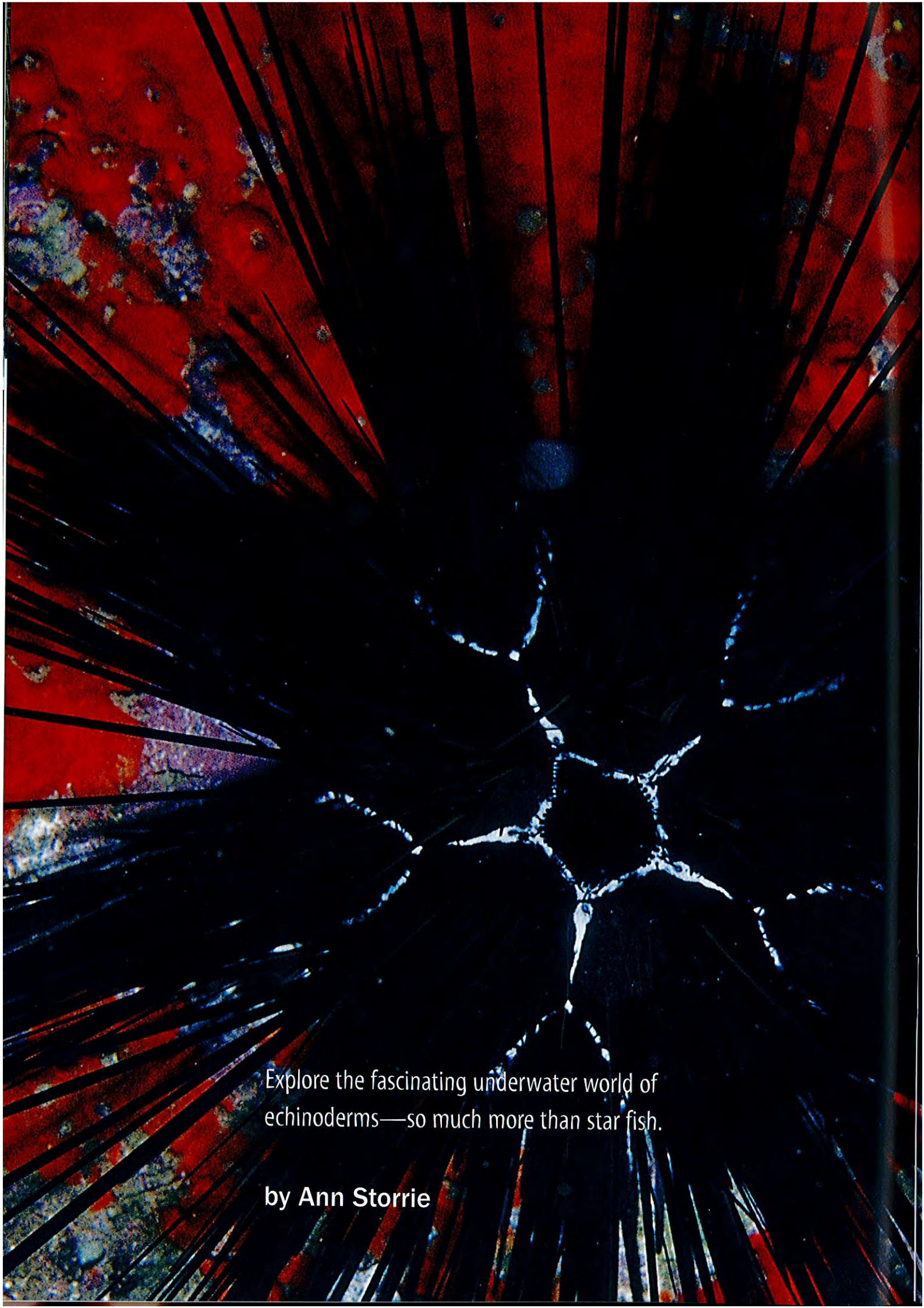
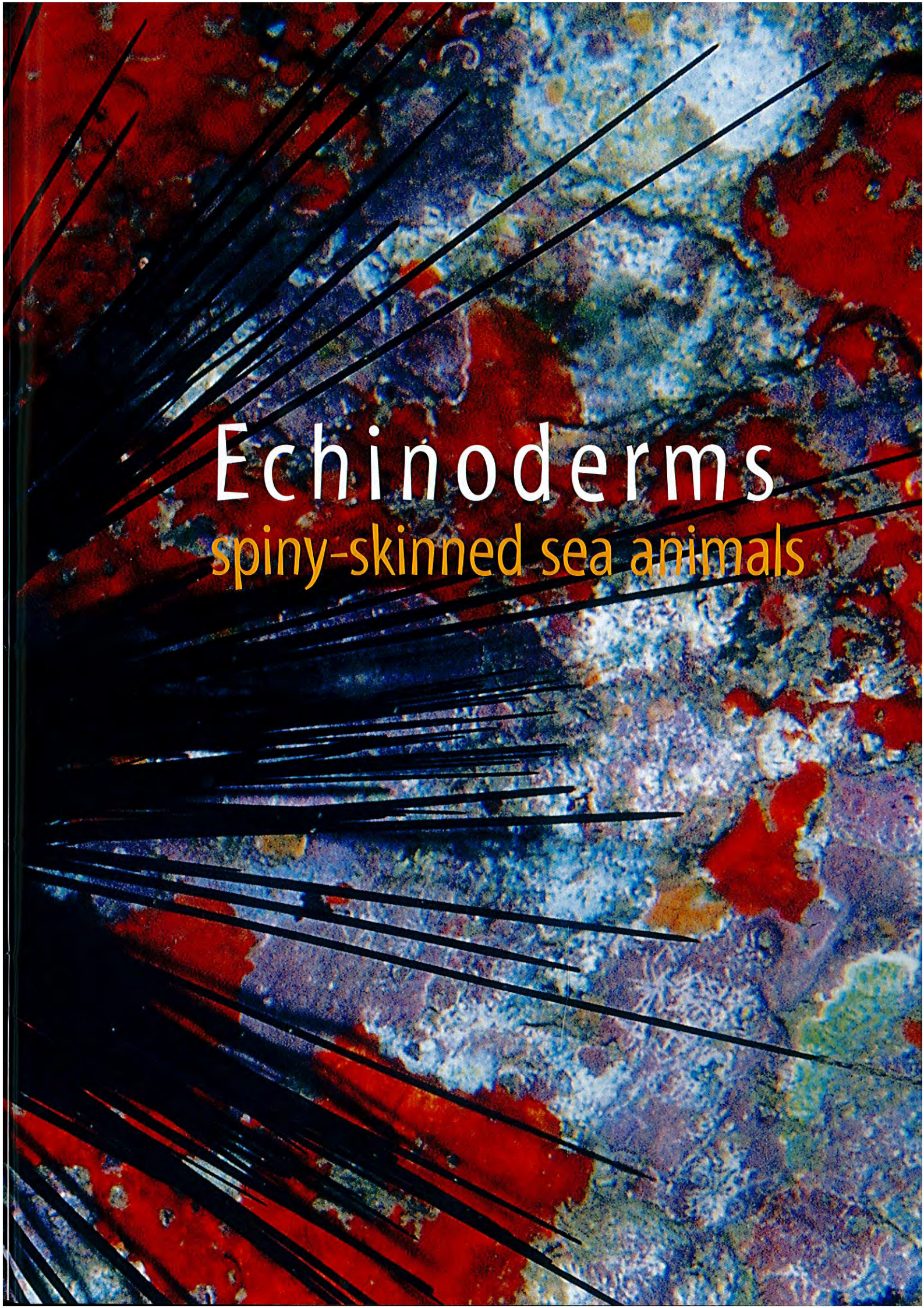
