Crown of Thorns

by Christophe Mason-Parker

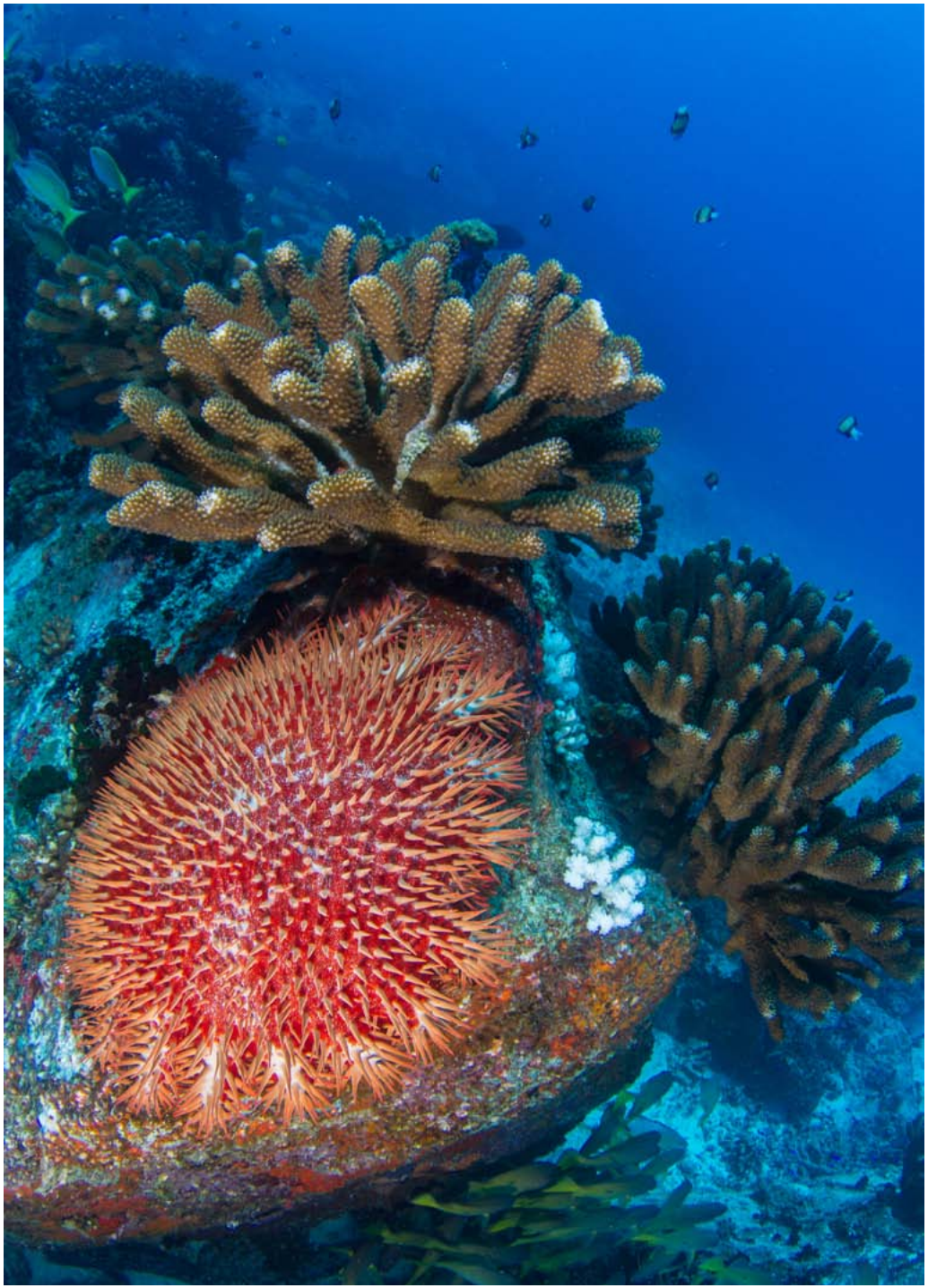
The Crown of thorns starfish (Acanthaster planci) belongs to the phylum Echinodermata, a diverse group of marine organisms that includes sea urchins, sea cucumbers and the sea stars. Crown of thorns starfish (COTS) inhabit the entire Indo-pacific region, where they prefer sheltered reef environments away from wave action and turbulent water.

