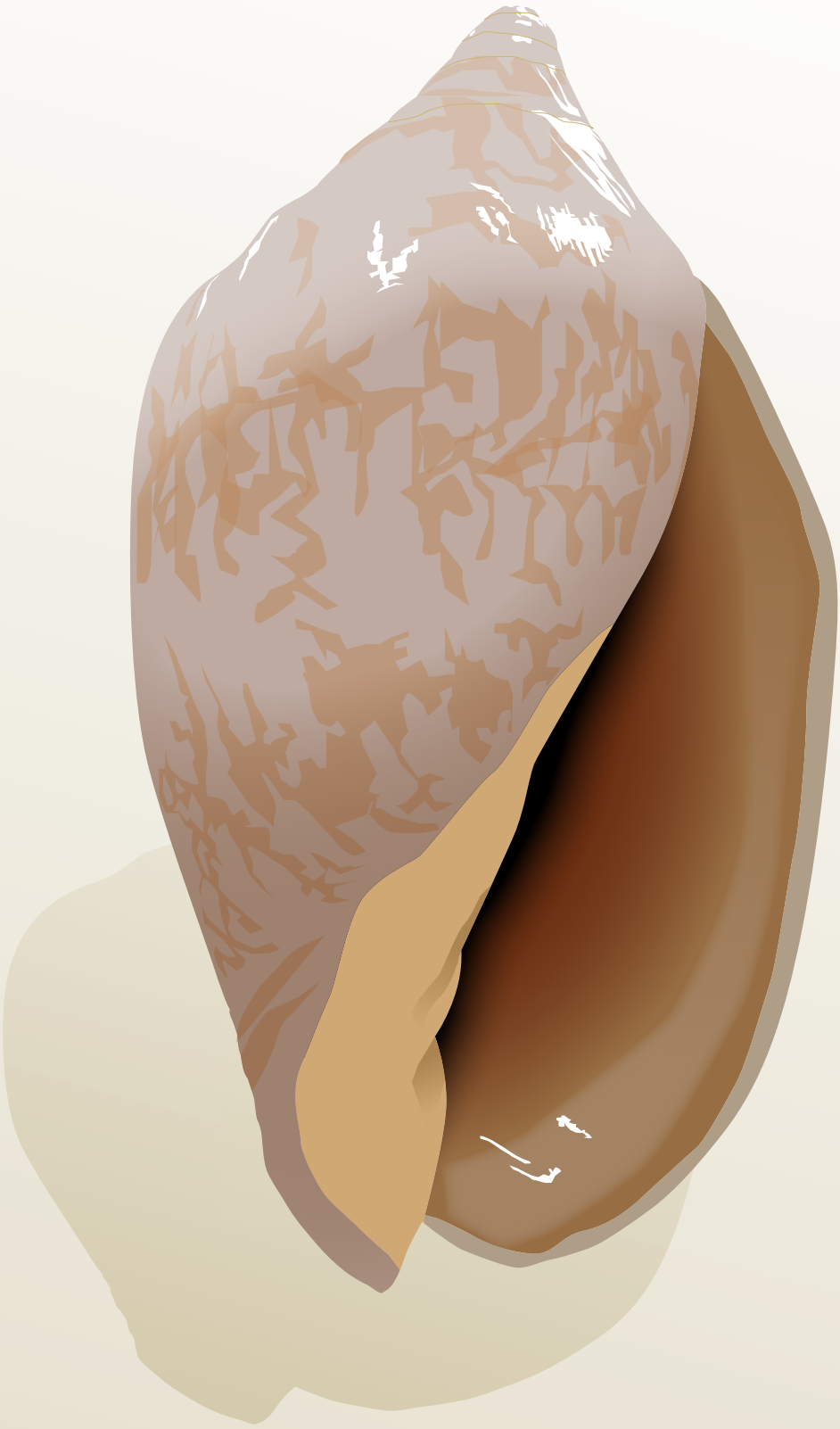


Shell Classification

USING A DICHOTOMOUS KEY

YEAR SEVEN STUDENTS

QGC | FUTUREMAKERS | QUEENSLAND MUSEUM NETWORK | Queensland Government

Introduction

The Queensland Museum Network has about 2.5 million biological specimens, and these items form the Biodiversity collections. Most specimens are from Queensland's terrestrial and marine provinces, but some are from adjacent Indo-Pacific regions. A smaller number of exotic species have also been acquired for comparative purposes. The collection steadily grows as our inventory of the region's natural resources becomes more comprehensive.