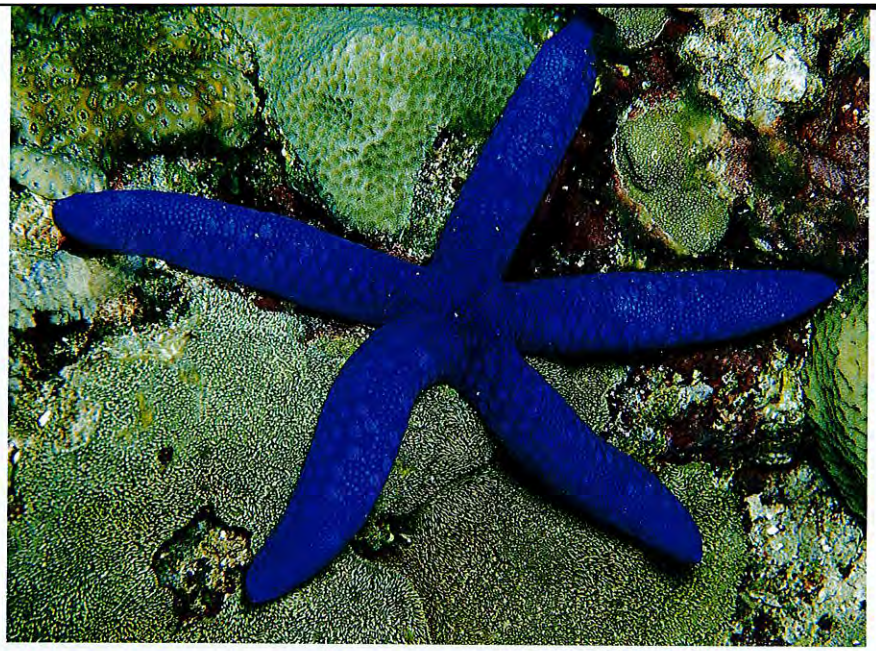


