

## Response to reviewers' comments for MS BGD10-2305-2013

### Reviewer 1

#### Phytoplankton community structure in the Lena Delta (Siberia, Russia) in relation to hydrography

We thank both reviewers for their very valuable comments! We will now respond to individual comments by reviewer 1

### Reviewer 1

**Reviewer's comment 1:** *Yet, to be published in BG the analysis of the new data need to be more than just descriptive and the general scientific achievements need to be pointed out.*

**Response:** We agree that it would be desirable to carry out more complex analyses and to link them to long-term environmental parameters. However, such data are simply not here yet. While most scientists seem to agree that permafrost thawing rates will be considerable for the foreseeable future and that they will affect the magnitude and chemical position of the Lena discharge into the Laptev Sea, how exactly might affect the local phytoplankton community can only be surmised. Importantly, as up to now we had little baseline information on the composition of the phytoplankton community we would not be able to assess the future impact of environmental changes on the biological system in the coastal Laptev Sea. Therefore our study might be regarded as descriptive (albeit an elaborate statistical description), but this description of the system in the Lena and brackish coastal waters is essential before any further analyses make sense, and therefore our study is filling an important gap.

**Action taken:** We have restructured and expanded the last paragraph of the manuscript as a conclusions and recommendations section (4.3) from line 3 on page 2326 onwards summarizing the main results and stating the broader implications for future research (also addressing a comment of reviewer 2 (see below)

**Reviewer's comment 2:** *It is not clear if the study is a methodological study on statistical methods used to explore the community structure or a study on the impact of changes of the environment on the community structure. The manuscript could further be developed along those lines.*

**Response:** In the last paragraph of the introduction we clearly state that it is our aim to create a baseline of the biodiversity in the region, looking into differences in different water masses (fresh vs brackish, mixed vs stratified) as we need these data for comparisons to future biotic changes in response to the possibly complex environmental changes that have been hypothesized (see next comment and response as well). The techniques we are using are not experimental. We are also not testing the validity of the statistical methodologies themselves. In fact they are standard techniques recommended for the type of biodiversity data sets available to us and they were used to partition the overall datasets into clusters of different environmental characteristics but not to test whether the methods were doing this efficiently.

The last paragraph was rephrased accordingly, and an additional explanatory sentence was added to the section on numerical analyses.

**Reviewer's comment 3:** *In the beginning of the abstract you mention that there have been substantial changes in the Lena delta possibly leading to changes in composition of and interactions between phytoplankton and zooplankton. I cannot see this relationship between your analysis and those aforementioned changes.*

**Response:** What we want to point out here is only that some of these environmental changes have been observed others are merely hypothesized changes, but that all of these changes might affect the plankton community. But crucially, while these environmental changes will illicit a biological response, there have, until now simply not been sufficient data to investigate this relationship. There is not even a vague taxonomic baseline against which to gauge future changes. Our manuscript created this baseline and therefore filled an important gap.

The reviewer is however entirely correct that it is confusing to also mention the zooplankton-phytoplankton link as we are concentrating on the phytoplankton and microzooplankton and the reference to zooplankton has therefore been removed. However, we do feel it appropriate that the phytoplankton-zooplankton interaction is discussed. Much is known from previous field and experimental studies about how microzooplankton can control phytoplankton and as we observed very pronounced changes in the communities from diatoms to microzooplankton, these need to be discussed.

**Reviewer comment 4:** *The introduction section is full of speculations, eg. Page 4, L1-6 “: : : is also likely to lead to considerable increase in : : : as well as methane : : : . Changes in these parameters could also have profound consequences : : :” (just to mention one), but hardly proofed with the analysis in the manuscript.*

**Response:** We thank the reviewer for this comment. The reviewer contends that the introduction includes a large amount of speculation. We cannot actually disagree and it is precisely what we wanted to point out. There are still enormous uncertainties attached to what changes climate change will cause in the arctic, we know even less about how ecosystems will respond let alone the magnitude of these responses. As such the information we provided is not meant as background information to concrete analyses that we want to compare the background data with but to set the scene and to show the enormous and fundamental gaps in our knowledge that still exist and that precisely because of these uncertainties we need baseline studies on the microbial foodweb, as this will be the 'first responder' to these changes. If we do not produce baseline data of the diversity in the foodweb NOW then we lose our chance to identify drivers of any changes that might occur in the future. In other words it was not the goal of the manuscript to analyze the complex changes occurring in the physical chemical environment as a whole, but to use the fact that these complexities exist as an argument for our urgent need to establish the basic taxonomic and ecological data we described and analyzed in the paper.

**Action taken:** The respective paragraphs in the introduction were rephrased to clarify this. We also added additional references and referred to a separate manuscript on methane distributions in the Lena Delta produced for the same special issue. The last paragraph in the introduction on the aims of the study was rephrased.

**Reviewer's comment 5:** *Methane was pointed out in the introduction as a relevant parameter, but not considered further more in the analysis.*

**Response:** See previous comment. The same applies to the comment about methane. Methane has been investigated in a separate study in this special issue. This reference was added to our manuscript (Bussmann 2013)

**Reviewer's comment 6:** *Most of the discussion in subsection 4.2 is about linked foodweb structures which do not come out of the analysis. The relationship to environmental changes is missing.*

Again we thank for this comment, but beg to disagree. The first two paragraphs of section 4.2. deal solely with our findings that community structure changes abruptly between the coastal areas with and without freshwater influence and we discuss the effects of environmental conditions specifically of salinity and stratification as possible explanations for the quick decline in cyanobacteria in coastal areas vs the partial persistence of chlorophytes in these areas. This considerable difference in community composition is clearly borne out by the analyses and is emphasized as a key result throughout the manuscript.

**Action taken:** To clarify this we have inserted a separate header '4.3. Conclusions' before line 3 on page 2326 and added an additional paragraph at the start of the section that again emphasizes the main results and broader implications of our findings namely that the effect of physical conditions on phytoplankton community. With further freshening and therefore increasing stratification expected, the balance between major phytoplankton groups can be expected to shift (not speculation but a likely hypothesis)

One small section about the microbial loop was removed (page 2324, line 14-18)