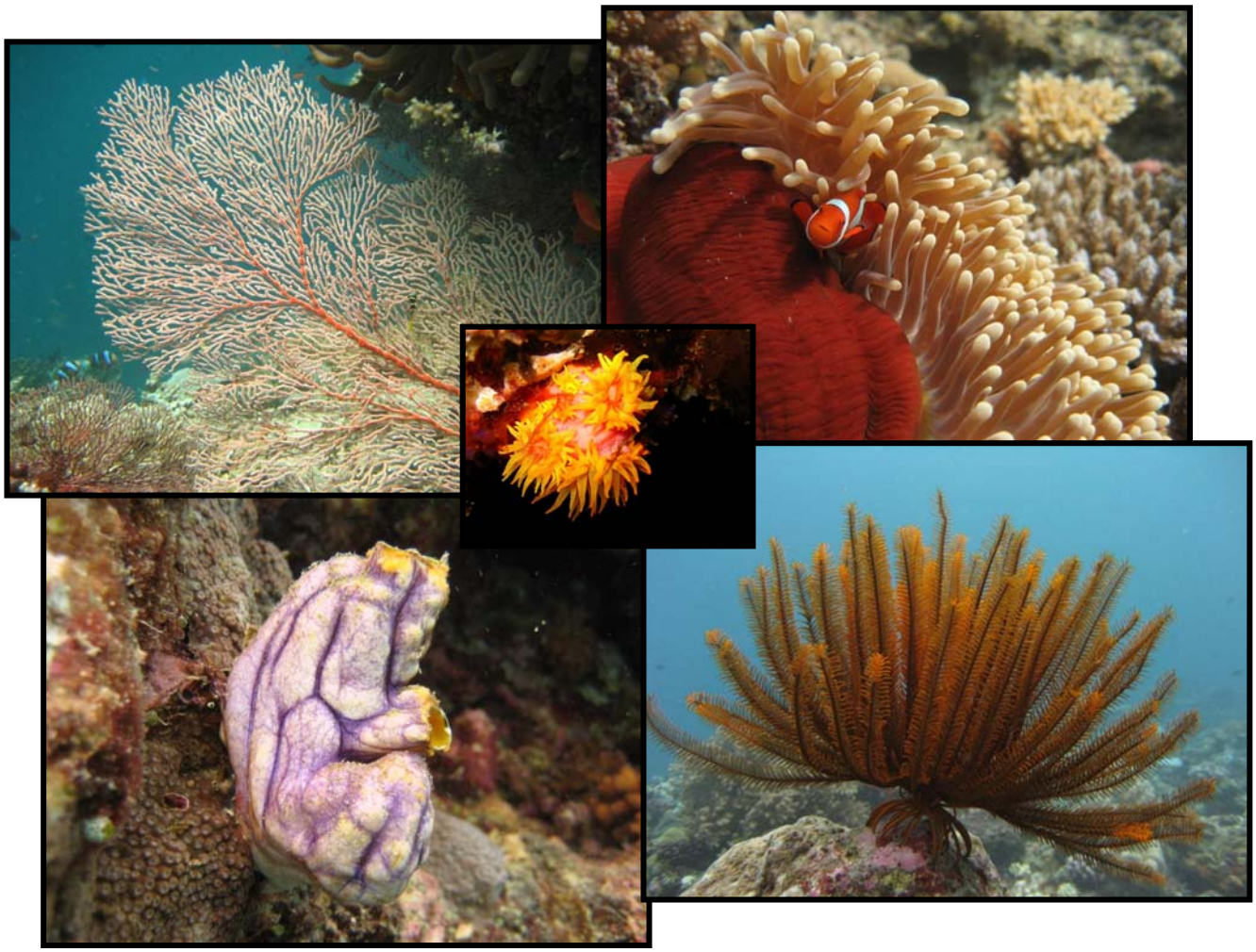
# MARINE INVERTEBRATES NOTES



Unlike fish, sharks and whales, most of the animals that live in the sea do not have a backbone, which mean they are "invertebrates". **A Marine Invertebrate is an animal that does not have a backbone and lives in the sea.**

Many marine invertebrates live attached to the ocean floor, reefs, or rocky shores and most look more like plants than animals. There are thousands of different types of marine invertebrates to be discovered and capture your interest and amaze you.

You can observe these animals while

1. Reef/beach walking
2. Snorkelling
3. Scuba diving

* * * * *

While participating in these activities though, you need to be careful that you don't hurt or kill these animals.

