

***Interactive comment on* “Spatial variability of particle-attached and free-living bacterial diversity in surface waters from the Mackenzie River to the Beaufort Sea (Canadian Arctic)” by E. Ortega-Retuerta et al.**

E. Ortega-Retuerta et al.

ortegaretuerta@icm.csic.es

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Review of the manuscript “Spatial variability of particle-attached and free-living bacterial diversity in surface waters from the Mackenzie River to the Beaufort Sea (Canadian Arctic)” by Ortega-Retuerta et al. submitted for consideration in Biogeosciences. I have examined the manuscript submitted by Ortega-Retuerta et al. and my overall assessment is that the paper would be publishable after minor revisions. The authors present novel data and interpretation on the structure and diversity of surface waters bacterial community from river to offshore waters of the Beaufort Sea. The paper is generally

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well organized but I strongly suggest that the authors ask an English-speaker to read through the MS and correct the grammar. This manuscript presents a unique data set that many readers will surely find interesting. I have however a number of questions and comments which I would like the authors to address before the paper can be accepted for publication in Biogeosciences.

General comment to referee 2: We thank referee 2 for his support and insightful comments in the previous version of the manuscript. We have carefully checked the English grammar in the revised version.

Specific comments: Abstract 1) Page 17403 lines 10-11: please be more precise concerning the differences/similarities observed between the particle-attached and free-living bacterial communities.

We have included the term “bacterial community structures” to help clarify

2) Page 17403 lines 13-14: Define the acronyms DOC and CDOM.

Done

3) Page 17403 lines 14-18: This phrase is too long, rephrase it in two sentences and clarify which type of significant differences you are talking about.

We have changed it into three sentences as follows: “Pyrosequencing of 16S rRNA genes from selected samples confirmed significant differences between river, coastal and sea samples. The PA fraction was only different (15.7 % similarity) from the FL one in the open sea sample. Furthermore, PA samples generally showed higher diversity (Shannon, Simpson and Chao indices) than FL samples”

Introduction 1) Page 17404 line 2: Replace the reference (ACIA 2005) by a more recent one.

We have included this reference: Wassmann, P., Duarte, C. M., Agusti, S., and Sejr, M. K.: Footprints of climate change in the Arctic marine ecosystem, Global Change

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Biology, 17, 1235-1249, 10.1111/j.1365-2486.2010.02311.x, 2011.

2) Page 17404 line 4: I don't understand why the authors focus on the influence of climate-related changes in UV radiation on primary producers more than on the influence of irradiance availability.

We agree with the referee that changes in light will not be restricted to ultraviolet radiation, so we have changed the sentence for a more general one: "changes in the light field will change the abundance, activity and distribution of primary producers"

3) Page 17404 lines 16-18: "POM inputs are also high in this area", please moderate this statement as the occurrence of phytoplankton blooms in the Beaufort Sea area is indeed often associated with sea-ice retreat and also with upwelling processes; but on an annual basis the primary productivity of this area stays generally low compared to other Arctic Seas.

We have changed the sentence to "Autochthonous particulate organic matter (POM) inputs can be high in the area coincident with the occurrence of algal blooms associated with the retreat of sea ice"

4) Page 17404 line 23: Please standardise the spelling of Mevel or Mével throughout the manuscript.

Only Mevel is written in the whole manuscript

5) Page 17406 line 2: I think that authors must clarify the meaning of community structure, diversity and activity, and clearly explain which method was used to determine each of these three characteristics of the bacterial community.

We have checked carefully the manuscript on this aspect and we used the terms: - community structure when we compared CE-SSCP profiles from different samples or the profiles given by all 16S rRNA sequences from each samples. Such comparison was made by indirect multivariate analysis using hierarchical cluster analysis. - diversity when we compared diversity (i.e. richness and evenness) estimators such as

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Chao1, Simpson and Shannon indices. - activity when we referred to a specific rate measured for the bulk bacterioplankton community (bacterial production in this case)

Material methods 1) Page 17406 line 17: More than 15 stations appear on Fig. 1 and in Suppl Table 1, please clarify.

We have changed it to 20 stations

Results 1) Page 17410 line 6: According to Table 1 the average temperature for riverine stations is 10.2 not 10.7, please correct the text or the table.

We apologize for the slip. The correct number is 10.2, we have changed the text accordingly.

2) Page 17410 line 10: To clearly distinguish coastal stations from open sea stations, I suggest replacing “surface temperature higher than 4” by “surface temperature higher than 4.5”.

One of the stations that we call “open sea” has a temperature of 4.5°C. However, for us it is clearly distinguishable from coastal stations based in its salinity (27, when all coastal stations have a salinity lower than 23) and suspended particulate matter (0.17 mg l⁻¹, when all coastal stations have SPM higher than 1 mg l⁻¹)

3) Page 17410 line 11: Please replace “open sea stations had salinity higher than” by “open sea stations showed a salinity higher than”. Please remove the salinity unit used here as it was not used before in the text or in Table 1.

We have changed it “Open sea” (S) stations showed salinity higher than 26 except for station WS1”

4) Page 17410 lines 15-19: Please mention the statistical tests used to discriminate statistical differences in bacterial production from various studied regions.

