Cushion star, *Hippasteria phrygiana* (inset); Elegant sea star, *Fromia nodosa* (far right)

Stars of the Ocean

12 Things You Might Not Know About Sea Stars

Text by Christian Skauge and Peter Symes
Photos by Christian Skauge

They can have up to 40,000 feet, produce millions of offspring and eat with their stomachs outside their bodies. Sounds like something from a sci-fi film? You probably see them on every dive you make! Christian Skauge and Peter Symes provide 12 intriguing insights into sea stars.

Diver with Mediterranean red sea star, *Echinaster sepositus*

Sea stars (or starfish—but they are not fish) are a common sight for divers, as they occur in all the world's oceans, from tropical reefs to the polar seabed. But how much do you know about these slow-moving predators?

They can have between five and 30 arms, arranged in radial symmetry, and they lack blood, a brain, a heart and other vital organs. Yet they have conquered the world's oceans. Here are some interesting facts about starfish:

1. Around 2,000 species

Starfish belong to a group of animals called echinoderms, which also includes sea urchins, feather stars, brittle stars and sea cucumbers. The name literally means "spiny skin", and the common starfish has around 2,000 cousins around the world. Sea stars have between five and 30 arms and a wealth of interesting features and characteristics, as well as colours, structures and shapes.

2. Feeding from the inside out

Sea stars move quite slowly, but many species are nevertheless voracious predators that consume large quantities of mussels. The sea star

The flexible tube-like feet of the common starfish, *Asterias rubens* (above). Starfish are quite active. This common starfish climbed onto some rocks (top left). To catch its prey, the common starfish will grab its prey with its sucker feet and keep pulling on its shell until the prey's closing muscle is exhausted (top centre). When the common starfish eats, it protrudes its stomach from its body. The transparent stomach sack releases enzymes that dissolve the prey's internal organs (centre). The red eye spot can be seen at the tip of each limb of the common starfish (far right).

will grab a mussel with its suction feet and continues to pull on its shell until the mussel's closing muscle is exhausted and starts to open. It then turns its stomach inside out, inserts it into the mussel and releases enzymes that dissolve the innards. After a while, the mussel meat becomes liquid, and the sea star can slurp up the delicious, nutritious soup that remains.

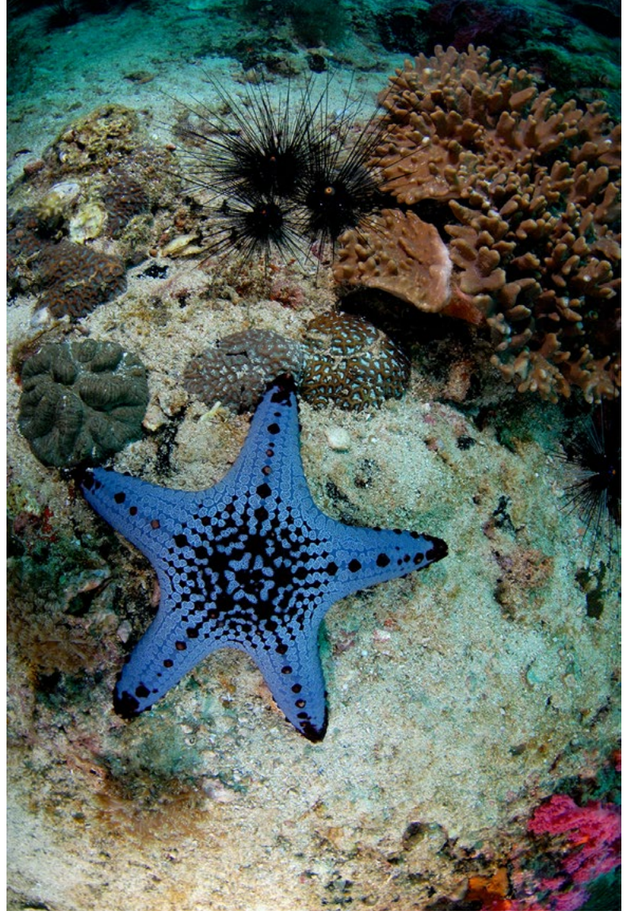
3. They can see you

Sea stars are found almost everywhere in the sea. They thrive in all kinds of habitats, no matter how silty, current-ridden, cold or deep they are. Sea stars generally live on the bottom, but can climb rock walls, piers or even ropes to get to where the food is. At the tip of each arm, many sea stars have a primitive eye that can distinguish between light and dark. Even though they do not move fast, they are surprisingly active animals.

