Starfish, Urchins a

s and Their Relatives

Sea stars, brittle stars, crinoids, sea urchins and sea cucumbers are all echinoderms, which means spiny-skinned animals. These creatures are plentiful in the waters of Western Australia.

By Ann Storrie

Although the outward appearance of some echinoderms may resemble a hedgehog (the name is derived from the Greek word *echinos*, meaning hedgehog), others are quite different. All, however, have a plate-like, calcareous skeleton. Sea urchins and some sea stars have spiny protrusions, while sea cucumbers have a smooth, almost fleshy skin. Microscopic examination is necessary to view the numerous plates, or ossicles, in the body wall of the fleshy echinoderms.

Echinoderms are radially symmetrical. This means that if they are divided through the mouth and down the body length, the two halves will be identical. Tube feet are another fascinating feature of all echinoderms. These extendable, hollow organs have suction-like tips. Each tube foot is part of a hydraulically operated system. Water, which fills the internal cavity of an echinoderm, is ducted to the tube feet by way of a system of canals, like a circulatory system. The control is so delicately balanced, the tube feet can be retracted or extended, or waved about in any direction in a very flexible manner.

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Main: A sea star is a typical echinoderm with a radially symmetrical body and tube feet.
Photo – Sue Morrison
Inset: Sand dollars are flattened urchins with a sea star insignia on the upper side.
Photo – Ann Storrie

Left: Starfish are found in a great variety of sizes, forms and colours.
Photo – Ann Storrie

Below: You don't have to be a scuba diver to enjoy sea stars. They can be found at shallow depths where they are easily seen by snorkellers.
Photo – Peter & Margy Nicholas/Lochman Transparencies

SEA STARS

Of the five classes of echinoderms, sea stars (starfish) are probably the best known. Most have five arms, although some species have seven or more. They feed on a variety of invertebrates and organic debris. Some are able to open bivalves, such as oysters. They pull gently but steadily on the shells with their tube feet. Eventually the mollusc's muscle tires and the shells open. The sea star is then able to evert its stomach to surround the flesh of the mollusc and digest it.

Sea stars have amazing powers of regeneration. Most, if cut in two, will survive to become two sea stars. Some species actually reproduce this way. Others can regrow from an arm if it is detached, although they will usually appear rather lop-sided.

Sea stars also reproduce sexually. Eggs and sperm are held in gonad pouches at the base of the arms. When spawning, the gonads of some species increase in size to almost the entire length of the arms. The spawn is then liberated into the sea, close to another

spawning sea star. Some species form a chamber, in which to incubate their eggs, on their central discs, while others brood their young between the angles of their arms.

Most sea stars can be safely handled. An exception is the crown-of-thorns (*Acanthaster planci*), a large sea star that can reach up to 60 centimetres across. It is usually bluish-grey, although some are bright purple or red. This animal has stout, hinged spines, two to three centimetres long, each with a three-sided blade at the tip. These are covered with a thin skin that produces venom and mucous. Avoid handling these animals, even with gloves, as a puncture wound from a spine is intensely painful and can lead to infection.

The crown-of-thorns has destroyed large areas of coral on the Great Barrier Reef and in the Indo-Pacific region. Fortunately, it has not reached plague proportions in the Ningaloo Marine Park, and, although you may find some in Coral Bay and on the outer reef, they have done little harm to corals in Western Australia.

BRITTLE STARS

Brittle stars are the most numerous and successful of the echinoderms, but because of their nocturnal and secretive habits, they are not as easily seen as sea stars. Like sea stars, brittle stars have a central disc with a mouth on the underside, and arms radiating out from the disc. Their arms are generally longer, and more flexible, than sea stars and lack adhesive suckers. Instead, they trap plankton and organic debris in a slimy mucous that covers their arms. Many brittle stars hide under rocks and coral slabs by day. At night, you may come across one or two arms that resemble worms meandering across the coral or sand. If you trace this back to a rock and peek underneath, you may find a brittle star that has simply sent out an arm in search of food.

Two specialised types of brittle star—basket stars and serpent stars—are often in full view, but may not be recognised as echinoderms by divers. Basket stars are nocturnal animals with huge, spreading arms that form a net to catch plankton. The net is made up of tiny, complex branched arms, and may measure up to 60 centimetres across. Basket stars are usually found in areas subject to strong currents. During the day, their arms are coiled into a tight knot that looks more like a rope stuck to the rock than a basket star.

Above: Serpent stars are usually found wrapped around the 'stem' of another animal, in this case around a sponge.
Photo – Eva Boogaard/Lochman Transparencies

Right: The crown-of-thorns starfish feeds on coral, but has caused little damage at Ningaloo Marine Park.
Photo – Bill Brogan

Serpent stars are usually found wrapped around the 'stem' of a gorgonian or black coral. It may look like one long strand of rope, but usually consists of five arms that can be unravelled and stretched out like 'normal' brittle star arms.

