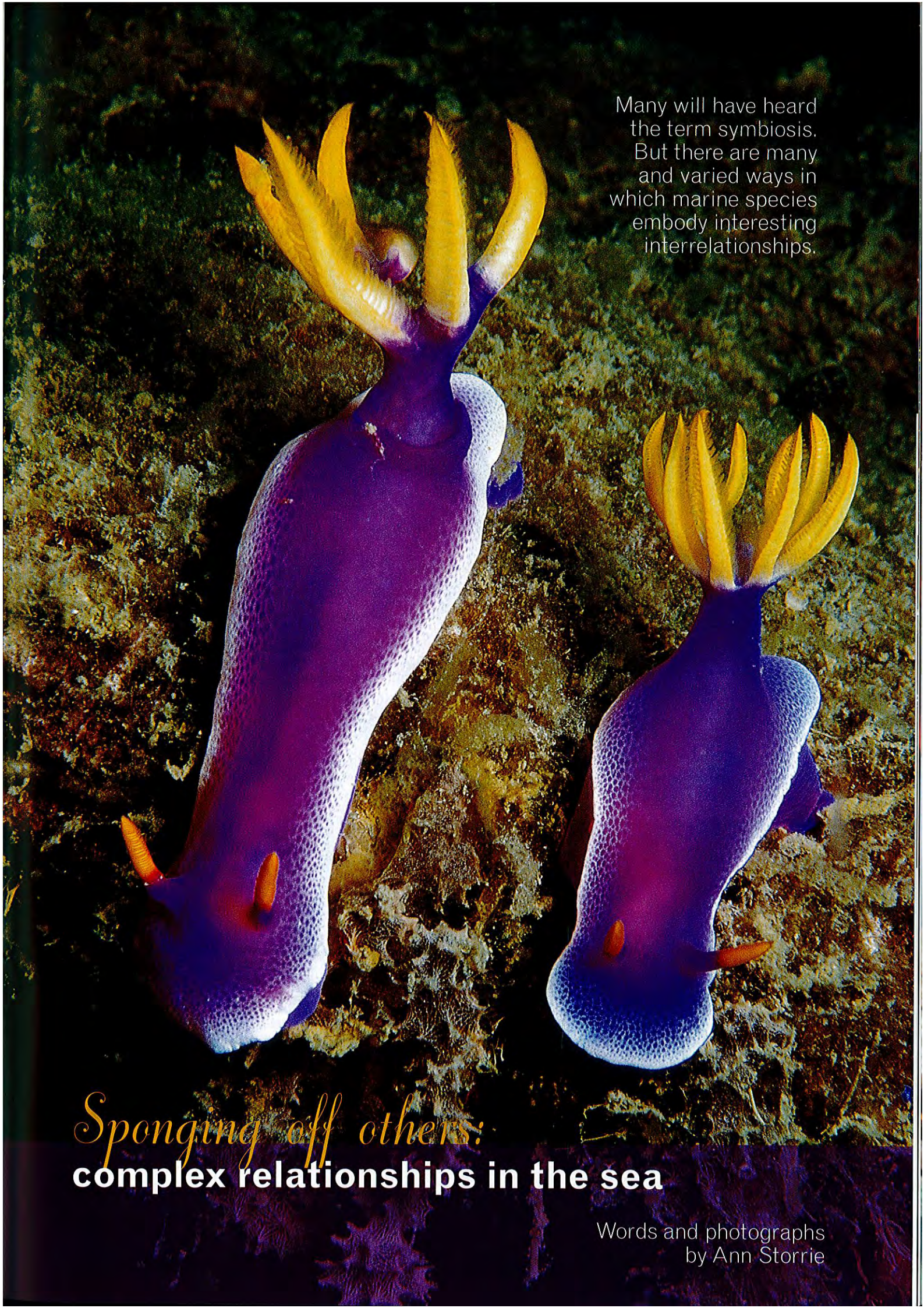


Many will have heard the term symbiosis. But there are many and varied ways in which marine species embody interesting interrelationships.

