EGUsphere, referee comment RC2
https://doi.org/10.5194/egusphere-2022-907-RC2, 2022
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Comment on egusphere-2022-907

Anonymous Referee #2

Referee comment on "Unifying biological field observations to detect and compare ocean acidification impacts across marine species and ecosystems: what to monitor and why" by Steve Widdicombe et al., EGUsphere, https://doi.org/10.5194/egusphere-2022-907-RC2, 2022

General comments

It is timely that indicators are defined that help to attribute biological change to OA. This manuscript shows how experimental studies can inform monitoring strategies. The authors claim that there is a linear relationship between the rates of chemical and biological change. They claim that this concept could bring together a variety of indicators from different sites to attribute change to OA.

While the identified indicators can develop the EOV/EBV framework further, I find the correlation/linear regression of chemical and biological rates of change questionable.

Linear regressions, correlations and the comparison of dose-response curves (e.g. Fig. 4A) are not innovative methods. What is new is that they are applied in the context of OA to calculate monitoring durations in the field. There are a number of dose-response concepts in (eco)toxicology that can be instrumental to understanding and modelling OA effects (see e.g. species sensitivity distribution in Wittmann & Pörtner 2013). It would help the reader in understanding that using linear regression is a valid method to compare curves in Fig. 4A, if the authors would refer them to the respective literature in (eco)toxicology.

The model seems to be based on a single example, abnormality of Mytilus edulis. It is questionable that there is a linear relationship between chemical and biological change in all species and in all indicators. I suggest to use the large amount of laboratory results (OA-ICC at the database PANGAEA pangaea.de) and a variety of indicators to develop a more robust model.

The conclusion that insensitive systems require longer monitoring is trivial from the viewpoint of an experimental biologist as this must be considered when planning experiments and when interpreting results. While clearly illustrated in this manuscript, I doubt that this is new information to researchers involved in monitoring programs.

An innovative approach would allow to consider processes such as transgenerational effects of OA (see e.g. Parker et al. 2015) and multiple drivers of biological change. I suggest to include a figure that at least conceptually depicts how dose-response curves may be affected.

Specific comments

- L 63-66: This sentence suggests that there are few field (monitoring?) studies on OA effects outside areas of unusually high CO2 levels. If this is so, I suggest to cite them and briefly summarize the state of the art here or in the following paragraph. This would give the reader a brief overview of what could be intensified/improved in the future. Otherwise, consider rephrasing this sentence and the sentence in l 462-464 of the conclusions. Also good to know here: Are there any monitoring data that allow the analysis of biological OA effects, and this just has not been done yet?
- L 75 ff Introduction: More explicitly name and address EOVs, EBVs, MBON here and in the conclusions. Clearly point out and explain the contribution of ecophysiology/experimental studies to improving the EOV, EBV framework with respect to OA here and in the conclusions (e.g. Hayes et al. 2015, Kissling et al. 2018, Pereira et al. 2013). I.e. what are the gaps this paper fills?
- L 132: Replace "or" with "and". Physiological data are important to attribute impacts to any environmental driver. Ecological data alone do not allow this. And vice versa.
- L 137 ff: State how these ecosystem traits and indicators relate to EOVs and EBVs (see references above).
- L 139 ff: In reality, it most likely "will depend on questions or concerns of the investigator". However, in monitoring, the choice of indicators should be consistent across sites and not depend on "questions or concerns of the investigator" locally. Otherwise, comparison is hampered. Investigators across sites should at least try to agree on common indicators and monitoring strategies. Consider including this point in line 339 ff, section 4, and the conclusions.
- L 144-146: Provide reference.
- L 250-251: Insert citation Wittman & Pörtner 2013.
- L 410: Why was linear regression used? Drawn from toxicological concepts? If so, please cite respective literature.
- L 411-412: Please provide evidence that supports this general statement.
- L 785: Figure 4: Add pH scales to the x-axis to clarify that these are dose-response curves.

Technical corrections

- L 51: Delete “process”.
- L 63-66: Long sentence, consider revising.
- L 66: Provide full citation for OA-ICC.
- L 73: Sentence “Biological observations…”: Replace “it” with “they”.
- L 141: Add “should be” in front of “associated”.
- L193: Delete “might”.
- L 326: Insert “GenBank and the European Nucleotide Archive (ENA)” after “(NCBI)”.
- L 337: Replace “environmentally” with “environmental”; add “as” after “such”.
- L 340: Delete comma.

References

Hayes et al. 2015 Identifying indicators and essential variables for marine ecosystems https://doi.org/10.1016/j.ecolind.2015.05.006

Kissling, W.D., Walls, R., Bowser, A. *et al.* Towards global data products of Essential Biodiversity Variables on species traits. *Nat Ecol Evol* **2**, 1531–1540 (2018). https://doi.org/10.1038/s41559-018-0667-3

Parker LM, O'Connor WA, Raftos DA, Pörtner HO, Ross PM. Persistence of Positive Carryover Effects in the Oyster, Saccostrea glomerata, following Transgenerational Exposure to Ocean Acidification. PLoS One. 2015 Jul 6;10(7):e0132276. doi: 10.1371/journal.pone.0132276.

Pereira et al. 2013 Essential Biodiversity Variables **-** A global system of harmonized observations is needed to inform scientists and policy-makers DOI: 10.1126/science.1229931