4. Lack of organs

Sea stars have no heart, brain or even blood. In fact, they do not even have gills. They obtain oxygen from papillae on their tube feet and on their backs. Despite these "deficiencies", sea stars are a very successful group of animals. Because






TOP (left to right): Common sunstar, *Crossaster papposus*, with knotted wrack, *Ascophyllum nodosum*; Over-under photo of blue star, *Linckia laevigata*, and a tropical island; Horned sea star, *Protoreaster nodosus*, on the sandy seabed; Common starfish, *Asterias rubens*, in a mangrove; Northern henricia, *Henricia sanguinolenta*, on a bed of crushed shells (right); Northern starfish, *Leptasterias muelleri*, with plumose, *Metridium senile* (far right)

they breathe the way they do, sea stars can be threatened by water pollution.

5. Shellfish on the menu

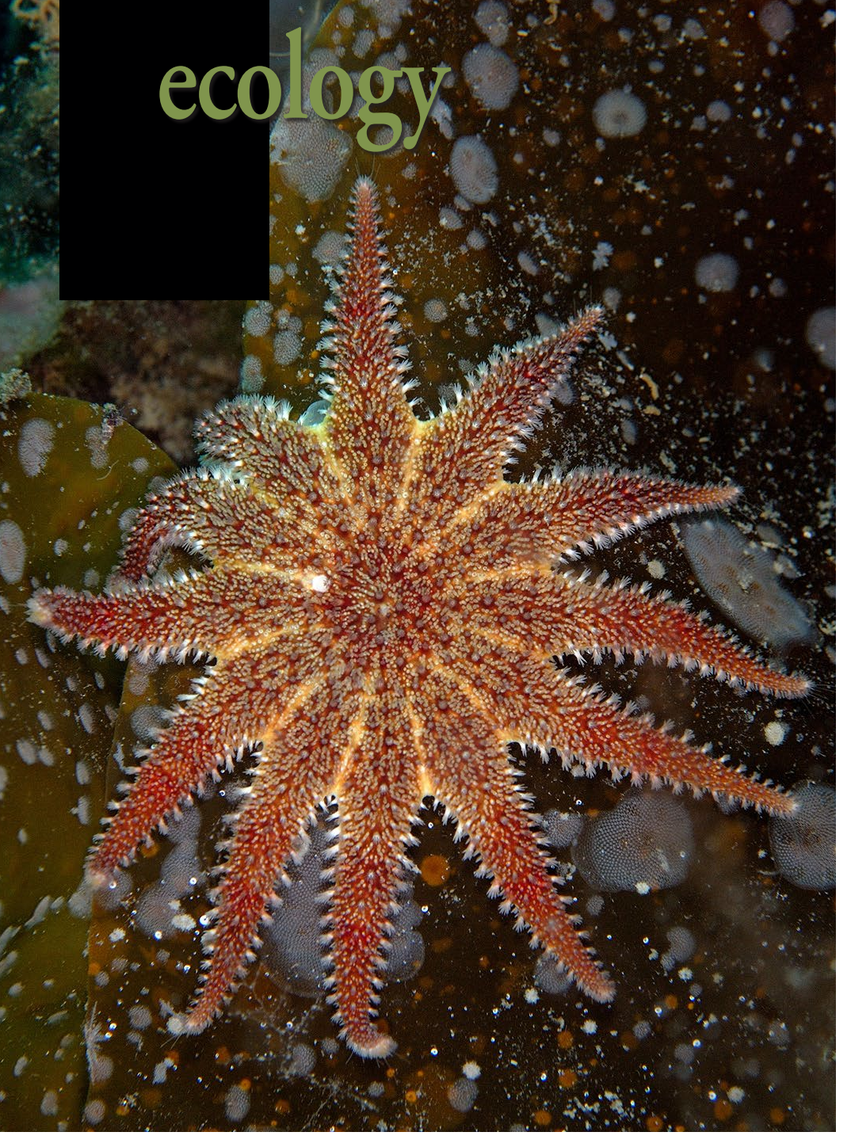
Most sea stars are predators, and some, like the red sea star, even feed on other sea stars. In general, sea stars prefer mussels, but their varied menu also includes sea snails, bristle worms, jellyfish, coral polyps and sometimes crustaceans. Even animals larger than themselves are at risk of being attacked and eaten; size is not so important when you are able to digest your food before putting it in your mouth. Sea stars also quickly gather in large numbers to scavenge if something edible falls to the bottom.

6. Suction feet

A sea star can have up to 40,000 suction feet, all controlled by a hydraulic system of water-filled channels inside the animal. This is called a water vascular system, and the feet are arranged in two or four rows along an open groove on the underside of the arms. The feet are used for locomotion, clinging to objects and searching for food. The suction power of the feet is enormous, and sea stars never get tired because they do not depend on muscles in the same way as we do.