Sponging off others: complex relationships in the sea

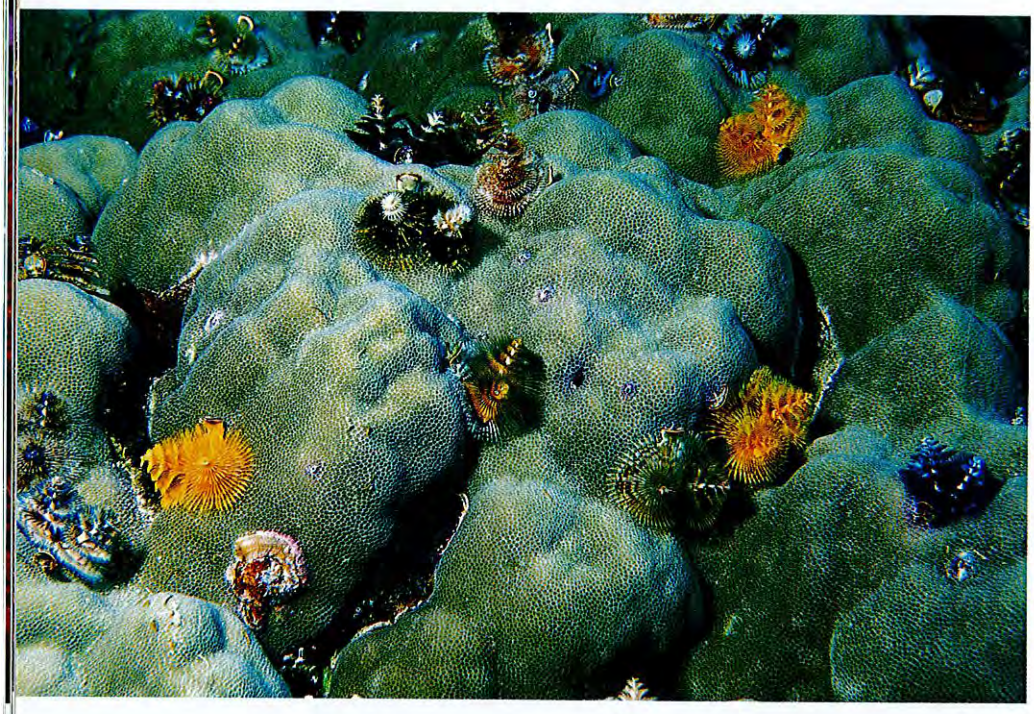
Words and photographs by Ann Storrie

Relationships between species are extremely complex and often misunderstood. Symbiosis is a term that means 'living together' and refers to different species that have a close interrelationship with each other. Even the term symbiosis is not straightforward. Some scientists define symbioses as relationships that benefit both species that are co-existing; others apply the term to three types of relationship—mutualism, commensalism and parasitism. Mutualism is where two different species benefit from living together, while commensalism is defined as where one species benefits while its host gains no advantage in the relationship. When one species benefits to the detriment of the other, the relationship is described as parasitic.

These relationships, especially in the sea, are often very difficult to separate. In fact, in some instances, all three appear to occur simultaneously. Many examples, especially of mutualism, have been published in previous *LANDSCOPE* articles (see 'Sea anemones', Winter 2001; 'Corals and their cryptic collaborators', Spring 2006; 'Coral castles and their inhabitants', Summer 2009–10 and 'Echinoderms', Spring 2010). Parasites and commensal animals, however, are often a little more cryptic and less understood, yet there are thousands upon thousands of these relationships in our oceans. Some scientists have postulated that there could be more than 40,000 parasites that infest fish alone.

The term parasitism is derived from the Greek word *parasitos* which means 'one who eats at the table of others' (*para* meaning 'beside' and *sitos* 'food'). Its meaning was originally quite respectable and simply meant a table guest. Around 400BC, however, Greek comedy began featuring rude, hard-to-get-rid-of dinner guests and the word became associated with freeloaders and those who overstayed their welcome. The Romans borrowed the word which became *parasitus* in Latin (*situs* meaning 'position' or 'site') and was thus corrupted to mean those taking advantage of their host by sitting next to him or her at the dinner table. The word continued to trickle down to French and English where parasitism now refers to the relationship whereby the parasite takes advantage of the host which is disadvantaged in some way.