The sea stars are found in a variety of colours ranging from crimson and grey to royal blue and black and are covered in an armour of needle sharp spines, which can reach 5cm in length. These menacing, yet strikingly beautiful marine invertebrates can grow up to 40cm in size, though individuals of 80cm have been recorded. The adult starfish may have over a dozen spine-covered arms, which they are capable of regenerating if damaged or lost to predators.

Crown of thorns sea stars are themselves coral predators. The animal feeds by eviscerating its stomach, forcing it out through its mouth before retracting it back into its body post feeding. During the feeding process the stomach releases enzymes, which digest the soft coral tissue and leave behind a white skeleton in its place. These feeding scars are easily identified in areas where crown of thorns are present. Coral skeletons are quickly covered by algae and before long the structure of the colony collapses, leaving behind a pile of coral rubble in its place.

A natural part of a healthy reef environment, COTS are usually found in low densities across their range, where their effect on coral reef ecosystems is limited. The sea stars show a feeding bias towards certain species of Acropora coral, though during 'outbreaks' when food becomes limited they will consume virtually all coral species, including soft corals.

An 'outbreak' is a term used to describe a sudden increase in COTS numbers, where the population is viewed to be adversely affecting the coral reef. It is difficult to quantify as in some areas an 'outbreak' may number thousands of individuals, while in others the figure may be

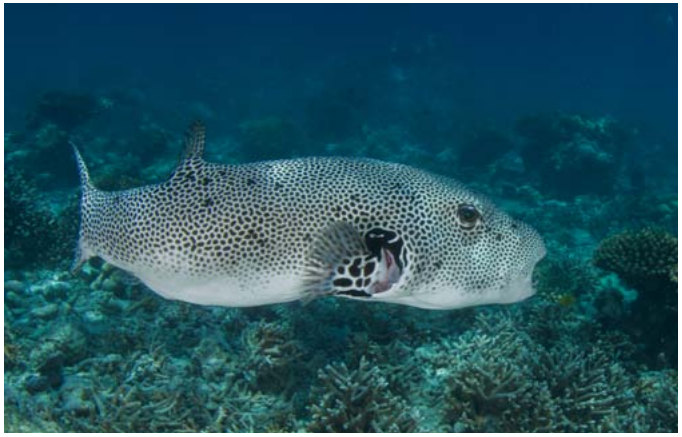


COTS are commonly observed feeding at night Canon 7D, Tokina 10-17mm, Ikelite housing and twin Ikelite DS160 strobes. ISO 160, f/13, 1/250

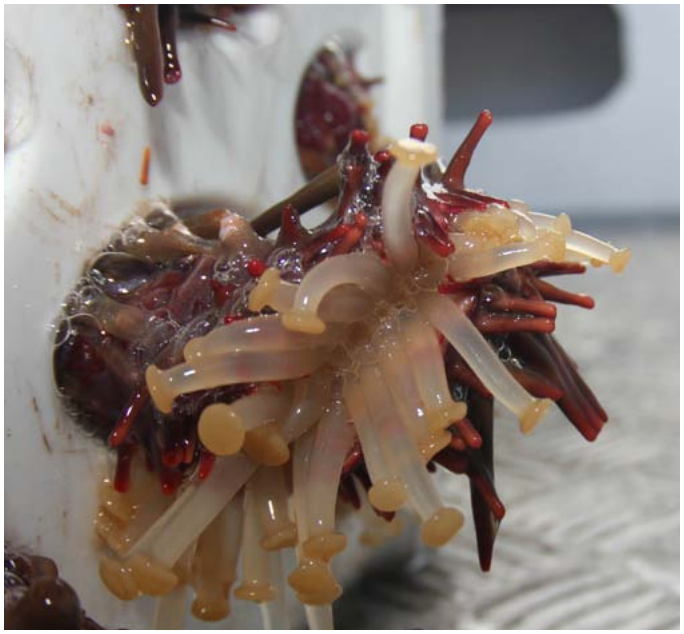
Close up of a COTS feeding on a coral, with the tissue already having been removed from the coral skeleton. Canon 7D, Canon 100mm Macro, Ikelite housing and twin Ikelite DS160 strobes. ISO 320, f/18, 1/125

a few dozen animals in a localised area. A key factor that 'outbreaks' have in common is evidence of high coral mortality. The species is usually nocturnal, though it will also feed during the day if competition is high. While small COTS are cryptic by nature, a coral reef where large individuals are observed feeding during daylight hours often means numbers are elevated above the carrying capacity.