We used a non-parametric Mann Whitney U test. We include this in Table 1.

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5) Page 17411 lines 18-19: Please at least show the correlation coefficients in the text.

We have included this data in the text: “In our dataset, the correlation coefficients were 0.96, 0.97 and 0.95 between salinity and CDOM, DOC and Si respectively”. We would like to note that these correlations are not applicable to the whole Malina sampling grid (e.g. Matsuoka et al 2012 this issue).

6) Page 17411 line 27: Standardize the number of digits throughout the text.

Done: “the first and second canonical axis explained 47.0% and 22.5% of this variance, respectively, for PA and 44.1% and 29.5% of this variance”

7) Page 17412 lines 10 and 13: How many samples did the authors analyze/select 3 or 6, please standardize.

Changed to six

8) Pages 17412-17413: Please present Figures 4 and 5 in the text in the same order than their numbering.

Done

9) Pages 17412-17413 lines 27-3: Please reformulate these sentences.

The sentences have been changed to “Sixty percent of OTUs shared between sea and coast samples and 78% of OTUs shared between coast and river samples were found in both PA and FL fractions. Conversely, a large percentage of OTUs that were exclusive from either sea or river samples were also exclusive from the PA fraction. In other words, 43.3 % of OTUs exclusive of the sea sample and 32.9% of OTUs exclusive of the river sample were also exclusive of the PA fraction”

10) Page 17413 line 11: Please add Fig.6 at the end of the sentence after “taxonomic compositions”.

Done

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Discussion 1) Page 17414 lines 2-8: This sentence is way too long, please reformulate it.

We split it into two sentences as follows: “The MALINA Arctic campaign sampled the Mackenzie Delta-Beaufort shelf area during summer in 2009 revealing an ecosystem characterized by its oligotrophy, (i.e., low primary production (Ortega-Retuerta et al., 2012b), dissolved amino acids, and labile organic matter (Shen et al., 2012)). This was partially sustained by Mackenzie River inputs that structured a complex gradient of suspended particles with mineral to organic content”

2) Pages 17414-17415 lines 25-4: This sentence is too long, reformulate it in two sentences.

We separated it into two sentences as follows: “For instance, bacterial community composition in river and sea samples (if we merged PA and FL fractions together) was similar to the one reported by Galand et al. (2008). We report here a transition from a community dominated by members frequently found to dominate in freshwaters”

3) Page 17415 line 22: Please replace by “contrasting with our expectations”.

We replaced it by “unexpectedly”

4) Page 17415 lines 12-16: Be more specific about the factors you are talking about, which factors and from which study.

We have changed the paragraph as follows: “We have previously shown that bacterial abundance and activity (production and respiration) was controlled by the availability of labile organic matter, with DOC, amino acids and primary production as proxies (Ortega-Retuerta et al., 2012b). This supports that these factors (DOC, amino acids, labile organic matter) control both bacterioplankton activity and community structure in this region, an important fact given that the community structure affects its activity (e.g. Obernosterer et al., 2010)”

5) Page 17416 lines 4-6: Please replace by “During the MALINA cruise, particles from

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river and coastal samples showed POC:SPM ratios of 2.2% (i.e. mineral-rich particles) while particles in the open sea showed POC:SPM ratios of 12.2% (i.e. organic-rich).”

Done

6) Page 17416 lines 9-16: This paragraph is really confusing, surely because of translation misunderstanding, please reformulate.

We have changed the sentence to “On the other hand, within the OTUs that were shared between river, coast and open sea samples (i.e. cosmopolitan OTUs) there was a higher proportion of OTUs found on both PA and FL fractions than within OTUs exclusive from a certain location (river, coast or open sea)”

7) Page 17416 line 29: Please replace by “Previous studies have also found higher diversity in the PA fraction.”

Done

Tables and figures Table 1: Please define the acronyms and delete parameters that are not used in the text (e.g., nutrients).

Done (see legend). Since all parameters showed are used in the CCA analyses, we prefer to maintain the data in the table.

Table 3: Please define acronyms PA and FL in the caption as in the caption of Fig 2.

Done

Figure 1: The map of the world is too small.

We made it bigger

Figure 2: Please explain the use of the different colors (blue, green, brown) as in Fig. 1. Also explain the use of the black and red for stations. In the right panel B, the name of the fifth station from the top is wrong (E4-E-A).

Done

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Figure 3: Please define acronyms PA and FL in the caption as in the caption of Fig 2. Define PO4.

Done

Figure 4: Please use the same acronyms for particle-attached and free-living bacteria than in previous figures. Mention in the caption that this figure showed only the results obtained for the western transect.

We have changed the numbering between Figs. 4 and 5. And changed the acronyms to standardize between figures.

Figure 6: Please define acronyms PA and FL in the caption as in the caption of Fig 2. Suppl. Figure 1: Please mention in the caption that river samples are from western transect only.

Done: "All selected samples belong to the Western transect".

Interactive comment on Biogeosciences Discuss., 9, 17401, 2012.

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