Explore the fascinating underwater world of echinoderms—so much more than star fish.

by Ann Storrie


Echinoderms
spiny-skinned sea animals



Sea stars, brittle stars, feather stars, sea urchins and sea cucumbers comprise the five groups, or classes, of echinoderms. The Latin word echinoderm literally means 'spiny-skinned' and is derived from the Greek word, echinos, which means 'hedgehog'. With a vivid imagination, a sea urchin could resemble a hedgehog, but others, such as feather stars, look more like beautiful flowers. The large, leathery-skinned sea cucumbers that browse over the ocean floor are often thought to be slugs, worms or waste products. Despite their diverse appearance, all echinoderms have many features in common, including a calcareous skeleton of plates, or tiny ossicles, in their body wall. Hence their name, spiny-skinned animals.

One method to help link the shapes of the different animals in the groups of echinoderms is to start with the sea urchin. Like sea stars, it has a body plan divided into five similar portions. If you stretch these portions, you will form a sea star. Imagine pulling the arms out further and you have a brittle star. Add more, thinner, branched arms for a basket star (a type of brittle star), or put hair-like growths called pinnules on the arms for a feather star. If you flatten the sea urchin, you can make a sand dollar, or if you stretch the urchin's body out vertically, you have a sea cucumber. With a little imagination, you may be able to envisage how all the echinoderms are related.

Other characteristics that belong to these fascinating creatures include extendable, hollow tube feet, most with suction-like tips. The feet are hydraulically expanded and contracted by a water vascular system within the body. The system is so delicately balanced that the feet can be waved about in any direction in a very flexible manner.

Echinoderms are also radially symmetrical which means they have two or more planes of symmetry. (Bilaterally symmetrical bodies, such as ours, have one plane of symmetry meaning if divided in half from the mouth down the body length, the right and left halves would be similar.) Unlike corals, echinoderms do not possess stinging cells, although some have venomous spines. Most are quite unpalatable to other animals and have few predators. This enables them to be very 'user friendly' to an enormous number of small sea creatures such as molluscs, shrimps, crabs, lobsters and tiny fish that seek shelter and food, and often live their entire lives within the arms, or on the calcareous skin, of their congenial hosts.

