

# ***Interactive comment on “Ideas and Perspectives: When ocean acidification experiments are not the same, reproducibility is not tested” by Phillip Williamson et al.***

## **Anonymous Referee #1**

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### General Comments:

The manuscript from Williamson et al. provides an important contribution to the discussion on the criteria that should be used in replication versus reproducibility studies, and the implications for each, using the recent discussion regarding the implications of ocean acidification on the behaviour of coral reef fishes as an example to tease apart this issue. I think that adding in a table or figure on this topic to help authors in the future to ensure that they meet these criteria in their studies would be helpful. Although I believe the authors' arguments are interesting and valuable, I think that the authors should consider editing the article in its entirety to prevent using subjective language

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throughout. I think that this topic is important and the audience as a whole will be more receptive if the authors' suggested ideas are laid out objectively and without subjective criticism of the published work on both sides.

Specific comments:

Lines 17-19: Is this the authors' argument? That the replication study was "confrontational"? It seems rather subjective and less constructive than the remainder of the abstract. Rather, it would be useful to provide an assessment of how to interpret and take further actions to understand the discrepancy when they arise from different experimental conditions here to close out the abstract. Below, you provide some really interesting suggestions for criteria for categorizing replication vs reproducibility studies, and I think a sentence along those lines would be more useful here.

Line 22: Add in an "i.e." in front of "increased"

Line 26: Change "very well understood" to "high studied"

Line 35: Past studies have frequently used conspecific chemical alarm cues as the stimulus in these flume studies, and thus this stimulus should also be noted in the parentheses (such as in Welch et al. 2014 and Heuer et al. 2016).

Line 35: I would recommend adding some examples of references here that have used this methodology so that interested readers can further read studies that have employed this methodology.

Line 37: Again, provide some references here for examples when this methodology has been employed.

Line 39: For the purpose of the appearance of objectivity, I recommend removing the phrase "an unambiguously titled" and replacing it with the phrase "the paper titled". It allows the reader to draw their own conclusions about the Clark et al. 2020a paper's title from the argument that you present below.

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Line 41: Replace "they" with "the authors"

Line 43: Add in the year following Clark et al. (Clark et al. 2020a)

Line 43.45: I recommend re-writing this statement in order to summarize the assertions in Clark et al. 2020a objectively. I recommend the following edit: "Since Clark et al. 2020 claim to have attempted to replicate the results obtained from earlier work without success, they imply that the earlier work was either unreliable, flawed, or fraudulent (Clark et al. 2017)."

Line 48: I recommend adding "substantial" here ("...attracted substantial media...")

Line 48: I again recommend adding the year here ("... the apparent thoroughness of the approach described in Clark et al. (2020a)...")

Line 50: Please be clear about WHO identified these potential weaknesses. Also, as detailed in the reply by Munday et al. 2020a Nature, there were actually many more criticisms than three, so you should be clear that there were SEVERAL criticisms, and that you are highlighting three in particular.

Line 63: I recommend editing to include the phrase "but not limited to" (as in, "...included (but not limited to) the following...")

Line 89: I recommend editing to say "...avoid creating confusion..." instead of "...avoid contributing to the confusion...". The recent Clark et al. 2020a paper created some confusion about the generality of CO<sub>2</sub>-induced effects on behaviour rather than contributing to existing confusion.

Line 90-91: I suggest editing this sentence to say: "First, it is important that replication studies examine key components of the original hypotheses, such as the life-stage dependence of the response to altered CO<sub>2</sub> conditions."

Line 91-93: Your point in this sentence is not entirely clear. I believe you are trying to say that all available evidence must be considered when evaluating potential contro-

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versies. Is that right? If so, please re-word so that aim is clear.

Line 94: For non-experts on this topic, provide some context for how studies of sensory physiology link to the studies on behaviour, which are the focus here.

Line 94: I believe that you mean Table 1 in Munday et al. 2020a, not supplementary table 1. Is that correct? If so, please correct this in the text.

Line 95-96: For the sake of readability, I recommend using parentheses instead of commas around the phrase summarizing the researchers, institutions, and countries involved.

Line 107: Add in a period after et al.

Line 107-109: I recommend rewriting this sentence to the following: "Given the plethora of independent evidence, ocean acidification likely does have adverse impacts on fish behaviour. However, the resilience of fishes to altered CO<sub>2</sub> is likely to vary depending on the species and circumstances under investigation."

Line 112: Add in a comma between ecosystems and which

Line 113: Change good to strong

Line 114: Rewrite this sentence as follows: "Our increasing appreciation for the complex relationship between ocean acidification and the ocean's biochemical, physiological, behavioural and ecological interactions are both scientifically exciting and sobering..."

Line 116-119: These two sentences are somewhat difficult to understand. Can you re-write to improve their clarity and brevity? I believe that your point here is that the complexity of the relationship between ocean acidification and natural processes is to be expected given the variability that these species would have experienced throughout their evolutionary history. If so, just say that.

Line 130: The terms over-simplistic and unscientific are perhaps not the most con-

structive adjectives to use here. Consider changing this sentence to something like the following: "Given this known variability, the results from any one ocean acidification study will therefore be unable to overshadow all of the other previous findings from that area of research."

Line 131-132: I am not entirely clear what you are trying to assert with this sentence. My initial reading of this paragraph is that this sentence can be deleted in its entirety, to instead focus on how practices in the field can be improved generally, through more widespread publication of replication studies and negative results, which are notoriously difficult to publish and often end up in low impact journals, causing researchers not to prioritize dissemination of their important results.

Line 135-139: I am not entirely clear what you are suggesting here as an alternative approach. You suggest that the published back and forth between Clark et al. and Munday et al. is ineffective, but do not clearly layout an alternative framework for these sorts of controversies. What do you mean specifically by a "more nuanced, non-confrontational framework"? These specifics would be useful for taking constructive steps in the future.

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