Review of the manuscript entitled "*Decadal changes in phytoplankton functional composition in the Eastern English Channel: evidence of upcoming major effects of climate change?*" by Hubert et al.

General comments

The manuscript by Hubert et al presents a very interesting dataset on a coastal ecosystem, combining environmental data with data on phytoplankton functional groups. Such a time series on flow cytometry in combination with environmental data at high temporal resolution over multiple years is relatively rare and can give a detailed view into the variability of the phytoplankton community over the last decade. The results of this manuscript are thereby very interesting and fit very well within the scope of the journal. The paper is generally coherent and well written, the references are complete and the study is embedded in a large body of literature on the region. The data analysis is thorough, approaching the dataset from multiple angels, but could be reported more completely and visualized more concisely, which are discussed in more detail below.

Specific comments

- Title: The question posed in the title whether there is evidence for major effects due to climate change is a bit vague (did you find evidence or not?). I guess it could be a valid question when 'evidence of' is removed from the sentence, although still speculative and not clearly addressed in the main text. Although in the conclusion is rightfully mentioned that the time series is too short to draw definitive conclusions about long-term and complex climate change, a paragraph discussing which evidence there is to suspect major effects due to climate change would improve the manuscript.
- Methods:
  o Line 87: cooled how? Do you have a temperature range and a maximum time from sampling until freezing?
  o Line 92: Using the term nitrogen to refer to $[NO_3^- + NO_2^-]$ is a bit confusing. Nitrogen is used to refer to the chemical element itself, while NO_3^- and NO_2^- are just a subset of the nitrogen compounds that are present in seawater. Also, in some figures and text the term NOx is used instead of nitrogen, which is generally used to refer to nitric oxide and nitrogen oxide, not nitrate and nitrite. I would suggest to be concise (and consistent) and refer to the property as $[NO_3^- + NO_2^-]$.
  o Line 100: How many different instruments? Please specify how you addressed comparability between instruments.
  o Line 121: Please specify brand and manufacturer of the beads.
  o Section 2.4.1: which k did you use (and why), which type of smooth (cubic spline?). It could be interesting to add the stations as grouping level to test whether station-level variability is significant (see Pedersen et al., 2019 on Hierarchical generalized additive models in ecology: an introduction with mgcv).
  o Section 2.4.4: nutrient imbalance is a bit suggestive, maybe nutrient stoichiometry?
- Results:
  o It would be good to include more data on the statistics, for instance by adding result tables to the appendix. This especially concerns; the number of datapoints used in the statistical analysis (separated per station), the GAM results, the Tukey post-hoc test of the PERMANOVA.

- o Throughout the result section it would be good to mention more of the actual measured values in text (for instance in line 195 and 200).
- o Line 195-204: This discrepancy between chlorophyll and cell abundance is quite remarkable, and clearly shows that just using chlorophyll to inform on the phytoplankton community gives an incomplete view of the phytoplankton community. It would be interesting to see to what extend this is due to a variability in pigments per cell as a light acclimation strategy or due to a community shift and cell size, for instance by plotting the amount of fluorescence per cell volume (TFLR/TFWS or TFLO/TFWS).
- o Line 221-224: If I understand correctly, the 45 and 39% refer to the factor 'season', which would then be the most important explaining factor, not year?
- o Since you are using GAM already, why not extend this to the decadal dynamics to plot a smooth through the time series? I see how the cumulative sum is informative, but a smooth on top of the bar plot would be more intuitive visualization of the temporal trend (as an addition, and just a suggestion).
- o N:P ratio: I really like the visualization, which is a clever way to represent nutrients stoichiometry. However, I do miss seeing the original data (or at least error bars) to evaluate the spread around the average point per year, or at least error bars. Appendix 1 shows that outliers have a high effect on the average plot (the high N:P outlier in the winter of 2014 seems to determine its position in the average plot, while in winter nutrients are not in limiting concentrations, while in the seasons where macronutrients might be limiting the N:P ratio is close to 16 again. On the other hand for the year 2016 the high Si:N in fall seems to drive the position of the point in overall plot).
- Figure and table captions: need more detail so it is possible to understand the figure without having to refer to the main text. Please include a brief description of the methods/statistics that are visualised in the figure. Also include the data that is visualised (whole dataset/per station/number of datapoints).

- Figures: need better units and axis, and either confidence intervals or the original data. It would also be nice to plot them stacked in columns, since many share a common x-axis, which would make it easier to compare between figures/parameters.
  - o Figure 3 and 4: add y-axis units, add confidence intervals and/or individual data points
  - o Figure 6: the x-axis needs to be more clear. They are labeled date 12 to 23, based on reading the rest of the paper I assume that it refers to the year 2012 to 2023 but this should really be more evident from the figure itself. Also the caption needs more detail (sea surface temperature? Which stations? Cumulative sum of what?). I like that the colour of the secondary axis tries to match the line colour, but the colour is slightly off.
  - o Table 3: I guess these results are from the Mann-Kendell test? Please specify in caption. Do these values have a confidence interval? And can they be added to the plots?

- Discussion:
  - o What I am missing here a paragraph bringing the physical parameters and phytoplankton dynamics together (possibly with a focus on climate change) and some more focus on the results of this study. In the introduction it is mentioned that

previous studies addressed decadal variation in larger plankton and chlorophyll, but that the picophytoplankton has sofar been neglected, which is the added value of this study. However, in the discussion only one paragraph (line 384-391) discusses the dynamics in this smallest size group. It would be nice to expand upon this and maybe add a wider perspective by comparing the results with other study locations or modeling studies (e.g. are the results expected and can we expect it in other regions?).

Technical corrections

- correspondence address: I guess something went wrong in the correspondence email address.
- line 2: run-off not rain-off
- line 11: Not clear where the +1.063 comes from, I can't find it in table 3, please double-check and if correct, discuss it in the main text.
- Line 11-12: please check sentence grammar.
- Line 12: Rollback?
- line 14-15: This sentence is a bit out-of-the-blue – shifting periods of what?
- line 17: It would be nice if the last sentence of the abstract discusses more about the data presented and potential implications, not about future works.
- Line 71-73: check grammar
- Line 78: This is great resolution and sounds like a very dense dataset, could you report the number of datapoints?
- Line 79: R/V before vessel name
- Line 95: chlorophyll a is not a measure of biomass given variability in Chl:C
- Line 95: which sampling depths?
- Line 170: typo in where
- Throughout the manuscript: eukaryotes with a k not c
- Figure 7 and Figure A1: please use a consistent color scheme (2019 is now different).
- Figure 7: I really like the 6 zones in the figure and (what I understand to be) the sequence of limiting nutrients, but the use of the 'greater than' symbol in the figure is a bit confusing (shouldn't it be reversed 'smaller then'? Or just use another symbol).
- Check consistency when referring to seasons (autumn vs. fall).
- In text it is often referred to temperature, it would be good to be more concise and be clear you are referring to sea surface temperatures (or SST) so it can't be mistaken for air temperature.