Comment on bg-2021-213

Anonymous Referee #2

Referee comment on "Calcification response of reef corals to seasonal upwelling in the northern Arabian Sea (Masirah Island, Oman)" by Philipp M. Spreter et al., Biogeosciences Discuss., https://doi.org/10.5194/bg-2021-213-RC2, 2021

The manuscript "Nutrients attenuate the negative effect of ocean acidification on reef coral calcification in the Arabian Sea upwelling zone (Masirah Island, Oman)" by Spreter et al. assessed coral calcification parameters from three coral colonies obtained from an upwelling zone off the coast of Oman. The authors performed several geochemical analyses on the cores and compared these, along with calcification, extension, and density, with satellite-derived SSTs for the approximate sites of these corals. While the geochemical and coral core analysis methods appear to be sound, there are some major concerns (outlined below) that need to be address regarding the framing of the results and implications. While the manuscript will need work, I think the paper can be reframed from more of a geochemical perspective to highlight the existing data in a way that does not overstate the calcification/growth results from 3 coral colonies.

Concerns:

- Overall, an n of 3 is fairly small to make these growth assumptions with. I recognize that geochemical analyses are expensive and time consuming so it is understandable that these have a small n, however, growth is highly variable across locations and genotypes and thus would require a higher n to make stronger predictions/estimates.
- Coral growth is reliant on a lot of different biological processes that are largely ignored throughout this text. While calcifying fluid is discussed, the authors never actually make these measurements. Further, the authors ignore how much variability in coral growth there is within a genus or even a species and over-estimate the reliance of growth on SST. The authors should consider what other factors can impact the variability across their cores and work to put it more in the context of the biology of corals. Along these same lines, coral cores collected from the Pacific may not experience similar environmental conditions and may likely have different populations/species of *Porites* corals, thus comparison of the corals from this study with Pacific corals should be made with caution.
- While the satellite SST matched very well with *in situ* SST measurements, the other

satellite phosphate and nitrate parameters were not similarly grounded in truth. Further, the lower resolution for these satellite products is concerning since nutrient values can be highly variable across a spatial gradient. Finally, because of the discussion of ocean acidification is a major component of this manuscript, it also may be valuable for the authors to also include carbonate parameters for the area (i.e., omega-aragonite, TA, pH, etc.)

- Some minor edits are also suggested below.

Abstract

Lines 14-15: This statement is a bit of an overstatement. Calcification responses to changing environments is very well studied. If this is intended to be in terms of a specific type of environmental variation, then that needs to be clarified.

Line 21: add comma after 'e.g.'

Line 25: add comma after 'e.g.'

Introduction

Line 29: Consider replacing 'zooxanthellate' with symbiotic

Lines 36-37: This statement should be backed with the literature. Coral calcification is not highly debated; however, responses are highly variable. I recommend referencing several papers covering this here.

Lines 50-52: This statement seems misplaced and should be incorporated better within the introduction. Additionally, recent reviews suggest different calcification responses in corals under global change (see Cornwall et al 2021, Global declines in coral reef calcium carbonate production under ocean acidification and warming, *PNAS*)

Line 54: savage disposal? Do you mean sewage?

Lines 54-55: This is an incomplete statement

Lines 55-56: Again, I suggest updating your language here to reflect more recent terminology of coral algal symbionts (see LaJeunesse et al. 2018, Systematic Revision of Symbiodiniaceae Highlights the Antiquity and Diversity of Coral Endosymbionts, *Current Biology*).

Lines 66-68: These sentences could be a bit stronger to introduce this important topic in your introduction

 Lines 70-72: This statement would benefit from a clear connection of how calcification responses from upwelling locations can be applied to systems without upwelling

Lines 84-125: This section should be moved into the methods as a section describing the sites. A condensed version of this could be included in the previous paragraph to describe the sites if that is desired.

Methods

Lines 128-134: It sounds like these colonies were not collected *in situ*, rather collected as dead skeletons from the beach. What about differences in local conditions? If these corals were washed up on shore you don't really know what depth or location they came from? Also what years? How do you know when they washed up on the beach?

Lines 216-219: Unclear what these numbers and acronyms represent. Please rephrase in a clearer way.

Note on the standard corals: How do we know that the other corals are effective standards for comparison? Who is to say that they were not influenced by SST or OA? Or other factors?

Results

Lines 248-249: Do these n refer to the number of transects for the measures?

Discussion

A lot of the current discussion is results. These should be moved to the results section and then the discussion can include more incorporation of implications/meaning of these results.

Lines 285-288: But don't you expect biological variability?

Line 324: add comma after 'e.g.'

Lines 367-369: Split into two different sentences for easier reading

Lines 414-433: This section is lacking incorporation of the current literature and needs some more grounding in terms of what is known and previous work.

Figures

Figure 1: This is a really helpful figure to demonstrate this reef system, collection site, and the currents/upwelling, however, this figure could be made a bit clearer with a few updates as suggested here. There is a lot going on with colours so I recommend making your land either white or grey to make the focus of the map more on the reef locations. I also recommend selecting a different colour to represent the coral reef provinces with

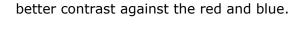better contrast against the red and blue.

Figure 2/3: Please define NEM, SIM, SWM, and AIM in your figure captions.

Figure 3: please include what years were assessed in to calculate these monthly values

Figure 5: again, please include the years assessed in the monthly values

Data accessibility/open science note: I highly recommend you post all your code for reproducing your analyses and figures somewhere like GitHub to support open science practices.