This collection helps scientists:

- identify and name species
- understand biodiversity in Australia and around the world
- study evolution, connectivity and dispersal throughout the Indo-Pacific
- keep track of invasive and exotic species

Many of the scientists who work at the Museum specialise in taxonomy, the science of describing and naming species. In fact, Queensland Museum scientists have played a role in discovering more than 4000 new species since 1862!

In the following activity you and your class will use the same techniques as Queensland Museum scientists to classify organisms.

Activity: Using a dichotomous key to classify shells. This activity requires the use of shell cards, which can be downloaded from the Queensland Museum learning resource page.

When the activity has been completed, the identities of the species can be viewed on the "post-activity" cards, which can also be downloaded from the Queensland Museum learning resource page.

Year 7 Australian Curriculum Links for this Resource

Science Understanding

Classification helps organise the diverse group of organisms (ACSSU111)

Science Inquiry Skills

Processing and analysing data and information

Construct and use a range of representations, including graphs, keys and models to represent and analyse patterns or relationships in data using digital technologies as appropriate (ACSIS129)

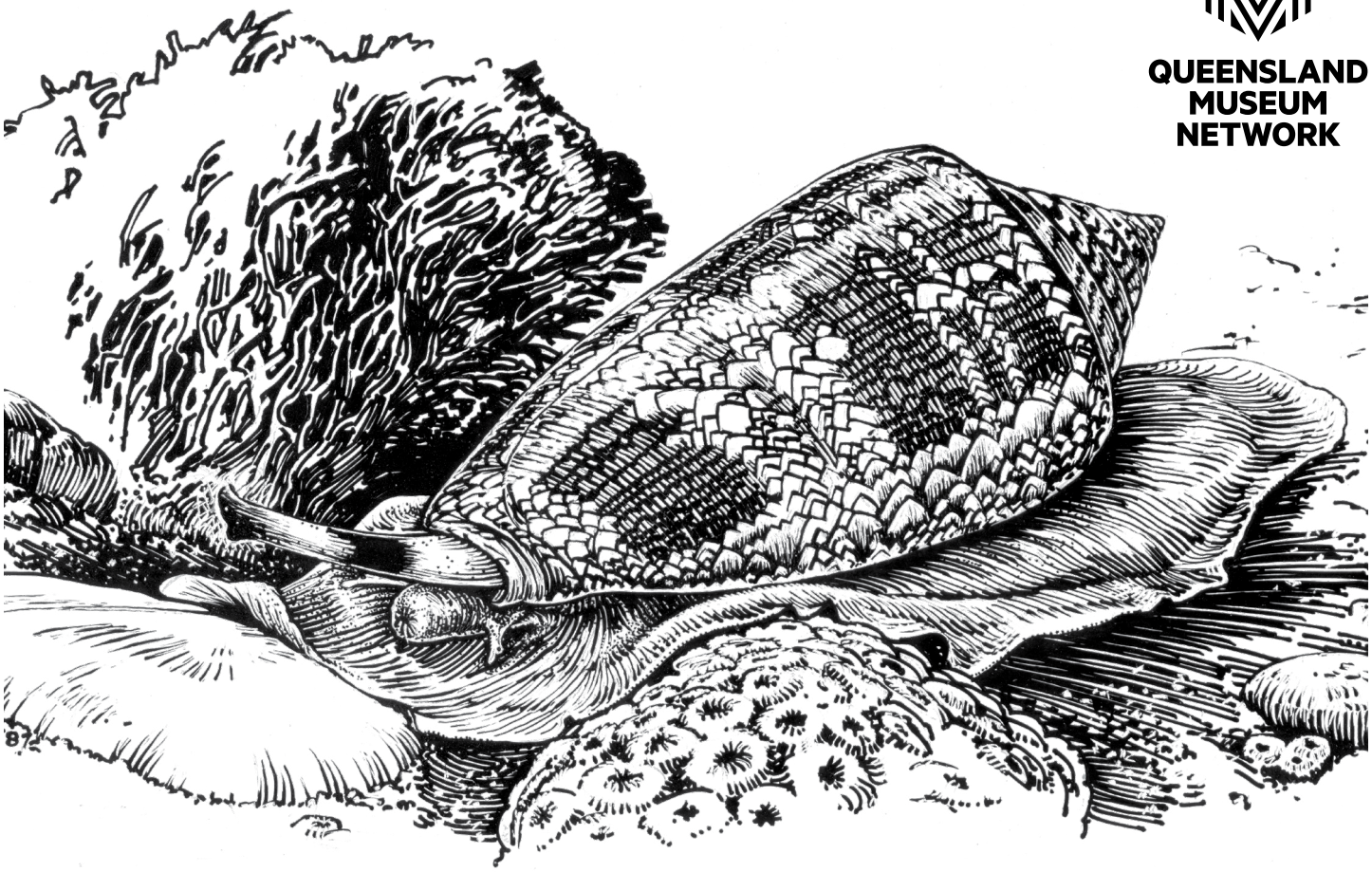
As this resource has been designed to complement classroom-based teaching and learning experiences, students are assumed to have developed knowledge about the following concepts:

