

## ***Interactive comment on “An Orphan Problem Looking for Adoption: Responding to Ocean Acidification Utilising Existing International Institutions” by Ellycia R. Harrould-Kolieb***

**Anonymous Referee #1**

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### General comments

This paper considers the role of several international institutions (primarily UN bodies) in addressing the problem of ocean acidification. As previously recognised by this author and others, there is no single institution with clear ‘ownership’ of developing policy responses; the different roles of different bodies are discussed, together with their limitations. The setting-out of such information is of interest, but is not that novel – and some important international policy responses are not covered. The discussion of relevant policy developments in CBD and the London Convention/London Protocol is not up to date. The limitations of the UNFCCC and the Paris Agreement (in not guarantee-

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ing that OA will not worsen; an unrealistic expectation) seem to be over-emphasised in relation to the major improvements that they could achieve in comparison to business-as-usual.

Specific comments 1. There would seem three major omissions. Thus there is no mention of: i) UN Sustainable Development Goal 14, and its target 14.3 that requires SDG Parties to “Minimize and address the impacts of ocean acidification, including through enhanced scientific cooperation at all levels”; ii) the role of the Intergovernmental Panel on Climate Change in assessing our scientific understanding of ocean acidification, in particular by WGII in the IPCC 5th Assessment Report, and thereby providing information to UNFCCC and other bodies; and iii) the development of internationally-coordinated ocean acidification monitoring, through the Global Ocean Acidification Observing Network (with several sponsors), in order to develop better understanding of processes, impacts and the potential effectiveness of local mitigation and adaptation measures. All those actions would see important ‘policy responses’ to ocean acidification.

2. The conclusions of the paper include the statements that “substantive action (rule-making or implementation) to prevent worsening ocean acidification and to respond to impacts has largely not occurred” and that “carbon dioxide reduction efforts within the UNFCCC have been found not to be strong enough to guarantee prevention of ocean acidification in the future”. The first of those conclusion is questionable, and the second seems politically and environmentally naïve. The only way to ‘guarantee’ that future ocean acidification will be ‘prevented’ would be to near-instantly cease all anthropogenic CO<sub>2</sub> emissions. The UNFCCC Paris Agreement may not have been specifically designed to combat ocean acidification; nevertheless it arguably represents an extremely ambitious global commitment that, if fully implemented, will reduce future acidification as much as is likely to be socio-economically feasible.

3. There is undoubtedly need to increase the ambition of national contributions to the Paris Agreement, and the issue of ocean acidification is clearly relevant in that context.

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There would also seem opportunities for closer working between the UNFCCC and other bodies with regard to ocean acidification. Whilst the desirability of such actions is recognised, it would seem somewhat dismissive to consider them as a 'piecemeal approach'.

4. This reviewer appreciates the rationale for distinguishing policies that explicitly respond to ocean acidification and those that only do so indirectly. Nevertheless there does seem to be overlap, and some repetition, as a result of the paper's structuring. In particular, consideration could be given to combining the information in Tables 2, 3 and 4 (noting that Tables 3 and 4 are currently labelled as Tables 1 and 2 in the Discussion version of the MS). A more comprehensive table (although with somewhat different information) of policy responses to ocean acidification is given as Table 2.1 in CBD Technical Series 75 (Secretariat of the Convention on Biological Diversity, 2014); that table could usefully be updated.

5. The topic of 'Geoengineering' within the paper does not seem to be well addressed. It is initially defined very broadly as "Those policies aimed at manipulating oceanic or atmospheric properties to address ocean acidification, whether they be mitigation, restoration or other type policies". But doesn't that include almost everything? Which particular 'manipulations' are included or excluded? In later text, "the sequestration of CO<sub>2</sub> in sub-seabed geological formations" is included; however, that is not widely considered as geoengineering, unless active removal of CO<sub>2</sub> from the atmosphere is also involved.