Parasites can generally be divided into two groups—endoparasites and ectoparasites. Endoparasites are those that live within the body or tissues of the host. Ectoparasites sit somewhere on the outside of the host. They may be temporary or permanent, they may have one or several hosts and the host may be harmed slightly, suffer severe damage, or may even be killed. It is generally not in the best interest of the parasite to kill its host and this is usually a rare event in the ocean. (An example of this in terrestrial invertebrates is the malarial parasite.)



Previous page
Main Many nudibranchs, including these beautiful *Chromodoris bullocki*, feed on sponges.

Above The pink squat lobster has a commensal relationship with large barrel sponges.

Above left A large barrel sponge amid a complex marine ecosystem.

Left Christmas tree worms bore into hard coral skeletons.

Surviving on sponges

Although many sponges have needle-sharp spicules and tough cells that contain highly toxic chemicals to deter predators, they are still the food of choice for thousands of parasites and commensal animals. Possibly the most primitive type of parasitism could have developed from predation by molluscs on sponges. Ancient slit shells, umbrella shells, some cowries and many carnivorous sea slugs, or nudibranchs, feed directly on sponges, often causing severe damage to their hosts.

The rose sponge nudibranch (*Verconia verconia*) is a tiny nudibranch only three centimetres long, yet several of these may consume nearly all but a few strands of the rose sponge (*Dendrilla rosea*). Although a slow grower, the rose sponge (like all sponges) will regenerate from just a few cells. Some nudibranchs make use of toxic chemicals found in many sponges. They retain the chemicals from their host sponge within their own bodies to use as a deterrent to fish predators.

Many echinoderms—such as sea stars and sea urchins, plus worms and small crustaceans—live on and in the structure of sponges. Many of these creatures—such as the pink squat lobster (*Lauriea siagiani*), and several species of porcelain crab that live between the folds and within the central cavity of large *Xestospongia* sponges—are probably more correctly commensal animals than parasitic animals, as it is doubtful that the sponge is harmed by them. These crustaceans simply use the sponge as a place of refuge while feeding on detritus and particles that land in the sponge.

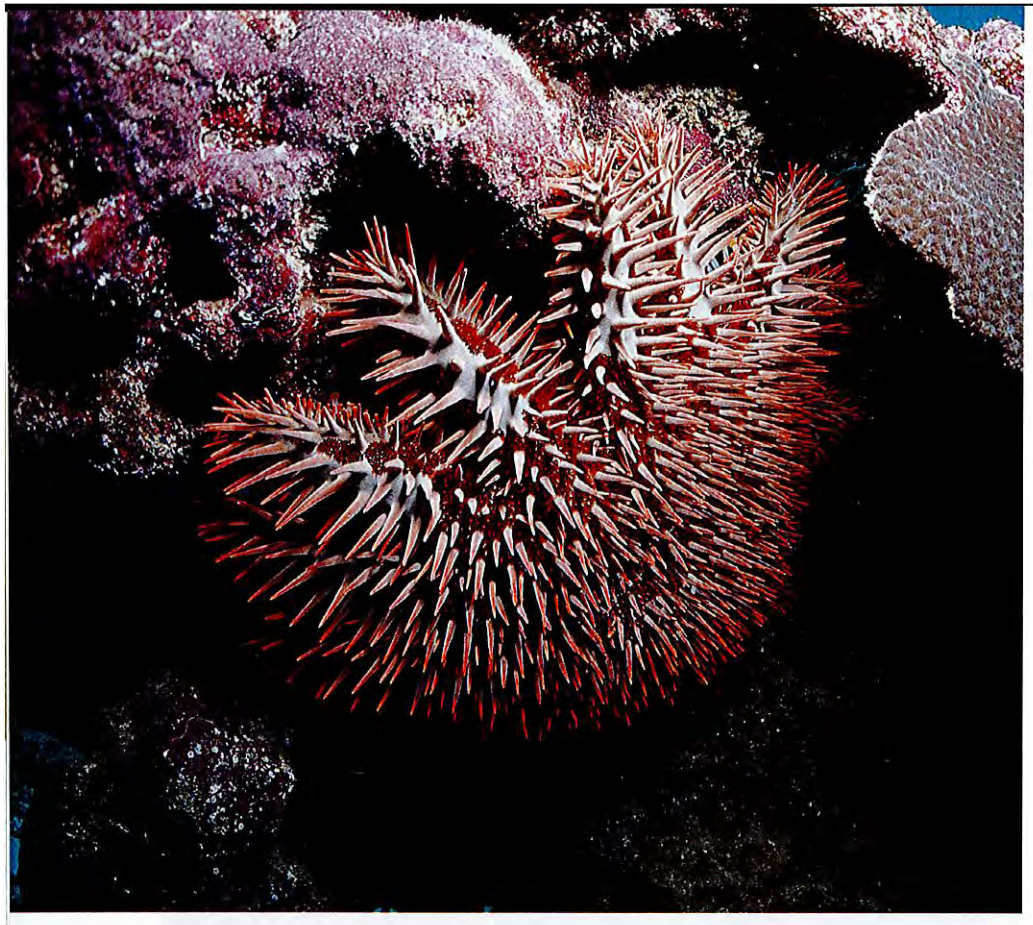
An interesting relationship occurs when some species of crab use pieces of other animals for camouflage. Spider crabs, or decorator crabs, attach sponges, corals, hydroids and other invertebrates to their carapace. These sedentary invertebrates can all grow on the rough surface of the crab's exoskeleton. They are probably not disadvantaged by the relationship and some may even benefit from suddenly having a mobile existence. Most sponge crabs break off large pieces of sponge and hold them over their bodies with their specially adapted back legs. It is quite an amusing sight to see a sponge appearing to trundle along the sand or over the reef, the crab invisible beneath this protective shield.