Sticking to sea stars

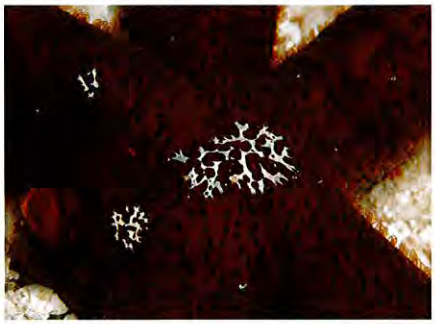
Of all the echinoderms, sea stars (often referred to as star fish) are probably the best known. Most have five arms, although several have seven or more, and their central mouth is on the ventral (bottom) surface. A very large and conspicuous sea star of the tropics is the blue sea star (*Linckia laevigata*). This sea star is common as far south as Ningaloo Marine Park and is often found in the shallow waters of Coral Bay. Its colour varies from bright blue to green, pink or yellow.

Tiny crabs, shrimps and molluscs are often found on this sea star and, in particular, a parasitic snail named *Thyca crystallina*. It lives on the sea star's under-surface where it feeds between the tube feet. Several of these tiny snails may be found on the same sea star. Don't try to prise them off as they stick very strongly to the spiny skin.

Previous page
Main Long spines of the diadema sea urchin.

Above right The blue sea star (*Linckia laevigata*) is common on shallow reefs and lagoons at Ningaloo Reef.

Below Feather stars or criniods will take advantage of coral outcrops to feed in the current.
Photos – Ann Storrie



Far left top A parasitic snail *Thyca crystallina* on the underside of the blue sea star (*Linckia laevigata*).

Far left bottom Comb jellies known as ctenophores can be found live on sea stars.

Left Commensal shrimps living among feather star arms take on a similar colouration to their host.

Below The majority of sea stars have five arms but their body mass can disguise the fact, like this pin-cushion sea star.
Photos – Ann Storrie

The sea star shrimp (*Periclimenes soror*) adopts the same colouration as the sea star on which it lives. It grows to only one centimetre in length and is quite thin and streamlined, which makes it difficult to see as it scurries around on its host. Like the snails, several shrimp often live on a single sea star.

Sea star shrimp also live on several other species of sea stars, including the large cushion stars (*Culcita* sp.) Cushion stars grow to about 25 centimetres in diameter and are like huge, colourful pincushions sitting on top of the reef. Unfortunately, some divers are tempted to pick them up to throw to one another. Please don't do this. It is far more interesting to gently turn them to look at the fascinating tiny animals underneath and to then place them back on the reef as you found them. Please don't move them onto a lump of hard coral. You can almost hear the sea star squealing as its little tube feet propel it off the stinging coral polyps.

