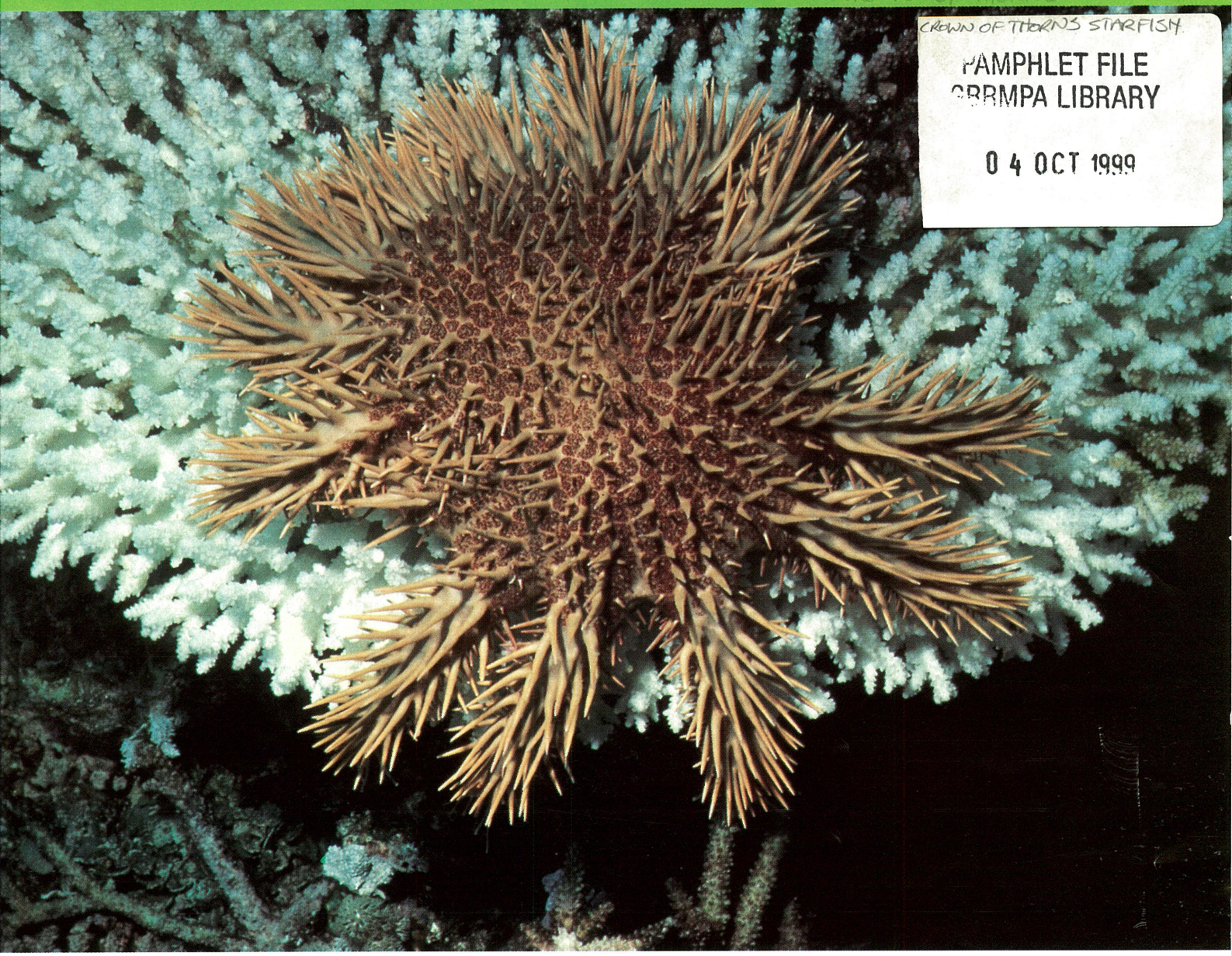
Crown of Thorns

Marine Parks
Great Barrier Reef Marine Park Authority
Queensland National Parks and Wildlife Service

"CROWN-OF-THORNS STARFISH"



Since the early 1960s many people have become disturbed by newspaper headlines such as, 'Starving millions are eating up the Great Barrier Reef' or 'Starfish Plague Returns'. After twenty years of study on the crown of thorns starfish, scientifically known as *Acanthaster planci*, the initial fears of some scientists have abated, while others remain very concerned.