7. Radial symmetry

Starfish are different from us in many ways. In addition to lacking several organs that are important to us, one of the most striking differences is that they are not bilateral (composed of two identical halves) like us. Instead, they consist of five identical segments. This five-point radial symmetry is

Sea Stars

The common sunstar, *Crossaster papposus*, eats other starfish species (far left). Spiny starfish, *Marthasterias glacialis*, on a bed of mussels under a boat (left). Larvae of a common starfish, *Asterias rubens* (below). A common starfish regenerating limbs resembles a shooting star (bottom right). A spiny starfish, *Marthasterias glacialis*, grows three new arms (bottom centre).

clearly visible in most species. It can also be seen in species with more arms—there will simply be two or more arms per segment.

8. Millions of babies

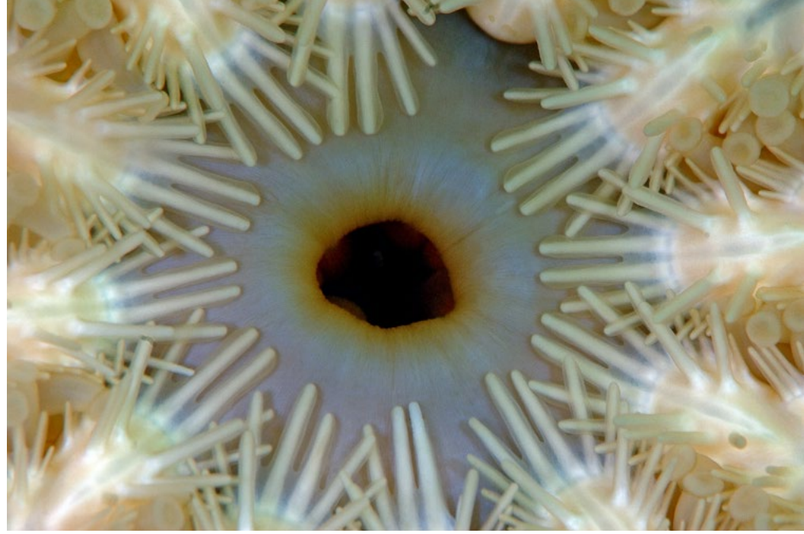
Sea stars mostly reproduce sexually and require a mate. When the female releases up to 2.5 million eggs into the water, the male responds to her call, and the fertilised eggs develop into tiny larvae that live mid-water for a few weeks before settling on the bottom.

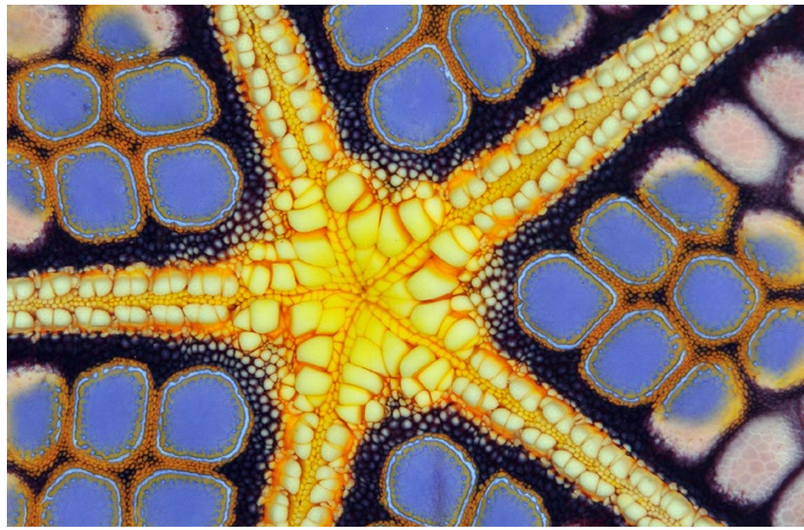
Other species, such as those in the *Solaster* and *Henricia* families, lack this larval stage and instead guard their eggs until they hatch as miniature sea stars. Some species are even capable of asexual reproduction and produce offspring entirely on their own.

