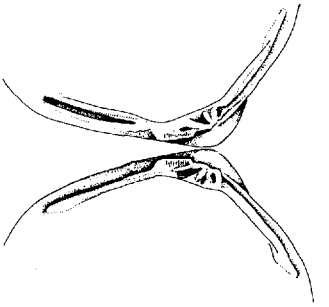
This family of small to medium freshwater bivalves is found in the Asian and Oceania regions of the world. In Australia the family has a widespread distribution except for south-western Australia and Tasmania. The shells are fairly thick and heavy, and oval in shape with small umbos and a sculpture of prominent concentric ridges. The shells are usually brightly coloured with yellows, reds and purples, both inside and out, and often with prominent flame patterns. They are found in flowing freshwater, usually living in great numbers in sand in shallow, fairly swiftly flowing rivers. However, because of their small size and requirement of flowing water they have become a pest in water reticulation systems, both of town water supplies and irrigation pipes, where they thrive and block pipes and metering equipment.

The shells in different populations vary greatly and many names have been proposed for these variants. However, no revisionary work has been carried out on the group and no firm characters distinguished for separating species. There is a strong possibility that only one species exists in south-east Australia.

***Corbiculina australis* (Deshayes, 1830)**
Cyrena australis Deshayes, 1830. *Ency. Meth. Hist. Nat. Vers.*, 2: 50

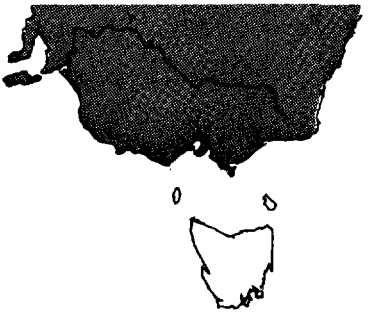
Shell small to medium, thick, with small central umbos. Sculpture of deep regular concentric ridges. Adductor scars obvious; teeth, three oblique cardinals, long crenate laterals. Shell with thin, horn-coloured periostracum. External colour yellow to purple with flecks to flames of opposite colour. Internally nacreous, yellow to pink to purple, rarely white.





Size 15-25 mm
Range Throughout S.E. Australia, except Tasmania
Habitat In sand in fairly swiftly flowing shallow rivers or creeks
Remarks Recorded as a fouling organism living in water pipes and irrigation reticulation systems. Killed by flushing system with diluted copper sulphate solution. This is dangerous to humans and stock.

Map 114:
Distribution of Corbiculidae:
Corbiculina australis



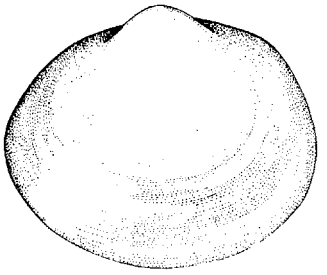
Sphaeriidae

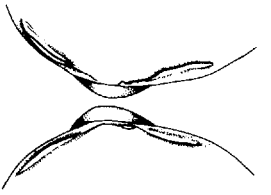
This is a cosmopolitan family of small freshwater bivalves commonly known as pea-shells. They are small, round, regular, fragile bivalves with the beak approximately centrally placed, weak hinge teeth and hermaphrodite reproductive systems. They are found in mud in streams, creeks, ponds and almost any permanent or semi-permanent water. It is suggested that they can be widely distributed in mud on the feet and feathers of birds, or even by wind. They are usually found in very large numbers and occur in mountain bogs above the snow-line to freshwater pools in desert areas.

A number of generic and specific names have been proposed for the Australian forms, particularly by Iredale (1943). However, these are largely based on minute differences of shell shape and on distribution. Recent opinions by Kuiper and by Meier-Brook (pers. comm.) tend to suggest that many of these species are not separable and that there are present in the Australian fauna one or more cosmopolitan species. A detailed revision of the Australian sphaeriids is badly needed. Lacking this, we are restricting the fauna to two species with the understanding that future revisionary work may lead to the re-establishment of other species in the fauna.

Sphaerium (Musculium) tasmanicum **(Tenison-Woods, 1876)**
Cyclas tasmanica Tenison-Woods, 1876. *Pap. Proc. R. Soc. Tasm.*, 1875: 82

Shell small to medium, thin fragile with beak more or less central, umbos sometimes prominent, valves inflated, rounded, teeth small, weak. Sculpture of fine growth lines. Colour white to transparent pale yellow.