Your presence is immediately sensed by fish, turtles, etc and they often leave the area before you would even know they were there. Human contact though can have serious consequences for marine invertebrates that cannot move away or are very slow moving. A little care, forethought and awareness of the outcome of our interaction with them can reduce any injury we might inadvertently cause to them by brushing against them, standing on them, kicking them with our fins, trying to pick them up, even just touching them. Remember, we are a visitor to their territory.

- Watch your step while reef walking. You could be walking on an animal or its home.
- Watch where you put your hands or feet while snorkelling or scuba diving.
- If you handle them, put them back where you found them. But better still, ***don't touch them at all – look only***.
- Replace any overturned rocks ***gently***. You don't want to squash the animals that live on the underside of the rock or under it. If you don't replace the rock as you found it, the animals will die if left exposed to the sunlight.

You also need to watch for dangerous animals that are poisonous and could hurt you. Some marine invertebrates are dangerous and can inflict injury, if disturbed or touched.

- Watch where you are going and be aware of what is around you. You may injure yourself by accidentally coming into contact with an animal or disturbing it, such as sea urchins, jelly fish, stinging hydroids, fire coral etc.
- Learn to identify hazardous marine life and don't try to pick up anything that you can't identify or you know can harm you. Some cone shells for instance are very dangerous, also the blue ringed octopus.

Before taking a closer look at the incredible diversity of marine invertebrates, it is useful to know a little bit about how animals have been organised into their groups by scientists.

An animal is described and grouped (or classified) according to its similarities. They are sorted into large groups called "phylum" based on how similar they are, for example, their skeleton, its body covering, how it reproduces, how it behaves, what it eats and many of its other features.

There are different levels of classification, each level describing features that they have in common, becoming more specific at each level until there is only one animal that has all the features described. The first large grouping is a "Phylum" followed by "Class", then "order", "family", "genus" and finally "species".

The following table lists the most common Phylum marine invertebrates have been grouped into with examples of the animals classified into those groups.

| **PHYLUM** | **ANIMALS** |
|---|---|
| Chordata<br>*Class: Ascidiacea* | Ascidians (also known as tunicates or sea squirts) |
| Porifera | Sponges |
| Annelida | Bristle Worms, Scale Worms, Tube Worms |
| Platyhelminthes | Flat Worms |
| Nemertea | Ribbon Worms |
| Arthropoda<br>*Class: Crustacea* | Shrimps, Lobsters, Hermit Crabs, Crabs, Barnacles |
| Cnidaria | Soft and Hard Corals, Hydroids, Gorgonians, Sea Whips, Sea Pens, Anemones, Tube Anemones, Sea Jellies |
| Echinodermata | Sea Stars, Feather Stars, Brittle Stars, Sea Urchins, Sea Cucumbers |
| Mollusca | Shells, Clams, Nudibranchs, Octopus, Cuttlefish, Squid, Sea Hares |

## PHYLUM CHORDATA
## CLASS: ASCIDIACEA

### ASCIDIANS

Scientists have placed Ascidians in the Phylum "Chordata". Chordata means "having a backbone". This phylum includes mammals, birds, reptiles and fish.

The reason ascidians have been placed in this phylum is that their free swimming larvae are tadpole-like and have a tail with a nerve chord and a rudimentary backbone known as a "notochord".

As an adult, it has a simple sac-like body. It is enclosed in an external coat (or tunic) made of a cellulose-like substance (called tunicin) unique in the animal kingdom. The body has two openings. Water is drawn through the incurrent opening by the action of beating cilia (minute hairs) lining the animals gut. The planktonic food is filtered out of the water and the waste and water exits through an excurrent aperture.

Ascidians live as solitary or colonial animals.

A solitary ascidian increases in size and sheds its outer skin (tunic) on a regular basis. The incurrent mouth opening is usually larger than the excurrent opening.

A colony grows as the small individuals in it replicate by budding (or subdivision). The smaller intake openings are often seen over the surface of the colony while they have a larger communal outflow siphon.

*Interesting Facts:*

- *Ascidian openings close at any disturbance. Sponges (having no nervous system) show no obvious reaction to disturbance and their oscula openings remain open.*

- *A small ascidian only 30 millimetres long can filter water at the rate of approximately 1 litre an hour.*

- *Tadpole-like larvae develop in the plankton. After less than 6 hours, they find a suitable spot such as reefs, rocks, sand or mud to attach themselves to then absorb their tail and change into an adult where it remains for the rest of its life.*

# PHYLUM PORIFERA

## SPONGES

Most people think of sponges as something used in the bathroom, without realising that, before the manufacture of the modern day sponges that we know today, people were scrubbing themselves with the skeleton of an animal.

