Contents

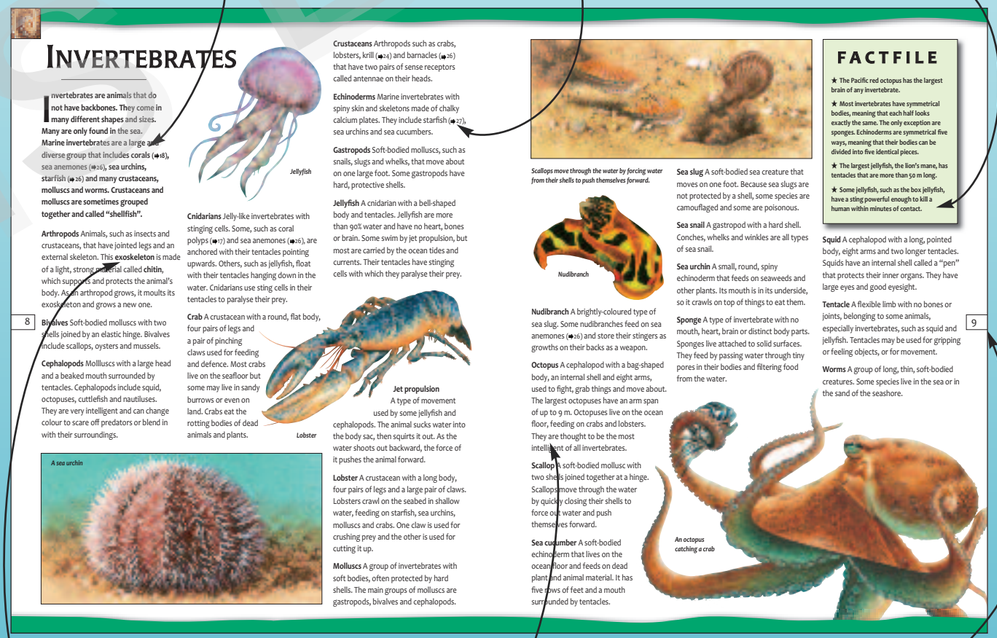
About this book

Each double page contains a brief introduction, explaining the general subject, followed by key words arranged in alphabetical order. To look up a specific word, turn to the index at the back of this book: this will tell you which page to go to. If you want to learn more about a subject, take a look at the factfile, or follow the arrows to read related entries.

INTRODUCTION
This explains the general subject and provides some basic knowledge.

ARROWS
These arrows show you where to look up other words mentioned in the entry. For example, (➡26) tells you to go forward to page 26 and (⬅6) tells you to turn back to page 6.

FACTFILE
The factfile provides extra information on the subject. Facts are presented in easy to read bullet points.



Invertebrates

Invertebrates are animals that do not have backbones. They come in many different shapes and sizes. Many are only found in the sea. **Marine invertebrates** are a large and diverse group that includes **corals (⬅18), sea anemones (⬅26), sea urchins, starfish (➡28) and many crustaceans, molluscs and worms. Crustaceans and molluscs are sometimes grouped together and called "shellfish".**

Arthropods Animals, such as insects and crustaceans, that have jointed legs and an external skeleton. This **exoskeleton** is made of a light, strong material called **chitin**, which supports and protects the animal's body. As an arthropod grows, it moults its exoskeleton and grows a new one.

Bivalves Soft-bodied molluscs with two shells joined by an elastic hinge. Bivalves include scallops, oysters and mussels.

Cephalopods Molluscs with a large head and a beaked mouth surrounded by tentacles. Cephalopods include squid, octopuses, cuttlefish and nautiluses. They are very intelligent and can change colour to scare off predators or blend in with their surroundings.

Jellyfish

Cnidarians Jelly-like invertebrates with stinging cells. Some, such as coral polyps (➡17) and sea anemones (⬅26), are anchored with their tentacles pointing upwards. Others, such as jellyfish, float with their tentacles hanging down in the water. Cnidarians use sting cells in their tentacles to paralyse their prey.

Crab A crustacean with a round, flat body, four pairs of legs and a pair of pinching claws used for feeding and defence. Most crabs live on the seafloor but some may live in sandy burrows or even on land. Crabs eat the rotting bodies of dead animals and plants.