- classification involves grouping organisms based on similarities and differences.
- biological classification uses a hierarchical system, including kingdom, phylum, class, order, family, genus and species.
- species have binomial (two-part) scientific names.
- dichotomous keys can be used to help identify specimens.

Future Makers is an innovative partnership between Queensland Museum Network and Shell's QGC project aiming to increase awareness and understanding of the value of science, technology, engineering and maths (STEM) education and skills in Queensland.

This partnership aims to engage and inspire people with the wonder of science, and increase the participation and performance of students in STEM-related subjects and careers — creating a highly capable workforce for the future.

QUEENSLAND MUSEUM NETWORK



Shell Classification Exercise

Classification start: know your animals

Seashells are made by organisms called molluscs, which are soft-bodied invertebrates. Molluscs have an organ called the mantle that secretes, or builds, the shell. The mantle covers the mollusc like a roof covers a house, and the word is originally from the Latin *mantellum*: a cloak.

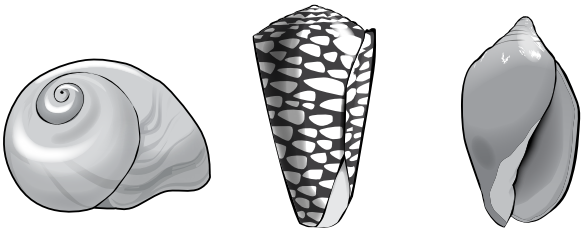
Not every mollusc lives in a shell- for example, squids have a reduced internal shell, and octopuses have lost their shell entirely.

Most of the shells we see on the beach are made by two groups of molluscs: bivalves and gastropods. Gastropods include organisms like snails and slugs, while bivalves include organisms like clams, oysters, and scallops.

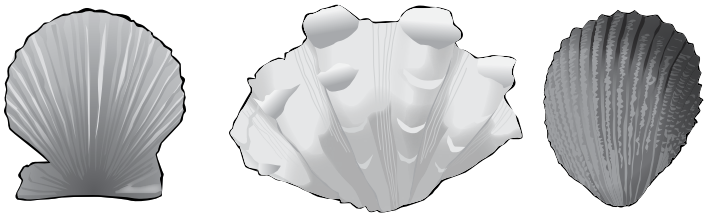
Gastropods have a single, coiled shell, while bivalves have two shells, or valves, that fit together. Together these two groups are very diverse; there are around 80,000 gastropod species, and around 9,000 bivalve species!

While it might seem like a difficult task to differentiate all these species, there are many tools that can help us. These include dichotomous keys: step-by-step guides that we can follow to identify an organism. When using dichotomous keys, you pick a particular creature or part of a creature (here, a shell), start at step 1 and follow the instructions.