Sponges range from minute encrusting species under rocks to massive structures in variable shapes such as branching, tube, finger, vase, round or honeycomb. They come in almost any colour and their texture can be firm, soft, rubbery or slimy.

The minute pores seen all over a sponge are the inhalant pores where water is sucked in to breathe and feed by filtering out plankton. The larger holes (oscula) are the exhalent openings where water and waste products are expelled. .

*Interesting Facts:*

- *Sponges filter large volumes of water non-stop throughout both night and day filtering their own volume of water every 4 – 20 seconds. In one day, a teacup size sponge pumps about 5000 litres of water through its body.*

- *Sponges are the most efficient "vacuum cleaners" in the sea, cleaning the water by filtering out most of the tiny food particles such as bacteria.*

- *Most sponges produce toxins that are distasteful to many animals, thus giving them protection from predators.*

- *It is interesting to note that the chemical compounds in sponges are examined by pharmaceutical companies and researched as possible drugs for various human diseases.*

## PHYLUM ANNELIDA

This phylum is made up of all the segmented worms and includes the land dwelling worms (leeches and the common earthworm) as well as the marine worms which belong to the Class "Polychaeta". They are brightly coloured creatures, and vary greatly in size, body shape, feeding methods and habitat. Some are sedentary and live in tubes (tube worms such as the Featherduster worm and the Christmas Tree worm) while others are active and mobile (bristle worms).

### TUBE WORMS

Tube worms, as the name suggests, live in a tube which they form around themselves. As a juvenile, they settle on a suitable coral colony and secrete a small tube around itself. The coral grows around the worm tube and slowly envelopes it, save for the opening at the top through which the worm can expand its feathery tentacles. The tentacles are covered in hair-like cilia which draw water over the tentacles that screen off planktonic food. When disturbed, even by the slightest water movement or shadow, the tentacles quickly withdraw into the safety of the worm's tube.

Christmas Tree Worms, so named because their tentacles look like little Christmas trees, are one of the most spectacular and familiar of all the tube-dwelling worms. Colonies of these worms can be found on hard corals and come in a variety of colours such as blue, green, yellow, red, pink or orange, and several colours are often present on one coral colony.

### BRISTLE WORMS/SCALE WORMS

Bristle Worms have bristles and Scale Worms have scales. These worms burrow under rubble or sand. They move around by swimming, crawling or tunnelling. They propel themselves using undulations of the body as well as leg like appendages. They have well developed head regions with complex eyes and sensory tentacles. These worms are predators as well as scavengers, consuming algae, other worms or organic waste.

Some worms can deliver a painful and long lasting sting to humans. If touched, their bristle-like hairs break off and embed themselves causing irritation and inflammation.

*Interesting Facts:*

- *Segmented worms have a hydrostatic skeleton – a body cavity full of fluid that helps maintain the worm's shape and enables it to swim. If a segmented worm is punctured, it loses its form, like a balloon, and cannot swim until the tear reseals.*

## PHYLUM PLATYHELMINTHES

### FLATWORMS

At first glance, flatworms can be mistaken for nudibranchs, but unlike a nudibranch, they have no external gills.

Flatworms have a much flattened, oval body, exhibiting dazzling colour patterns. Their bright colours probably warn predators that they are poisonous. They may be semi-transparent or have frilly margins.

Most are under 8cm in length and live under boulders or amongst coral rubble.

They move by first secreting a layer of mucous and then by beating the hair like cilia on the underside of their body ride smoothly over it.

Flatworms are predatory and capture prey such as small worms and crustaceans with a muscular, tubular pharynx that can be rapidly everted through the mouth.

*Interesting Facts:*

- *If they are broken into small bits, each part may grow into a new flatworm*
- *Many flatworms mimic nudibranchs in their appearance – probably as a defence against predators (if the nudibranch is poisonous and predators leave the nudibranchs alone, the flatworm might also be protected as the predator thinks the flatworm is a nudibranch).*

## PHYLUM NEMERTEA

### RIBBON WORMS

As their name suggests, Ribbon Worms have long, flattened, ribbon shaped unsegmented bodies that have remarkable powers of extension and contraction. They range in size from several millimetres to several metres in length. They are slippery or sticky to touch. Most are found under rocks, or dead coral slabs, among algae or in soft bottom sediments. They feed on invertebrates or their eggs, grasping them with a proboscis extending from the front of the head.

Many are nocturnal and are only seen on sand at night.