The Problem

Why has this spiny-skinned sea creature, which belongs to the marine group of animals called echinoderms, caused such concern? The crown of thorns is a predator; that is, it eats other living animals – small reef-building animals called coral polyps. Polyps usually construct communal limestone homes which are built up into a multitude of shapes and sizes that eventually give rise to what is known as a 'coral reef'. The crown of thorns starfish is mobile. Using suckers under its arms called 'tube feet', it is able to move across coral reefs to find new prey. After finding a suitable coral, the crown of thorns pulls its stomach out through its mouth (a process known as 'stomach eversion') over the coral polyps and releases digestive juices onto the coral, breaking down the polyp's tissue into a readily absorbed 'polyp soup'. It leaves only a white coral skeleton which is soon invaded by algae, worms, boring molluscs or reef settling organisms.

When present in large numbers, crown of thorns starfish often eat together in groups called aggregations. Researchers have shown that chemicals released during the digestion of corals can actually attract other starfish to a feeding site. As the number of starfish feeding in an area increases, the 'smell' of digested coral may increase and so recruit still more starfish into the feeding group.

The crown of thorns phenomenon is not unique to the Great Barrier Reef. In recent years crown of thorns aggregations have caused large scale coral destruction in other areas of the Pacific. Other animals too can devastate coral. Certain species of gastropods (marine snails) and an encrusting sponge have the potential to devastate coral colonies at a level comparable to that of the crown of thorns.

The white limestone skeleton of this **Acropora sp.** *is a clear indication that the crown of thorns has eaten the resident coral polyps.*

Population explosions

Like many other sea creatures, female crown of thorns release millions of eggs each year but usually only a very small proportion survive to become mature starfish. If conditions change to allow more larvae to settle on coral reefs and to allow more of the larvae that settle on a reef to survive, this can lead to what ecologists term a 'population explosion' on that reef.