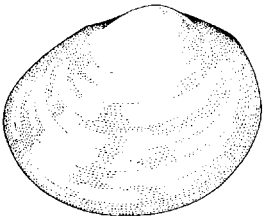




Size 5-10 mm
Range Throughout S.E. Australia.
Habitat In soft mud mainly in ponds, billabongs and dams in shallow water where there is weed growth
Remarks The species is referred to *Musculium* after Clarke (1973) but this is here used only as a subgenus

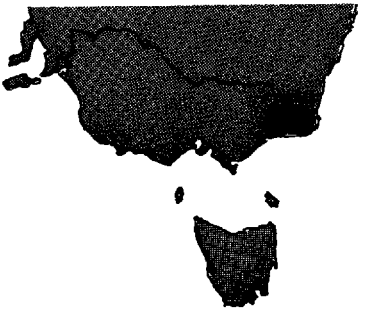
***Pisidium casertanum* (Poli 1795)**
Cardium casertanum Poli, 1795. *Test. Sicil.*, 2: 65

Shell small, thin fragile with beaks towards the posterior end, valves not inflated, teeth very indistinct. Sculpture absent. Colour white, often with brown staining.



Size 2-4 mm
Range Throughout S.E. Australia
Habitat In mud and sand in wide range of habitats from fast flowing rivers to creeks, billabongs, lakes and dams
Remarks This is a cosmopolitan species with many local forms depending on the habitat

Map 115:
Distribution of Sphaeriidae:
Sphaerium (Musculium) tasmanicum
Pisidium casertanum



Systematic List of Non-marine Molluscs of South-eastern Australia

The families and species of non-marine molluscs which occur in South-eastern Australia are listed here, together with the other available names we are tentatively including in their synonymy. Available names listed as synonyms by Iredale (1937a, c, 1938, 1943), or by McMichael and Hiscock (1958) for the Hyriidae, are not included unless we disagree with their placement. This synonymy indicates our ideas of relationship and similarity and in many cases indicates a species-complex from which other recognised species may be separated when the necessary taxonomic revisions have been carried out. The synonyms are listed with the capital letter of the genus name with which they were originally described. The abbreviations used are: (I)—species introduced into Australia; (E)—species endemic to South-eastern Australia.

Gastropoda

Family Viviparidae

Vivipara (*Notopala*) *sublineata* (Conrad, 1850)
syn. *P. hanleyi* Frauenfeld, 1864
V. alisoni Brazier, 1879

Family Hyrobiidae

Glacidorbis hedleyi Iredale, 1943 (E)
Glacidorbis pedderi (Smith, 1973) (E)
Tatea rufilabris (Adams, 1862)
syn. *B. huonensis* T.-Woods, 1876
T. paradisiaca Pilsbry, 1897
T. kesteveni Iredale, 1943
Coxiella striata (Reeve, 1842)
syn. *P. badgerensis* Johnston, 1879
Coxiella molesta Iredale, 1943 (E)
Beddomeia complex:
Beddomeia launcestonensis (Johnston, 1872) (E)
syn. *B. tumida* Petterd, 1889
B. minima Petterd, 1889

Beddomeia lodderi (Petterd, 1889) (E)
Beddomeia bellii (Petterd, 1889) (E)
syn. *B. hullii* Petterd, 1889
Petterdiana paludinella (Reeve, 1857) (E)
Valvatasma tasmanica (T.-Woods, 1876) (E)
Phrantela marginata (Petterd, 1889) (E)
Pupiphryx grampianensis (Gabriel, 1939) (E)
syn. *P. cooma* Iredale, 1943
Pupiphryx dunrobinensis (T.-Woods, 1876) (E)
syn. *D. dyeriana* Petterd, 1879
P. smithii Petterd, 1889
P. elongatus May, 1920
Rivisessor gunnii (Frauenfeld, 1863) (E)
syn. *H. turbinata* Petterd, 1889
P. brownii Petterd, 1889
Angrobia angasi (Smith, 1882)
Potomopyrgus niger (Quoy & Gaimard, 1835)
syn. *A. petterdiana* Brazier, 1875
B. legrandi T.-Woods, 1876
H. tasmanicus Martens, 1858
B. pattisoni Cotton, 1942
P. sparsus Iredale, 1944
Hydrobia buccinoides (Quoy & Gaimard, 1835)

Family Truncatellidae
Truncatella scalarina Cox, 1867
Truncatella vincentiana (Cotton, 1942)

Family Bithyniidae
Gabbia australis Tryon, 1865
syn. *G. centralia* Iredale, 1943
G. suspecta Iredale, 1944

Family Hydrococcidae
Hydrococcus tasmanicus (T-Woods, 1876)
syn. *A. brazieri* T.-Woods, 1876

