

## Abstract

Comment:

- it would really improve by adding the gap in knowledge. I would suggest something like:

Seagrasses can act as carbon sinks, by buffering low pH values during the day and storing carbon in the sediment underneath their meadows. However, available data is scattered and collected using different methodologies making its interpretation and generalization very challenging.

Reply:

We have added a slightly modified version of the suggested sentence as: “Seagrasses can act as carbon sinks; buffer lowering pH values during the day and storing carbon in the sediment underneath their meadows. However, available data documenting these processes is scattered and collected using different methodologies, which makes its interpretation and generalization very challenging.”

## Introduction

Comments:

Separate paragraphs in L40, L50, L61

Reply: We have introduced separations at the line numbers of the original document (now L41, L52, L64)

L100 – missing closing bracket “(”

L101 – Add comma after increasing

L111 – sometimes oxygen appears as “O<sub>2</sub>” and other as “oxygen”. Keep consistency when possible.

Reply: L100 (now L105), we have deleted the opening bracket in L103 to improve readability of the sentence. We added the comma after increasing in L105 (before L101). We have changed all mention of the formula (O<sub>2</sub>) to “oxygen” in the text unless specific values with units (i.e. mmol O<sub>2</sub> day<sup>-1</sup>) are mentioned.

## Methods

Comments:

L127 – L129 I suggest the following change in order to increase clarity of the statement:

We compiled data from multiparametric sensors, which was collected during different periods ranging from 2011 to 2019 (for details see Table 1), and data using the benthic chambers methodology, which had a higher number of literature studies with a total of 12 publications for *P. oceanica* and/or *C. nodosa* meadows (for details see Table 2), and a wider temporal cover with studies carried out from 1982 to 2019.

Reply: we have changes the sentence as suggested, now L134-137 in the revised document.

Table 1

- caption: change text to: Characteristics of sampling stations with data for multiparametric sensors. Temperature and salinity represent average values during the deployment.

Reply: changed as suggested.

Table 2

- caption: change text to: Characteristics of sampling stations with data for benthic chamber deployments. Temperature and salinity represent average values during the deployment.

Reply: changed as suggested.

- Add NA to missing values. A lot of sites do not have depth info, is it possible to add this? If exact depth is unknown, is it possible to add a range? For instance, Barron et al. 2004 is (<2 m) and Barron et al. 2006 is 7m. Does all metabolic data have depth data associated? This is especially relevant as depth is then analyzed as a fixed effect.

Reply: We agree with the reviewer that depth is crucial information. We have gone back to each individual article and extracted the information about depth that somehow had got lost during compilation and processing of the database. We have used discrete values, i.e. for Barron et al. 2004 we have used 2m depth, even though the article states <2m, as this allows for the use of depth as a continuous variable in a regression analysis. We have re-done the statistic model using all data available for depth, therefore some changes in reported statistical values have occurred but nothing changing the results.

L131-132 move sentence "Data available as oxygen concentration over time was processed and analysed to obtain the metabolic parameters, when this was not available, we used the reported metabolic rates."

Reply: we have moved this sentence to data analysis and integrated it there combining with a similar sentence containing the same information (L210-214).

L136 remove comma after study

L144 include deployed after were

L147 change Posidonia by *P.oceanica*

Reply: revised the text as suggested

L178-L187 I suggest the following change in order to increase clarity in the text:

We compare metabolic data obtained between both methodologies, benthic chambers and multiparametric sensors. For benthic chambers, reported metabolic data in NCP, GPP and CR were extracted from literature as well as accompanying biotic parameters. In these articles metabolic data was generally estimated from changes in dissolved oxygen using the Winkler titration spectrophotometric method (Labasque et al., 2004). Benthic chambers enclose a section of the seagrass meadow, and flexible fitted plastic bags, not permeable for gases, assure the possibility of movement of the seagrass shoots inside, see details in the method section of each paper for the exact construction used. The benthic chamber methodology has been more generally used to assess metabolism of seagrass meadows and the database of this study contains a total of 100 NCP estimations. For multiparametric sensors data, we have calculated metabolism from raw oxygen

profiles where possible (including for published and new data described in 2.1), and only used directly reported values for the data obtained from Champenois et al., 2012 and 2019.

Reply: We thank the reviewer for the suggestion, which we have largely followed. The text now reads: "We compare metabolic data obtained by both methods, benthic chambers and multiparametric sensors. For benthic chambers, reported metabolic data as well as accompanying biotic parameters were extracted from the literature. In these articles Net Community Production (NCP) and Respiration (R) was generally estimated from changes in dissolved oxygen using the Winkler titration spectrophotometric method (Labasque et al., 2004). Benthic chambers enclose a section of the seagrass meadow, and flexible fitted plastic bags, not permeable for gases, assure the possibility of movement of the shoots inside, see details in the method section of each paper for the exact construction used. The benthic chamber methodology has been more generally used to assess metabolism of seagrass meadows and the database of this study contains a total of 100 NCP estimations. For multiparametric sensor data, data available as oxygen concentration over time was processed and analysed to obtain the metabolic parameters (see section 2.3.1), when this was not available, we used the reported metabolic rates. We compare the data obtained between both methodologies, with calculated metabolism from raw oxygen profiles obtained with the multiparametric sensors where possible, and only used directly reported productivity values for the sensor data obtained from Champenois et al., 2012 and 2019."