*Interesting Facts:*

- *Some ribbon worms can endure high levels of heavy metals in their habitat and survive where the sea has been polluted by industrial wastes.*

## PHYLUM ARTHROPODA
## CLASS: CRUSTACEA

Crustaceans belong to the phylum Arthropoda. Other classes in this phylum include the insects, spiders, centipedes and millipedes.

Crustaceans have a segmented body which is divided into the head, thorax, and abdomen. Each segment may bear jointed appendages or limbs that can be specialised for walking, grasping, feeling, digging, swimming, carrying, cutting or feeding. A tough protective, yet flexible, outer coat covers the body. As they grow, they periodically cast off their old skeleton. The new soft body and skeleton then rapidly expands before the new skeleton hardens.

Most crustaceans remain hidden for long periods in burrows or crevices being actively hunted by larger predators. Generally the best time to observe crustaceans is at night when many species emerge from their retreats to feed.

Animals in this class include the crabs, hermit crabs, lobsters, shrimps, and barnacles.

### CRABS

A crabs body is encased in a carapace with a reduced abdomen folded under as an abdominal flap. The first, or front pair of a crab's ten walking legs are modified as pincers, or claws, and are used for defence and to capture prey. The other four pairs of legs are walking legs. When crabs walk or run, they go sideways because the legs on one side of the body push, while those on the other side pull.

### HERMIT CRABS

Most hermit crabs have no protective shell for their soft abdominal parts and they utilise the shells of dead molluscs in order to survive. They back into the empty shells and use the large claw of the first pair of walking legs to block the entrance against predators. The hermit crab holds tight to the shell with a hook like structure on its tail. Hermit crabs are constantly house-hunting as they require new, bigger shells as they grow.

### SHRIMPS AND LOBSTERS

The main difference between shrimp and lobsters and crabs is that the abdomen of shrimps and lobsters is muscular and extends posteriorly, whereas in crabs it is flexed forward under the body. Unfortunately for lobsters and prawns, humans consider their abdomens rather tasty.

Most shrimps are small, transparent and not easily seen, whereas the lobsters grow much larger.

**BARNACLES**

Barnacles are sedentary and their entire body is enclosed within protective calcareous plates so that they look significantly more like a mollusc than a crustacean. Barnacles may attach themselves directly onto the substrate as do the acorn barnacles, or by a stalk as is the case with the goose barnacles which are often washed ashore on logs or other floating objects. The larvae settle on a solid surface head first and spend the rest of its life upside down.

Barnacles feed by filtering plankton from the currents. Feathery-like tentacles called cirri protrude from the shell sweeping the plankton into its mouth.

*Interesting Facts:*

- *A crustacean's body cannot be flexed or twisted and to make up for this, the eyes are perched on movable stalks.*

- *Some crabs can spend long periods out of the water. Their gills are kept moist in their gill chambers and are stiffened and spaced to obtain the most possible oxygen from the air.*

- *Many crabs rely on camouflage to hide from predators and they live together with other reef animals such as corals, anemones, sponges and echinoderms, and have shapes and colours to blend in. They not only use the host for protection, but in some instances, gaining a ready food supply as well.*

- *Other crabs, instead of being camouflaged to look like their host in colouration, disguise themselves with other reef material to make themselves less obvious. The boxer crab carries a small anemone on each nipper while the sponge crab holds a coat of sponge firmly on its back with its back legs, thus cleverly using the sponge's distastefulness to deter predators and avoid being eaten.*

- *Most hermit crabs take up residence in the discarded shells of molluscs, but the little Coral Hermit Crab lives in the burrows originally made by tube worms in living coral. Having given up mobility for security, they cannot go after food, so must rely on what comes to them. Their feather like appendages are used as scoop nets for capturing plankton.*

## PHYLUM CNIDARIA

The term "Cnidaria" refers to the power to sting, a feature of those animals which have special stinging cells in their bodies. This common feature is the reason these animals have been grouped together.

The basic structure of a typical cnidarian is a flower-like polyp. This polyp has no breathing mechanism, no blood and no excretory system. It is a sac-like organism with an opening at one end surrounded by one or more circles of tentacles. These stinging cells are on the tentacles that surround the mouth and are concerned with feeding and defence.

The tentacles are hollow containing a space which connects to the gut. Once the prey is subdued, the tentacles manoeuvre it to the mouth. It then passes to the stomach where it is digested and the useful products are absorbed. The refuse is regurgitated and ejected via the mouth.