GASTROPODS

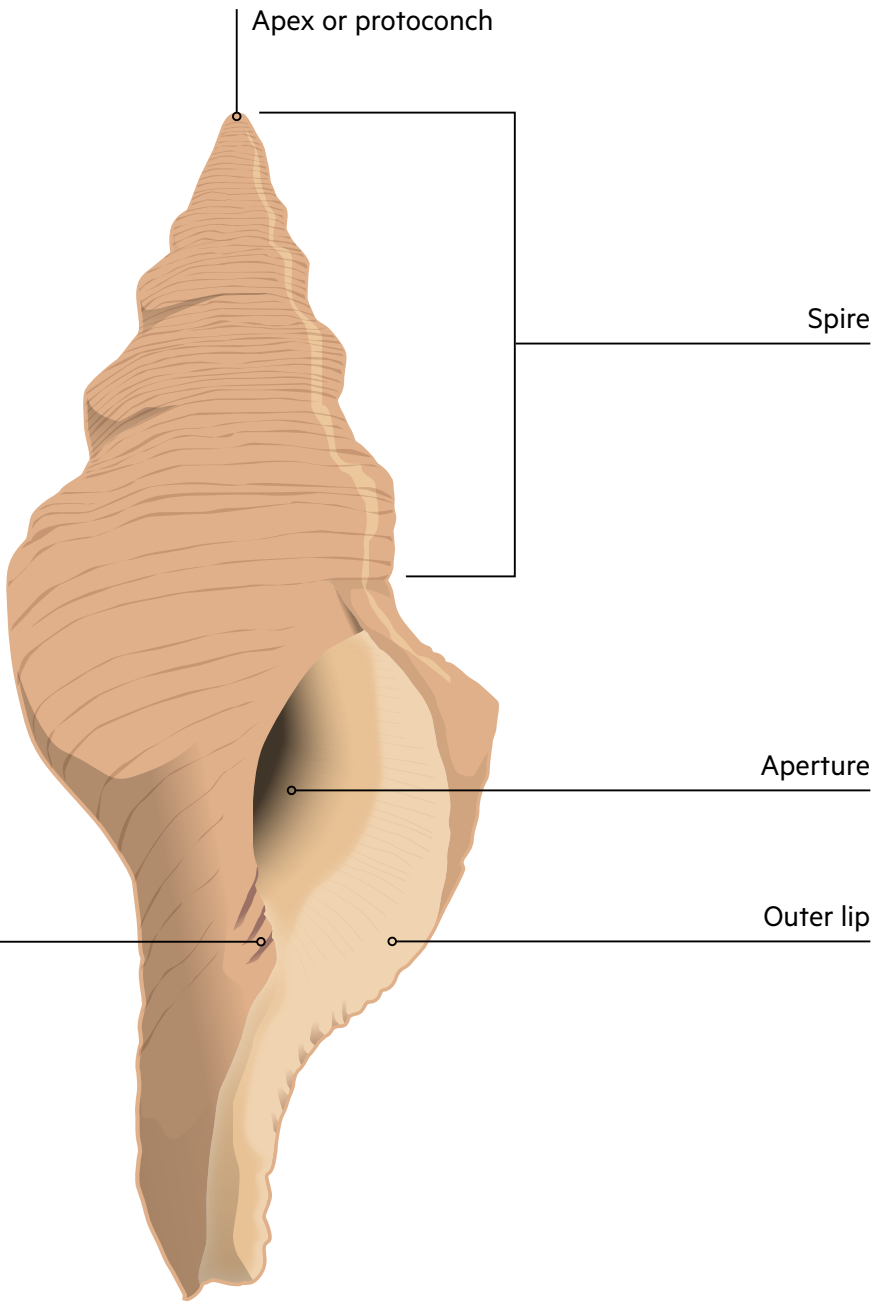


BIVALVES

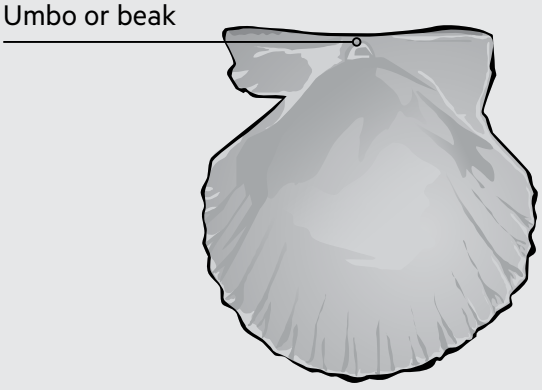


Before you start using the key, have a look at the figures below to familiarise yourself with different parts of gastropod and bivalve shells.

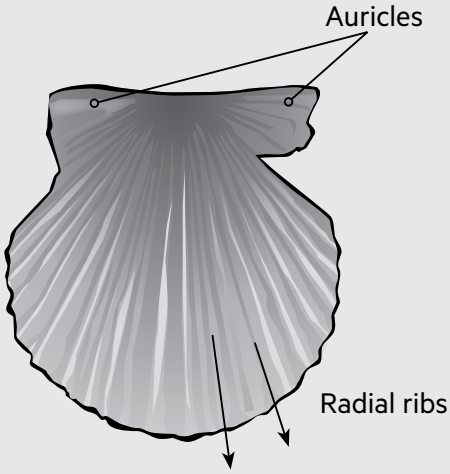
GASTROPOD:
front view of shell



BIVALVE:
internal view of valve



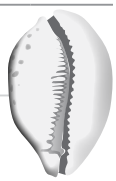
BIVALVE:
external view of valve



Dichotomous Key for Queensland Museum Shell Cards

Please note that every dichotomous key is different. This key cannot be used as a general shell identification guide, because it has been developed specifically for the Queensland Museum Shell Cards.