Family Thiaridae
Plotiopsis balonnensis (Conrad, 1850)
syn. *M. tetrica* Conrad, 1850
P. subornata Iredale, 1943

Family Ellobiidae

Ophicardelus ornatus (Ferussac, 1821)
syn. *A. quoyi* H. & A. Adams, 1855
A. sulcatus H. & A. Adams, 1855
Marinula xanthostoma H. & A. Adams, 1855
Marinula meridionalis (Brazier, 1877)
Marinula parva (Swainson, 1856) (E)
Leuconopsis pellucidus (Cooper, 1841)
syn. *L. victoriae* Gatliff, 1905
Leuconopsis inermis Hedley, 1901
Melosidula zonata (H. & A. Adams, 1855)
Plecotrema octanfracta (Jonas, 1845)

Family Amphibolidae

Salinator fragilis (Lamarck, 1822)
Salinator solida (von Martens, 1878)

Family Lymnaeidae

Austropeplea lessoni (Deshayes, 1830)
syn. *A. perlevis* Conrad, 1850
A. melbournensis Pfeiffer 1857
Austropeplea tomentosa (Pfeiffer, 1855)
syn. *L. aruntalis* Cotton & Godfrey, 1938
L. huonensis T.-Woods 1876
L. launcestonensis T.-Woods 1876
L. brazieri, Smith 1882
L. gunnii, Petterd 1889
L. victoriae, Smith 1882
L. subaquatilis Tate, 1880
L. neglecta Petterd, 1889
L. tasmanica T.-Woods, 1876
L. lutosa Petterd, 1889
G. gelida, Iredale, 1943
P. opima Iredale, 1944
S. aegrifer Iredale, 1944
Lymnaea stagnalis (Linne, 1758) (I)
Pseudosuccinea columella (Say, 1817) (I)

Family Ancylidae

Ferrissia (*Pettancylus*) *petterdi* (Johnston, 1879)

syn. *G. beddomei* Petterd, 1888
G. eremia Cotton & Godfrey, 1938
Ferrissia (*Pettancylus*) *tasmanica* (T.-Woods, 1876)
syn. *A. maria* Petterd, 1902
A. australicus, Tate 1880
A. smithii Cox, 1890
P. importunus Iredale, 1943
P. enigma Iredale, 1943

Family Planorbidae
Physastra gibbosa (Gould, 1847)
syn. *L. renola* Iredale, 1943
P. pectorosa Conrad, 1850
P. concinna Adams & Angas, 1864
P. subundata Sowerby, 1873
P. tenuistriata Sowerby, 1873
A. subacuta Cotton & Beasley, 1941
P. australiana Conrad, 1850
P. dispar Sowerby, 1873
P. nitida Sowerby, 1874
P. vandiemenensis Sowerby, 1873
P. pyramidata Sowerby,1873
P. attenuata Sowerby, 1874
P. brunniensis Sowerby, 1874
P. mamillata Sowerby, 1874
P. huonensis T.-Woods, 1876
P. yarraensis T.-Woods, 1878
A. adamsiana Tapparone-Canefri, 1874
P. aciculata Sowerby, 1873
L. epicropa Iredale, 1944
L. digressa Iredale, 1944
L. calda Iredale, 1944
L. placata Iredale, 1944
M. reperta Iredale, 1944
Glyptophysa aliciae (Reeve, 1862)
syn. *P. kershawi* T.-Woods, 1878
G. ellea Iredale, 1944
G. interna Iredale, 1944
Glyptophysa cosmeta Iredale, 1943
Isidorella newcombi (Adams & Angas, 1864)

Isidorella hainesii (Tryon, 1866)
syn. *P. aperta* Sowerby, 1874
P. subinflata Sowerby, 1874
A. rubida Tate, 1882
P. pilosa T.-Woods, 1878
P. brazieri Smith, 1882
I. moola Iredale, 1943
I. montana Iredale, 1943
I. ludia Iredale, 1944
Ancylastrum cumingianus (Bourguignat, 1854) (E)
syn. *A. irvinae* Petterd, 1888
L. instigata Iredale, 1943
Planorbarius corneus (Linnaeus, 1758) (I)
Segnitila victoriae (Smith, 1882)
syn. *S. australiensis* Smith, 1882
S. idorea Iredale, 1944
Gyraulus scottianus (Johnston, 1879) (E)
syn. *P. leonatus* Iredale, 1943
Gyraulus tasmanicus (T. Woods, 1876) (E)
syn. *P. mccoyi* Gabriel, 1939
P. isingi Cotton & Godfrey, 1932
Gyraulus meridionalis (Brazier, 1875)
syn. *P. atkinsoni* Johnston, 1879
G. ardessus Iredale, 1943
G. caroli Iredale, 1943