Within the phylum there are two main body forms – free swimming (sea jellies) and sedentary polyps (corals, anemones, hydroids). The sea jellies swim with the mouth and tentacles facing downwards while the stationary polyp is attached to a substrate with the mouth and tentacles facing upwards, outwards or downwards.

### CORALS

There are two types of coral – hard coral and soft coral.

**HARD CORALS** are the builders of coral reefs and provide homes for countless numbers of reef organisms. An individual coral polyp consists of a fleshy sack topped with a ring of tentacles around a central mouth opening. It sits in a limestone skeletal case which is actually secreted by the polyp. Members of the colony are linked by living tissue. Therefore nutrients captured by a section of the colony can be shared around.

Skeletons deposited by countless generations of coral polyps form the solid limestone foundation or platform on which the reef flourishes.

The majority of corals keep their polyps retracted during the day and they are normally only seen as skeletal formations. However, at night the polyps are out feeding and the hard skeleton of the colony may be completely obscured by the waving polyps. The polyps have long slender stalks tipped with beautiful flower-like tentacles.

Hard corals vary in size and shape, such as plate corals, boulder coral, branching or staghorn corals, micro-atoll corals, brain corals or mushroom coral.

**SOFT CORALS** are similar to hard corals in that both contain colonies of polyps that gather planktonic food, however, as their names suggest, soft corals lack a hard limestone skeleton. Instead the supporting "stem" consists of fleshy tissue that is reinforced by a matrix of microscopic calcareous particles called "sclerites". Soft corals generally have eight tentacles compared to the six or multiples of six found in hard corals. Soft corals have tiny pinnae (side branches) on the tentacles in contract to the smooth tentacles of hard corals. Soft corals

grow more quickly than hard corals and can release chemicals into the water to kill nearby hard corals which take up their living space and food.

*Interesting Facts:*

- *Mass spawning, or release of eggs and sperm, takes place on the Great Barrier Reef one or two nights after the full moon in November. For several nights, millions of eggs and sperm are released from coral polyps and float to the surface. Those fertilised eggs which escape predators hatch into larvae and drift with the plankton. Finally a tiny percentage manage to settle on the reef and begin new coral colonies.*

- *Soft corals use chemicals to stop the larvae of other animals, such as sponges, from settling and growing on top of them.*

**GORGONIAN SEA FANS**

The bushy or branched colonies of sea fans are called gorgonians because their skeleton is composed of a flexible but strong horny substance called gorgonin. The skeleton consists of a rod (which is firmly anchored to the substrate) from which side branches bearing the live polyps arise. The side branches are extensive and often inter-connected so that colonies of them appear either bushy or fan-shaped.

Fans grow at right angles to the current, and when the polyps are expanded their tentacles almost touch, forming a very efficient plankton collector. They occur mostly in deeper waters along reef slopes and around coral bases.

**HYDROZOANS**

Stinging Hydroids are the most common form of hydrozoans occurring on coral reefs. The majority of hydroids are fine, fern-like structures that look more like plants than animals.

Hydroids are colonial animals. Each colony has the appearance of a feather with a central stalk and many side branches. Tiny polyps with characteristic “cnidarian” tentacles occur on the branches. Some polyps are specialised for feeding and armed with nematocysts, others function as reproductive organs. Food is shared among the polyps by an interconnecting digestive tube.

If accidentally brushed against, these hydroids will inflict a nasty, painful sting and some swelling. Uncomfortable stings received from these common creatures have caused many a sleepless night. Prevention is definitely the best cure!!

Other forms of hydrozoans are the fire corals which secrete a hard limestone skeleton. They also include the beautiful, delicately branched lace corals that are common under ledges or on the walls and ceilings of caves.

*Interesting Facts:*

- *The bluebottle is a hydrozoan colony which drifts on the ocean under a float.*

## ANEMONES

On the reef there are many species of sea anemones and they occupy a great variety of habitats. Each anemone consists of a single polyp that, like a coral polyp, has six or multiples of six tentacles laden with stinging cells around its mouth. These stinging cells kill or paralyse their prey which is then passed to the mouth. The stinging cells in the tentacles also repel predators such as butterfly fish. Tentacles vary in number according to the type of anemone, but in every case, they surround the mouth and function in obtaining food. In some the tentacles are short and knobbly while in others, they are long and slender. Sea anemones attach to a substrate by a basal sucker-like disc. They may be very small or may reach up to one metre in diameter.

*Interesting Facts:*

- *The tentacles of many species of sea anemone are home for the beautiful clown fish. Most fish would be stung by the anemone, but clownfish have a special mucus coating which prevent the anemone from stinging them.*

## JELLYFISH

Jellyfish are gelatinous creatures, some of which are highly transparent, or tinted blue, pink, mauve, yellow or brown.