L196 add dot after cite.

L277-278 How where the abiotic parameters analyzed? Is a simple linear regression? Are there random factors considered? Add these details.

L279 A common technique for handling negative values is to add a constant value to the data prior to applying the log transform. The transformation is therefore  $\log(Y+a)$  where  $a$  is the constant.

L280 – did you check for normality/homoscedasticity in the residuals of the models?

Remove the part of methods related to pH. Unless I have missed it, pH is not used in any part of the manuscript.

Reply: L277-278: yes that is correct, we fitted individual regression models for the abiotic parameters with site as a random factor. We have added the model formula to the text for clarification.

L279: Yes, we have tried transforming NCP by adding 100 ( $\log(NCP+100)$ ) to avoid negative values. However, this did not give a better result compared to using non-transformed values, as data were not normally distributed either. As a normal distribution is not a strict requisite we checked the residuals of each model by plotting them and assured a normal distribution for all models, also non-transformed NCP.

We removed the methodology related to pH. We did not pursue pH as a factor in our analysis as this is too dependent on the measurement time. The mention of this parameter was a remnant of a previous version of the manuscript, we have now removed this.

## Results

Comments:

Table 1 – this is a great summary table. The word Annual needs correction. I also would suggest removing this row from the table or add annual values for all the cases where data for the four seasons is available. I would suggest including in the caption or in the table that the sensors can provide data for the 2 species together.

Reply: We have replaced the word “annual”, we have not removed it from the table as some studies do not distinguish between seasons and just give a yearly average. We had included both species within the same limitation (between the same lines) in Table 1 with sensor data to reflect the measurement site and specific habitat but have not included the observation that sensors do not pick-up the species specific signal in the legend as we included this information in the results.

L303 – L309 split in two sentences

Reply: We have split the sentence in three for clarity. The paragraph now reads: “Benthic chambers and multiparametric sensors yielded very different CR with  $41.2 \pm 4.55$  (SE)  $\text{mmol O}_2 \text{ m}^{-2} \text{ d}^{-1}$  for benthic chambers and  $229.9 \pm 25.57$   $\text{mmol O}_2 \text{ m}^{-2} \text{ d}^{-1}$  for sensors ( $t_{df=84.86}=9.57$ ,  $p<0.0001$ ) in a mixed model, with as only factor methodology and as random effect study. This difference with almost an order of magnitude is found for NCP as well with  $18.8 \pm 3.80$  and  $143.2 \pm 28.21$   $\text{mmol O}_2 \text{ m}^{-2} \text{ d}^{-1}$  for benthic chambers and sensors respectively ( $t_{df=25.61}=2.78$ ,  $p<0.001$ ) as well as for GPP ( $55.3 \pm 6.39$  and  $329.2 \pm 29.91$   $\text{mmol O}_2 \text{ m}^{-2} \text{ d}^{-1}$  for chambers and sensors;  $t_{df=101.05}=11.14$ ,  $p<0.0001$ ) (Fig. 2). Therefore we decided to analyse the metabolic rates estimated using benthic chambers and multiparametric sensors separately.”

L323 It is unclear if the following sentence “tested in a mixed model with “Site” \_as random factor, including depth, region and seasons” \_means that the model used 3 fixed effects (2 categorical and 1 continuous “depth”) in the form  $Y = \text{Species} + \text{region} + \text{season} + \text{depth} + (1|\text{site})$ . This could be described in the methods or by adding this info after seasons.

Reply: We have added the model formulation to the text to clarify what model was used.

L324 change didn’t to did not.

Reply: changed

Caption of Figure 5 – include that there were no differences

Reply: added

## Discussion

Comments:

L412 change was to were

L413 add an S to quarter

L422 remove comma before masking

L438 for some reason for is strikethrough.

L456 -458 any potential explanation for this result? It is really surprising.

L510 use independently

L516 -520 Could you add cites for the lack of historical marked sites and temperature effect in *C.nodosa*?

Reply: L412, L413, L422, L438 changed as suggested.

L456-458: We think differences and local adaptation to temperature between sites might have been bigger than a clear relationship of CR and temperature. We have added a sentence: “There is no data available for intermediate temperatures, leaving two clusters,

one between 13 and 16 °C and one between 23 and 27°C. The bulk of the data is collected between 23 and 27 °C, therefore dominating the regression while at lower temperatures a clear increase in CR is visible between 13 and 16 °C. Differences between sites for summer measurements might obscure a possible relationship of CR and temperature.”

### **Appendix and Supplementary**

I cannot access these materials so I cannot evaluate them. What is confusing to me is if there are two supplementary files (an appendix and a supplement) or just one. I ask this because sometimes figures are referred as Fig 5A and others Fig1S

Reply: there is only 1 supplementary file, we might have introduced confusing references to this file. We have tried to clarify the text and references, referring to Fig. XS now instead of Fig. XA. The full database on which the paper is based is available in a repository. We have now deposited the file and it should be shortly publicly accessible at <https://digital.csic.es/>. Due to problems with the online submission system of that repository it is submitted by email, and could take a few days to be online. We will include the handle in the final article.