Lobster

Jet propulsion A type of movement used by some jellyfish and cephalopods. The animal sucks water into the body sac, then squirts it out. As the water shoots out backward, the force of it pushes the animal forward.

Lobster A crustacean with a long body, four pairs of legs and a large pair of claws. Lobsters crawl on the seabed in shallow water, feeding on starfish, sea urchins, molluscs and crabs. One claw is used for crushing prey and the other is used for cutting it up.

Molluscs A group of invertebrates with soft bodies, often protected by hard shells. The main groups of molluscs are gastropods, bivalves and cephalopods.

A sea urchin

Crustaceans Arthropods such as crabs, lobsters, krill (⬅24) and barnacles (➡26) that have two pairs of sense receptors called antennae on their heads.

Echinoderms Marine invertebrates with spiny skin and skeletons made of chalky calcium plates. They include starfish (➡28), sea urchins and sea cucumbers.

Gastropods Soft-bodied molluscs, such as snails, slugs and whelks, that move about on one large foot. Some gastropods have hard, protective shells.

Jellyfish A cnidarian with a bell-shaped body and tentacles. Jellyfish are more than 90% water and have no heart, bones or brain. Some swim by jet propulsion, but most are carried by the ocean tides and currents. Their tentacles have stinging cells with which they paralyse their prey.

Scallops move through the water by forcing water from their shells to push themselves forward.

Nudibranch

Nudibranch A brightly-coloured type of sea slug. Some nudibranchs feed on sea anemones (⬅26) and store their stingers as growths on their backs as a weapon.

Octopus A cephalopod with a bag-shaped body, an internal shell and eight arms, used to fight, grab things and move about. The largest octopuses have an arm span of up to 9 m. Octopuses live on the ocean floor, feeding on crabs and lobsters. They are thought to be the most intelligent of all invertebrates.

Scallop A soft-bodied mollusc with two shells joined together at a hinge. Scallops move through the water by quickly closing their shells to force out water and push themselves forward.

Sea cucumber A soft-bodied echinoderm that lives on the ocean floor and feeds on dead plant and animal material. It has five rows of feet and a mouth surrounded by tentacles.

Sea slug A soft-bodied sea creature that moves on one foot. Because sea slugs are not protected by a shell, some species are camouflaged and some are poisonous.

Sea snail A gastropod with a hard shell. Conches, whelks and winkles are all types of sea snail.

Sea urchin A small, round, spiny echinoderm that feeds on seaweeds and other plants. Its mouth is in its underside, so it crawls on top of things to eat them.

Sponge A type of invertebrate with no mouth, heart, brain or distinct body parts. Sponges live attached to solid surfaces. They feed by passing water through tiny pores in their bodies and filtering food from the water.

An octopus catching a crab

Squid A cephalopod with a long, pointed body, eight arms and two longer tentacles. Squids have an internal shell called a "pen" that protects their inner organs. They have large eyes and good eyesight.

Tentacle A flexible limb with no bones or joints, belonging to some animals, especially invertebrates, such as squid and jellyfish. Tentacles may be used for gripping or feeling objects, or for movement.

Worms A group of long, thin, soft-bodied creatures. Some species live in the sea or in the sand of the seashore.

FACTFILE

★ The Pacific red octopus has the largest brain of any invertebrate.

★ Most invertebrates have symmetrical bodies, meaning that each half looks exactly the same. The only exception are sponges. Echinoderms are symmetrical five ways, meaning that their bodies can be divided into five identical pieces.

★ The largest jellyfish, the lion's mane, has tentacles that are more than 50 m long.

★ Some jellyfish, such as the box jellyfish, have a sting powerful enough to kill a human within minutes of contact.

BOLD WORDS
These highlight useful words that do not have their own entry.

KEY WORDS AND ENTRIES
Key words are arranged alphabetically across each double page. Each entry provides a short explanation of what the key word means.

PAGE NUMBER
Page numbers are easy to find at the side of the page.