FEATHER STARS

Feather stars, or crinoids, are so named because of their feather-like arms. They come in all colours of the rainbow. Some have bright yellow or red arms, whereas others are green,

black or orange, and some seem almost to fluoresce with brilliant purple or dark blue. They are predominantly nocturnal. However, their bright arms are often seen curled between crevices in the reef during the day. At night, they may perch on top of coral, where they can capture passing plankton for food.

Feather stars differ from sea stars and brittle stars in several ways. Their stomach is on top of the body, rather than underneath, and the tube feet have been modified into types of tentacles on the arms. These help to sweep food into grooves that run down each arm towards the mouth. Like the sea stars, their anus is also on the dorsal surface, but is elevated in a cone. Feather stars can move about and attach themselves to the rock by means of leg-like projections called cirri. Some can even 'swim' by waving their arms up and down.

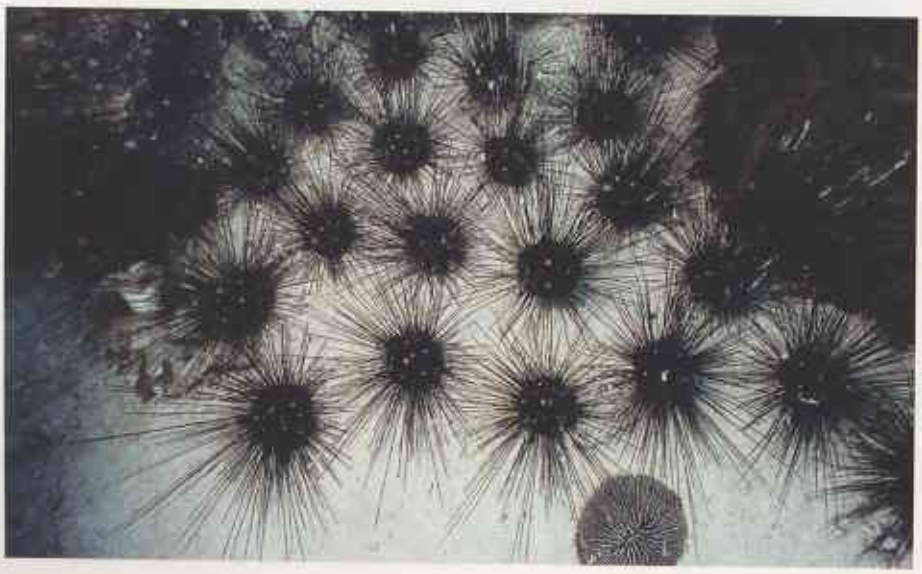
The tentacles on the arms give the animal a feathery appearance. They are also coated with a sticky substance that helps it to catch its food. This substance unfortunately sticks to wetsuits and gloves, and many divers find feather stars stuck to them after a dive. If this occurs, gently pull the feather star and/or its arms off and replace the bits into the water. You never know, you may have helped to replicate the species.

SEA URCHINS

Many divers have spent considerable time pulling sea urchin spines from their skin. A diadema urchin is a real 'hedgehog' of the ocean, with long, fine black spines that penetrate all thicknesses of wetsuit and gloves. Be especially careful at night, when they can form a carpet as they move across the sand in search of food. Despite their awesome defence, these sea urchins are still vulnerable to predatory fish such as triggerfish and pufferfish.

Another urchin that can cause severe pain, and even unconsciousness, is the flower urchin (*Toxopneustes pileolus*). It is an urchin that bites. Numerous short spines are hidden in a rosette of flower-like pedicellariae that are pincer-like organs. It is these, rather than the spines, that cause damage. Each pedicellariae is a rounded triangular shape with three fangs that make up a jaw. When sensory hairs on the inner side of the jaws are stimulated, the jaws close and inject venom through the fangs. The venom interferes with nerve-muscle coordination and paralyses the muscle.

Not all sea urchins are dangerous. Pencil urchins have large, rounded spines that resemble slate-pencils. If



Above left: Feather stars, or crinoids, perch in a prominent position on the reef to catch plankton.
Photo – Clay Bryce/Lochman Transparencies

Above: Heart urchins are specialised sea urchins. Their skeletons are quite beautiful.
Photo – Ann Storrie

Left: Diadema urchins wander over the sand in search of food. Their spines can easily pierce wetsuits.
Photo – Ann Storrie

you pick one up, examine the base of the spines. They provide one of the best examples of ball-and-socket joints in the animal kingdom.