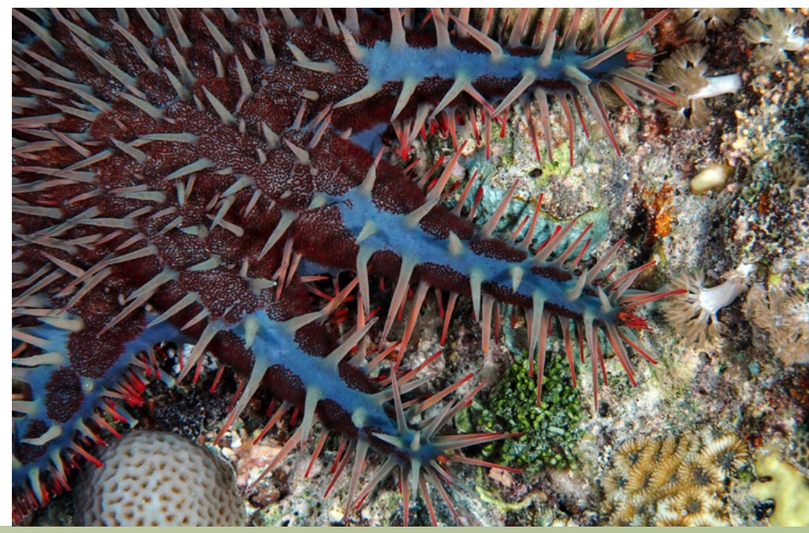
9. Shooting stars

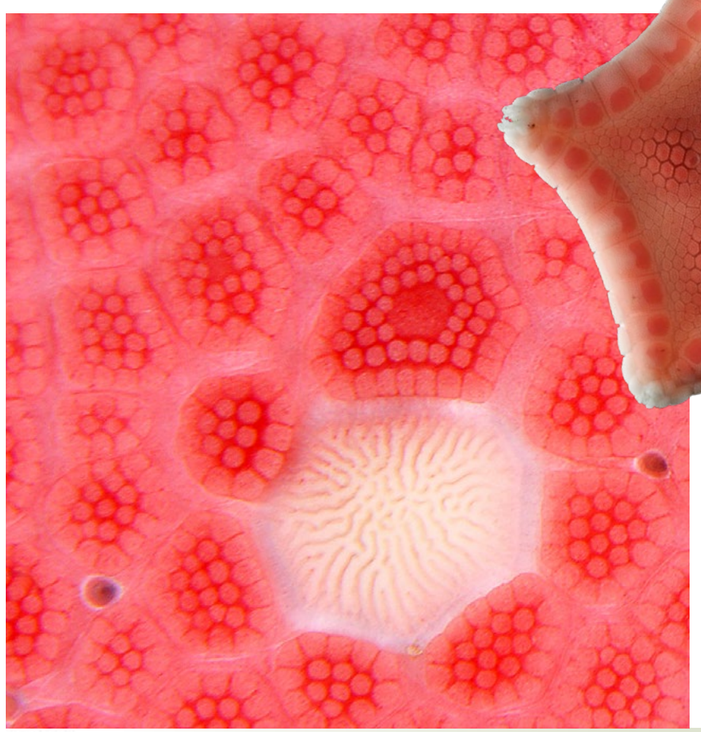
Sea stars have great self-healing powers and can easily regenerate an arm that has been lost to a predator or otherwise damaged. They are able to survive even if only the central disc remains, and sometimes you may encounter

Can you find the madreporite plate on this Egyptian sea star, *Gomophia egyptiaca* (left)? Close-up of the madreporite plate on a cushion star, *Ceramaster granularis* (bottom left). Cushion star, *Ceramaster granularis* (inset left). Mouth on the underside of a spiny starfish, *Marthasterias glacialis* (top right). Anus is located in the middle of the upper side of a cushion star, *Culcita novaeguineae* (right centre). Crown-of-thorns starfish, *Acanthaster planci*, is covered with needle-like spines (bottom right).









sea stars that resemble small shooting stars, where one arm is intact and all the others are just small buds waiting to grow out.

10. Water-powered

The starfish has a sieve-like opening on its back called a madreporite plate. This round, hard and porous opening allows water to be sucked into the water-filled channels of the vascular system to propel the hydraulic tube feet. In a way, you could say that sea stars are water-powered! Scientists also believe that the madreporite plays a role in how sea stars navigate and orient themselves.

11. Eating and being eaten

Although starfish are predators, they are also prey. They are hunted by other sea stars, crabs, birds, sea otters, harlequin shrimp and a few species of sharks. Even seagulls can be seen pecking at sea stars at low tide. Their most dangerous enemy is, of course, humans. In some Asian countries, sea stars are considered a delicacy. Would you like a bite? Despite its name, you will not find it at Starbucks.

12. Found in all oceans

Sea stars are found in all the world's oceans. They thrive in all kinds of habitats, no matter how silty, current-ridden, cold or deep they are. However, they cannot live in fresh water because it lacks the calcium they need to build their bodies. That is why they are not found in the Baltic Sea and similar waters with low salinity. The largest num-

Rosy starfish, *Stichastrella rosea* (top left). Starfish host smaller commensal species such as sea-star shrimp, *Periclimenes soror* (top right), and squat lobster, *Galathea* sp. (far left). Sand sea star, *Astropecten irregularis* (left). Ghardaqa sea star, *Fromia ghardaqana* (right).

bers are found in the Indo-Pacific region, but they also thrive in the North Atlantic. ■

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