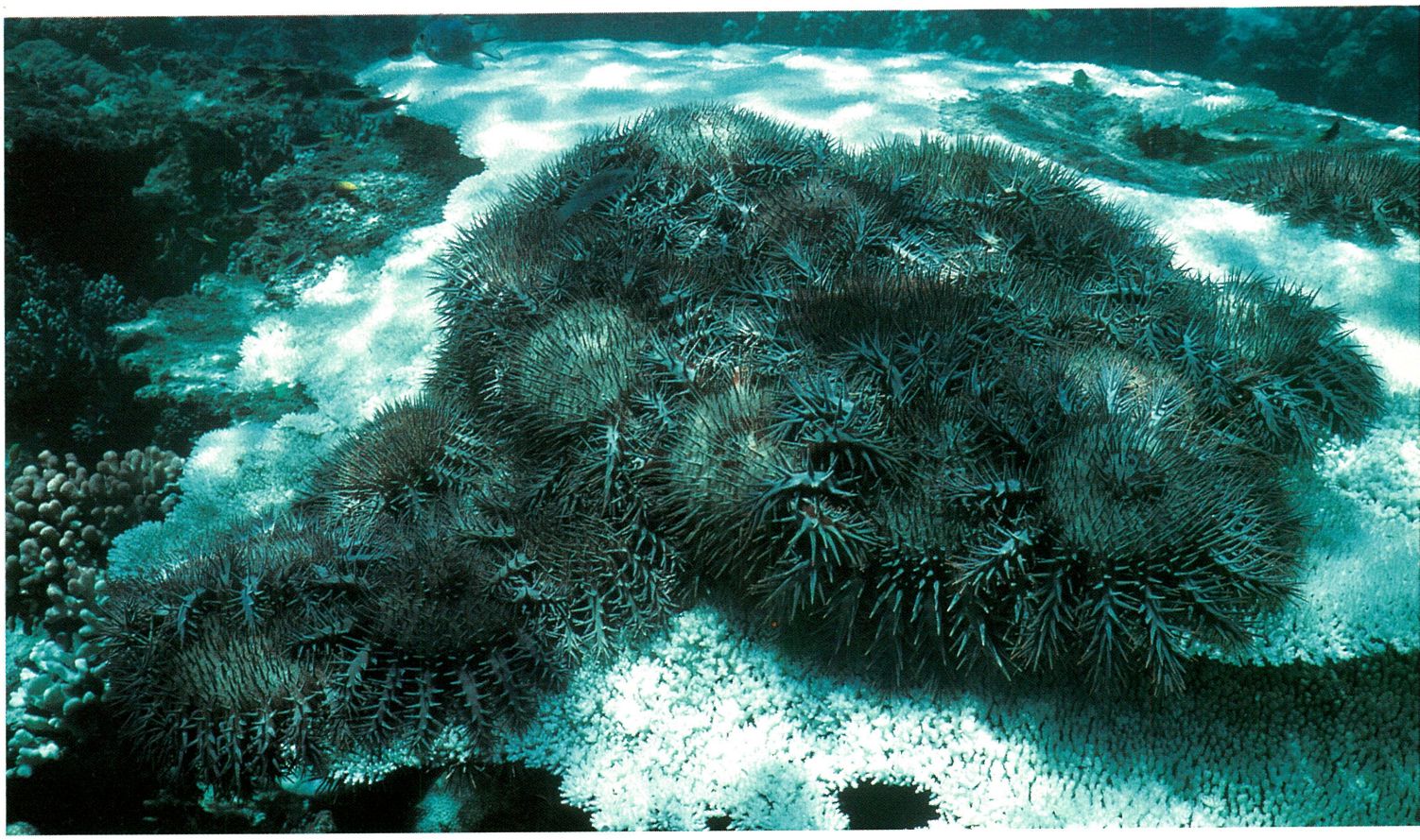
It is not known what causes population explosions in the crown of thorns. Some scientists believe that the discovery of crown of thorns spines in old reef sediments indicates that population explosions have occurred from time to time in the past before humans became a factor in reef ecology. However, other scientists believe that the spines occurring in sediments are from normal populations of crown of thorns starfish.

Some evidence suggests that extra heavy rainfall during the monsoonal season, which causes a run-off of extra nutrients into the coastal waters adjacent to the Reef, may have a role to play. The nutrient enriched waters lead to an increase in phytoplankton (algae) upon which the starfish larvae feed. This could enhance survival of the larvae and lead to a subsequent marked increase in the numbers settling on reefs. Extra heavy rainfall following droughts may have allowed phytoplankton blooms and therefore greater survival of crown of thorns larvae on rare occasions in the past. These events may be occurring more frequently in recent times because of increasing land clearing for urban and industrial expansion, forestry and agricultural activities. These developments generally cause an increase in water and sediment run-off during heavy rains. However, why an increase in phytoplankton should favour just the crown of thorns larvae and not some of the many other larval forms which also feed on it is not yet clear. Since an adult crown of thorns can release 10 to 30 million eggs, a 1% increase in survival rate of the young starfish could mean as many as 300,000 more adult starfish from each adult female. This, in turn, could trigger a population explosion.

Others believe that increased human activities such as shell collecting and reef fishing have caused a decline in natural predators which would normally keep the starfish numbers in check irrespective of the numbers of larvae that settle on reefs. Some scientists who have adopted this theory maintain that the population explosions of crown of thorns could result in catastrophic damage to coral reef communities.

