

Review " Global climate change and the Baltic Sea ecosystem: direct and indirect effects on species, communities and ecosystem functioning" by Markku Viitasalo and Erik Bonsdorff

General comments

The review provides a valuable overview of past decades scientific studies with relation to climate change projection and the Baltic Sea.

I miss data synthesis in terms of figures and statistical tests on cross-experimental and cross-ecosystem data, proving significance of made conclusions.

More attempts to weight the importance of different factors would make some scenarios to be presented as more likely than others. Several sections is now a list of different outcomes with seemingly similar probability to occur.

A more critical view on the ability to prove climate effects would enhance the scientific value of the manuscript. The same is true for lack of understanding of adaptive and evolutionary processes for the outcome of projected climate change.

Detailed comments

r. 20 Effects of climate would explicitly require statistically significant changes attributed to climate factors. Since this type of data are scarce, scientific "evidence on effect of climate " is unlikely to be found. I suggest a rephrasing.

r. 22 Please specify "responses" of what effectors? By which type of species?

r. 25 "will improve " is ambiguous. Increase or decrease cyanobacterial blooms? Reduced blooms would be an improvement.

r.26 The impact of allochthonous carbon is primarily influenced by the specific loading of organic matter. Not the latitude.

r. 29 Influence of organic matter is primarily hampering photosynthetic production. That cannot be counteracted by the proposed food chain. Please remove or adhere hypothesis better to current knowledge.

r. 44 To uncertainties the adaptation and even evolution of organisms in most trophic levels driven by changed climate should be pointed out. This is not possible to study in short term experiments or modelling.

r.60 The shortcoming of not covering meteorological definition of climate change should be mentioned (i.e., significant differences between 30 year periods). One may even question of it is meaningful to make scientific conclusions of climate effects on chemistry and biology.

r. 88 OAW is defined as abbreviation but OA used below. Please harmonize.

r. 104 Please present the duration of those experiment in relation to organism generation time and discuss its influence on the conclusions that can be made.

r. 109 This could primarily be associated with weather changes given the periods investigated (i.e., mainly within a 30-year period).

r. 188-190 This firm conclusion would merit from a prestaton of a strong relationship between eutrophication and "shallow coastal water areas". Please specify what quantities that is used to indicate both factors and the strength of the statistical relationship.

r. 195-196 The presented ranges of temperatures investigated does not appear to include the natural variation observed of the annual cycle. Please comment.

r.221 Good that also adaptation is discussed here. Please also include in the introduction.

r. 255-258 This is one of several examples where direct or indirect effect by climate change on biota is not part of the conclusion (cf. title of the MS). The statement is just a list of factors influencing the organisms today and is assumed to do so in the future, however, without proposing the net outcome of this (i.e. the effect).

r. 267-269 Do you mean that projected climate driven temperature may lead to a rapid increase in hypoxia? increase in temperature? Please rephrase accordingly if so. The conclusion that potential phosphorous release alone will cause eutrophication is premature. Projected enhancement of precipitation and river discharge of organic matter may counteract this by reducing light irradiance to the water column.

r. 305 Please specify what analysis you refer to? The modelling?

r. 331-335 The main sentence and the subordinate clause appear contradictory. If the factors are difficult to disentangle, how can you then derive significant climate factors? Please clarify and rephrase.

r. 501 Or could it be referred to as a shift in weather conditions?

r. 571 As pointed out above few if any studies including biological variables cover at least 2 climate periods. Most also lack coverage of adaptive and evolutionary processes. This should be recognized and the statements rephrased accordingly.

r. 575 Please correct and shorten the sentence. Message is unclear.

r.583 "...will promote cyanobacterial blooms...". "Improve" is ambiguous.

r. 585 The dominating effect of reducing photosynthesis is overlooked (reduced light irradiance and intensified competition for the limiting nutrient with bacterioplankton). Please include and rephrase. Again, the proposed food chain cannot counteract this. The sentences are also close to repetition of what is said in the abstract. Consider replacing by complementing text.

r. 604. I am sceptic that cyanobacterial bloom would be markedly reduced as they are also found in sediment records representing pre-industrial conditions. Consider rephrasing sentence.

Table 1. Effects by increased precipitation and discharge of organic matter is overlooked. This primarily influence phytoplankton carbon dioxide fixation but also bacterioplankton and other parts of the food web. This is demonstrated both in long-term field data and controlled mesocosm experiments.