

Dear Editor,

Thank you for giving us the opportunity to revise and resubmit our manuscript entitled, Linking marine benthic biodiversity and ecosystem functions related to carbon cycling in a continental mud depocenter.

We sincerely appreciate the constructive comments and suggestions provided by the Editor and the Reviewers. We have carefully addressed all points, revised the text accordingly, and updated the terminology throughout the manuscript to ensure consistency and clarity.

Below, we provide a point-by-point response detailing how each comment has been addressed in the revised manuscript.

Sincerely,

Chueh-Chen Tung

On behalf of all co-authors

Dear authors,

The reviewer is satisfied with the substantial revisions you applied to the manuscript. I have a number of minor comments that would need to be addressed before I can accept the manuscript:

- The introduction misses focus. The title of the manuscript deals with biodiversity - ecosystem functioning, but the introduction is in parts restricted to relationships with species richness alone, while in the remainder of the manuscript you do present several indices of structural and functional biodiversity. Therefore, I suggest to broaden the introduction to relationships with structural aspects of biodiversity (amongst other species richness, but also others), as well as functional aspects of biodiversity. Please also check the logical flow in the text.
- Statistical analysis: please clarify in which instances you present an analysis based on biomass data, and where you present an analysis on abundance data.

Response: Thanks for your thoughtful and critical comments. Please, see below how we dealt with the specific comments and recommendations.

Comment 1: L42 The current global decline in biodiversity and species abundance IS expected (not 'are').

Response 1: Thank you for pointing out this grammatical error. The revised sentence now in line 37 reads: "The current global decline in biodiversity and species abundances (Dirzo et al., 2014) is expected to cause a loss of essential ecosystem processes and functions (Oliver et al., 2015)."

Comment 2: L44 related to species richness: this is too narrow. I think you mean biodiversity, which can then also encompass structural and functional biodiversity. So replace species diversity by biodiversity.

Response 2: Thank you for this constructive suggestion. We agree that "biodiversity" is a more appropriate and comprehensive term that encompasses both structural and functional aspects. We have updated the sentence accordingly to broaden the scope. The revised

sentence now in line 38 reads: “Therefore, understanding how ecosystem functioning is linked to biodiversity is crucial for explaining ongoing ecological changes and for the development of sound strategies for management and adaptation.”

Comment 3: L47 relationships between biodiversity and ecosystem functioning in marine realm: this field has been studied for the last 20y already, so replace 'now' by last 2 decades.

Response 3: Thank you for correcting this timeline. The revised sentence now in line 41 reads: “Over the last two decades, hypotheses regarding biodiversity–ecosystem function (BEF) relationships have been increasingly addressed in marine ecosystems.”

Comment 4: L50 species richness -> biodiversity ? It is unclear why you focus on species diversity alone.

Response 4: Thank you for highlighting this point. We agree that focusing solely on species richness is overly restrictive. The revised sentence now in line 45 reads: “The link between productivity, biomass, and biodiversity is often debated.”

Comment 5: Figure 1 indicate Helgoland on map

Response 5: Thank you for the suggestion. We have added the label for "Helgoland" to Figure 1 in the revised manuscript.

Comment 6: L174 biomass measurements: including shells?

Response 6: Yes, the total wet weight measurements included the shells and exoskeletons of the organisms.

To ensure that the mass contributed by inorganic structures did not skew our results, we converted the wet weight to ash-free dry mass (AFDM) and finally to energy (J) using taxon-specific conversion factors from Brey et al. (2010), which yield tissue weight. We have clarified this procedure in the revised manuscript (line 154): “For each taxon, the total wet weight (including shells) was measured with a precision of 0.001 g.” Additionally, in line 181, it reads: “Macrofauna biomass (in g wet weight) was first converted into energy units (Joules, J) using taxon-specific conversion factors provided by Brey et al. (2010).” Finally, in line 242, it reads: “Macrofauna biomass (wet weight) was converted to ash-free dry mass

(AFDM) to accurately depict metabolically active tissue, using taxon-specific conversion factors provided by Brey et al. (2010).”

Comment 7: L201 this reads as if you measured sediment temperature upon sampling, but this is not mentioned in section 2.1. Please clarify.

Response 7: Thank you for pointing out this ambiguity. We have clarified this sentence in the revised text. The revised sentence now in line 159 reads: “The bottom-water temperature was taken as the sediment temperature measured in each sample.”

Comment 8: L264 mentions biomass data; L265-266 describes abundant data. Do you mean high biomass taxa instead of abundant taxa? Or do you have both a biomass and an abundance dataset - this needs to be clarified, since L268-269 mentions abundance-based clustering and the next sentence mentions community biomass again.

Response 8: Thank you for pointing this out. We apologize for the confusion caused by imprecise terminology. To clarify, we analyzed a single dataset based entirely on biomass (ash-free dry mass, AFDM); we did not perform cluster analysis on an abundance (individual count) dataset. The terms "abundant taxa" and "abundance-based clustering" in the original draft were typographical oversights. We intended to refer to "high-biomass taxa" and "biomass-based clustering," respectively. We have revised the manuscript to ensure consistent terminology.

The revised sentence now in line 243 reads: “The resulting data were fourth-root transformed to reduce the dominance of high-biomass taxa and emphasize the contribution of low-biomass taxa.”

And in line 246 reads: “To evaluate whether the structural differences captured by our biomass-based clustering led to variations in total community biomass, we conducted a one-way Analysis of Variance (ANOVA) with 'Cluster group' as a four-level categorical factor.”

Comment 9: L276 community dissimilarity based on abundance or biomass?

Response 9: Thank you for seeking clarification. The dissimilarity matrix was calculated solely using the transformed biomass (AFDM) data. We have explicitly specified this in the

revised sentence. It now in line 250 reads: “A distance-based redundancy analysis (dbRDA) was performed to identify the environmental variables that best explained biomass-based community dissimilarity.”

Comment 10: L281 'overlapping' grain size metrics -> correlated grain size metrics?

Response 10: Thank you for asking clarification on this wording. By "overlapping grain size metrics," we meant that sediment grain-size proportions are compositional data that inherently sum to 100% (e.g., sand %, silt %, clay %, and mud %). To remove this ambiguity, we have rephrased this sentence in the revised manuscript in line 255 as follows: “First, compositional grain-size variables (e.g., proportions of sand, silt, and clay that sum to 100%) were excluded to avoid inherent compositional dependency and collinearity.”

Comment 11: L305 A total ... was identified.

Response 11: Thank you for the correction. We have revised the sentence grammar accordingly. The revised sentence now in line 278 reads: “A total of 171 taxa, belonging to 9 phyla, 14 classes, 31 orders, and 89 families was identified from 31,086 individuals.”

Comment 12: L319 add space after 9.7

Response 12: Thank you for the correction. The missing space has been inserted in the revised draft.

Comment 13: Table 1 pocket (not pocked)

Response 13: Thank you for the correction. It has been corrected to "pocket" in Table 1.