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Interactive comment on “The 2011 marine heat wave off southwest Australia” by T. H. Rose et al.

T. H. Rose et al.

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Interactive comment on “The 2011 marine heat wave off southwest Australia” by T. H. Rose et al.

Response to Referees

Anonymous Referee #1 Received and published: 6 June 2012

Main points: The reviewer correctly notes that we present little information on biological responses to the heat wave in Cockburn Sound. This is primarily due to the fact that historically there has been insufficient monitoring of sensitive ecological communities in the Sound, so that untangling natural variability in populations (of seagrass or coral, for example) from the effect of the extreme event was not feasible. In recent years, however, ecological monitoring effort has intensified, so that biological responses to

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gradual warming and discrete events may be examined in the future. As such, the only ecological information available stemmed from anecdotal reports which, while useful, did not provide a rigorous assessment of biological responses. The authors hope that the study, which is based almost entirely on physical data, will highlight an important knowledge gap in the study region and promote further ecological research and monitoring.

Minor points: Title: 'Cockburn Sound' has been added to the title, as suggested.

Abstract: A short sentence relating to the lack of biological response data has been added to the abstract, as suggested.

Introduction: The comment "A recent analysis showed that, in the last 30 yr, the number of days of anomalously high seawater temperatures has increased along 38% of the world's coastlines" is taken from a recent study by Lima and Wethey (Nature Communications 3, 704). This citation has been added to the revised paper.

Page 1692 line 3: The reviewer requests further information on the abundance of ectotherms in the study system. We have added to the information in the 'study area' section of the methods, which now includes targeted and non-target invertebrate and fish species (all of which are ectothermic).

Study area As suggested by the reviewer, additional information on habitat types and fishing activities has been added to the study area section.

P1694 line 4. The statement "contributes >\$ 20 billion to the Australian economy each year" has been referenced with the State Government report by Botting et al. And additional information on industry has been added to the methods section.

P1694 line 6 : "West" has been changed to lower case, as suggested.

P1694 line 12. As the reviewer suggests, there is perhaps no such thing as a typical multiple use embayment and this sentence has been reworked and 'typical' replaced with 'complex'. Furthermore, we have reworked the 'ecological threats' sentence to be

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more specific, as suggested.

Results and Discussion The reviewer makes an excellent point and it would be useful to include some measure of cumulative stress. We have calculated Thermal Stress Anomalies (as per Selig et al 2010 Global Ecol Biogeogr) for each of the sites and incorporated the information into the plots. This analysis has further supported the notion that this was a very significant warming event, in that TSAs of up to 3.3°C and a maximum of 17 Degree Heating Weeks were recorded.

P1694 line 1 The term “general system wide trend” is a bit vague and has been removed, as suggested by the reviewer.

P1694 line 7: A discussion of cumulative thermal stress has been included, as suggested.

Anonymous Referee #2 Received and published: 12 June 2012

Main points: The reviewer acknowledges the importance of the study in that it provides much-needed information on discrete extreme events in marine ecosystems. However, as with reviewer #1, the perceived weakness of the paper relates to the lack of biological response data (see response to reviewer #1’s main point, above).

Minor comments 1. The appropriate citation (Lima and Wethey 2012) has been added.

2. The reviewer makes a valid point that ‘mitigating’ the ecological effects of extreme events at the scale of the study will be a challenge, and that perhaps adaptive management is the best case scenario. We agree and have exchanged ‘mitigate’ for ‘manage’ in the revised manuscript.

3. The Pearce et al 2011 citation has been added after the statement “the strongest La Nina events ever recorded”, as suggested.

4. The reviewer suggests that the section on sea-level at Fremantle and the strength of Leeuwin Current may need some additional explanation. In the interest of conciseness,

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we have referred the reader to some papers that describe this process in detail.

5. The maximum recorded anomalies were recorded within restricted locations; this information has been added to the text.

6. As suggested, we have removed the last sentence of the 'study area' paragraph, which is not relevant to the study.

7. A reference has been added to the end of the first paragraph on page 1696, as suggested.

8. As previously discussed, we had access to very limited biological data and cannot explicitly test the notion that biological activity intensified during the heat wave. However, we do think it is appropriate to at least attempt to explain the drivers of the low DO levels. Based on previous research, it seems plausible that increased stratification, perhaps in conjunction with increased biological activity (i.e. increased algal bloom followed by microbial activity), were the most likely drivers of the observation. We have reworked the sentence and added a reference to support this explanation.

Interactive comment on Ocean Sci. Discuss., 9, 1691, 2012.

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