Some scientists maintain that the crown of thorns population explosions observed in recent years are natural phenomena that have occurred repeatedly in the past and that the predator has a role in maintaining high species diversity on reefs. By eating away the living corals on the surface of a reef, particularly fast growing species like staghorn corals, the crown of thorns creates space for young corals and other sedentary reef animals to become established. In other words these starfish may 'prune' the reef corals and indirectly allow different coral species to successfully compete for the limited available space. These theories and others have their adherents, but there are inadequate observations to satisfactorily resolve these alternatives.

Researchers have demonstrated that crown of thorns starfish release chemicals during the digestion of coral which actually attract other starfish into the feeding group.



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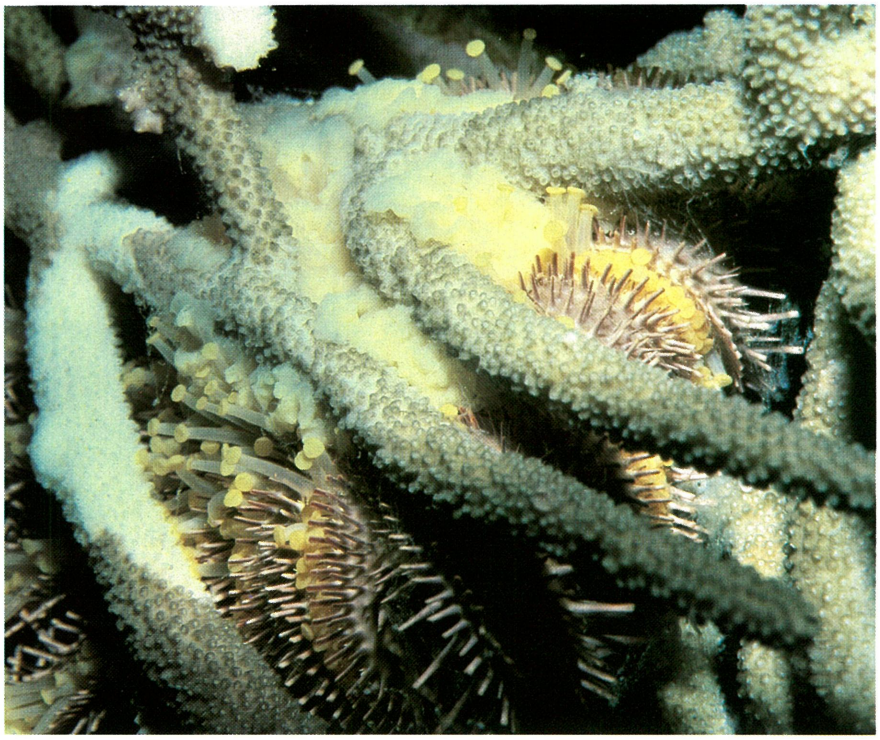
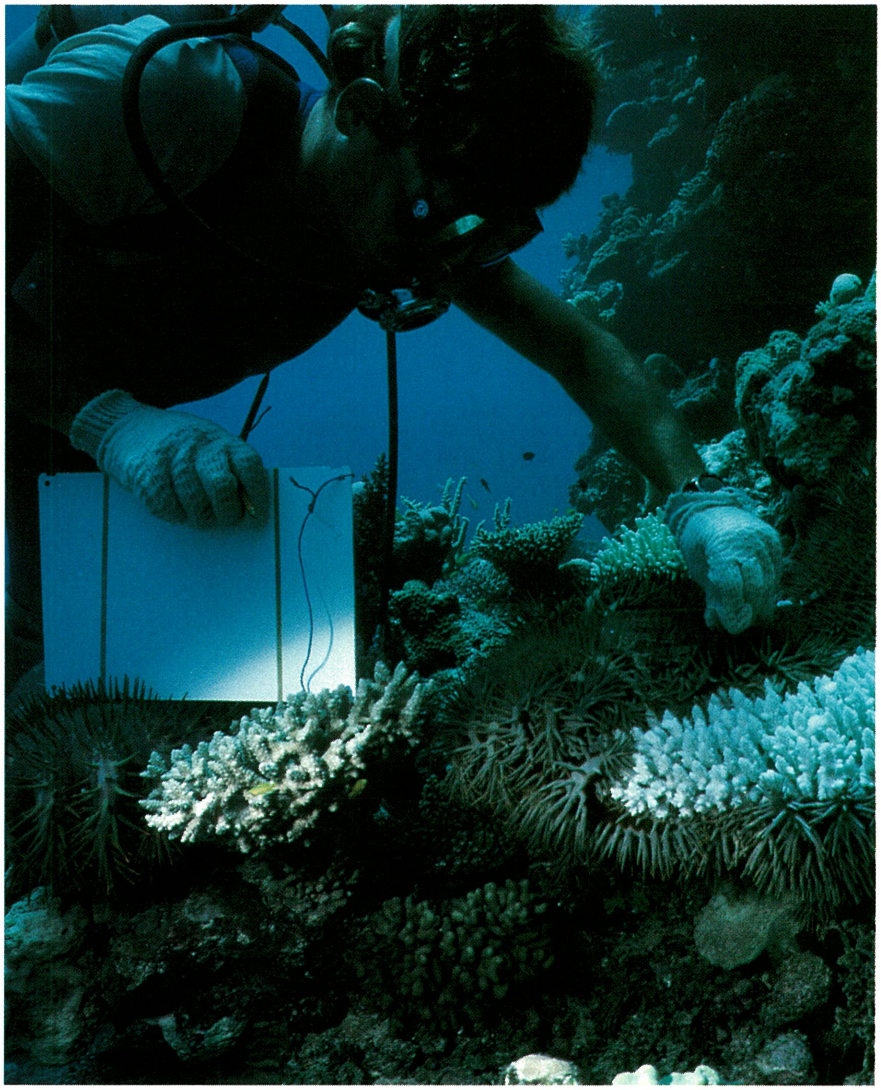
Research

