

## Predator/Prey Relationships

### *The pattern of Crown-of-Thorn starfish outbreaks and hard coral in the Great Barrier Reef*

The Crown-of-thorns starfish (COTS) is a highly specialized coral predator found on coral reefs throughout the Indo-Pacific. The Reef Monitoring team has collected data on COTS numbers and hard coral cover on the Great Barrier Reef annually since 1984.

Historically two series of outbreaks (1966-74, 79-91) were responsible for wide spread coral mortality on the central Great Barrier Reef (GBR). The GBR is currently experiencing a third series (from 1994 on). Here we summarize some published information on the relationship between COTS and the coral that they prey upon.



#### Adult starfish distribution

On the Great Barrier Reef there are two characteristic patterns of COTS distribution. Between latitude 14 and 20 degrees, above Cooktown, starfish numbers wax and wane in a wave from north to south. A wave of outbreaks was in the middle of a southward movement when monitoring began in the early 1980s. A new wave starts in the north around 1994 and is currently centered off Townsville. The second pattern is the separate and continuous series of outbreaks on the southern Swain reefs off the coast of Mackay. Some of these reefs currently

have high numbers of starfish. The southward sequence of outbreaks is probably driven by the East Australian Current (EAC). Starfish larvae are pelagic so are transported by the

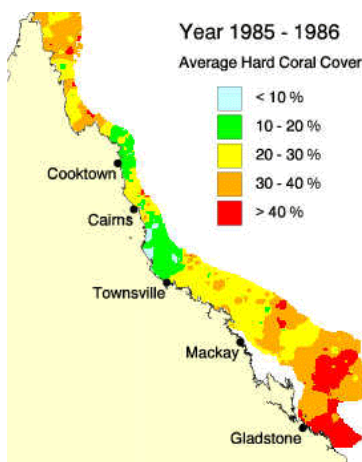
movement of water. The waves of outbreaks seem to originate around latitude 14°S above Cooktown, a region where current reversals periodically occur. Between 15 and 20°S, between Cooktown and Bowen, the EAC moves consistently from north to south, presumably transporting larvae from reef to reef to cause the southerly movement of outbreaks. The large tidal currents around 20°S, Bowen, may disrupt the southward dispersal of larvae.

#### The effect of COTS predations of coral on a large spatial scale

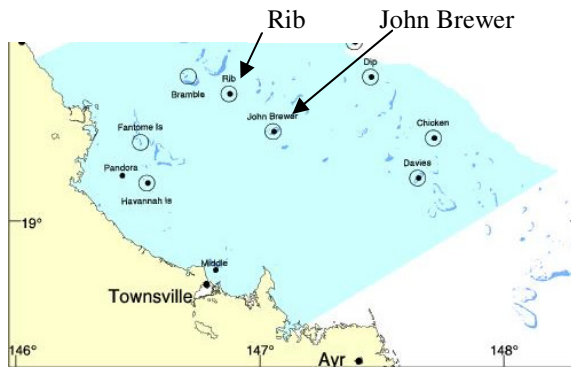
Starfish are described as 'outbreking' when a population on a reef reaches the level where coral is being consumed faster than it can grow. Surveys since 1984 have found that the average coral cover on reefs with a COTS outbreak declines at a rate of about 6% per year to reach a low of about 9%. For comparison, coral cover on reefs with no history of COTS outbreaks ranged from 16 to 40%. Coral cover has not increased on 25% of reefs that have suffered COTS outbreaks. Increases in hard coral after COTS outbreaks on the remaining 75% of reefs were significantly greater than on reefs with no outbreak history. Estimates of median recovery times for these reefs (representing an increase of 30% coral cover above post-outbreak levels) ranged from 10-25 years.

#### One example of the relationship between predation and community composition on the GBR

Of the 48 reefs between latitude 14 and 19 degrees that have a history of outbreaks, 27 (56%) have experienced an outbreak in the current series. Rib Reef and John Brewer reef are two such reefs. AIMS has surveyed sites on the NE face of these reefs annually since 1992, so we can examine the composition of the coral community.

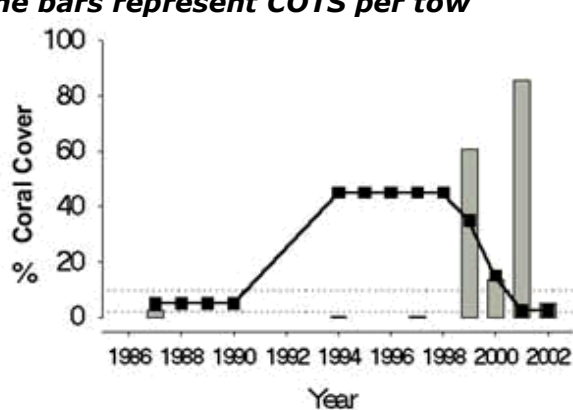


In these two examples where the time between outbreaks is short, predation was focused on one variety of hard coral (*Tabulate Acropora*).

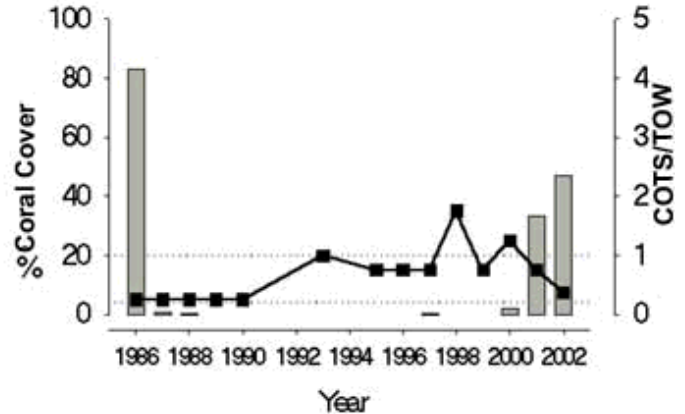


Other coral types were both less abundant and experience proportionally less change over time. Studies of the feeding preferences of COTS have shown that *Acropora* is highly favored. The least favored coral type was the genus *Porites*.

**The bars represent COTS per tow**



**Table 1:** Historical cover of coral and COTS density at John Brewer Reef.



**Table 2:** Historical cover of coral and COTS density at Rib Reef.

**Questions:**

1. What is the predator and prey in this interaction?
2. How many outbreaks have taken place on the reef since 1984?
3. What is an outbreak?
4. What seems to be the cause of the outbreak?
5. Compare the reef with a COTS outbreak to a reef with no outbreak? What is the percent coral coverage in both cases?
6. What percent of the Great Barrier Reef has not recovered?
7. Which type of reef has been more successful at recovering?
8. How much of the hard coral must recover for a successful recovery? On average, how long does that take?
9. Does COTS eat more than one species? Explain.
10. How long did it take for the coral at Brewer Reef to recover? At Rib Reef?
11. Explain the predator and prey relationship between the coral and COTS. Use data from the graphs to explain.
12. Which Reef seems to recover faster from the outbreak? Why?
13. Why is there a spike in coral at Rib Reef?