

Biogeosciences Discuss., referee comment RC1  
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## Comment on bg-2020-449

Anonymous Referee #1

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Referee comment on "Abundances and morphotypes of the coccolithophore *Emiliana huxleyi* in southern Patagonia compared to neighbouring oceans and Northern Hemisphere fjords" by Francisco Díaz-Rosas et al., Biogeosciences Discuss., <https://doi.org/10.5194/bg-2020-449-RC1>, 2021

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### General comments:

In this manuscript, Díaz-Rosas et al. study the distribution of *Emiliana huxleyi* morphotypes in the Patagonian fjords and relate their distribution patterns to extensive oceanographic data. Most importantly, they aim to test whether the distribution of *E. huxleyi* morphotypes with different degrees of calcification relates to regional gradients in carbonate chemistry and calcite saturation state. In addition, the coccolithophore distribution is compared with the neighbouring coastal and oceanic areas and northern hemisphere fjords with similar hydrographic conditions. The results of this study contribute to the ongoing discussions on the fate of coccolithophores and pelagic calcification under the projected decrease in oceanic pH and calcite saturation state. The study will be of interest to a wide range of readers, from biological oceanographers to researchers focused on biology, biodiversity and ecology of coccolithophores.

The manuscript is very well-written and abounds with novel data presented in a well-structured and systematic way. The methods are described in-depth and are suitable for addressing the aims of the study. The results are appropriately presented, discussed in a balanced way, and the conclusions are in line with the presented data. I find this manuscript suitable for publication in *Biogeosciences*, following some minor revisions. Specific comments are written below.

### Specific comments:

- The authors should discuss the possible origin of morphological variability within *E. huxleyi* (especially within the morphotype A) in more detail as it has implications for the niche analysis and the overall conclusion of the manuscript. The heavily calcified "A-CC" and "R/hyper-calcified" morphotypes have been reported as stable under different environmental conditions (e.g. Von Dassow et al. 2018) and seem to be also genetically distinct (e.g. Hagino et al. 2011). On the other hand, the "light", "moderate", and "robust" morphotypes could also represent the continuum of phenotypic plasticity within the same genotype or population, though there is evidence that they are also genetically distinct (Young et al. 2014). If they are indeed the same genotype, the results of the niche analysis suggest that *E. huxleyi* morphotype A has a remarkably broad niche and is highly adaptable to changing carbonate chemistry or calcite saturation state while exhibiting different phenotypes under different environmental conditions. If each morphotype

represents a separate genotype or a population, then their individual niches are narrower (e.g. as seen for the "light" morphotype), and they are arguably less adaptable to environmental changes. In any case, the use of "light", "moderate", and "robust" morphotypes in this study is valid as it provides a detailed insight into the degree of calcification found under different environmental conditions. Finally, the overall conclusion on the high adaptability of *E. huxleyi* as a species holds regardless of the nature of its morphotypes.

- in Figures 4 and 6, it would be useful to have station names written above the plots a), b) and c) so that the readers can immediately see which stations the series of plots are referring to. Currently, this is not immediately clear, and the information is only found in the figure caption.

- Line 415-416: *"The low diversity of coccolithophores assemblages, dominated by E. huxleyi, is common to both the Patagonian and Norwegian fjord systems."*

The dominance of *E. huxleyi* and apparent low coccolithophore diversity may also represent a seasonal feature of both systems, as is the case in well-studied areas such as the Mediterranean Sea, where winter communities are dominated by *E. huxleyi*, while summer communities can have a larger proportion of other species. Detailed seasonal studies, including sampling along the vertical profiles, would likely reveal significant additional coccolithophore diversity in the Patagonian and Norwegian fjords.

- Line 111-113: *"iii) does the abundance and relative composition of E. huxleyi morphotypes reflect populations in adjacent Pacific, Atlantic, or Southern Ocean waters or instead exhibit similarities to the Norwegian fjord system, suggesting it is shaped by local factors?"*

The authors can consider leaving out the part: "suggesting it is shaped by local factors?" at this point while listing the aims of the manuscript. The explanations for the similar community composition in Norwegian fjords and the studied area can be addressed later in the discussion section.

- *Conclusion point 5 – "Niche analysis shows that the moderate A morphotype and A-CC morphotypes are generalists, whereas the R/hyper-calcified morphotype has a more marginal (specialized) realized niche."*

Can this observation indicate that the R/hyper-calcified morphotype is truly genetically distinct (as was shown earlier, e.g. by Hagino et al. 2011), while A-CC is a part of the same population as the "light", "moderate" and "robust" morphotypes (i.e. morphotype A)?

- The lightly calcified genotype (LC) should be addressed in the conclusions, as it shows a narrower niche than the other ("moderate" and "robust") type A-related morphotypes.

- It would be interesting to include the other *E. huxleyi* morphotypes (B, O and B/C) into the expanded niche analysis (Figure 7b) to show how their niches compare with the different type A morphotypes addressed in this study. Of course, if the data on their distribution and abundance is available in the expanded dataset when coastal/oceanic sites are included.

- *Line 509: "Our study of how E. huxleyi populations and morphotypes respond to the highly dynamic physical and chemical environments"*

The authors can omit the term "populations" here, as the populations in the genetic sense were not studied in this work.

- Line 451: "4.4 Comparison of *E. huxleyi* morphotypes in Patagonia to nearby oceans vs. Norwegian fjords"

Rephrase, e.g. "to nearby oceans and Norwegian fjords"

- Line 490: "...eastern South Pacific (Beaufort et al., 2011; Alvites, 2016; von Dassow et al., 2018), although it has been seen (and reported as rare)"

Should read "although it has been seen..."

- Line 502: "...a genetic underpinning of *E. huxleyi* morphotype (Krueger-Hadfield et al., 2014)..."

Should read "morphotypes"