Various organisations, including the Great Barrier Reef Marine Park Authority, the Australian Institute of Marine Science, the James Cook University of North Queensland, the University of Queensland and the island research stations are conducting research on the crown of thorns starfish. As a result, biologists know that when starfish larvae hatch they may drift along in the ocean currents for a month or more before they settle on coral reefs. Their drift patterns in the ocean currents have been suggested by following the movements of drift cards, (literally waterproof postcards), which have been dropped in the ocean near reefs which have large aggregations of breeding starfish. Some drift cards have been recovered 400 kilometres from their point of release. The spread of 'plagues' may therefore be the result of the passive transport of larvae in the ocean currents, rather than the purposeful migration of the adults.

From other field and laboratory observations and experiments biologists now know how and when the crown of thorns breeds, its growth patterns, food preferences, feeding habits, some natural predators and so on. Research has also shown that a reef can recover reasonably well within ten to twenty years after major damage has occurred but many reefs have become re-infested before recovery is complete. This has caused some scientists to speculate that continued re-infestation might result in reefs becoming impoverished for long periods of time.





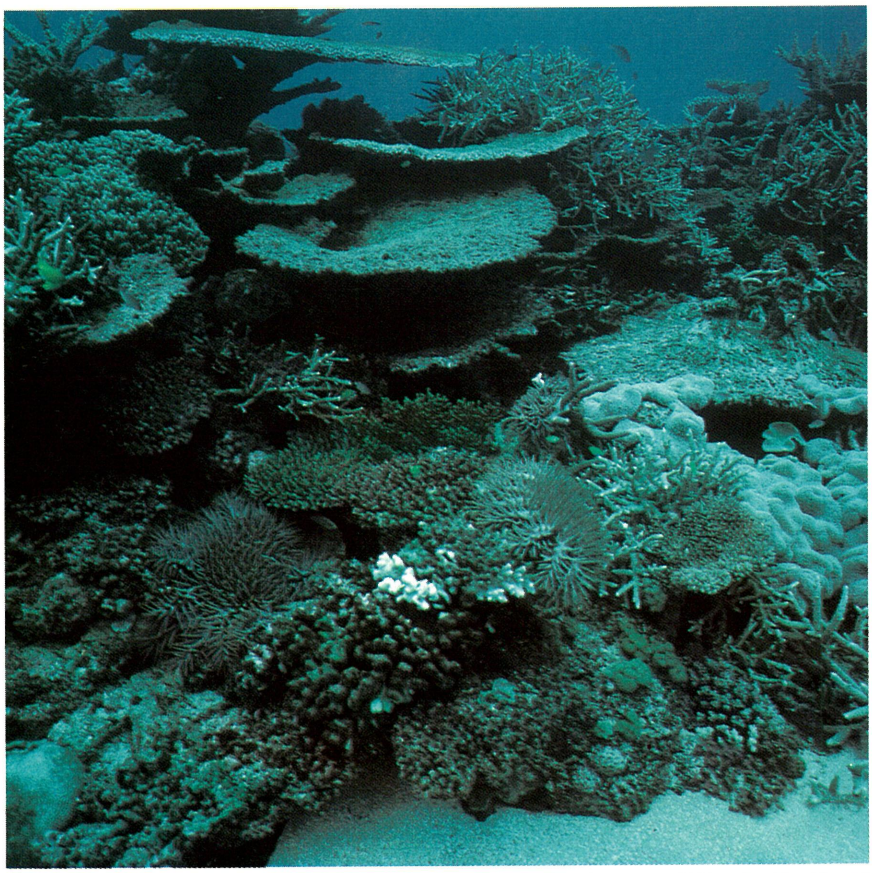
Top right—
Yellow-ended 'suckered feet' of the crown of thorns starfish pull out its white stomach which then digests the living coral polyps of this staghorn coral.

Bottom right—
Research — the key to understanding the crown of thorns phenomenon.
Photo courtesy of the Australian Institute of Marine Science.

Monitoring

Extensive analysis of the presence and impact of crown of thorns starfish has been carried out by the Great Barrier Reef Marine Park Authority. To date records for 516 individual reefs have been compiled and analysed. These records provide data going back to 1952.