1a	Single shell (gastropod)	Go to 2
1b	Two shells (bivalve)	Go to 9
2a	Shell has spiky projections along outer lip	Spider Conch *Lambis lambis*
2b	Shell does not have spiky projections along outer lip	Go to 3
3a	Aperture of shell lined with "teeth" (see image)	Go to 4
3b	Aperture of shell not lined with "teeth"	Go to 5
4a	Shell is covered in dark brown spots	Tiger Cowry *Cypraea tigris*
4b	Shell is brown with dark brown multi-lined pattern	Arabian Cowry *Cypraea arabica*
5a	Shell has highly extended spire	Spotted Augur *Terebra maculata*
5b	Shell does not have highly extended spire	Go to 6
6a	Shell has a line of holes	Donkey's Ear Abalone *Haliotis asinina*
6b	Shell does not have a line of holes	Go to 7
7a	Columellar folds present	Blood-red Volute *Cymbiola rutila*
7b	Columellar folds absent	Go to 8
8a	Shell has numerous fine lines across surface	Striated Cone *Conus striatus*
8b	Shell has a pattern of white triangles on a dark brown background	Marble Cone *Conus marmoreus*



9a	Valves have greater width than height (see image)	Go to 10
9b	Valves have similar width and height (roughly circular shape)	Go to 11
10a	Projecting sculpture present along external sides (see image)	Fluted Giant Clam *Tridacna squamosa*
10b	Projecting sculpture absent along external sides	Strawberry Clam *Hippopus hippopus*
11a	Radial ribs present on external sides	Go to 12
11b	Radial ribs absent on external sides	Go to 14
12a	Auricles absent at umbo	Orange Cockle *Vasticardium vertebratum*
12b	Auricles present at umbo	Go to 13
13a	About 20 radial ribs on external sides of both valves	Glory Scallop *Mimachlamys gloriosa*
13b	About 10 radial ribs on external side of one valve, about 20 on the other valve; both valves covered in scales	Scaly Scallop *Scaeochlamys livida*
14a	Radial ribs present on internal sides	Saucer Scallop *Amusium balloti*
14b	Radial ribs absent on internal sides	Go to 15
15a	Mother-of-pearl (pearly shine) present on internal sides	Pearl Oyster *Pinctada* sp.
15b	Mother-of-pearl (pearly shine) absent on internal sides	Jewel Box Clam *Chama* sp.

Mother-of-pearl: what is it?

Mother of pearl, or nacre, is an iridescent (colour-changing) layer of shell produced by some molluscs. It is secreted by the mantle and helps protect molluscs from parasites or particles of debris. The secretion of nacre can lead to the formation of pearls.

Mother-of-pearl has been used in many commercial products, including buttons and jewellery.

Why is Classification Important?

Cone snails: deadly molluscs

Cone snails are found around Australia, with 133 species recorded in Queensland. These snails are predatory and have incredible adaptations for hunting. For example, cone snail teeth have become specialised, harpoon-like structures which are combined with venom and fired into prey!

Eleven different species of cone snails. Source: QM, Peter Waddington

When it comes to food, cone snails fall into three groups: worm-eaters, mollusc-eaters, or fish-eaters. While all cone snails should be considered dangerous and potentially deadly due to their potent venom, the fish-eating species are the most dangerous to people. This includes a fish-eating species, *Conus geographus*, that caused a human fatality on the Great Barrier Reef in 1935.

Many cone snail species can be distinguished using the patterns on the shells. For example, the photograph to the left shows 11 different species. How would you describe the appearance of these different cone snails?

Being able to tell cone snail species apart is important for taxonomists, the medical profession, the public, and anyone who gets stung by a cone snail.

Shell of *Conus geographus*, the Geography Cone. Image: QM, Jeff Wright.

The Cone Snail in action
https://www.youtube.com/watch?v=4wihKnARrAw

Source: The Nature of Science. Killer Cone Snails. Published Aug 9, 2015 (runtime 3:47)