

Earth Syst. Dynam. Discuss., referee comment RC1  
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### **Comment on esd-2021-33**

Donald Boesch (Referee)

Referee comment on "Baltic Earth Assessment Report on the biogeochemistry of the Baltic Sea" by Karol Kuliński et al., Earth Syst. Dynam. Discuss.,  
<https://doi.org/10.5194/esd-2021-33-RC1>, 2021

[Responses to Reviewer#1, Donald Boesch, \(in blue\)](#)

### **General Comments**

This is an excellent assessment on the current state of biogeochemistry of the Baltic Sea. It is comprehensive, thorough, up-to-date, and effectively synthetic. The assessment considers past, present and future biogeochemical dynamics and how they are affected by human activities and the changing climate. It will be a standard, stock-taking reference for future research and science applications in the Baltic Sea, but will also be of significant interest outside of the region because of the diversity of environmental conditions and biogeochemical processes in the Baltic.

[Thank you. We appreciate the thorough review and suggested changes.](#)

### **Specific Comments**

I have no substantive criticisms of the sections summarizing and synthesizing the current state of knowledge. They are uniformly thorough and sound. The section of knowledge gaps and future research could be sharpened if it is meant to be useful beyond a wish list of scientists. This section is replete with characterizations of poorly quantified and uncertain, poorly understood, poorly characterized, great knowledge gaps, hot topics, significant gaps, correct estimate, not understood, and not sufficiently clear. But, do these unknowns and uncertainties matter equally, either in achieving robust understanding or for practical utility in sustainable development in the face of climate change. Some level of prioritization as to the most critical knowledge gaps and research opportunities to narrow them would be helpful.

[We agree with this opinion. We will prioritize the knowledge gaps and research needs in the revised version.](#)

All scientists want more data and the next critical experiments and refined models, but what difference will these make. For example, it is not at all clear how better quantification of the nutrient loads and their geographical distribution and changes in the catchment can better quantify baseline conditions before 1970 (lines 1349-1353). Is a baseline even a relevant concept for characterizing good ecological status when, because of changing climatic and other conditions, it is no longer an achievable state?

[It is indeed true that we will not return to the past and we agree that the statement does not make proper sense in its current formulation. However, the past is de facto used to establish targets/thresholds on indicators of eutrophication, but most importantly, by validation of models for periods long enough to encompass the transition from oligotrophic to eutrophic is a prerequisite for gaining any confidence in projections into a less eutrophic future. We will alter the paragraph in the manuscript to reflect these aspects.](#)

### **Technical Corrections**

Perhaps give a more complete name for BONUS such as BONUS: Science for a Better Future of the Baltic Sea Region (line 49).

We will correct that.

It would be helpful, for context, to mention the other Grand Challenges that Baltic Earth is dealing with (line 60).

We will do that.

A reference is required here to support the statement about the decrease in nutrient loads and briefly some indication of the proportional amount of the decrease would be helpful. I realize this is discussed in more detail later, but the statement needs some support on first mention (lines 99-100).

We will add the reference Gustafsson et al., (2012)

Misplaced, open parenthesis (line 150).

We will correct that.

The RCPs are pathways greenhouse gas concentrations and their radiative forcing, not global warming, per se. (line 158) The authors should make clear that the CMIP5 projections are those used in the IPCC AR5. Updated projections will be included in AR6 that will be released this year.

We will clarify that.

Clarify the sentence: "The results generally show a greater variation among climate models . . . for projections until the mid-21<sup>st</sup> century, but greater variation among RCPs towards the end of this century". (lines 161-164)

We will rephrase that to show that the variation concerns projected temperature and precipitation changes.

Make clear that these projections are for air temperature. (lines 165-167)

We will correct this sentence to make it clear that the temperature projections concern air temperature.

Are the SSPs for climate derived from CMIP6 model ensembles? (lines 172-173)

In the IPCC methodology, SSPs are different from the RCPs, although there are clear links between which SSPs are consistent with which RCPs. The CMIP6 model ensembles do not directly specify SSPs, but align most of the simulation results to the relevant RCPs (and to some extent SSPs). The SSPs mentioned here were from adapted for the Baltic Sea Region from the overall concept of the SSPs, with consideration of which SSPs fit with relevant RCPs.

Doesn't all carbon enter the Baltic Sea in either inorganic or organic form? (line 221)

Yes. We will rephrase that sentence.

Is this TOC increase for the northern Baltic or an average for the entire Baltic? (line 228)

This refers to the northern Baltic only. We will clarify that.

The caption for Figure 2 should explain the color coding in the histograms. (lines 344-345).

We will add this information to the Fig. 2 caption.

Clarify what is meant by "71% (89%) of the phytoplankton nitrogen and phosphorus uptake." (line 520)

We will clarify that. In principle, we wanted to underline in this sentence the importance of dissolved organic matter in N and P cycling. The numbers refer to the shares of N and P pools used for primary production, which go through the dissolved organic matter pool first.

Misplaced, open parenthesis (line 728).

We will correct that.

Do mid-80<sup>th</sup> and late 90<sup>th</sup> refer to the mid 1980s and late 1990s, respectively? (lines 1052 and 1054)

Yes. We will correct that.

The three long sentences on lines 1059-1066 are confusing and should be more clearly stated.

We will rephrase this section.

Non-stoichiometric uptake may not be clear to the non-specialist reader. I suggest that this should be reworded more plainly. (line 1461)

We will rephrase that and explain the meaning of the non-stoichiometric uptake.