Dear Dr. Van der Meer,

Thank you for your report. We have made your suggested structural edits of moving delta notation and our model equation into the methods section. We have also made the suggested wording changes to the title and in lines 74-75.

There was content in the revised manuscript (that is unchanged in the version resubmitted here) which currently speaks to many of the concerns you mentioned in your most recent report and in the reviewer comments:

> (1) "That geochemist need to be aware of trophic level changes, yes, maybe, but how do they check this? And are these relatively small changes not just "noise" for paleo reconstructions?"
>
> *Response:* Starting in Line 683 we say: "Consideration of the possible dependence of coral-bound δ15N on food web dynamics informs the questions that can be competently addressed by this proxy. Although we do not have direct estimates of the δ15N range that can be expected from local food web variability, the scatter around the global compilation of Wang et al. (2014) for coral-bound δ15N of *D. dianthus* relative to the δ15N of PON suggests that this range is modest, on the order of ~1-2 ‰. Given this range, we suggest that the coral-bound δ15N proxy will be most useful for reconstructing larger environmental δ15N signals and where chosen coral samples belong to the same species and are collected at comparable depths as has already been successfully demonstrated by Wang et al. (2017), Studer et al. (2018) and Chen et al. (2023)."
>
> In other words, we say that geochemists need to be aware of trophic level changes. We do not suggest that there is a way to 'check' for this but instead say that geochemists need to ask the right question if they want to apply this proxy. We say that they should try to reconstruct large environmental d15N signals to avoid "noise" that might be introduced by the food web effects. This text speaks directly to your concern.
>
> (2) "Their mentioning of this feast and famine life style, for instance, I assume the more these organisms can eat during the famine part of their existents the better they do. So, if they can eat almost anything, including dissolved organic matter or the end products of efficient resource recycling (line 565) together with the long turnover times, this recycling will have an effect on the N isotopes in CWC paleo archive. Of course, the authors mention that they assume the organic matter should be fresh, but as reviewer two mentions sponges and their microbial symbionts could turn recalcitrant DOM into "fresh" organic matter again, leaving their imprint on the isotopic composition on top of the recycling etc."
>
> *Response:* You also ask us not to overinterpret our data. Since we do not have data on DON, we want to refrain from speculating about the questions you posed. However, we have added a sentence at line 566 that repeats some of our earlier discussion on the d15N of DON: "While we cannot speculate about the flux of DON to corals living at >1000m depth, the d15N of deep DON

has a uniform value of ~5 permil, which cannot explain the high d15N of CWCs (see Sigman and Fripiat, 2019)."

(3) "The experiments and environmental data here are from solitaire organisms living on a rocky coastline far from the sediment surface, the paleo records will be generated from cold water coral reefs on the seafloor….I totally get that these processes do not play a role in this environmental setting, but, again, these are not the typical settings for paleo archives."

Response: We want to note that we've amended the methods section to show how this species (*B. elegans)* has been used as a paleo archive. We did not make this clear in our first submission but in the most recently submitted draft we included amended text to show that *B. elegans* is a valuable paleoarchive. Therefore it is important to the paleo community to understand both shallow and deep settings. Indeed, this is why we've stated "The relationship between CWC species represented in fossil archives to the depth structure of their zooplankton prey warrants further investigation." In other words, we need to understand how d15N relates to depth structure in the ocean a bit more clearly. This is the subject of an ongoing study among scientists in this co-author list.

We made the required structural changes (e.g. moving equations to our methods) and have addressed your comments in the points above. We are excited to share this work with the community.

Happy New Year,
Anne Gothmann on behalf of Mottram et al.