During 1984 records were received for 178 reefs throughout the Great Barrier Reef Region. Analysis of these records indicates that on fifty-seven per cent (102) of those reefs no starfish were sighted; on eighteen per cent (32) starfish were uncommon; on nine per cent(16) starfish were common; and aggregations were recorded for sixteen per cent (28) of those reefs.

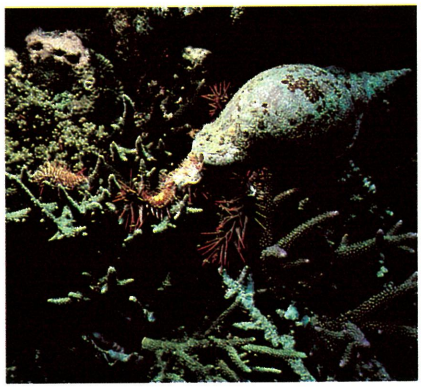


Crown of thorns often hide in crevices and under plate corals but even when they are not hidden they blend in well with their coral reef background. How many can you see?

In summary, the majority of reefs for which reports have been received have very few starfish present. These surveys also indicate that while the existence of a crown of thorns aggregation on a reef is not necessarily associated with total coral destruction, destruction in excess of 50% is common and in some cases destruction exceeds 90%.

This monitoring program will continue as will the Authority's commitment to support appropriate research projects which will help develop a better understanding of the crown of thorns phenomenon. If you visit the Reef you can assist by reporting your visit; it is important to report that you have seen no crown of thorns starfish as it is to report positive sightings. It is preferable to use crown of thorns reporting forms which are available from the Office of the Great Barrier Reef Marine Park Authority, but a report by letter is also useful.

The giant triton shellfish **Charonia tritonis** *is one of a number of marine creatures which can feed on adult crown of thorns.*



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This Reef Note is one in a series published by the Great Barrier Reef Marine Park Authority to promote a better understanding of the Great Barrier Reef.

March 1989
ISSN 0814-9453

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