HEART URCHINS AND SAND DOLLARS

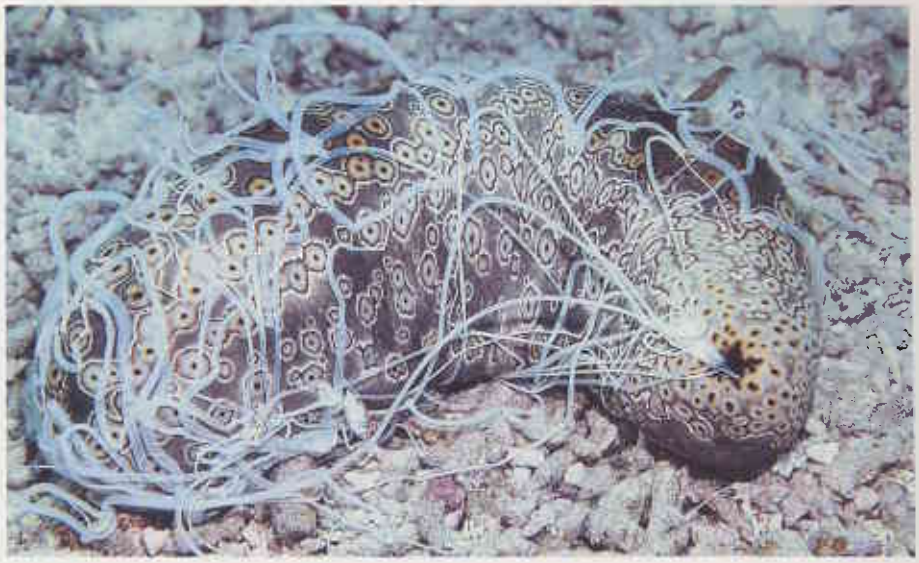
Heart urchins and sand dollars are specialised sea urchins. Heart urchins are shaped like an Australian football and have short bristles covering the body. There are several species, all of which live under the sand and are often found in the shallows of Coral Bay.

Sand dollars are urchins with very flattened bodies and a sea star insignia on the upper side. They lie just under the sandy surface of the sea floor and an experienced eye can often detect them by their outline. They have numerous tube feet and spines that are very tiny.

SAND SLURPERS

Sea cucumbers are so unlike typical echinoderms that it is hard to believe they are closely related. Some are sausage-shaped, leathery-skinned creatures that lie on the sea floor and eject sticky, toxic, white tubules when disturbed. Others are small, colourful creatures that attach themselves to rocks and wave tentacles in the current to collect plankton. Still others are long and thin, and are often mistaken for worms as they move around rocks and across the sand. Sea cucumbers also have several names including holothurians, beche-de-mer, trepang and a few rather derogatory expressions that have been awarded to them by divers who find them ugly. All sea cucumbers, however, have the calcareous ossicles that characterise echinoderms.

The large sea cucumbers with leathery skins usually browse on the sea floor, moving slowly on their tube feet. They ingest great quantities of sand, from which they extract edible, organic matter. The waste is left in a trail behind the animal, as it slowly continues over the sea bed. If disturbed, they eject sticky tubules, called Cuverian tubules, as a means of defence. It is best to avoid them, as they can irritate the skin and cause severe pain if accidentally rubbed into the eyes. This did not deter Indonesian fishermen, who collected them to dry and sell to the Chinese for food. The fishermen once used to collect them as far south as Coral Bay.



Above: When disturbed, sea cucumbers can eject sticky tubules as a means of defence.
Photo – Ann Storrie

Right: The tentacles of small, colourful sea cucumbers catch plankton and curl downwards to deliver the catch into the mouth.
Photo – Peter and Margy Nicholas

The small, attractive sea cucumbers that attach to rocks feed by means of colourful tentacles. After plankton is trapped in the tentacles, the sea cucumbers fold these appendages into their mouths to remove the food. The long, thin sea cucumbers that move over the sea floor feed by sweeping their tentacles across the sand. Other tiny sea cucumbers live on barrel sponges, and apparently feed on substances secreted by the sponge.

Many species of sea cucumber are found in Ningaloo Marine Park. The large, leathery, sand-slurping individuals are often seen in the lagoon at Coral Bay. Many are jet black, although some have beautiful patterns and textures on their skin. You may even like to take a close look at a sea cucumber's anus. Pearlfishes live in the intestines of several species of sea cucumber, especially the leopard sea cucumber (*Bohadschia argus*). The fish apparently feeds on the gonads and other tissues of its host. Don't, however, hold your breath waiting for a fish to emerge. It is rarely seen.

Ann Storrie is an underwater photojournalist and a regular contributor of photographs for *LANDSCOPE*. Together with Sue Morrison from the WA Museum, she has written a book on *The Marine Life of Coral Bay and the Ningaloo Marine Park*, due to be released later this year. This article is adapted from one of the chapters from the book. Ann can be contacted on (08) 9385 9355.

'Conserving the western ringtail possum' tells a story of rehabilitation, release and repopulation.

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What have rabbits done to our land and what have we done about them? Find out in 'Run, Rabbit' on page 49.

Discover the fascinating world of 'Starfish, Urchins and their Relatives' on page 10.

Learn about a study of life in the tropical mudflats of Roebuck Bay on page 16.

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