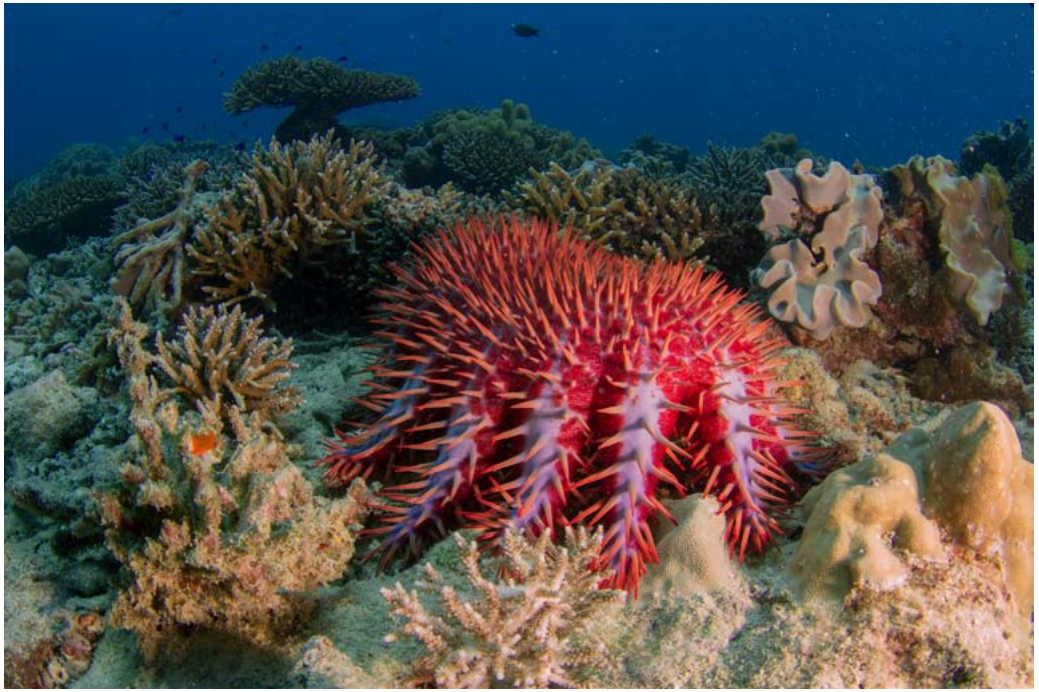
Crown of thorns sea stars are voracious predators and can decimate large areas of coral reef in very little time at all. Increasing numbers of outbreaks are posing a threat to coral reef health and resilience. The reason for these 'outbreaks' remains poorly understood, despite much research into the subject. That said, several hypotheses have been suggested as contributing factors. One of these is a reduction in the animal's natural predators. Few marine organisms predate on COTS but the giant triton shell, Charonia tritonis is one such animal. Unfortunately, the mollusc has been over harvested



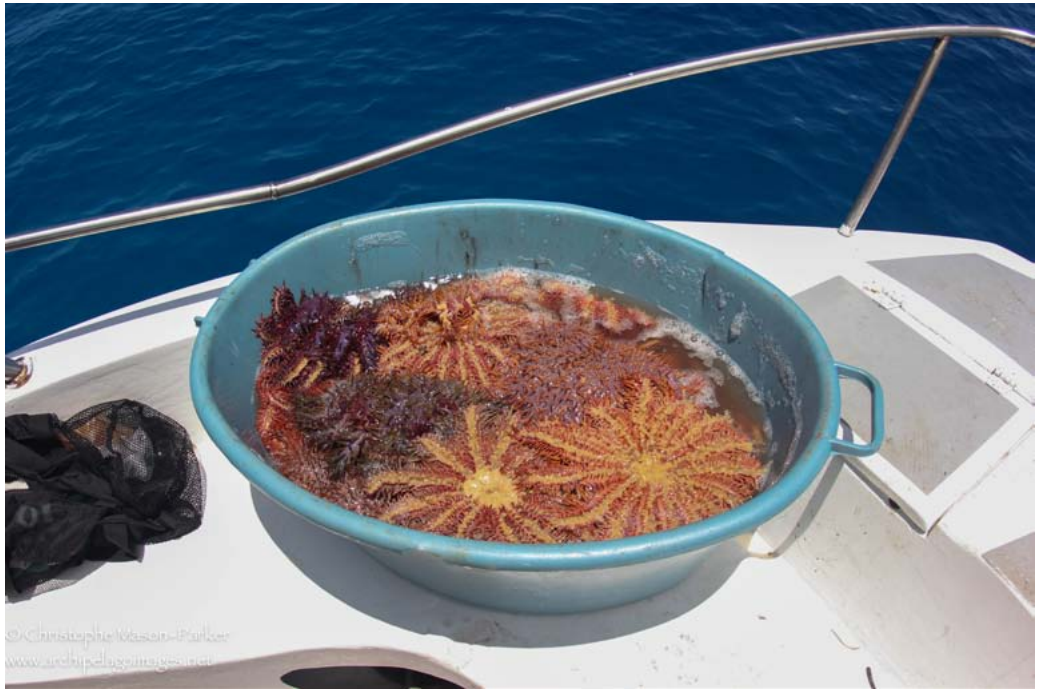
The Star Puffer (Arothron stellatus) is known to feed on COTS Canon 7D, Tokina 10-17mm, Ikelite housing and twin Ikelite DS160 strobe. ISO 160, f/11, 1/250