Family Physidae
Physa acuta Draparnaud, 1805 (I)

Family Onchidiidae
Onchidium verruculatum Cuvier, 1830
Onchidium damelii Semper, 1882
Oncis chameleon (Brazier, 1886)
Onchidina australis Semper, 1882
Onchidella patelloides (Quoy & Gaimard, 1832)

Family Succineidae
Succinea (Austrosuccinea) australis (Ferussac, 1821)
syn. *S. legrandi* Legrand, 1871
S. tamarensis Petterd, 1879

S. nortoni Cox, 1864
S. macgillivrayi Cox, 1864
S. arborea Angas, 1864

Family Athoracophoridae
Triboniophorus graeffei Humbert, 1863

Family Achatinellidae
Tornatellinops jacksonensis (Cox, 1864)

Family Cionellidae
Cionella lubrica (Muller, 1774) (I)

Family Pupillidae
Gastrocopta (*Australbinula*) complex:
Gastrocopta (*Australbinula*) *margaretae* (Cox, 1868)
Gastrocopta (*Australbinula*) *rossiteri* (Brazier, 1875)
syn. *G. hedleyi* Pilsbry, 1917
Gastrocopta (*Australbinula*) *bannertonensis* (Gabriel, 1930)
Gastrocopta (*Australbinula*) *strangeana* (Iredale, 1937)
Pupilla complex:
Pupilla australis (Angas, 1864)
Pupilla nelsoni (Cox, 1864)
Pupilla tasmanica (Johnston, 1883)
Pupoides complex:
Pupoides adelaidae (Angas, 1864)
Pupoides beltiana (Tate, 1894)
syn. *T. amolita* Iredale, 1940
Pupoides ischna (Tate, 1894)
Cylindrovertilla kingi (Cox, 1864)

Family Valloniidae
Vallonia pulchella (Muller, 1774) (I)

Family Ferussacidiae
Ferussacia folliculus (Gmelin, 1790) (I)

Family Rhytididae
Victaphanta atramentaria (Shuttleworth, 1853) (E)

Victaphanta compacta (Cox & Hedley, 1912) (E)
Victaphanta milligani (Pfeiffer, 1853) (E)
syn. *H. fumosa* T.-Woods, 1878
Victaphanta lampra (Reeve, 1854) (E)
Tasmaphena sinclairi (Pfeiffer, 1845) (E)
Tasmaphena ruga (Legrand, 1871) (E)
Tasmaphena helmsiana (Iredale, 1938)
syn. *S. dulcis* Iredale, 1943
Tasmaphena lamproides (Cox, 1868) (E)
Rhytida capillacea (Ferussac, 1832)
syn. *N. fricta* Gould, 1852
S. glaciamans Iredale, 1938
S. revera Iredale, 1943
Strangesta gawleri (Brazier, 1872) (E)
syn. *S. tumidula* Iredale, 1937
Prolesophanta dyeri (Petterd, 1879) (E)
Tasmadelos nelsonensis (Brazier, 1871) (E)
syn. *T. abitens* Iredale, 1938

Family Caryodidae
Caryodes dufresnii (Leach, 1815) (E)
syn. *C. superior* Iredale, 1937
C. extra Iredale, 1937
C. derta Iredale, 1937
Anoglypta launcestonensis (Reeve, 1853) (E)
Pygmipanda atomata (Gray, 1834)
syn. *B. kershawi* Brazier, 1872
P. divulsa Iredale, 1937

Family Orthalicidae (Bulimulidae)
Bothriembryon tasmanicus (Pfeiffer, 1853) (E)
Bothriembryon mastersi (Cox, 1867)
syn. *B. decresensis* Cotton, 1940

Family Punctidae
Paralaoma caputspinulae (Reeve, 1854)
syn. *H. morti* Cox, 1864
H. hobarti Cox, 1868
H. halli Legrand, 1871
H. mucoides T.-Woods, 1879

H. sitiens Legrand, 1871
H. murphyi Cox, 1864
H. discors Petterd, 1902
P. stabilis Iredale, 1937
P. decresensis Iredale, 1937
P. gelida Iredale, 1941

