

Control of crown-of-thorns starfish is protecting coral on the Great Barrier Reef

Outbreaks of coral-eating crown-of-thorns starfish (COTS) are responsible for substantial losses of live coral cover on the Great Barrier Reef. They are also one of the few threats to the Reef that is amenable to direct intervention. Thanks to innovations made possible by adoption of an Integrated Pest Management approach¹ to the COTS control program, manual control by trained dive teams is effective and is demonstrably protecting live coral cover on the Reef during the current outbreak.

CSIRO's recent analyses of data from the control program (**Figure 1**) show that repeated control efforts at reef sites demonstrably protects and improves live coral cover. The more sustained the effort at a site, the more significant this protective effect becomes over time. This statistical significance of this effect is especially noteworthy given the considerable coral mortality that occurred on many reefs in the region in 2016 and 2017 following mass bleaching events.

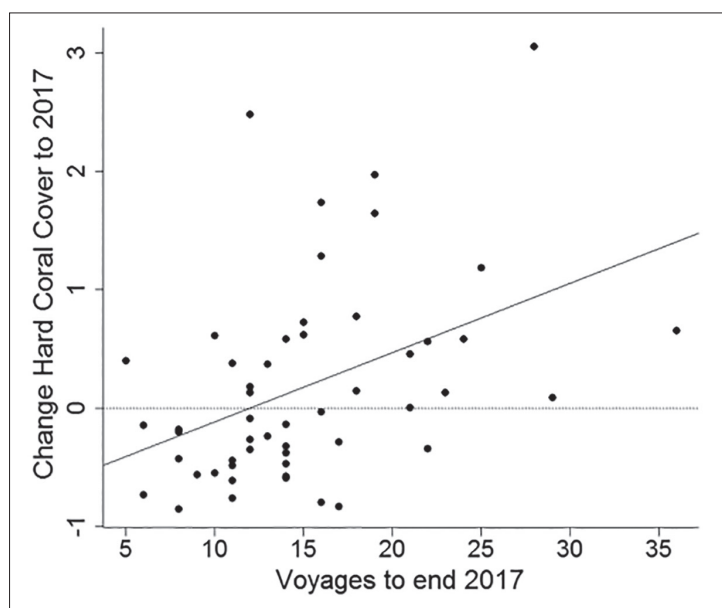


Figure 1: The relationship between the intensity of control effort at a site (number of voyages visiting that site) and the change in hard coral cover (2013-2017). Sites where more effort was invested tended to show smaller declines or increases in hard coral cover ($R^2 = 0.19$, $F_{1,50} = 11.99$, $p < 0.0012$). The dotted horizontal line represents no change, with sites above the line showing increased cover and sites below a decrease.

Integrated Pest Management (IPM) is a well-established approach to pest management on land, but the application of its principles to COTS is a world first. This approach aims to deliver the most efficient and effective control of the pest – and live coral saved – for the resources available, and enables control programs to evolve in efficiency and effectiveness over time as knowledge gaps are filled and tools are developed. Researchers from CSIRO, AIMS, JCU and UQ are already actively investigating improvements and new approaches including new technologies and strategies for surveillance and control. Many of these strategies have already been taken up by the control program and GBRMPA is ensuring all new COTS control vessels use the IPM approach/recommendations. For example, manual control using the new single shot control technology, enables targeting of the largest COTS first: these individuals are the ones that eat the most coral per day and make the biggest reproductive contribution.

¹ Funded through the Australian Government's NESP Tropical Water Quality Hub (NESP TWQ)

COTS CONTROL PROGRAM

Can we stop the current outbreak? No, but the data show we can defend ecologically and economically important sites, and possibly entire reefs.

Can we reduce the impact of the current outbreak? Yes, we can protect coral cover at ecologically important sites. Further research to guide and optimise control effort is currently underway and offers the hope that ecologically meaningful moderation of the impact of the current outbreak will be possible.

Can we stop future outbreaks through improved water quality? This would be ideal, however the substantial pollution reductions that would be required to prevent outbreaks occurring are yet to be achieved, and despite significant investment no change in Reef water quality has been measured. As part of the Integrated Pest Management approach we are investigating various Early Warning and Response strategies that could enable an effective manual control response to an incipient outbreak.

Manual control of COTS is currently the ONLY action we can take that demonstrably defends and improves live coral cover on the Great Barrier Reef. Sustained investment in manual control is essential. With continuous improvement in control methods and strategies we can have a direct and immediate positive impact on live coral on the GBR.

Reef resilience action	Demonstrated stabilisation/ improvement in live coral cover as a result of action to date	Relative investment (\$) to date
Water quality	None, but with linkage to reef resilience and coral recovery	Very high
GBRMP Zoning & Compliance	Some	High
COTS control	Yes - directly	Medium ²

The COTS control program also includes one of the most successful youth employment program ever delivered through the Queensland Government's Skilling Queenslanders for Work program, with 85% of 230 young trainees (to date) now in full time employment, most in marine and tourism industries. Over 50% of the trainees are Indigenous, so this program is not only helping to improve coral cover through COTS control, but is changing lives in far north Queensland Indigenous communities.

For more information about COTS, IPM and the control program on the GBR:

www.rrrc.org.au/COTS

Presentations at the GBR Restoration Symposium

NESP TWQ IPM research project: Integrated Pest Management of crown-of-thorns starfish

NESP TWQ IPM research project: crown-of-thorns starfish: surveillance and life history

NESP TWQ IPM research project: Implementation of the crown-of-thorns research strategy: regional strategies

NESP TWQ IPM research project: Establishing the future NESP COTS research framework including an ecologically-based approach to the management of COTS at multiple scales

Hide and seek: Tracking COTS with e-DNA technology

² Approximately \$100 million has been invested by Australian Government in COTS management and research since 2014 – including \$58 million to the GBR Foundation in 2017-2018

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