The body, or bell, of the jellyfish varies in shape from a shallow saucer to a deep cup which usually lies uppermost in the water with the tentacles and mouth surrounded by lobed "lips" called oral arms hanging down below. Within the umbrella circumference are powerful muscles that contract to move the jellyfish up or forward and relax to let it float down, thus propelling the jellyfish in a somewhat zig-zag fashion. Jellyfish are predators and feed mainly on small invertebrates which they trap and paralyse using stinging cells on the tentacles and oral arms. The sting of many jellyfish is harmless to people, however, the sting of the Box Jellyfish can be fatal.

*Interesting Facts:*

- *Sea Jellies are usually found in numbers in shallow water. Their fragile, jelly-like bodies break down quickly when washed up on shore.*

- *A sea jelly may drift with the current or may move slowly by pulsing its bell to suck in and push out water*

- *The Lion's Mane sea jelly may have a bell 1 metre across and trail up to 800 tentacles up to 10 metres in length.*

## PHYLUM ECHINODERMATA

In this phylum there are five major classes – sea stars, brittle stars, feather stars, sea urchins and sea cucumbers.

These animals look quite different on the outside but they have three basic structures in common linking them together as echinoderms. The term "echinoderm" means "spiny skin". As well as their "spiny skin", they are all radially symmetrical (ie their body organs are repeated, usually five times around a central disc) and they have running through their body a unique water vascular system which operates their tube feet by hydraulic pressure.

### SEA STARS (STAR FISH)

A typical sea star has a body of a central disc and five arms radiating from it. However, some species, such as the Crown of Thorns, may have more. Each arm contains identical sets of respiratory, digestive, movement, sensory and reproductive organs.

On the underside of each sea star's arm is a groove in which the tube feet are found which they use primarily for movement, but which in some species are also involved in feeding. Tube feet can be protruded or retracted by altering the pressure of fluid within them. When tube feet contact a substrate their suckered tips adhere to the surface and by muscular contraction the sea star body is then drawn up behind them and in this way they crawl about the sea floor.

Most are carnivorous and feed upon sponges, corals, crustaceans, molluscs or even other sea stars.

*Interesting Facts:*

- *By exerting immense pressure with their tube feet Sea Stars can open up bivalve shells. They evert their stomach out of the mouth around their prey and secrete digestive enzymes over it to partially digest it before swallowing.*

- *Sea stars have remarkable powers of regeneration. Should an arm be broken off, it can regenerate a new one. The broken off arm can also grow a new sea star.*

### BRITTLE STARS

Brittle stars are, as their name implies, brittle and their arms break off easily but are quickly regenerated. The arms of the brittle star are long and clearly differentiated from the central disc. The body disc generally appears quite soft.

Unlike the sea stars, their arms have no ambulacral groove on the underside and the tube feet lack suckers. The tube feet situated along the arms play no part in mobility, but instead are primarily used for feeding.

Brittle stars are commonly seen crawling around reef flat coral rubble by sinuous snake-like movements of their arms. Brittle stars are the most active and fastest moving echinoderms.

*Interesting Facts:*

- *Brittle Stars escape attackers by shredding their arms, which then regrow.*
- *A brittle star swims by rowing with its arms. Compared to a sea star, it is a speedy mover.*

**FEATHER STARS**

Feather Stars have between 5 and 200 arms spreading from a central disc. Each arm has many fine feathery branches.

They have special appendages called "cirri" on the underside of the body to cling to boulders, in crevices or on coral.

They do not move a lot but can use the cirri for crawling and can actually swim by flapping their feathery arms. At night, they move to a prominent position, usually where there is a good current of water, and spread out their long feathery arms to catch plankton.

Their prey is enmeshed in mucous and passed to the mouth which, unlike other echinoderms, is on the upper side.

*Interesting Facts:*

- *Many crabs and shrimps hide among the feather stars crown, not only gaining protection, by also benefiting from the incoming food supply.*

**SEA URCHINS**

Sea urchins are mostly recognised as such by their spines, which in many species are sharp, pointed and, in some cases, venomous. Sea urchins have a basic echinoderm body structure including a water vascular system with associated tube feet. The tube feet are used for movement, aided by leverage from the movable spines on the underside of the body. As a result they can move much faster than sea stars. The mouth is centrally located on the underside of the body and is equipped with well developed jaws and a set of horny teeth.