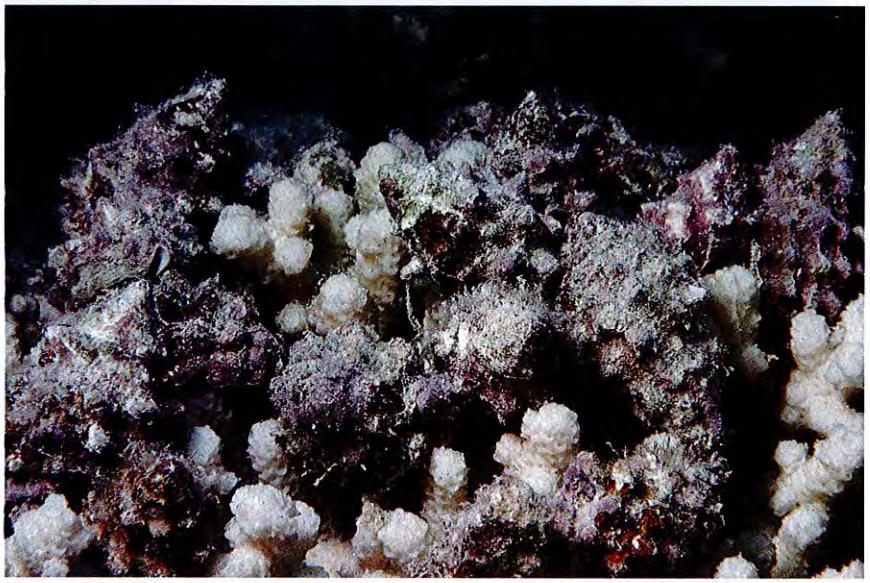
Top The rose sponge nudibranch (indicated by the arrow) is hard to distinguish from its host sponge. This one is laying a white ribbon of eggs.

Above Decorator crabs often 'plant' sponges onto their carapace for camouflage.

Predation is also a term that can be closely associated with parasitic relationships. Many parasites predate on their host, yet some sources define the difference between a predator and a parasite as one in which the predator kills its prey and the parasite does not. It is obviously a far more complex issue as many parasites do kill their hosts and many predators do not. Like the rose sponge nudibranch, the regal angelfish (*Pygoplites diacanthus*) predates on sponges, but does not eat all the sponge which can thus regenerate. However, because the angelfish is not living in a close symbiotic relationship with the sponge, the fish is termed a predator, not a parasite.

Sponges themselves are usually not considered true parasites; however, a few species of the genus *Cliona* bore into the shells of molluscs which causes the shell to become brittle. Other sponges are known to bore into the calcium carbonate base of some corals for protection.