Pedicamista coesa (Legrand, 1871) (E)
Pasmaditta jungermanniae (Petterd, 1879) (E)
Laomavix collisi (Brazier, 1877)
syn. *H. furneauxensis* Petterd, 1879
Miselaoma weldii (T.-Woods, 1877) (E)
syn. *L. sinistra* Gabriel, 1930
Miselaoma parvissima (Legrand, 1871) (E)
syn. *H. spiceri* Petterd, 1879
H. trucanini Petterd, 1879
T. ninguicola Iredale, 1937
Magilaoma penolensis (Cox, 1868)
syn. *M. parpictilis* Iredale, 1937
Excellaoma retipora (Cox, 1867)
syn. *H. melbournensis* Cox, 1868
F. pulleinei Tate, 1899
E. neta Iredale, 1937
E: pattisonae Cotton, 1953
Turbolaoma turbinuloidae (Gabriel, 1930) (E)

Family Charopidae

Planilaoma luckmanii (Brazier, 1877) (E)
Discocharopa vigens (Legrand, 1871) (E)
syn. *H. bassi* Legrand, 1871
Discocharopa mimosa (Petterd, 1879) (E)
syn. *H. lottah* Petterd, 1879
Discocharopa inexpectata (Gabriel, 1947) (E)
Elsothera sericatula (Pfeiffer, 1850)
syn. *P. biretracta* Mousson, 1869
Elsothera limula (Legrand, 1871) (E)
Elsothera ricei (Brazier, 1871) (E)
Elsothera murrayana (Pfeiffer, 1864)
syn. *E. submurrayana* Cox & Hedley, 1912
E. reteporoides Tate, 1887
Elsothera funereâ (Cox, 1868)

Allocharopa brazieri (Cox, 1868)
Allocharopa okeana (Gabriel, 1947) (E)
Allocharopa tarravillensis (Gabriel, 1930) (E)
Allocharopa erskinensis (Gabriel, 1930) (E)
Allocharopa legrandi (Cox, 1868) (E)
Allocharopa kershawi (Petterd, 1879) (E)
Pernagera kingstonensis (Legrand, 1871)
syn. *C. eastbournensis* Hedley, 1892
H. architectonica Legrand, 1871
Pernagera tasmaniae (Cox, 1868) (E)
Pernagera tamarensis (Petterd, 1879)
syn. *P. monticola* Iredale, 1941
Pernagera officeri (Legrand, 1871)
syn. H. stanleyensis Petterd, 1879
Pernagera gatliffi (Gabriel, 1930) (E)
Dentherona dispar (Brazier, 1871)
Dentherona subrugosa (Legrand, 1871) (E)
Dentherona illustra (Gabriel, 1947)
syn. *C. lakesentranciencia* Gabriel, 1947
Dentherona jemmysensis (Gabriel, 1947) (E)
Dentherona saturni (Cox, 1864)
syn. *H. lirata* Cox, 1864
H. pexa Cox, 1868
E. altior Iredale, 1941
C. snowyensis Gabriel & Macpherson, 1947
Cralopa colliveri (Gabriel, 1947) (E)
Egilodonta bairnsdalensis (Gabriel, 1930) (E)
Rhophodon problematica (Gabriel, 1947)
Geminoropa hookeriana (Petterd, 1879) (E)
syn. *H. antialba* Petterd, 1879
Geminoropa scindocataracta (Gabriel, 1930) (E)
Roblinella gadensis (Petterd, 1879) (E)
syn. *H. roblini* Petterd, 1879
Roblinella agnewi (Legrand, 1871) (E)
Roblinella curacoae (Brazier, 1871) (E)
Roblinella mathinnae (Petterd, 1879) (E)
Roblinella belli (Cox, 1864)
Roblinella speranda Iredale, 1937
Bischoffena bischoffensis (Petterd, 1879) (E)
Oreomava otwayensis (Petterd, 1879) (E)

Oreomava cannfluviatilus (Gabriel, 1929) (E)
Oreomava johnstoni Iredale, 1933 (E)
Pillomena meraca (Cox & Hedley, 1912)
Pillomena dandenongensis (Petterd, 1879)
syn. *C. brazenori* Gabriel & Macpherson, 1947
Pillomena nivea (Hedley, 1896)
Pillomena marysvillensis (Gabriel, 1947)
Letomola barrenense (Petterd, 1879) (E)
Setomedea aculeata (Hedley, 1899)
Thryasona diemenensis (Cox, 1868) (E)
syn. *H. daveyensis* Legrand, 1871
H. thompsoni Legrand, 1871
H. marchianae Legrand, 1871
Thryasona elenescens (Cox & Hedley, 1912) (E)
Mulathena fordei (Brazier, 1871) (E)
syn. *H. tranquilla* Legrand, 1871
H. mccoyi Petterd, 1879
T. translucens Gabriel, 1934
Flammulops excelsior (Hedley, 1896)
Stenacapha hamiltoni (Cox, 1868) (E)
syn. *H. savesi* Petterd, 1879
H. kingi Brazier, 1871
H. langleyana Brazier, 1875
H. wynyardensis Petterd, 1879

