**Editor's Comments**

MINOR REVISIONS

I have now heard back from two reviewers who were both positive about your report. However, both have recommended some helpful minor changes and have some questions for you, and therefore my decision is 'minor revision'. I look forward to seeing a revised version.

*Many thanks for your rapid handling of our paper.*

**Reviewer 1 (Anonymous)**

Basic reporting

The article “Joint estimation of crown of thorns (Acanthaster plancii) densities on the Great Barrier Reef” describes basic but very significant issue: detectability of COTS in the field using traditional mark and capture methods and clarify which factors are affecting on the detectability of COTS in Great Barrier Reef. It is true that despite the fact that detectability of animal in the ocean is expected to be lower than on land, there are few studies facing this issue seriously. The conclusion that larger COTS are easier to find is not an unexpected result but still worthwhile accurately testing in the field.

The manuscript is well written and organized. I think it worth publishing after minor revisions.

In the title misspelling Acanthaster plancii ⇒ Acanthaster planci

*Now corrected in the title*

Experimental design

Tagging COTS is sometimes difficult because they easily remove tags within a few days. Please write in more detail as to how authors tag COTS (which material was used for penetrating the body) and how long do authors expect the tag would last in the field.

*We were aware of the tag-shedding issue and designed our study to use standard clothing taggers (plastic t-tags) over a single sampling day at each transect. This has been clarified in the text.*

It seems the survey was carried out within a month (May 2014). Are there any COTS with possibly removed the tags even with more than two tags per COTS?

*The risk of double tag loss was assumed to be approximately zero over a single sampling day. This has now been clarified in the text.*

Please mention the average interval (how many days) of each mark-capture survey.

*As above, the single-day sampling has now been clarified on line 117 in the text.*

Although the meanings are simple, equations are not easy to follow readers are not easy to find the meaning of each symbol.

*We have combed through the text and added additional verbiage where possible to each symbol when reported.*

Validity of the findings

Well analyzed and the results are very interesting and valuable as written in the manuscript.

Comments for the Author

I think this kind of basic work is very crucial for accurately understanding ecology.

Although the result of this work is basically applicable for GBR, I hope similar study will be done in the near future in different reefs in order to accurately estimate the number of COTS in the field.

*We very much appreciate the Reviewers considerate comments and hope to see the work extended to other locations.*

Unfortunately, I could not understand the meaning of Fig 1d. Is it possible to explain more detail?

*We have re-written the figure caption to read: "reef schematic showing partitioning of reef (r) perimeter into manta-tow sections (s), delineated by radiating straight lines"*

**Reviewer 2 (Mohsen Kayal)**

Basic reporting

The manuscript is well written and clear. There are a few points that need clarification before the manuscript is published (see comments to authors below).

Experimental design

No Comments

Validity of the findings

No Comments

Comments for the Author

The term “pest” as used to refer to COTS would benefit a clear definition, given that COTS are native to reefs in many regions and their populations naturally show cyclic variations. It is not clear whether the pest designation comes from the oscillating demography of this species, or to a possible increase in frequency of outbreaks related to human activities, or to the destructive predation impacts to coral populations when outbreaks occur.

*We now define CoTS as a pest "due to their destructive impacts on coral populations when outbreaks occur"*

Similarly, the term “true density” needs to be defined and probably be written within brackets. In particular, as small COTS individuals were neither observed (all COTS had central disks >15cm) nor searched for (highly cryptic behavior of juvenile COTS), the authors might want to refer to “known or reference adult density based on the more thorough search method used" rather than “true density”.

*We have specified the size range on line 94 and changed 'true density' to read 'model-calibrated density' throughout.*

The authors have tested the effects of different factors on detectability of COTS. For example coral cover, time of the day, observation team, presence of tags, etc. (l. 141-143). Surprisingly habitat complexity was not measured as a covariate, although mentioned as one of the main factors influencing COTS detectability (l.136-140). I guess this is due to logistic limitations given that measuring habitat complexity would have asked for additional sampling efforts that were not part of the survey. Yet, the authors still need to mention the potential importance of habitat complexity in discussion (2nd paragraph), as it remains probably the main determinant of COTS detectability after individual size.

*We have added "* *habitat complexity (which we did not measure) may have also affected detectability" to the 2nd paragraph of the discussion (line 286).*

Overall, although coral cover and habitat complexity are often related, it seems logical that coral cover would mostly influence presence of COTS within a reef area (given targeted movement of COTS toward live coral, eg see Kayal et al. 2012 in PLoS ONE), while habitat complexity would be most influential on COTS detectability (given lower sight of observer and cryptic behavior of COTS).

*We have also added "however complexity levels were subjectively considered to be similar among transects" to the text.*

Besides, weather conditions (visibility, light, swell, etc.) are also expected to affect COTS detectability, but there is no information about how far apart were the repeated observations performed. Thus it is unclear if such factors could have differed between observations and potentially affected the results of the study.

*We have added "Surveys were conducted on days with similar sea-state conditions, at depths where sea state was assumed not to have affected detectability" to the text.*

SPECIFIC COMMENTS

l. 79: the term “AUD” can be defined or spelled out.

*We have changed this to read "Australian dollars" in the text.*

l. 98-99: are the reef identification codes necessary? If yes, please state what they correspond to.

*The reef identification codes are unique identifiers for reefs within the Great Barrier Reef World Heritage Area; we have included them for precision about which reefs we are referring to. This has been added to the text.*

l.103-104: “initial surveys of the reef surface at between seven to nine meters”, precise “depth” if this is what it is about.

*'Depth' has been added to the text.*

l.109 is missing a space after the coma.

*Corrected.*

l. 110-111: “Each transect was re-surveyed K=6 times during both day (60% of observations) and night”, how far apart in time were these repeated surveys performed? Is it within a few hours or over several days? This is important information given that probability of observing the same individuals is expected to decrease over time.

*As outlined for Reviewer 1 above, this has now been clarified in the text.*

l.175: add “are” before “difficult to estimate”.

*Corrected.*

l. 205-206: “probability of a CoTS outbreak - defined as three or more CoTS or feeding scars per manta-tow (Doherty et al. 2015)”, I am surprised that feeding scars are accounted for for as much as detection of individual COTS in these observations. Shouldn’t we expect several feeding scars per COTS? Field observations often suggest so, of course depending on coral availability and habitat patchiness. For example, from Kayal et al. 2012 (PLOS ONE): “an average ratio of 8.6 ±1.7 SE feeding-scars per seastar was calculated over the process of the outbreak”.

*This is a widespread (if ad hoc) convention used in Australia for policy and management and is therefore a condition of the data used.*

Besides, the cited paper by Doherty et al. is missing in the Reference list of the manuscript.

*This reference has now been added to the Reference List.*

l.214: remind the reader what the “B” parameter refers to.

*We have added "CPUE scaling parameter (B)" to the text.*

Figure 1c: the parameters yi and zi need to be defined to make this figure self explanatory.

*We have now defined these parameters in the figure.*

Figure 2b: it seems that the dots represent the probability of COTS detection over the 6 sampling events. Yet, there is not information on this in the legend. Similarly, a color code seems to be used to distinguish the 2 reefs. Additionally, the legend refers to “dotted lines” which I do not see on the plot (only the dashed lines are shown).

*These items have now been corrected in the figure legend; the only ambiguous colors used are defined in panel d.*

Figure 3c: Does the diagonal line represent the 1-1 x-y ratio? Please define in legend.

*The diagonal line has been defined as a 1:1 line in the figure legend.*