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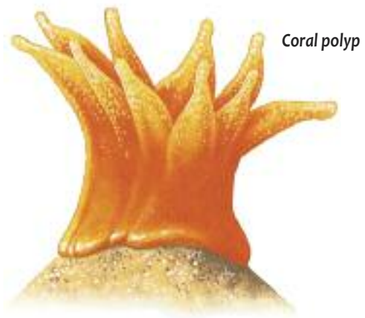
CORAL REEFS

A coral reef is an underwater structure formed from the hard skeletons of tiny animals called polyps. Coral reefs are found in warm, clear, shallow waters around volcanic islands or rocky coastlines. They teem with wildlife. Many small creatures feed on plants called algae (➡20) inside the coral. The coral itself is consumed by some animals such as parrotfish and the crown-of-thorns starfish. Predators, such as sharks, rays and barracudas, prey on the creatures that feed on algae or coral.



Coral polyp

Atoll A ring of coral islands. An atoll forms where a coral reef has grown around a volcanic island. When the volcano stops erupting, it will sink into the ocean floor. As it gradually sinks, the coral reef keeps growing upwards and will eventually be all that shows above water.

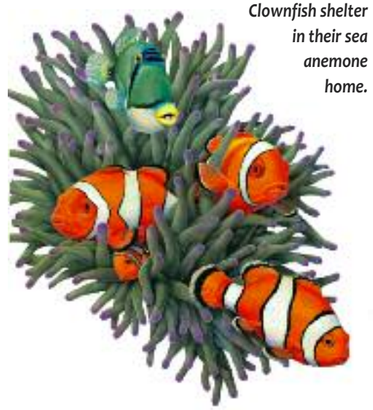
Barracuda A two-metre-long fish that hunts around coral reefs. It has a fierce appearance, with sharp teeth jutting forwards from its lower jaws. It hunts in groups known as **batteries**.

Barrier reef A coral reef that is separated from the shore by a pool of seawater called a **lagoon**. Barrier reefs lie farther from the shore than fringing reefs.

Butterflyfish A small, brightly-coloured fish, often with eye-like markings on its tail. These encourage predators to attack the wrong end of the fish's body, giving it a chance to escape. Butterflyfish feed on small crustaceans and coral polyps.

Clownfish A small orange and white fish that lives inside the poisonous tentacles of sea anemones (➡26). The fish is protected from the poison by a layer of mucus, but its enemies would be stung to death.

Coral A hard substance produced by the skeletons of tiny animals called polyps. Different kinds of polyps produce different shapes of coral. Some are shaped like branching plants, others are flat like a fan, long and thin like pipes or rounded like human brains. Only the living surface of the coral is coloured by the presence of algae (➡20). The layers of polyp skeletons underneath are white.



Clownfish shelter in their sea anemone home.

Crown-of-thorns starfish A large, brightly-coloured starfish (➡21) with at least 12 arms covered in long, venomous spines. It feeds on coral polyps. This can threaten the survival of the reef.

Fringing reef A coral reef that grows in shallow water along a rocky coastline.

Moray eel A three-metre-long eel that hides in coral crevices, waiting to burst out on its prey, a fish or an octopus.

Parrotfish A brightly coloured fish with a hard, beaked mouth. It scrapes algae (➡20) from the reef, biting off chunks of coral as it does so. Its throat contains bony plates that grind the coral into sand and help to digest the algae.

Polyp A tiny animal made up of a stomach, mouth and tentacles. Its soft body is protected by a hollow, cup-like skeleton. When the polyp dies, this forms the hard, dead part of coral and a new polyp grows in the remains.

Sea snake A snake that spends its life in the oceans. Sea snakes live in warm, tropical waters, hunting fish and eels. They breathe air at the surface and have flattened tails to help them swim. There are around 60 species of sea snake, all of which are venomous. Many species have stripy skin, to help them camouflage with the dappled light and shade of the sea.

