Symbiosis is a relationship where different animals live together for each other's benefit. One of the ocean's most well known examples of symbiosis occurs within the stinging cells of sea anemones. Anemonefish, shrimps and crabs spend a relatively safe existence nestled in the beautiful, yet often deadly tentacles of their attractive hosts.


Sea Anemones
by Ann Storrie

Sea anemones are a large group of carnivorous invertebrates with beautiful flower-like tentacles. Anemones attach themselves to rocks and other underwater structures by the muscular disc at the base of the body, although some species burrow into mud or sand. They are usually brightly coloured, and may be white, green, blue, orange, red or mauve.

## STINGING TENTACLES

Sea anemones are related to corals, hydroids and jellyfish. All of these undersea creatures have stinging cells called cnidoblasts (pronounced 'ni-do-blasts', with a silent 'c') on the tentacles surrounding the mouth. Cnidoblasts are so small that they usually can't be seen without magnification, and each contains a vesicle called a nematocyst. The nematocyst is a harpoon-like tubule that lies coiled up like a spring.

When discharged, the tubule shoots out to penetrate, or wrap around its target. Many nematocysts contain toxins that can either kill or render the prey unconscious.

Some anemones, such as the armed anemone *Dofleina armata* (described in the CALM publications *Discovering the Swan River and the Swan Estuary Marine Park* and *Wonders of Western Waters*), have nematocysts that are dangerous to people. However, many anemones just feel sticky to touch. This sticky residue is actually the toxins that have been discharged from nematocysts, but which can't penetrate tough human skin

*Previous page*
False clown anemonefish (*Amphiprion ocellaris*) in a magnificent anemone.
Photo – Ann Storrie

*Left:* A sand-dwelling anemone.
Photo – Eva Boogaard/Lochman Transparencies

*Below left:* Pink anemonefish (*Amphiprion perideraion*) inhabit large sea anemones.
Photo – Peter & Margy Nicholas/Lochman Transparencies

Sea anemones feed on small fish, invertebrates, plankton and other particles in the water. As the prey swims into the tentacles of the anemone, it is stung by the nematocysts and then transferred by the tentacles into the central mouth. This is the only opening to a single body cavity where food is digested. The wastes are then expelled back out through the mouth. The cavity isn't completely hollow, and is divided by vertical partitions called mesenteries. Cilia (tiny hair-like projections) on the mesenteries aid water circulation, while other special cells secrete enzymes for digestion, absorb nutrients and take up oxygen. Gonads for sexual reproduction are also found on mesentarial filaments.

Anemones are able to move slowly by gliding on the disc at their base (called a pedal disc), or by walking on their tentacles. Some can float using a gas bubble held within the folds of the pedal disc, while others may use their tentacles to swim.

## COLOURFUL CLOWNFISH

More than 1,000 species of anemones are found throughout the world's oceans. Many live in temperate waters and are quite tiny and inconspicuous. Only about 10 species of anemones provide homes for anemonefish, or clownfish as they are more commonly known. These host anemones occur in the tropics and are usually large and colourful.

One of the most entertaining sights under the water is that of clownfish swimming in and out of an anemone's

*Right:* A cluster of anemones feeding on zooplankton.
Photo – Clay Bryce/Lochman Transparencies

*Below:* Clark's anemonefish lays its eggs on the reef next to its host anemone.

*Below right:* A red and black anemonefish (*Amphiprion melanopus*) in its bulb-tentacle anemone home.
Photos – Ann Storrie

tentacles. Family groups of these appealing little fish continually dart in and out of their colourful anemone homes.

The symbiotic relationship between clownfish and anemones now appears to be more complex than marine biologists at first thought. Benefits for the fish are fairly obvious. Clownfish are relatively poor swimmers and, without the protection of the anemone's stinging tentacles, they would be quickly caught and eaten by predators. The fish's eggs are also protected by the anemone. The eggs are usually laid on the rocks or reef directly beneath, or beside, the anemone's tentacles. This is obviously a time when the anemone is not supposed to move!

The rewards of the relationship for the anemone are a little more obscure. In aquaria, clownfish will carry large particles of food back to their host. The anemone thus obtains scraps dropped by the fish as the fish eats its meal within the tentacles. In nature, however, the clownfish usually only eats small particles of plant and animal matter that are found close to the anemone. It consumes this food on the spot, and does not usually bring lumps of it back into the tentacles. Thus, it is doubtful whether the anemone gains much food from the fish in the wild.

The anemone may be cleaned of detritus and parasites by the fish, although this is not necessary for the anemone's survival. Some studies carried out on the Great Barrier Reef and in New Guinea, however, showed that when resident clownfish were removed from a particular species of anemone, the anemone disappeared. The anemones were eaten by butterflyfish. Unlike most fish, many coral-eating butterflyfish are immune to the anemone's stinging cells. These fish are normally kept at bay by the little clownfish that voraciously defend their territory.

Just how the clownfish becomes immune to the anemone's stinging tentacles is not fully understood. Clownfish don't have natural protection—they need to acquire it! Fish that have been separated from their host anemone for a few days will be stung when reunited with the

*Left:* Anemones often form a carpet over parts of the reef.
Photo – Ann Storrie

*Below:* An anemone shrimp (*Periclimenes venustus*) is well camouflaged against the anemone in which it lives.
Photo – Peter & Margy Nicholas/Lochman Transparencies

anemone. It may take several hours for them to re-acquire their immunity. Most clownfish carefully touch the tentacles, first with their fins, then their ventral surface, and finally, the whole body. One theory is that the anemone's mucus is smeared over the fish and hence provides the protection. The fish is recognised as the host's own surface tissue, and therefore is not stung. The fish must return to touch the anemone's tentacles every minute or so to keep up the protective coating. Another hypothesis on the acquired immunity is that the fish's own mucus has evolved to lack components that cause the nematocysts to fire.