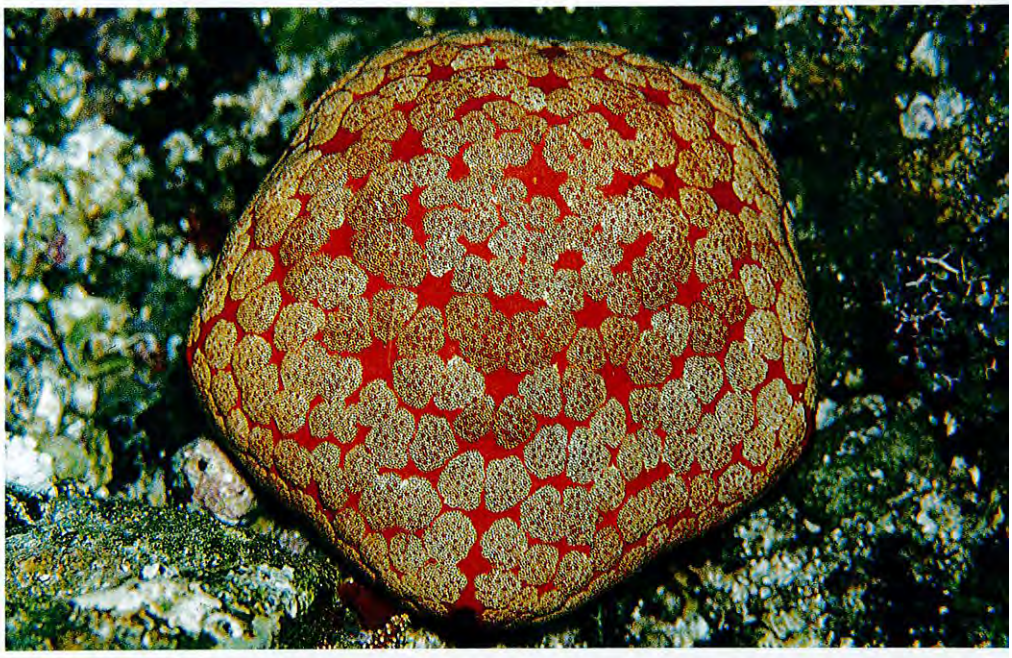
Unusual comb jellies are also found on some sea stars. Comb jellies are gelatinous, jellyfish-like animals that are called ctenophores (pronounced teen-o-fours). They come in many shapes and colours and none possess stinging cells. The jelly-like forms have bands of tiny hair-like cilia that luminesce in the light as they swim through the water. Other forms of ctenophores, known as benthic ctenophores, or platyctenes, do not float free in the ocean, but live on the sea bed (benthic means 'bottom-dwelling'). Some are flattened, colourful creatures that are often mistaken for flat worms. One species named *Coeloplana astericola* is oval-shaped with dark, reddish-brown blotches on a white base. These ctenophores stick tightly to the spiny skin of sea stars from the genus *Echinaster*. Several may be found on one sea star, giving the star a colourful, mottled appearance. If you look very closely, you may be able to see the ctenophores' thread-like tentacles moving over the sea star.