6. The main title of the paper "An orphan problem looking for adoption" is successful in terms of attracting attention; however, the validity of the analogy is questionable. Thus an 'orphan' has lost his/her parents (in what way is that true for ocean acidification?), and the paper would seem to conclude that the 'adoption' by just one body is probably not the best way forward. The secondary title "Responding to ocean acidification utilising existing international structures" is more prosaic, yet also more accurate.

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#### Technical comments

Line 79: "reducing acidity using additives other than iron". Wording seems clumsy; "adding alkalinity" would be simpler

Lines 82-83: "Non-CO<sub>2</sub> mitigation policies": it is not clear whether this is intended to cover measures to reduce emissions of other greenhouse gases (methane, nitrous oxide etc)

Line 93, Table 1: "Interventions for Preventing Worsening OA". It is not clear how the policy domains of adaptation and protection, restoration and reparation 'prevent worsening', since the cause of OA is not addressed.

Line 105: 'negative effects that are already occurring' could also cite i) effects on oyster aquaculture (Barton et al reference given at the end of the para) and ii) the experimental coral growth studies by Allbright et al (2016) Nature 531, 362-365 (doi 10.1038/nature17155)

Line 123: UN Sustainable Development Goals (adopted in September 2015) are surely relevant here, with involvement of UNGA and (for SDG 14) IOC/UNESCO

Lines 141 – 166. This discussion mixes OSPAR's concerns about ocean acidification with CO<sub>2</sub> sequestration. The latter is not usually considered to be geoengineering.

Lines 158-159: "carbon dioxide sequestration and storage, which had effectively been banned until this point". Is that correct? Which body had been responsible for such banning?

Lines 175-218: A very detailed account is given of CBD policy discussions on ocean acidification in the period 2008-2012, but nothing since. The CBD's 2014 report on ocean acidification and subsequent COP decisions warrants coverage.

Line 253: change "preventing" to "limiting" (emission reductions can only slow further OA, they won't prevent it. To do that, negative emissions are required)

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Line 260: Citation(s) needed to justify the statement that “At 1.5 deg C risk from acidification is likely to be on the verge of high risk”. How is ‘high risk’ defined?

Line 263-264: “It is difficult to conclude that the Paris Agreement, unless implemented in its most stringent form, is strong enough to prevent a worsening of acidification into the future”. That statement is technically correct - in that further worsening of acidification (compared to present day conditions) is inevitable. But it is also misleading: the Paris Agreement will, if implemented, greatly reduce the rate of worsening (RCP 2.6 of RCP 8.5; Gattuso et al, 2015).

Line 267-2268: The focus on MARPOL seems misplaced – if, as stated, it is responsible for only 2.2% of global emissions. Thus CO2 emissions from industry, agriculture, land-use change, aviation and land transport (i.e. the other 97.8%!) are much more important.

Line 269: What has been the effect of the MARPOL (and IMO) measures to increase fuel efficiency in shipping? My understanding is that it has been trivial (less than 1%)

Line 279: Additional references desirable to justify statements on importance of S and N deposition from ships causing local acidification. This effect has been questioned by Hunter et al. (2011) "Impacts of anthropogenic SOx, NOx and NH3 on acidification of coastal waters and shipping lanes." *Geophysical Research Letters* 38

Lines 281-29: The discussion on ocean fertilization policy discussions by the LC&P and the CBD is not up to date. For update, see Williamson & Bodle (2016) *CBD Technical Series* 84.

Line 305: What is considered to a ‘hotspot’ for ocean acidification? Isn’t that where protection or other measures might be needed most?

Line 336-7: “leniencies built into the agreement mean that this is not guaranteed”. Is it realistic to expect guarantees? The global commitment to keep the temperature increase “well below 2C” is generally considered to be very ambitious, rather than

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lenient. It is possible that it may not be fully implemented; nevertheless, it is extremely unlikely (= impossible?) that international agreement could have been reached on anything more demanding.

Lines 520-532: the first seven references do not seem to be in alphabetical order.

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