

Communication to the Provincial Government of Southern Leyte on the density of Crown-of-Thorns Seastar (*Acanthaster planci*) in Napantao Marine Protected Area, Southern Leyte, Philippines

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Introduction

Crown-of-thorns Seastars (COTS) are a highly successful predator of Scleractinian corals, preferentially predating on faster-growing *Acropora* spp. and *Montipora* spp. (Pratchett et al. 2014). Whilst a natural component of a complex coral reef ecosystem in low population densities, anthropogenic activities may cause an increase in COTS abundance. Increased nutrients in the water column from agricultural runoff and the removal of natural predators increases COTS survival rates. This, in turn, increases the risk of population growth rates which can reach outbreak levels (e.g. Chesher 1969).

The high feeding rates of COTS and the potential for large aggregations in outbreaks often results in widespread reef damage through the death of entire coral colonies, leading to devastating ecological impacts to reef systems on both short- and long-term timescales (Fabricius 2013). Throughout literature, what constitutes to an outbreak is varied due to the variability between local ecosystems, however, outbreak densities are generally agreed to be greater than 25-30 COTS ha⁻¹. This range is due to varying reef conditions and environmental drivers such as live Scleractinian coral cover, reef health and resilience (e.g. Pratchett et al. 2014). An outbreak can also be assumed utilizing a threshold of time with >1 COTS individual

recorded per 20min time increment whilst SCUBA diving (GBRMPA 2017).

A preliminary assessment of the abundance of COTS was conducted by Coral Cay Conservation (CCC) in February 2020 to trial a new survey methodology that would enable the monitoring of COTS populations within the coastal waters of Barangay Napantao and elsewhere within Sogod Bay.

Materials and Methods

A rapid snorkel assessment was conducted inside the Napantao Marine Protected Area (MPA) by four trained surveyors on the 8th February 2020. Surveyors arranged themselves in a line perpendicular to the shore, leaving a gap of ~4m between surveyors. A surface marker buoy (SMB) was attached to a rock and connected to a 50m transect. The 50m transect was subsequently passed to another installed SMB designating the survey area. Surveyors maintained an even and steady pace throughout the survey period.

Following a compass bearing of approximately 180°, parallel to the shore, surveyor teams surveyed whilst reeling out the 50m transect. Each surveyor monitored for evidence of COTS such as new and old feeding scars, ensuring the inspection of crevices and shaded parts of the reef due to the diurnal cryptic behavior of COTS.

(COTS feeding in diurnal aggregation is a potential indicator of an outbreak as their behavior prompts nocturnal feeding habits). Each surveyor searched a 2.5m width of reef, staying parallel to each other and the shore, ensuring there was minimal overlap. Each surveyor covered an area of $2.5\text{m} \times 50\text{m} = 250\text{m}^2$, equating to a total benthic area of 500m^2 per buddy pair. Survey depth ranged from 2 – 5m depth.

Surveyors recorded the diameter (cm), abundance (N), behavior (cryptic or diurnal feeding), depth (m), presence of COTS feeding scars, and percentage (%) cover of live, dead and soft coral.

Pre-survey training was conducted through SCUBA diving to equip surveyors with the necessary skills to highlight behavioural evidence, locate and record COTS. These dives were undertaken at 10-12m where data were recorded.

Results

A total of 19 COTS feeding scars (4.75 ± 1.11 250m^2^{-1}) (Table 1), and an accumulative abundance of 6 COTS in a 1000m^2 area of reef.

Of the 6 recorded COTS, 4 were categorised as sub-adult (15-25cm), with 1 adult ($>25\text{cm}$) and 1 juvenile (6-15cm). All individuals were recorded between 1.5 – 3m depth (Table 2). Individual COTS were predominantly recorded in large areas of branching *Acropora* spp. colonies (Fig. 1).

The number of COTS recorded during the snorkel equated to a density of 120 COTS ha^{-1} , surpassing the 0.25 COTS 100m^2^{-1} threshold; quadruple the population density considered to define an outbreak ($>30\text{ha}^{-1}$).

At depths of 10-12m, an aggregation of >10 COTS, ranging in size, but predominantly juveniles, were recorded. Considering the total dive time as 60 minutes, the density recorded equated to >3 COTS min^{-1} . One indication of a COTS outbreak is recording >1 individual(s) every 20 minutes, adding

to the evidence of an outbreak in Napantao.

To conclude an outbreak within the Napantao MPA, the criteria were used providing a maximum score of 5 (Table 3), in addition to the observation of multiple thresholds. Following the assessment of criteria, Napantao MPA scored 5/5.

Table 1. Number of COTS feeding scars recorded during rapid snorkel assessments conducted by CCC survey teams.

Surveyor	Area surveyed (m^2)	Number of COTS feeding scars
1	250	7
2	250	4
3	250	2
4	250	6

Table 2. Depth (m), Size Class (J = Juvenile, S = Sub-adult, A = Adult), recorded group size and behavior of COTS recorded within the Napantao Marine Protected Area (MPA)

COTS	Depth (m)	Size Class	Size of Group	Behaviour
1	1.5	S	1	Open
2	1.5	S	2	Cryptic
3	1.5	S	2	Cryptic
4	2	S	1	Open
5	2	A	1	Cryptic
6	3	J	1	Cryptic

Table 3. COTS outbreak criteria developed to assess the focus area based on observed variables by survey teams. If the focus conforms to a criterion, a score of '1' is awarded. The maximum score is 5.

Criteria	Result
Density of $>30/\text{ha}$ (actual number) found during snorkel assessment?	1
Multiple feeding scars seen?	1
Different sizes of COTS, including juvenile, sub-adult and adult? (This indicates breeding on the reef and is a sign that the population can increase rapidly)	1
Diurnal feeding behaviour displayed?	1
COTS observed in groups of 2 - 3?	1
Total criteria score (max 5)	5



Figure 1. COTS (*Acanthaster planci*) displaying cryptic behaviour whilst nestled in the base of branching *Acropora* sp. coral colony in the Napantao Marine Protected Area (MPA) (Thomas Heckl)

Conclusion

The results from the rapid snorkel assessment and dedicated SCUBA assessment suggest that COTS densities within the Napantao MPA have surpassed outbreak levels, coupled with the maximum score for outbreak criteria, therefore justifying the active removal of individuals in an effort to protect coral colonies, reef structure and function. The removal actions will aim to reduce COTS numbers to optimal levels for overall reef health.

N.b. At the time of publication, March 2020, due to the ongoing global COVID-19 pandemic, and in accordance with local advice, no SCUBA diving is being undertaken. As a result, COTS cannot be removed from the reef until SCUBA diving resumes.

References

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