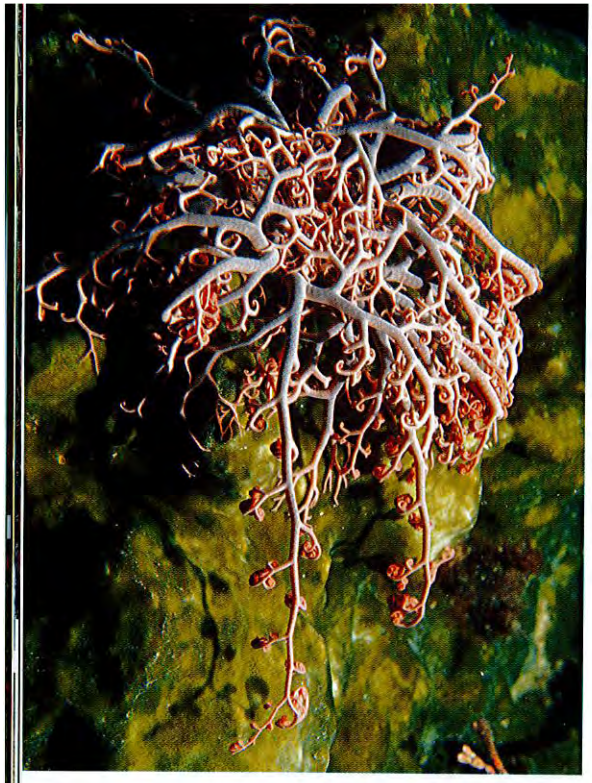
Basking in brittle stars

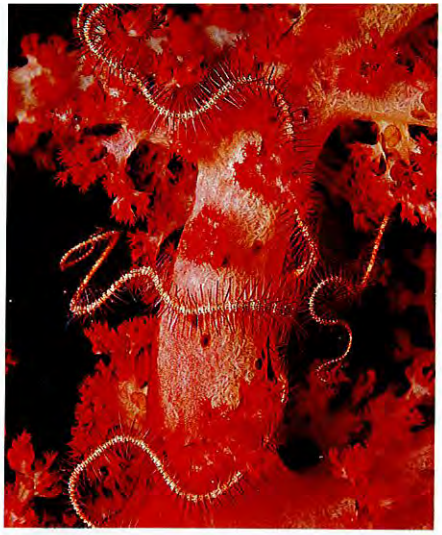
While brittle stars are the most numerous echinoderms, their nocturnal and secretive habits ensure that they are not as easily seen as sea stars. They have a central disc with a mouth on the underside, their arms are usually longer and more flexible than that of sea stars and their tube feet lack adhesive suckers.

Basket stars are very interesting types of brittle stars. These echinoderms have huge spreading arms that may measure up to 60 centimetres across. During the day, they curl their arms into a tight ball that looks more like a rope coiled and stuck to a rock or coral, than an animal. At night, the arms unfold to form a huge net, or basket, that traps plankton. The food is then transferred to the mouth via grooves that run beneath the arms.

The basket star shrimp (*Periclimenes lanipes*) lives in large, tropical basket stars. The shrimp is very small, extremely shy of bright lights and is almost impossible to find among the network of branched arms. It usually has pale stripes and a similar base colour to that of the basket star. If you touch the arms of a basket star, or even shine a bright torch on them, they will curl inwards, completely enclosing the shrimp. It is best to wait quietly with a soft light and watch for tiny movements among the arms to catch a glimpse of this elusive little animal.







Left A brittle star on a soft coral.
Photo – Ann Storrie

Far left The basket star has a large cluster of arms that fan out to feed in the current.
Photo – Eva Boogaard/Lochman Transparencies

Below A feather star on a gorgonian sea fan.
Photo – Alex Steffe/Lochman Transparencies

Feather star friends

Feather stars, or crinoids, are some of the most colourful animals on the reef. They have feathery arms that range in colour from bright yellow and orange, to deep red, purple, blue and green. Some even have different colours and stripes or bands in their arms. Most of the large, colourful species occur in the tropics; however, some species live in temperate waters. Many stay well hidden during the day in crevices in the reef. At night, they perch on top of coral, or other animals such as gorgonians or sponges, to get a good vantage point to catch passing plankton.

Feather stars differ from sea stars and brittle stars in several ways. Their mouth is on the top of the body, rather than underneath, and their tube feet have been modified into types of tentacles called pinnules on the arms. These are coated with mucous to help catch food which is then swept into grooves that run down each arm towards the mouth. Like sea stars, their anus is also on the dorsal surface, but is elevated in a cone. Leg-like projections called cirri enable the feather star to 'walk' on the reef and to grip it tightly in a current. They can also 'swim' almost as elegantly as a Spanish dancer by moving their arms up and down.

The number of arms varies greatly between species. Feather stars of the genus *Comanthina* may possess more than 150 arms.The arms are very tightly packed—even the largest feather star reaches only 25 centimetres in diameter. Many tiny shrimp, squat lobsters and even fish have taken advantage of the shelter and steady food supply in these miniature ecosystems.

The crinoid clingfish (*Discotrema crinophila*) is an attractive, elongated fish with a short, rounded snout. It can assume a base colour similar to the colour of its host feather star, and it usually has one or two yellow or white stripes running from the eyes to the tail. A pair usually lives in their feather star, although they are so well camouflaged and fast to move under their host that you are lucky to glimpse either.