*Interesting Facts:*

- *The spines of the slate pencil urchin were once used for writing on slateboards.*
- *At breeding time, the almost hollow shell of a sea urchin becomes full of eggs or sperm. These tasty organs are eaten by fish and humans.*
- *Tiny stalked nippers keep the urchin's surface clear of debris. However an urchin may hide itself with debris held on with its tube feet.*

## SEA CUCUMBERS

At first glance, sea cucumbers seem to have little in common with the other echinoderms. They do not have arms or spines but they do have tube feet and a body made up of five sections, just like other echinoderms. The body is elongated with a head and tail (although it may be hard to tell which end is which). Most species have a tubular shape and the body is covered with a thick leathery skin. They move by squeezing up then stretching out their bodies. As it crawls slowly over the sea floor, it sucks up sediment and sand like a vacuum cleaner. They digest any organic material and leave behind a trail of clean sand.

*Interesting Facts:*

- *Sea cucumbers get their name from their widespread use in Asia as a base for soups, having a considerable commercial trade, referred to as beche-de-mer. The live animals are gathered from the reef and dried in the sun or with special ovens.*

- *Several species spurt out white sticky, toxic threads when threatened by predators or roughly handled by humans. If really stressed it can vomit up its intestines, which are full of food for the predator to eat. The sea cucumber escapes and its intestines grow back in a week or so.*

- *Sea cucumbers have a single reproductive organ that opens at the top of their head. A spawning sea cucumber raises its head off the ocean floor and releases a steady stream of either sperm or eggs. The eggs are fertilised in the water and the larvae develop in the plankton until they are ready to settle on the bottom and become little sea cucumbers.*

## PHYLUM MOLLUSCA

Sea shells belong to the phylum mollusca. You can learn more about these animals by doing the separate "Shell Honour".

The four major classes of the phylum are the gastropods, bivalves, cephalopods and chitons.

The bodies of molluscs are unsegmented and soft and they do not have an internal skeleton. Most of these animals compensate for this by secreting a hard external casing made of calcium carbonate to protect their bodies and provide for muscle attachment and support for their soft parts. These are the shells we find washed up on the beach, most belonging to the gastropods and bivalves.

The largest class of all the molluscs is the gastropods. They comprise the sea and land snails and are also known as univalves because their shell consists of one piece. They include the beautiful glossy cowries, cone shells, spiders and strombes and have a huge range in size, shapes, colours and patterns.

However, not all gastropods have a shell. Nudibranchs, misappropriately named sea-slugs, are among the most spectacular and strikingly coloured animals living on the reef and belong to this class.

Sea Hares also belong to this class. They have small, flattened internal shells. Many sea hares are camouflaged in dull browns and greens, and may be overlooked as they feed on algae. If disturbed, they may jet out purple ink.

All bivalves have two shell valves that are hinged together. Bivalves include oysters and clams.

The cephalopods include the nautilus as well as the squid, octopus and cuttlefish which do not have an external shell. The cuttlefish has a flattened body and a spongy internal shell, which is often found washed up on the beach. They propel themselves through the water by jetting water from the mantle cavity through a siphon.

These animals react quickly to changes in their surroundings because they have giant nerve fibres with few junctions, so messages pass quickly to and from their brains.

All cephalopods except nautiluses have an ink sac opening off the end of the gut. Ink is discharged to confuse enemies.

Chitons live on rocky ocean shores, their soft parts protected by shells consisting of eight plates embedded in a fleshy girdle.

*Interesting Facts:*

- *The colour of a sea hare may range from green and brown to pink and comes from colouring materials in the algae it eats.*

- *The largest species of sea hare may measure 50 cm and weigh 2 kg.*

- *A nudibranch larva swims free and does not change into an adult unless it meets a suitable surface with opportunities to feed.*

- *The striking colours of a nudibranch mean to a would-be predator that they are probably nasty tasting and possibly toxic to eat. Once a fish nibbles a nasty-tasting nudibranch, it is not likely to taste other creatures which resemble it.*

- *One group of nudibranchs feeds on coral polyps, hydroids and other stinging animals. They take the nematocysts of their prey and store them in the tips of the feathery projections on their backs. Any animal trying to eat such a nudibranch receives a battery of stings from these stolen weapons.*

- *Many cephalopods can change their skin colours rapidly and dramatically to escape enemies, hide when hunting or show emotion. The skin contains small, elastic bags of colour, which shrink and expand to pale or colour the animal.*

- *Cephalopods have the most advanced nervous system of all invertebrates. Their eyes are remarkably human-like and accurately register shapes, textures and colours – they see us much the same as we perceive them!!*

- *The bite of a blue-ringed octopus causes paralysis and breathing problems. This octopus flushes orange and bright blue when agitated.*

## INTERESTING RELATIONSHIPS BETWEEN MARINE INVERTEBRATES AND OTHER SEA CREATURES

### Clown Fish and Anemone

The clown fish lives in the anemone and so gain protection from predators. The stinging cells of the anemone kill small fish on contact which the anemone then conveys to their mouth for food. However, the clown fish acquire an immunity from the stinging cells by gradually covering themselves with a layer of the mucous that the anemone secretes to stimulate itself not to fire off its stinging cells onto its own tentacles as they move around. An anemone fish cannot survive without an anemone and is never seen for long without one.