Of 28 species of clownfish that inhabit anemones, one third use just one species of anemone as hosts. However, Clark's anemonefish (*Amphiprion clarkii*) can live within any of the 10 species of host anemones. This species is thus the most widely distributed and best known clownfish in the world. In Western Australia it can be seen in the Abrolhos Islands and waters to the north, including Shark Bay, Ningaloo and Rowley Shoals marine parks. It is usually black with white bands on the head, body and at the base of the tail.

## CLEVER CRUSTACEANS

Clownfish aren't the only animals that seek safety among stinging cells. Many species of crabs and shrimps live within, or under, the tentacles of anemones. Some shrimps from the Genus *Periclimenes* assume the colours of the anemone, and are so well camouflaged that they are hard to see with the naked eye. The anemone provides protection and some food for these crustaceans, while the shrimps and crabs clean the anemone of detritus. Many shrimps and crabs also live among the stinging cells of hard corals and bubble corals. It is not yet known how they obtain their immunity to the nematocyst's stings.

Some of the most attractive crustaceans are the porcelain crabs (Family Porcellanidae). These are not true crabs, but are more closely related to squat lobsters (Family Galatheidae). They have long antennae and the

*Right:* Porcelain crabs are often found hiding on the column, under the tentacles of magnificent sea anemones.
Photo – Ann Storrie

*Below right:* A boxer crab (*Lybia tesselata*) carries stinging anemones in its claws for protection.
Photo – Alex Steffe/Lochman Transparencies

presence of a tail. They are often found in the coral rubble close to where the anemone is attached, or on the underside, or column, of the anemone. They seem to prefer to live slightly away from the stinging tentacles. These crabs and the underside of the anemone may be very colourful, so if you are lucky enough to dive in tropical anemone-land, make sure you take a torch with you. When you find a giant anemone, also called a magnificent anemone (*Heteractis magnifica*), lift one side very gently to reveal the column, or smooth underside. In the light, it is often bright purple, orange, red or pink. You may also see porcelain crabs scurrying for cover.

Some crabs have developed a unique form of defence using anemones or corals for protection. Hermit crabs and decorator crabs often plant anemones on their shells or backs to ward off predators. These crabs may use algae and other invertebrates, including anemones, collecting them in their front claws and placing them in position. Hermit crabs coat their shells, while decorator crabs place the camouflage material directly on their backs and sometimes over their legs as well. As well as providing excellent camouflage, crabs using anemones in this manner also obtain a coating of stinging cells to keep potential predators at bay. The anemones gain a mobile existence with new feeding opportunities and may also pick up floating food scraps that have been discarded by the crab.

Boxer crabs (*Lybia* species) do not necessarily live in anemones, but will carry small anemones or attach them to their claws. One species (*Lybia edmondsoni*) is known as the pompom crab, because it looks as if it is carrying two pompoms wherever it goes. When threatened, these crabs wave their anemones at the predator, as if doing a little pompom dance!

Possibly the ultimate form of symbiosis between crabs and stinging cells occurs in a species of crab living in corals on the Great Barrier Reef. The crab defends its territory by attacking the tube feet of the crown of thorns sea star, thus saving its host from being devoured!

There are many other examples of symbiosis between different animals in the marine environment. Not all involve invertebrates with stinging cells. Different species of fish live together for mutual benefit. The relationship between gobies and shrimps in sandy burrows is well researched, and some fish even live within the intestines of large sea cucumbers. No matter how bizarre, these relationships enable a large number of animals to survive in the ocean. As we study and learn more about these amazing creatures, perhaps a little bit more symbiosis will rub off on the human race.

Ann Storrie is a freelance writer and underwater photographer. She has co-authored two full-colour books (*The Marine Life of Ningaloo Marine Park* and *Wonders of Western Waters: the Marine Life of South-Western Australia*) which also feature many of her photographs. Both books are published by CALM. Ann can be contacted on (08) 9385 9355.

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# LANDSCOPE

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*Western Australian botanists are taking part in a global plan to store seed from 10 per cent of the world's flora by 2010. See page 23.*

*Mushrooms the size of a dinner plate can appear within 48 hours of a fire in the karri forest. Read about forest fungi on page 48.*

*The Pilbara's numerous islands are rich in history, wildflowers and wildlife, with prolific marine life in the surrounding waters. See page 34.*

*Discover the rich bird life and tranquillity of the Canning River Regional Park on page 17.*

*Many of WA's threatened marsupials can be seen in the south-west for the first time in decades. Read about their return to Dryandra Forest on page 10.*

## COVER

*Paradoxically, the stinging tentacles of sea anemones—a group of carnivorous invertebrates that sometimes resemble colourful flowers—can also provide a safe haven for many underwater creatures. Anemonefish gain immunity to the stinging cells and live primarily in sea anemone tentacles. Other animals, such as crabs, carry a protective anemone on their backs. Turn to page 28.*

*Cover illustration by Ellen Hickman*

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