At least two species of commensal shrimps from the genus *Periclimenes* live and feed entirely within the feather

star's arms. It is thought that the larvae take on the host's colour after several moults; however, if the shrimps have to change hosts, their colours can change to match. The adults' bodies are banded similar to bands on their host and their base colour provides almost perfect camouflage. The maximum length of these shrimp is about two centimetres, they have very short antennae and their eyes sit on thick stalks that extend either side of the head. It is amazing that sometimes the stalks and eyes are the same colour as the tips of the pinnules on the feather star's arms.

The elegant squat lobster (*Allogalathea elegans*) is not always considered to be very elegant! Terms such as bizarre, ugly, spider-like or alien are more commonly used to describe these amazing little animals. They have huge chelipeds (pincer-like claws) and a long, tapering rostrum. (The term 'huge' is, of course, relative, as the entire animal grows to only two centimetres in length.) Like their shrimp neighbours, they adopt the same colours as their host. They usually live in pairs, the female being the larger.

Several other strange animals such as translucent snapping shrimps, orangutan crabs (*Achaeus japonicus*) and crinoid brittle stars may also live within the protective arms of feather stars. Finding these creatures requires lots of patience and care. If you pick up a feather star, its arms, which break very easily, will stick to your hand and wet suit. To avoid this, use a probe or chopstick to gently part the arms. The less movement the better and, if you are lucky, your tiny creature may sit still and in full view for several seconds.

Above Elegant squat lobster (*Allogalathea elegans*).

Below left Some sea urchins can be quite striking looking but also poisonous.

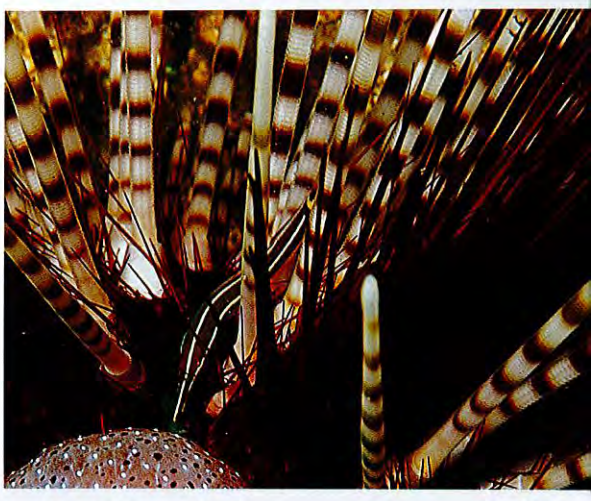
Below A clingfish found among the spines of a diadema sea urchin.
Photos – Ann Storrie

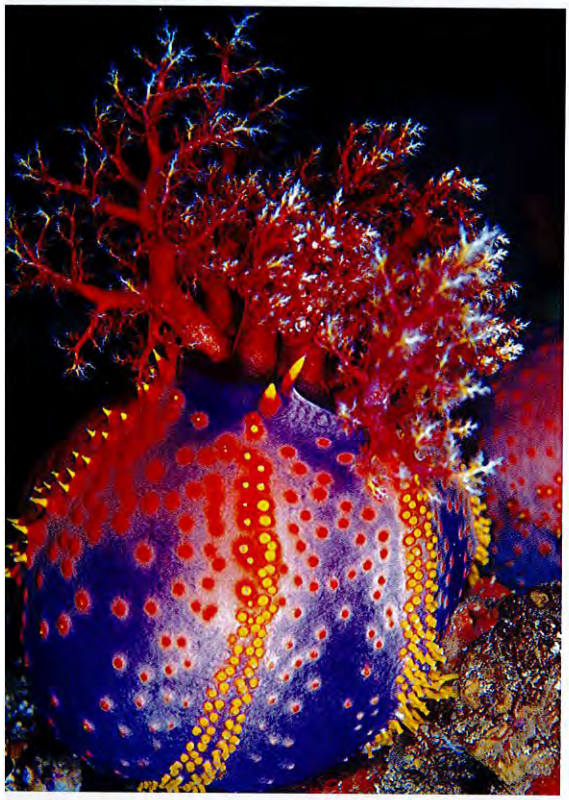
Safety in spines

Sea urchins are usually spherical animals with a five-plated internal case, or shell, that is known as a test. This is covered with a thin layer of skin and spines. Some spines, such as those on pencil urchins, are large with blunt ends, while diadema urchins have long, thin, needle-sharp spines that contain venom. The beautiful fire urchin that is common at the Houtman Abrolhos Islands has very short spines that are highly venomous, can penetrate most gloves and can cause intense pain.