Close up of some COTS recently removed from a reef. Canon 550D, Tokina 10-17mm, ISO 200, f/8, 1/200



A feeding COTS observed on a morning dive. Canon 7D, Canon 100mm Macro, Ikelite housing and twin Ikelite DS160 strobes. ISO 250, f/13, 1/160



A bucket of COTS collected as part of a removal campaign. Canon 550D, Tokina 10-17mm, ISO 200, f/8, 1/800

across its range leading to depleted population numbers. The same is true of Cheilinus undulatus, more commonly referred to as the Napolean or Maori wrasse. The species is known to prey on adult crown of thorns, but sadly has the dubious honour of being one of the first coral reef fish to be listed on the IUCN Red List as Endangered. Certain species of puffer also feed on COTS but they tend to be found in extremely low densities. In reality it is unlikely that predator reduction is a major factor in crown of thorns sea star outbreaks. While these species undoubtedly feed on COTS, they are unlikely to consume an entire animal and with the sea stars ability to survive the loss of multiple limbs, in all probability many would survive predation.

Another theory behind the 'outbreaks' of crown of thorns sea stars is that of increased terrestrial runoff leading to phytoplankton blooms. It is thought that the increased nutrients entering coastal waters enhance larval survival. The hypothesis is given weight by several observations of 'outbreaks' adjacent to areas of land with high runoff.

Regardless of the exact cause, what is known is that 'outbreaks' are increasing in frequency at numerous locations throughout the Indopacific. In response to this government agencies, local NGOs, and dive centres have gone on the offensive and now actively remove crown of thorns from dive sites within the region.

COTS are highly venomous and produce a painful sting if contact is made with the spines. The effects can last weeks and in extreme cases can lead to hospitalisation. Care is therefore required when dealing with the animals and traditionally long spikes or tongs have been used to impale or grab the seastars before removing them from the reef.

Methods for tackling the outbreaks differ depending on the location but all have the ultimate aim of reducing COTS numbers on affected reefs In recent years, new methods of control have been developed, which involve injecting the COTS with bile salts or sodium bisulphate. Both methods eliminate the need to manually remove the animal from the reef and reduce the risk of divers becoming spiked in the process.

A pair of COTS make their way across a table coral leaving behind them a skeleton devoid of living tissue Canon 7D, Tokina 10-17mm, Ikelite housing and twin Ikelite DS160 strobes. ISO 200, f/11, 1/200

It is estimated that globally seventy five per cent of coral reefs are under threat from a multitude of natural and anthropogenic factors. Pollution and overfishing are difficult subjects to tackle as they are intrinsically linked with the socioeconomics of a locality, whilst climate driven threats such as ocean acidification and coral bleaching are challenging issues to address on the local level. COTS outbreaks, however can be equally damaging yet they provide an opportunity to combat an invidious problem that requires minimal financial input, few tough political decisions, and can help bring together different key stakeholders to collaborate for a common goal.

Further research is being undertaken into the exact causes of COTS population explosions, but until we have the answers, removal campaigns will continue to provide the best solution to an increasingly persistent problem.

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