### Porcelain Crab and Anemone

The spotted porcelain crab lives in the shelter of sea anemones. They keep from being captured and eaten by the anemone by moving around among the tentacles.

### Shrimp and Goby

A few species of shrimp live with goby fish. These shrimps, usually in a pair, excavate a deep burrow which a pair of gobies share with them. The fish gain shelter and protection in the shrimp's burrow and in return, the fish, by a quick movement of its tail to propel them down the burrow, warn the shrimp of impending danger. The shrimp maintains the home burrow while the fish keeps watch and signals when it is safe to bring out debris.

### Cleaner Shrimp

Most crustaceans spend daylight hiding, but a group of shrimps are day shift workers. These shrimps are known as "cleaner shrimps". They wait at "cleaner stations" for fish to arrive and signal by the way they hang in the water that they wish to be cleaned. The shrimp crawl over them, even into their mouths and under their gill covers, removing and eating small parasites.

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Many shrimps and small crabs live in association with corals, anemones, sponges, ascidians, molluscs and echinoderms. These shrimps and crabs are sometimes coloured and patterned to blend in with their background so that it is almost impossible for predators to detect them.

Some crabs, rather than being camouflaged to look like their host in colouration, dress themselves with other reef material to make themselves less obvious. Decorator Crabs apply bits of sponge, or debris to their carapace for camouflage and if they move to a different habitat, they change their coat to suit.

The Sponge Crab carries an entire sponge on its back. It holds the sponge firmly on its back with modified claws on its last two pairs of walking legs, thus cleverly using the sponges' distastefulness to deter predators and avoid being eaten. The crab can set aside their sponge coat and pick it up again if it wishes.

The Boxer Crab carries two small anemones on its claws. If threatened, the crab, like a boxer with gloves, spars with its claws endeavouring to sting its opponent with an anemone.

## DANGEROUS MARINE INVERTEBRATES

Most of the marine invertebrates are not dangerous to humans, but there are some that are potentially harmful or may cause irritation if touched or handled.

### Cone Shells

Cone shells are hunters. They inject poisonous saliva into their prey through sharp grooved teeth at the tip of a retractable proboscis. The poison is extremely powerful and acts almost instantaneously on the victim. The poison has to act quickly to be effective for there would be no point in the cone shell poisoning its prey merely to watch it swim or crawl away to die out of reach. Two cones known to have caused fatalities to humans are the *Conus geographus* and *Conus textile*.

### Blue Ringed Octopus

The blue ringed octopus possesses a deadly venom capable of killing humans. It feeds on crabs and molluscs which they paralyze by injecting poison with their beak-like jaws.

### Box Jelly Fish

At each of its four corners, it has clusters of long trailing tentacles, loaded with batteries of venomous stinging cells, whose touch may be fatal or cause severe injury.

### Stinging Hydroids and Fire Coral

A brush with stinging hydroids or fire coral may result in a mild to rather severe sting with persisting rashes and itching. The polyps have tentacles armed with stinging cells. When brushed against, threads loaded with toxins are fired.

### Sea Urchins

The long slender needle-like spines of some sea urchins break off easily and lodge in the flesh. Because of their barbs, they are difficult to remove and may fester. Another sea urchin, the flower urchin, has a spectacular array of densely packed, waving nippers that reach out in every direction. They look like three-petalled flowers, but they are equipped with poison glands and contact with them is dangerous. It can cause muscle weakness, shock, neurological damage, respiratory distress and sometimes death.

### Sea Cucumbers

Sea cucumbers contain toxins and if handled, care should be taken not to let them come in contact with the eyes.

**Crown of Thorns Starfish**

This starfish is widely known for its devastation of coral reefs. The upper surface of this large starfish is a bristling mass of stout spines, each coated with a thin layer of skin that secretes an irritant poison. A puncture wound from the crown-of-thorn's spines is painful and may become inflamed and swollen.

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