Many small fish shelter within the long spines of diadema urchins. Pipefish align themselves with the spines for camouflage, while the urchin clingfish (*Diademichthys lineatus*) may live most of its solitary life within the confines of the spines. This attractive little fish is usually red to brown with white or yellow stripes running from the tip of its head to the tail.

Many small shrimps and crabs also live on urchins, scurrying between the spines for a meal. The parasitic snail *Luetzenia asthenosoae* feeds on the fluids of its host and is sometimes seen in groups during a 'mating frenzy', leaving eggs trailing through the urchin's spines.





Co-habiting with sea cucumbers

Few divers spend time seriously looking at sea cucumbers. These echinoderms are sausage-shaped and many move over the sea bed on their five rows of tube feet, vacuuming up sediment and detritus, extracting the edible material and then excreting the waste in a characteristic trail behind them. Although some are black and ugly, others have beautifully patterned leathery skin which occasionally excites abstract photographers and which harbours many interesting animals.

The scale worm *Gastrolepidia clavigera* moves around the lumpy skins of several species of tropical sea cucumbers. The worm can change colour to match the surrounding blotches and patterns and is usually found on the under surface of its host. Several scale worms may live on one sea cucumber.

The tiny swimmer crab *Lissocarcinus orbicularis* has partly flattened hind legs to aid swimming and burrowing. If disturbed, it hides in the folds of skin and sometimes burrows part way into the sea cucumber's anus where it is almost invisible. *Periclimenes imperator*, a very attractive shrimp with a flattened head and purple-tipped chelipeds, is often close by. These commensal shrimps also live within the gills of the Spanish dancer nudibranch and on large sea stars. If you are very lucky, you may also see a bumblebee shrimp (*Gnathophyllum americanum*). It has a blunt head, one very long cheliped, black and white bands on the body and orange markings on the tail and chelipeds. It is associated with several echinoderms including sea stars and urchins.

One of the most bizarre relationships occurs between large sea cucumbers and the pearlfish (*Encheliophis homei*). These slender, translucent, elongated fish live within the body cavity of their host and only emerge at night to feed. They usually enter either tail or head first through the anus, although they have been observed entering via the mouth. A pair will sometimes be seen close to their host. They do not venture far and will shoot back inside if danger threatens. It is thought that they may also feed on the gonads and other tissues of their host. These fish have also been found in large sea stars as well as pearl-oyster shells.

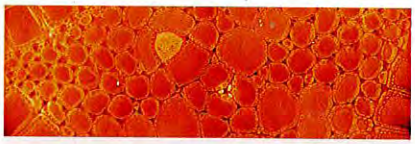
This fascinating group of marine animals that provide food, shelter and protection to so many other organisms occurs in all our temperate and tropical seas. Some live in intertidal pools; others are found in the deepest parts of the ocean. Wherever you see an echinoderm, think of its marvellous adaptations to its environment, and its own private ecosystem of tiny shrimps, crabs, worms or fish. Never dismiss it as another boring sea star.

Above A tiny swimmer crab *Lissocarcinus orbicularis*.

Top left Even though sea cucumbers are bottom feeders, they can be observed extending their bodies up into the water column.
Photos – Ann Storrie

Centre left A striking sea cucumber that is common in the warmer waters extends its tentacles to feed in the current.
Photo – Alex Steffe/Lochman Transparencies

Left A commensal shrimp on a sea cucumber.
Photo – Clay Bryce/Lochman Transparencies



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