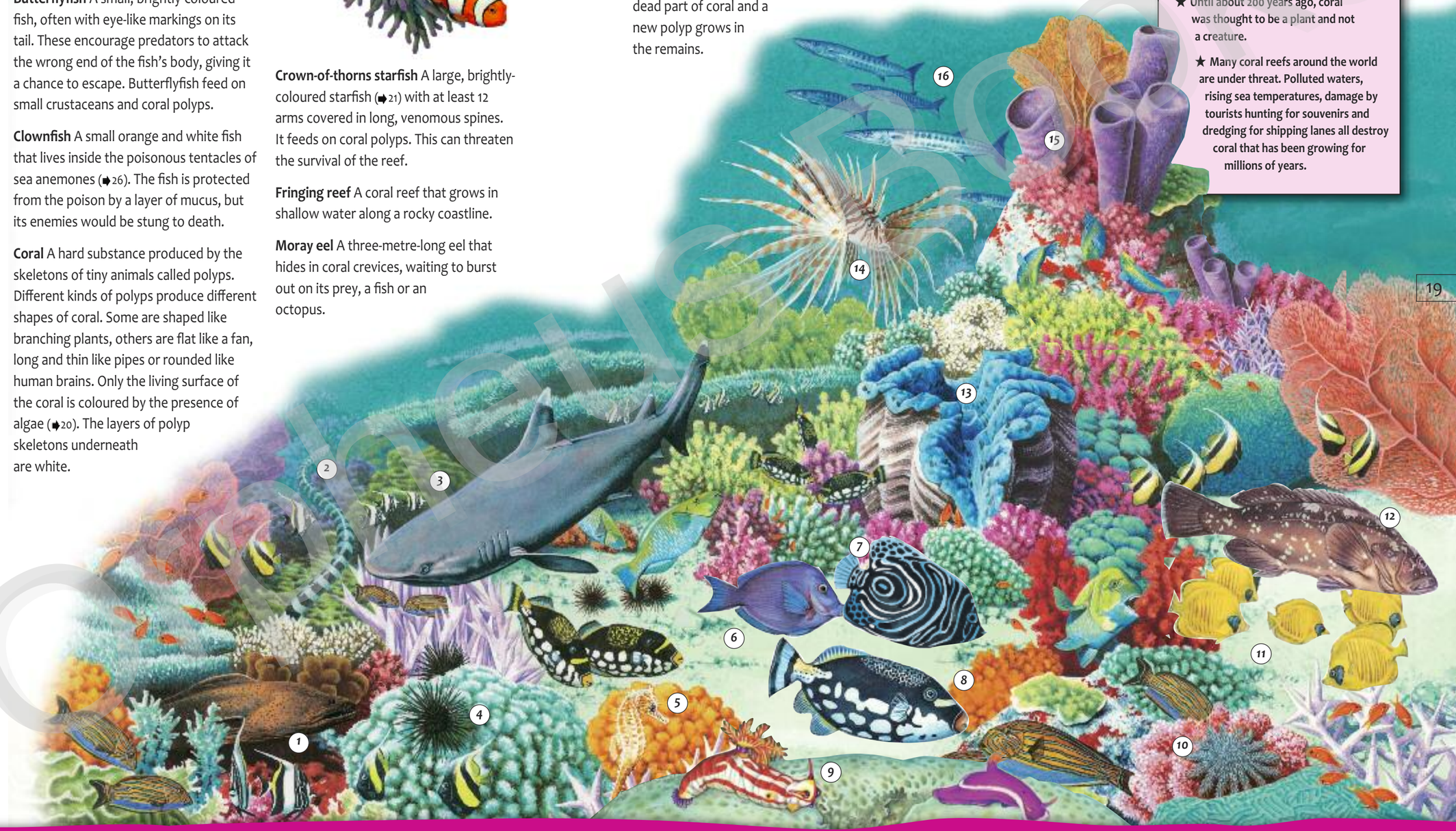
FACTFILE

★ The Great Barrier Reef, which runs along the northeastern coast of Australia, is the world's largest coral reef. It is more than 2000 km long along.

★ The bright colours and distinctive patterns of many reef fish are thought to help them recognize their own species among the throng of wildlife on the reef.

★ Until about 200 years ago, coral was thought to be a plant and not a creature.

★ Many coral reefs around the world are under threat. Polluted waters, rising sea temperatures, damage by tourists hunting for souvenirs and dredging for shipping lanes all destroy coral that has been growing for millions of years.

