

Great Barrier Reef coral loss and crown-of-thorns starfish

By Jasmine Hunt

This is the third in a series of articles on the National Environmental Research Program Tropical Ecosystems hub (NERP TE). [Editor's note: see 12 November 2012 Australian Canegrower for the first article in this series.]

Annual surveys of reefs by researchers from the Australian Institute of Marine Science (AIMS) have shown that average coral cover on the Great Barrier Reef (GBR) fell to half its initial level during the 27 years prior to 2012.

The study, conducted with partial support from the federal government's National Environmental Research Program (NERP), found while storm damage (cause of 48% of the losses) and bleaching (10%) were two of the key culprits of coral cover loss, another major factor was crown-of-thorns starfish (42%).

CEO of AIMS, John Gunn, said at the time that although we know all too well that storms and cyclones cannot be stopped, perhaps we can stop the spread of the starfish.

"If we can, then the Reef will have more opportunity to adapt to the challenges of rising sea temperatures and ocean acidification," said Mr Gunn.

Dr Peter Doherty, Research Fellow at AIMS, and one of the program's original creators, described the study as the most comprehensive reef monitoring program in the world.

"The program started broadscale surveillance of more than 100 reefs in 1985 and from 1993 it has incorporated more detailed annual surveys of 47 reefs," Dr Doherty said.

"Our researchers have spent more than 2,700 days at sea and we've invested in the order of \$50 million in this monitoring program," he says.

Dr Doherty said if the trend continues, coral cover will halve again by 2022.

"Interestingly, the pattern of decline varies among regions. In the northern Great Barrier Reef coral cover has remained relatively stable, whereas in the southern regions we see the most dramatic loss of coral, particularly over the last decade when storms have devastated many reefs," he said.

Of course, Australia, and particularly the east coast of Queensland, has always

experienced storms and cyclones - however the population of crown-of-thorns starfish has exploded; and two severe coral bleaching events had major detrimental impacts.

A NERP project (1.1 - Monitoring status and trends of coral reefs of the Great Barrier Reef) led by Dr Hugh Sweatman, Australian Institute of Marine Science, found that crown-of-thorns starfish was the major cause of coral loss up until four years ago, when large cyclones became the leading cause.

Dr Sweatman's research showed that the past seven years had seen three unusually large cyclones (Larry, Hamish and Yasi), which hit parts of the GBR. These storms affected a large proportion of the reefs, particularly in the central and southern GBR.



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Dr Peter Doherty, AIMS



"How rapidly the corals and associated organisms can recover from the effects of these large cyclones will be critical to the long-term persistence of the GBR," he said.

The short timing between these major weather events has been part of the problem, too.

"Our data show that the reefs can regain their coral cover after such disturbances, but recovery takes 10-20 years. At present, the intervals between the disturbances are generally too short for full recovery and that's causing the long-term decline in coral cover," said Dr Sweatman, who was also an author of the major crown-of-thorns study.

"We can't stop the storms, and ocean warming (the primary cause of coral bleaching) is one of the critical impacts of the global climate change," said John Gunn.

"However, we can act to reduce the impact of crown-of-thorns," he says.

Mr Gunn said their study showed that in the absence of crown-of-thorns, coral cover would increase at 0.89% per year. Mr Gunn said AIMS would be redoubling their efforts to understand the life cycle of crown-of-thorns.

What are crown-of-thorns starfish?

Crown-of-thorns starfish can be found in tropical and subtropical waters, mostly where coral reefs are located. It is the second largest starfish in the world, is covered in venomous, thorn-like spines and preys on coral polyps.

Crown-of-thorns starfish spawn in late spring and early summer when the water temperature reaches about 28°C.

Each mature female may produce up to 100 million eggs in a single spawning season and once hatched; the larvae

drift in the water column and feed on microscopic algae until they settle amongst dead coral rubble on a reef downstream from where they were spawned.

About six months after the larvae settle, their diet changes from algae to the coral itself.

Crown-of-thorns starfish can live for 12 to 14 years and reproduce after three years.

However, when an outbreak occurs their life span is often much shorter as they die of starvation after just a few years.

According to a late 1990s study, an adult crown-of-thorns starfish can consume up to 6 square metres of living coral reef per year.

What can be done to minimise crown-of-thorns starfish populations?

Jon Brodie, Senior Principal Research Officer at James Cook University said in his article 'Great Barrier Reef dying beneath its crown-of-thorns' (published

by *The Conversation*, April 2012), that three major outbreaks of crown-of-thorns starfish occurred in the GBR during the past 50 years – 1962-1976; 1978-1991 and 1993-2005; and it is now accepted that we are at the beginning of the next wave which appears to have started off in Cairns in 2009.

He said each wave started near Cairns and spread through larval dispersion up and down the GBR generally as far as Princess Charlotte Bay in the north and Mackay in the south.

He noted the large scale outbreaks seen on the GBR since 1962 are most likely to have been caused by nutrient enrichment associated with increased discharge of nitrogen and phosphorus from the land, due to increased soil erosion and large-scale fertiliser use.

Increased nutrients drive phytoplankton blooms with increased biomass and also a shift to larger phytoplankton types more palatable to crown-of-thorn-starfish larvae as food.

In additional comments in February 2013 he also noted that the primary source of the increased nutrients described above were from fertiliser use in sugarcane and banana cultivation in the Burdekin and Wet Tropics regions as well as soil erosion in grazing lands.

Mr Brodie said if the current wave moves in a similar way we can expect starfish populations to progress throughout the central GBR over the next 10 years or so.



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Dr Hugh Sweatman, AIMS



CANEGROWERS Senior Manager – Environment, Matt Kealley, noted in his 'EnviroNotes' column (published in *Australian Canegrower*, 30 April 2012) that in relation to sugarcane production, the cause of crown-of-thorns starfish

outbreaks has been linked to nutrients and runoff containing nitrogen and phosphorus from soil erosion and fertiliser use.

He said one research theory was that increased nutrients cause phytoplankton

blooms which support larger phytoplankton types that are more palatable to crown-of-thorns starfish larvae as food.

A secondary cause is thought to be the removal of predators to crown-of-thorns starfish larvae such as fish.

However, the cause of the outbreaks of crown-of-thorns starfish has not been altogether proven, and studies such as those conducted as part of the NERP program will help to uncover the exact causes and mitigation procedures. ■