Cravings for corals

Corals belong to a group of animals called Cnidaria which includes sea jellies, hydroids and anemones. All animals in this phylum have stinging cells for capturing food and for defence. It would thus be easy to assume that few parasites could live on coral polyps, yet corals host more species of parasitic and commensal molluscs than does any other group of marine animals. Many species of worm, crustacean, echinoderm and fish also feed on coral polyps and some make their homes by boring into hard coral skeletons.

Two of the most destructive and infamous coral predators in Australia are the crown-of-thorns sea star (*Acanthaster planci*) and a small gastropod mollusc, *Drupella cornus*. Both species feed on live coral polyps. The crown-of-thorns sea star often occurs in large numbers on the Great Barrier Reef where it has destroyed huge amounts of coral. Its numbers, however, have not fluctuated greatly in Western Australia and as a small, natural part of the reef fauna, these sea stars have had less impact on our corals. *Drupella* snails, conversely, have consumed large patches of hard corals in Ningaloo Marine Park in the past (see 'Snail threat to Ningaloo Marine Park?', *LANDSCOPE*, Summer 2007–08). Since 1989, the Department of Environment and Conservation and one of its predecessors, the Department of Conservation and Land Management, have conducted several surveys which have shown large variations of population densities of the snails at different sites; however, their overall numbers have been low to moderate and have caused no significant loss of coral cover at Ningaloo Marine Park since the outbreak that occurred in the late 1980s and early 1990s.

Top left Crown-of-thorns sea stars have eaten large amounts of coral on the Great Barrier Reef.

Above left *Drupella* snails eat coral polyps, leaving the white skeletons behind.

Left Ovulids, or allied cowries, feed on soft corals.

Far less visible and less destructive—and also very attractive—predatory–parasitic molluscs that are all associated with Cnidaria belong to the family Ovulidae. Most ovulids (also known as allied cowries, spindle cowries and egg cowries) live permanently on their host. These hosts are soft corals and gorgonians. The ovulids feed on the coral polyps, the polyps' secretions, and possibly on sediment and other animals such as sponges and brittle stars that live on the same host.

Many ovulids are very difficult to see as they are often only a few millimetres in size and are extremely well camouflaged. Their mantles (fleshy folds of epidermis that secrete the shell and can either cover it, or retract back into it) are usually the same colour as the coral polyps. Some even have polyp-like protrusions on their mantle. Surprisingly, these can be retracted or flattened when the coral polyps retract, thus rendering them almost invisible whether the coral polyps are displayed or not.

Most ovulids lay their eggs on their specific host. It is thought that the hatchlings—or veligers—which hatch into the water column, are programed with the colour of their food, enabling them to detect and land on it. To find tiny spindle cowries, look for small mounds on the stems of gorgonian fans or peer into the folds of large leather corals for beautiful egg cowries (*Ovula ovum*) that are very common in Ningaloo Marine Park and Coral Bay.

Fish are great predators on coral (see 'Reef fish and corals: unlocking the secrets', *LANDSCOPE*, Autumn 2011). In some areas they eat about one third of the annual growth of coral. Parrotfish, in particular, can often be seen (and heard) crunching on hard coral colonies. Most butterflyfish and coralfish, and some angelfish, feed on coral polyps. Their tiny mouths and snouts are designed to pick individual polyps from the reef. This adaptation has been taken almost to extremes with the forceps fish (*Forcipiger flavissimus*), also known as the long-nosed butterflyfish, and the long-nose butterflyfish (*F. longirostris*), once known as the longer-nosed, or big long-nosed butterflyfish. The latter beats its close relative by a nose! Its snout is around half its body length. Interestingly, both these butterflyfish feed on small crustaceans and other invertebrates found in coral crevices as well as on the occasional coral polyp. Other species of butterflyfish feed exclusively on coral polyps.

The world is my oyster

"Why then, the world's mine oyster, which I with sword will open." Shakespeare invented this phrase in 'The Merry Wives of Windsor'. Most of us know about pearls in oysters and understand this reference to oysters being something from which to extract great profit. However, oysters are truly the world and sustenance for a tiny parasitic crab, the female of which may spend its entire life feeding and breeding inside the shell of a single oyster.

Pea crabs of the genus *Pinnotheres* are (surprise, surprise) about the size of a pea. Different species are found in different hosts, and clams, mussels, other bivalve molluscs, sea urchins and sand dollars all have their resident pea

Above right Beautiful spindle cowries are often only a few millimetres long.