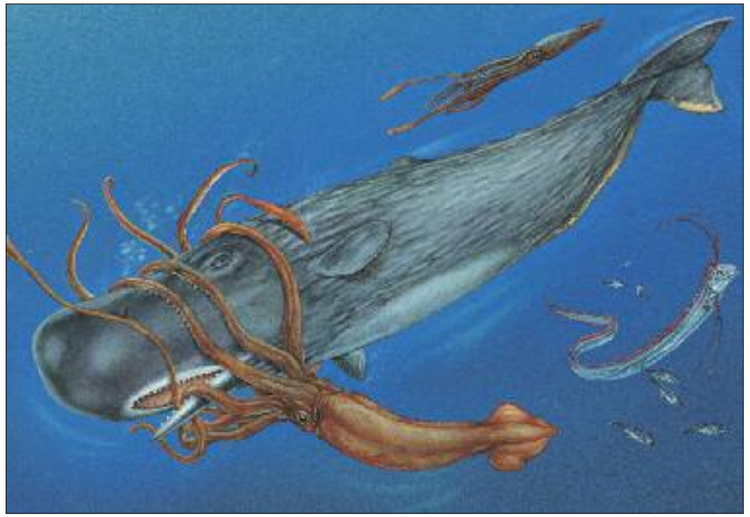


KEY

1 Morray eel
2 Sea snake
3 Reef shark
4 Sea urchin
5 Sea horse
6 Surgeonfish
7 Angelfish
8 Triggerfish
9 Nudibranch
10 Crown-of-thorns starfish
11 Butterflyfish
12 Grouper
13 Giant clam
14 Lionfish
15 Tube sponge
16 Barracuda

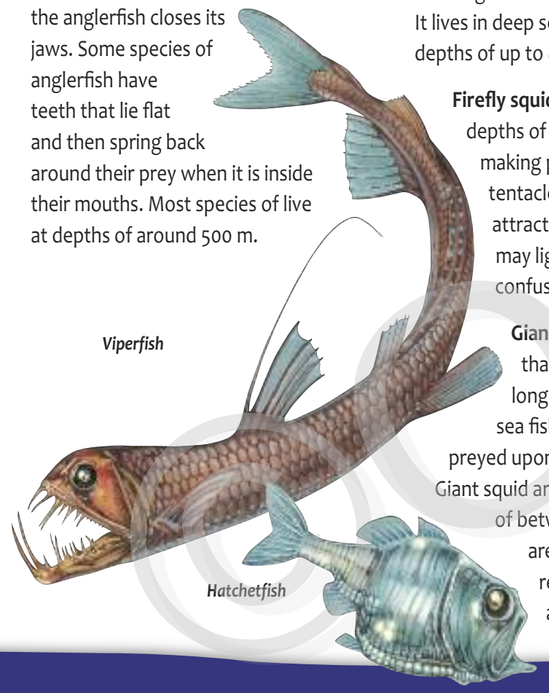
Deep sea creatures

More than 200 m deep, it is dark and cold and no plants can grow. Only a few animals can survive these conditions. Some migrate to the surface every night to feed. Others eat dead matter that sinks from above, or prey on each other. Many creatures can create their own light. Near the ocean floor the water is pitch black and the pressure is immense. Animals rely on touch or smell to detect food. Some of the animals that live at the bottom of the ocean are attached to the ocean floor and look more like plants than animals.



A giant squid locked in battle with a sperm whale

Anglerfish A fierce-looking deep water fish. Anglerfish have a long thin dorsal fin with a light at its tip, called a **lure**. It hangs this in front of its mouth. When its prey lunges at the light, believing it to belong to another tiny animal, the anglerfish closes its jaws. Some species of anglerfish have teeth that lie flat and then spring back around their prey when it is inside their mouths. Most species of live at depths of around 500 m.



Bioluminescence Natural light created in the body of a living creature. Many deep water animals are bioluminescent. They may use light to lure prey, or as a signal to other creatures of the same species. They may also flash lights on and off to confuse an attacker.

Brotulid The world's deepest-living fish. It is long and thin with a pointed tail. It lives in deep sea trenches (⬅ 6) at depths of up to 8000 m.

Firefly squid A small squid that lives at depths of 200 to 400 m. It has light-making parts at the tips of its tentacles, which it can flash to attract small fish. Its whole body may light up to attract a mate or confuse a predator.