Family Arionidae
Arion intermedius Normand, 1852 (I)
Arion hortensis Ferussac, 1819 (I)
Arion ater Linnaeus, 1758 (I)

Family Zonitidae
Oxychilus cellarius (Muller, 1774) (I)
syn. *H. sydneyensis* Cox, 1864
Oxychilus draparnaldi (Beck, 1837) (I)
Oxychilus alliarius (Miller,1822) (I)
syn. *O. tasmanicus* McLauchlan, 1951
Vitrea contracta (Westerlund, 1873) (I)
Vitrea crystallina (Muller, 1774) (I)
Zonitoides arboreus (Say, 1816) (I)
syn. *H. lyndhurstensis* Cox, 1868
A. lyndhurstoides McLauchlan, 1954

Family Limacidae

Deroceras reticulatum (Muller, 1774) (I)
Deroceras caruanae (Pollonera, 1891) (I)
Lehmannia (Lehmannia) nyctelia (Bourguignat, 1861) (I)
syn. *L. legrandi* Tate, 1880
Lehmannia (Limacus) flava (Linnaeus, 1758) (I)
syn. *L. megalodontes* Quoy & Gaimard, 1824
L. olivaceus Gould, 1852
L. brechworthianus Lehmann, 1864
L. bicolor Selenka, 1865
Limax maximus Linnaeus, 1758 (I)

Family Milacidae

Milax gagates (Draparnaud, 1801) (I)
syn. *L. marus* Quoy & Gaimard, 1824
L. pectinatus Selenka, 1865
M. tasmanicus Tate, 1881
M. nigricolus Tate, 1881

Family Cystopeltidae

Cystopelta petterdi Tate, 1881
syn. *C. bicolor* Petterd & Hedley, 1909
C. purpurea Davies, 1912
C. astra Hedley, 1890

Family Euconulidae

Euconulus fulva (Muller, 1774) (I)
Melocystis jacksoniensis (Gray, 1834)
syn. *H. parramattensis* Cox, 1864
Echonitor cyrtochilus (Gude, 1905)

Family Helicarionidae

Helicarion cuvieri Ferussac, 1821 (E)
Helicarion niger (Quoy & Gaimard, 1832) (E)
Helicarion rubicundus Dartnall & Kershaw, 1978 (E)
Helicarion mastersi (Cox, 1868)
syn. *H. callidus* Iredale, 1941
Helicarion freycineti Ferussac, 1821
syn. *V. robusta* Gould, 1846
Nitor subrugatus (Reeve, 1852)

Family Testacellidae

Testacella haliotidea Draparnaud, 1801 (I)

Family Camaenidae

Chloritobadistes brevipila (Pfeiffer, 1850)
syn. *A. metuenda* Iredale, 1938
Chloritobadistes victoriae (Cox, 1868) (E)
Semotrachia subsecta (Tate, 1879)
Glyptorhagada silveri (Angas, 1868)
syn. *H. kooringensis* Angas, 1877
G. euglypta Tate, 1899
Glyptorhagada bordaensis (Angas, 1880)
Pleuroxia lemani (Gude, 1916)
Pleuroxia hinsbyi (Gude, 1916)
syn. *P. mawsoni* Iredale, 1937
Sinumelon fodinale (Bednall, 1892)
syn. *S. serlense* Iredale, 1937
S. subfodinale Iredale, 1938
S. finitinum Iredale, 1938
S. simulante Iredale, 1938
S. petum Iredale, 1937
S. aversum Iredale, 1937
S. remissum Iredale, 1937
Meridolum jervisensis (Quoy & Gaimard, 1832)
syn. *H. corneovirens* Pfeiffer, 1851
H. gulosa Gould, 1846
H. duralensis, Cox 1868
H. liverpoolensis Brazier, 1872
G. alleni Iredale, 1943
M. bowdenae McLauchlin, 1954
M. middenense McLauchlin, 1954
Meridolum mastersi (Cox, 1864)
Meracomelon sutilosa (Ferussac, 1829)
syn. *H. evandaleana* Pfeiffer, 1864
H. tomsetti Tate, 1887
N. cooperi Cotton, 1940
Meracomelon stutchburyi (Pfeiffer, 1857)
syn. *H. sublorioliana* Pilsbry, 1890
Meracomelon cassandra (Pfeiffer, 1864)
syn. *X. marcidum* Hedley, 1912
M. moorundianum Iredale, 1937

Family Bradybaenidae

Bradybaena similaris (Ferussac, 1831) (I)

