

Biogeosciences Discuss., referee comment RC2  
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## Comment on bg-2021-302

Anonymous Referee #2

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Referee comment on "Species richness and functional attributes of fish assemblages across a large-scale salinity gradient in shallow coastal areas" by Birgit Koehler et al., Biogeosciences Discuss., <https://doi.org/10.5194/bg-2021-302-RC2>, 2022

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The study by Koehler et al. aims to estimate fish species richness (SR) along the Swedish coast, which covers the full salinity gradient of the Baltic Sea, using extensive species records datasets and robust SR estimation methods. While the methods and results of this study are not especially novel, this study does fill a knowledge gap of estimating the standardized fish species richness across the entire Baltic Sea salinity gradient and is therefore interesting and valuable. The datasets and methods used seem adequate and robust.

I do not have major comments but several medium/minor comments that I would like the authors to consider:

- **Manuscript structure:** the manuscript was heavy to read due to many similar metrics (obs, std, estim), many tables and figures. It is not clear what are the benefits of using the 3 metrics (obs, std, estim.). Is there something you want to investigate by analyzing these 3? They seem very redundant, and indeed their relationship with salinity and temperature are very similar. Their differences & complementarity are not discussed much. I would suggest that you shift one of the metrics (std) in the supplementary material to improve the flow of the manuscript.
- **Tables and figures:** The number of tables and figures are numerous and not optimally designed. I add more comments below but especially consider transforming some tables to figures (e.g., table 1, 2). Focus the figures on the gradient in functional attributes by removing the map. Add results of "standardized" metrics in M&M. Study-area figure: would be great to add a map of the Baltic Sea and its salinity gradient (just like the map in fig 3) and localization in e.g., north-east Atlantic, and have the name of the regions, such as in table 1 indicated in the map. Maybe combined such a figure with table 1.
- **Rare species vs seasonal migrant's vs range-shifting species:** how do you distinguish between species living in the Baltic Sea and species visiting the Baltic Sea (e.g., seasonal migrants)? In the future, it is expected that new species (range-shifting, invasive) will enter the Baltic Sea, this will impact species richness/IC. IC should thus

then be seen only as a snapshot and might change through time? It could be useful to add couple of sentences in the text on which type of species are included here when calculating the IC (residents only, seasonal migrants, etc.), and, if this is the case, to precise that IC might change through time (seasonally, future).

- Offshore study: I suggest removing the offshore study as it is data poor, no/little overlapping between data sources, and not well integrated into the manuscript. It is also not clear how offshore is defined: depth or nautical mile distance to the coast, or both? I'm wondering why the BITS survey which covers a large area wasn't used in other sub-basins, not enough observations at shallow depths? At the moment, the inclusion of the offshore data is not well justified nor discussed in the manuscript.
- Discussion on other drivers. The authors focus on salinity and temperature These two are indeed structuring the biological communities, but the Baltic Sea have also other important pressure that could influence the results and should be discussed: pollution (nutrients, eutrophication), fisheries, invasive species (ballast waters)
- Discussion on functional attributes (traits): the spatial patterns of functional attributes are not discussed. It could be interesting to discuss the potential impacts of their spatial patterns on ecosystem functions.

Others:

L32 "coastal species numbers often remain uncertain". Are you referring to species richness or abundance?

L49 "intensified water cycle" could you be more precise? In some regions isn't it less intensified (drier?)

L78: add the definition for offshore areas (depth, nm distance from the coast)

L116: does the area of the sub-basins impact the SR, or this is controlled for with calculating SRest?

L128: what can be the influence of different gears number of samples on the species richness? This is well explained in the discussion but it could be nice to add a couple of lines acknowledging this potential problem already here in the M&M

L139: "25 samplings" : any specific reason behind this cut-off?

L110-147: how did you control for potential taxonomic misidentifications in the samples?

L167: ChaoRichness was used to estimate asymptotic fish SR, but also ShD and SiD?

L170: was it SR/ShD/Si D obs or est that were standardized to the minimum observed IC? The usefulness of using the std metrics is not clear, please justify. IC varies very little between sub-basins, resulting in very similar (redundant?) metrics. (see comments before)

L222: "nine sub-basins for which fish incidence data for shallow offshore areas was available" In M&M it wasn't clear how many sub-basins will have offshore data analyses. Please add the detail that nine offshore sub-basins are analysed in the M&M

L237: could you translate 0.1-1.5% in terms of numbers? 2-3 species?

L250. Fig 1: extrapolation: how did you choose how much you extrapolated? Up to +%0% the actual sampling, was it that? add info

Table 3: instead of a table why not report as a figure (like Fig.3), even without the map but with the area ranked by salinity. It simplifies the reading of the results. Best to avoid table if possible

Table 5: please add the number of observations in each model

Figures 4-6: I would suggest not repeating the map with salinity but focusing on the metrics per sub-basins, with ordering the sub-basins by salinity level

L372: are the methods used to assess IC comparable between your study and others?

L379: I can't find this value in 1.07? Please explain better what is this ratio, and maybe describe it in results instead?

L394: can you explain why/how your study "reinforces that SRobS is strongly dependent on IC". I would have rather thought that the highest SRobS locally the highest IC, (so IC dependent on SRobS).

L400-414: very good paragraph, some of this text could be useful even earlier in the M&M

L400: to not confound with fisheries effort, please use sampling gear instead of "fishing methods"?

L417: "SR increasing ca. threefold across the ca. 10-fold salinity gradient" add the direction of change

L440: distributional changes, unlike biological changes, do not seem to lag behind abiotic changes (species tracking their thermal niche). The distributional changes could impact SR?

L460: add also reference to SR patterns for other compartments in the Baltic Sea (e.g. phytoplankton Olli et al. 2019)

L463: why does the fish/benthos SR pattern suggest that the benthic-pelagic coupling differs along the salinity gradient? the strength does not depend on the SR per se but many other parameters, see Griffiths et al. 2017.

L483-484: important point, and what could this be the impact for SR in the Baltic Sea? (spill-over effect?)