Giant squid A type of squid (⬅ 9) that can grow to at least 13 m long. Giant squid feed on deep sea fish. They themselves are preyed upon by sperm whales (⬅ 15). Giant squid are thought to live at depths of between 200 and 1000 m, but are difficult to study, so relatively little is known about them.

Gulper eel A two-metre-long eel with a gaping mouth and a light on its tail, used to attract prey. The gulper eel can live at depths of up to 3000 m. It has huge jaws and a stretchy stomach that allows it to swallow animals that are larger than itself.

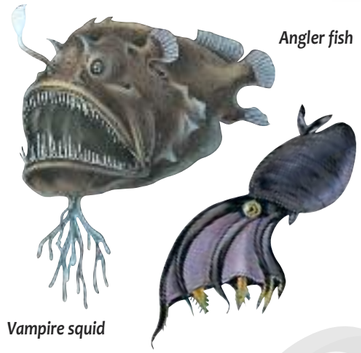
The skeletons of tiny plankton that have rained slowly down from surface waters into the ooze.

Hatchetfish A small, bioluminescent fish that lives at depths of up to 1500 m. It has a flattened body that makes it hard for predators to spot in the water. It feeds on other, smaller fish.

Lanternfish A small fish with bioluminescent spots. It spends the day at depths of 300 to 1500 m but rises to the surface at night to feed on zooplankton (⬅ 7).

Ooze A thick layer of mud and sediments that builds on the ocean floor. It may lie up to 500 m thick in some places. The animals that live on the sea floor must either lift themselves out of the ooze, burrow inside it or find some way of slithering across it. Some animals eat the ooze for the animal and plant remains that it contains.

Rat-tail A common fish, also known as a **grenadier**, that has a long thin tail and swims above the ocean floor. A special sensor running down its spine feels the movements of other creatures nearby. It makes a loud drumming noise by vibrating muscles attached to its swim bladder (⬅ 11). This may be a way of signalling to others of its kind.



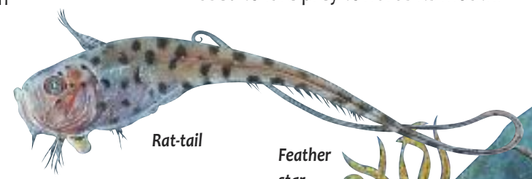
Tripodfish A fish that lives on the ocean floor at depths of up to 5 km. It rests on the ocean floor on a "tripod" made of its long, stilt-like fins and tail. Another pair of fins is held up in the air to detect the movements of passing prey, whereupon the tripodfish pushes itself forward to snatch up its victim.

Sea pen A type of invertebrate (⬅ 8) that can live at great depths. A sea pen is not one animal, but is a colony of polyps (⬅ 19). One polyp forms a long stalk, that anchors the pen to the sea floor. Other polyps branch off and filter food from the water.

Sea spider A fine-legged, spider-like creature that lives on the ocean floor, feeding on sponges (⬅ 9) and worms. Its long legs allow it to pick its way across the ooze.

Vampire squid A small sea creature that lives at depths of 600 to 900 m. It has a web of skin that stretches between its eight arms and is covered in light-emitting spots. It can flash these very quickly to confuse predators.

Viperfish A long, thin fish with fierce jaws and needle-like teeth. The viperfish lives at depths of 80 to 1500 m. It has a special light organ at the end of a spine on its back, which is used to lure prey towards its mouth.



FACTFILE

★ The deeper you go in the ocean, the greater the weight of water pressure pressing down from above. Below 50 m, this pressure is too great for human divers.

★ In 1960, scientists descended 10,911 m into the Marianas Trench in the Pacific Ocean in the submersible *Trieste*. To withstand the pressure, the capsule walls were 13 cm thick.

★ Some deep-water animals such as shrimp are dark red. Red light does not reach the depths at which the shrimp live so they are practically invisible in the blue-green water.

★ Cans, bottles and ship wrecks litter the ocean floor. Found on all parts of the ocean floor, especially beneath shipping lanes, is clinker, burnt coal dumped from steamships between the 1850s and 1950s.