Family Helicidae

Cochlicella acuta (Muller, 1774) (I)
Cochlicella ventrosa (Ferussac, 1821) (I)
Helix (Cryptomphalus) aspersa (Muller, 1774) (I)
Theba pisana (Muller, 1774) (I)
Eobania vermiculata (Muller, 1774) (I)
Cernuella (Cernuella) virgata (da Costa, 1778) (I)
Cernuella (Xerocincta) neglecta (Draparnaud, 1805) (I)
Cernuella (Microxeromagna) vestita (Rambur, 1868) (I)
Candidula intersecta (Pioret, 1801) (I)

Bivalvia

Family Hyriidae

Velesunio ambiguus (Philippi, 1847)
Velesunio moretonicus (Reeve, 1865)
Alathyria jacksoni Iredale, 1934
Alathyria profuga (Gould, 1851)
Alathyria condola Iredale, 1943
Hyridella (Hyridella) australis (Lamarck, 1819)
Hyridella (Hyridella) drapeta (Iredale, 1934)
Hyridella (Hyridella) depressa (Lamarck, 1819)
Hyridella (Hyridella) narracanensis (Cotton & Gabriel, 1932)
Hyridella (Protohyridella) glenelgensis (Dennant, 1898) (E)

Family Corbiculidae

Corbiculina australis (Deshayes, 1830)
syn. *C. angasi* Prime, 1864
C. debilis Gould, 1850
C. permena Iredale, 1943
C. maroubra Iredale, 1943
C. subovalina Iredale, 1943

Family Sphaeriidae

Sphaerium (Musculium) tasmanicum (T.-Woods, 1876)
syn. *S. macgillivrayi* Smith, 1882
S. tatiarae Cotton & Godfrey, 1938

S. victoriana Iredale, 1943
S. problematicum Gabriel, 1939
S. terenda Iredale, 1943

Pisidium casertanum (Poli, 1795)
syn. *P. etheridgii* Smith, 1822
A. bradena Iredale, 1943
P. tasmanicum T.-Woods, 1876
P. dulvertonensis T.-Woods, 1876
G. kosciusko Iredale, 1943

Glossary of Terms

Acute—sharply pointed or angled
Adductor muscle—muscle which closes the valves of a bivalve
Aestivation—period of suspended animation during hot or dry weather
Anatomy—structure of the soft parts
Apertural teeth—teeth or shell processes in the shell aperture
Aperture—opening in a gastropod shell
Apex—tip of the spire of the shell
Archeogastropod—group of primitive gastropods
Armature—apertural teeth
Axial—sculpture parallel to the axis of the shell
Axis—plane of symmetry from apex to aperture
Beak muscle—small muscle at umbo of a bivalve
Bivalve—shell consisting of two hinged valves
Body whorl—large, final coil of a shell containing the body
Buccal mass—muscular organ associated with the mouth containing the radula
Bulimuliform—elongate shell with broad body-whorl, of the family Bulimulidae
Calcareous—consisting of (usually) calcium carbonate
Callus—thickening of the shell, usually around the aperture
Carinate—keeled or angled
Cardinal teeth—interlocking teeth forming the hinge of a bivalve, central upright teeth
Columella—axial pillar of a spiral shell
Complex (of a genus)—group of species believed to be related but the status of which is unsure
Concave—excavated, hollowed out, opposite of convex
Concentric—sculpture in a circle following the shape of the shell
Conical—cone-shaped
Convex—bulging out, opposite of concave
Cusps—separate points or denticles of a radula tooth
Decollate—with the shell apex broken off
Denticulate—composed of fine teeth or denticles
Depressed—lowered
Dextral—right-handed, of coiling
Digitate—composed of finger-like processes
Discoid—disc shaped
Diverticulae—of a gland, branching ducts leading to small sacs
Dorsal—top, upper surface, opposite to ventral
Ecomorph—local form of a species, of a different shape or colour, probably associated with ecological factors
Elongate—long
Epidermis—surface skin or covering
Epiphragm—hard calcareous covering, secreted by the snail to seal the aperture during aestivation
Eutrophic—of aquatic habitats, enrichment due to build-up of nutrients causing high biological production
Form—variety of shape, colour or size not constituting a separate species

Fusiform—spindle-shaped, broad in the centre and tapering at each end

Gape—of a bivalve, the natural opening of the shells

Gastropod—scientific name for single shelled molluscs (snails, etc.), means the stomach and the foot in association

Genus (generic)—a group of closely related species

Globose—spherical or globular in shape

Glochidian larva—larva of some freshwater bivalves which is parasitic on fish

Granulate—composed of granules

Helical, Helicoid—spirally coiled

Hermaphrodite—reproductive system consisting of male and female structures together