Above far right The female oyster pea crab lives her entire life inside an oyster.

Right Parrotfish crunch the coral with their strong parrot-like beaks.

crabs. Some pea crabs even invade the burrows of mud shrimps, live in the gills of sea squirts and in the rectum of sea cucumbers. Oyster pea crabs (*Pinnotheres ostreum*), however, invade the commercially harvested oyster, *Crassostera virginica*.

The larvae of these crabs are usually free swimming and feed on plankton. During their first stage of development, the soft, juvenile crabs invade the oysters and feed on particles caught in the oyster's gills. As they develop, males leave their hosts in search of mature females which can carry more than 9,000 eggs.

Fishy feeders

Internal and external parasites of fish have been studied extensively due to their importance in the commercial fishing industries. Aquarists are also very familiar with many fish parasites that threaten their fish tank inhabitants. Recreational divers, however, are often unaware of the parasitic relationships around them. The larger species of ectoparasites, such as fish lice that live on the bodies of many fish, are the most obvious.

Fish lice are isopods which belong to a diverse group of small crustaceans, many of which are parasitic. They attach themselves to the body of their host, often in the gill region, where they can feed, with ease, on their host's tissues and body fluids. Like most parasites, fish lice do not usually kill their hosts, so only one, or at the most two, parasites are found on each fish. When a fish louse larva lands on an unoccupied host, it will develop into a female. If another larva lands on the same host, it will develop into a male, thus maximising reproductive potential. All fish—from the largest shark to the smallest damselfish—are susceptible to fish lice.

Most ectoparasites found on fish are too small to be seen by the human eye. Protozoans, microscopic worms, tiny crustaceans, larvae and many other organisms invade the epidermis of their fish hosts. One of the most fascinating methods which most fish employ to control some of these parasites is to have another close symbiotic relationship with cleaner fish and cleaner crustaceans. Several species of wrasse, goby, clingfish and shrimp hover over, or hop on board, their fish visitors and methodically pick parasites from the fish's skin, fins, mouth and gill slits. Most cleaner fish choose a 'cleaning station'—somewhere sheltered on the reef where fish regularly visit. The process can be quite a sight: large predatory fish hover, waiting to be cleaned by these small fish that would make a tasty, bite-sized meal. Even enormous moray eels open their mouths wide for cleaner wrasse and shrimp to disappear inside to clean their teeth and gums.

Above Tiny cleaner wrasse would be a bite-sized meal for large moray eels.

Right A fish louse in the gill slit of a wobbegong shark.

Below A regal angelfish eating a sponge.

These examples of the complex relationships between marine creatures are only a drop in the ocean. There are many, many more fascinating stories to be told of life in the sea, and even more that are yet to be discovered. Understanding the complexity of life in our oceans is mandatory if we are to protect our wonderful underwater world.

Ann Storrie is an accomplished underwater photographer and marine enthusiast. She has contributed numerous articles to *LANDSCOPE* magazine, as well as having co-authored and photographed Department of Environment and Conservation books such as *Wonders of Western Waters*. She can be contacted by email (naturescapes.au@hotmail.com).

Volume 26 Number 4 WINTER 2011

contents

Regulars

Publishing credits

Executive editor Madeleine Clews.

Editors Joanna Moore, Samille Mitchell.

Scientific/technical advice Kevin Thiele, Lachie McCaw, Keith Morris, Kevin Bancroft, Shaun Wilson.

Design and production Gooitzen van der Meer, Peter Nicholas, Tiffany Taylor, Lauren Wright.

Illustration Gooitzen van der Meer.

Cartography Promaco Geodraft.

Marketing Cathy Birch.
Phone (08) 9334 0296 or *fax* (08) 9334 0432.

Subscription enquiries
Phone (08) 9219 8000.

Prepress and printing GEON, Western Australia.

ISSN 0815-4465

Please do not send unsolicited material, but feel free to contact the editors.

Published by the Department of Environment and Conservation (DEC), 17 Dick Perry Avenue, Kensington, Western Australia.

Visit DEC online at www.dec.wa.gov.au to search the *LANDSCOPE* catalogue.

Department of
Environment and Conservation