Hinge teeth—teeth forming the hinge between the two shells of a bivalve

Homologous—structures having the same development origin

Horny—like horn, either in colour or texture

Impressed—pushed in

Interstices—fine sculpture between ribs or other main sculpture elements

Jaw—hard structure in mouth for cutting food

Juvenile—not adult

Keel—longitudinal ridge

Lateral teeth—interlocking teeth of a bivalve hinge, sloping teeth either side of the cardinal teeth

Ligament—elastic material which hinges the valves of a bivalve and functions to open them

Limpet—mollusc with slightly elevated, roof-like shell

Lines—very fine sculpture

Lip—outer edge of aperture

Lirae—fine raised lines

Lunate—shaped like a half-moon, of the aperture of a shell

Mantle—fleshy or membraneous covering of the anterior part of the body

Microsculpture—fine sculpture of the shell

Morphs—varieties or forms, of different shape

Multicuspid—radula tooth with many cusps

Nucleus—central part of spiral of shell or operculum

Operculum—horny or calcareous plate which closes the aperture when the animal retracts into the shell

Papillae—small nipple-like processes

Parietal—of the inner wall of the shell aperture

Patelliform—limpet shaped

Paucispiral—with few spirals, of an operculum

Periostracal hairs—hair-like processes on the outer covering of the shell

Periostracum—epidermis or thin outer covering of the shell

Planispiral—flattened, coiled in one plane

Plica—folds or plaits

Pneumopore—breathing hole, aperture into the mantle cavity

Protoconch—embryonic shell, at the apex of the shell

Pulmonary—of a lung

Pulmonate—group of snails where the mantle cavity functions as a lung

Pupilliform—shaped like a pupa, elongate with rounded segments

Pustule—low, small, raised knob, of sculpture

Pyriform—pear-shaped

Radial—radiating from the apex in line with the axis

Radula—ribbon-shaped structure bearing rows of minute teeth

used for feeding, a structure unique to molluscs

Reflected—bent backwards, of a lip

Reticulation—cross-ridges forming a fine network

Rhachidian—central tooth in each tooth row of the radula

Riblets—small rib

Ribs—well defined ridge

Sculpture—surface ornament of the shell

Septum—partition

Sinistral—left-handed, opposite to dextral

Slug—gastropod mollusc with shell lost or reduced to a vestige, usually internal

Snail—gastropod mollusc with a coiled shell

Species—group of interbreeding natural populations which are reproductively isolated from other such groups

Spiral—winding round, circling the apex

Spire—all the coils of a shell above the whorl

Striae—fine scratched or incised lines

Subglobose—depressed globose shape

Succiniform—with wide body whorl and short pointed spire, of the family Succineidae

Sunken spire—spire sunk below the level of the body whorl

Suture—junction between whorls of a gastropod

Taxonomy—study of the classification of natural objects

Teleoconch—adult part of shell, whorls subsequent to the protoconch

Threads—very fine lines of sculpture

Trachea—breathing tubes, for transportation of air within the body

Tracheopulmonate—group of slugs possessing trachea as part of their respiratory system

Transverse—across the long axis

Trochoid—flattened conical or top-shaped

Turbinate—shaped like a top with rounded sides

Umbilicus—hollow axis at the base of a shell

Umbo—the protruberance on each valve of a bivalve above the hinge; beaks or larval shell

Unionid—type of bivalve hinge with strong complexly grooved teeth

Valves—the two parts of the bivalve shell

Vector—species which carries and transmits a parasite or disease

Veliger—aquatic larva of a mollusc

Ventral—underside, opposite to dorsal

Vestige—a structure now degenerate and of little use that was well developed in ancestral forms

Whorl—one complete spiral turn of a gastropod shell

Winged—of bivalves, flattened extensions of the dorsal margin of the valves

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* A major work on Australian non-marine mollusc systematics.

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The pages where the description and figures of the species are to be found are denoted by bold type

The non-marine molluscs form a significant part of the invertebrate fauna of South-eastern Australia. Several species are of economic importance, mainly pests and parasite vectors. Non-marine molluscs are also valuable as environmental indicators and are used extensively by ecologists in environmental impact studies.

This field guide of non-marine molluscs is intended as a check-list and a field and laboratory identification manual to this diverse and significant group. It is intended to give a current assessment of the knowledge of this group and is the logical next step in the available literature. The book provides basic information on the study and identification of an important group of Australian animals and it is hoped that it will stimulate further research into the native fauna of this most man-modified part of Australia.

Cover photo *Victaphanta atramentaria* by F. Collet

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