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Biogeosciences Discussions

Interactive comment on "Spring phytoplankton communities of the Labrador Sea (2005–2014): pigment signatures, photophysiology and elemental ratios" *by* Glaucia M. Fragoso et al.

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GENERAL COMMENTS:

This paper provides a decadal assessment of phytoplankton communities of the Labrador Sea using pigment markers and CHEMTAX analysis, as well as environmental parameters (T, S, nutrients, MLD, etc) and photosynthetic parameters. A single transect was sampled during each late spring – early summer for 10 years with high geographic resolution. The comprehensive suite of measurements makes this a valuable data set that should provide a useful reference for future cruises. I believe it is appropriate for Biogeosciences.

The analyses appear to have been competently performed and I have no worries about the data.

Although the text itself is generally well written, at the broader level the manuscript itself unfortunately has two serious problems. First, it is not well structured – in particular, it lacks a clear Aim. Secondly, and perhaps as a consequence, the authors have attempted to cover too much data in a single publication. They describe the entire data set rather than derive a clear story from it. As a result, key parts of the story are insufficiently described despite a huge volume of complex text, and the overall story is confusing. Three subplots are introduced (Accessory pigment:Chl_a ratios, POC:PON ratios, and photosynthetic parameters) that add little to (what I consider to be) the main story but add considerable verbiage and unnecessary confusion. There is possibly sufficient data here for a thesis, in which each of these subplots would warrant a separate chapter. Here they would be better relegated to separate publications, possibly followed by a review paper that integrates this study with previous work in the region.

Due to lack of a coherent focus, the data and discussion are not well integrated.

Despite these problems, this is a very useful study that should be published, but the manuscript requires substantial revision.

STRUCTURAL COMMENTS:

Introduction:

This paper desperately needs a clear Aim to provide a basis for a narrative, to dictate what is included in (or excluded from) the paper, to provide a focus for the Results, Discussion and Conclusions, and by which to judge the success of the project. There is an implicit aim in the sampling regime – "What are the major determinants of phytoplankton composition and abundance in the Labrador Sea?" My comments hereafter will address this aim, and I leave the authors to judge how appropriate they are to the

revised paper.

The Introduction must provide sufficient information to provide the context for the Aim and to allow the reader to understand the significance of the results as they are presented. It must introduce all of the major topics covered in the paper , but nothing else. Thus, the first two paragraphs (lines 42-65) are unnecessary; as is the paragraph on CHEMTAX starting line 86 (which should be replaced by a brief outline on the approach taken to address the Aim).

The description of the study region is currently split between the Introduction (lines 66-84), Methods (lines 114-132), and Discussion (lines 409 – 413). Given that the notional paper is now about the Labrador Sea, I suggest that all of this information should be amalgamated in the Intro, as should most of the description of the NAO (lines 425-430), and Figure 1.

I would specifically identify the main factors that may control phytoplankton – temp, salinity, mixed layer depth, light, nutrients, ice, meltwater. I also think that the Introduction should mention that the cruises occurred at different times of the Spring/Summer, introducing the notion of a temporal sequence, as this was the basis for one of the Conclusions (which surprised me on the first read!). Also that there were some cruises that deviated from the normal transect.

I note that there was another publication by the same authors in the same region this year. I am surprised that there was not a specific reference to how this study relates to the previous one.

Methods:

The inclusion of results in section 2.4 surprised me at first, but I think that this section is peripheral to the main story and is appropriate here.

Results:

I was frustrated by the fact that CHEMTAX results were presented only at the commu-

nity level as defined through cluster analysis – but what was happening with the individual taxa that comprised these communities? Later I discovered that these results were (sort of) presented in the Discussion. I suggest that the distributions of individual taxa should be presented (with figures) before the distributions of communities.

I would like to see a more detailed analysis of the factors controlling phytoplankton in each water mass. Even though there was considerable data on photosynthetic properties, I didn't get a clear message on the role of light in controlling biomass.

The Results should include a specific section on the temporal sequence, possibly exploring the sequence of events in each region. I note in Fig 3 that the data for 2012 and 2014, which were sampled late in the season, differ from other years, particularly Chl and nutrients in the central region.

Discussion:

Much of the discussion about individual taxa in section 4.1 should be first described in the Results section. Most of sections 4.2 and 4.3 should be saved for another paper.

The Discussion should focus specifically on the results of this paper in relation to the Aim, only referring to other studies to provide context, generally in the style of "Our results match those of Smith and Jones. . .". Only then should the wider implications of the work be discussed, and there should be clear signals when the narrative extends beyond the current work. Much of this Discussion reads like a review. It was often difficult to determine whether the results being discussed were from this paper or from others.

Conclusions:

Most of the final paragraph seems more appropriate to the Introduction. The authors may also consider any further research questions that arise from this study.

Abstract:

I think the first sentence is redundant and that the second sentence should be extended to include the Aim. The abstract will require revision in line with the changes to the rest of the manuscript.

SPECIFIC COMMENTS:

Line 186 and Table 3: Lutein not used for chlorophytes? (Does the BIO method separate ZEA & LUT?) If not, Table 3 ZEA must be ZEA+LUT

Lines 192-200 and Figure 2: I note that two of the categories include Hex but no Chlc3 – I assume this is a simplification of the text and diagram as this combination does not exist to my knowledge. Figure 2 is unnecessary and should be replaced with a table including all pigments.

Section 3.2: Did the authors try further subdivision of group C3b? This group is by far the biggest, it is widest spread across the S-T diagram (Fig 5a), and its composition is "mixed", yet Fig 4a shows major divisions within the group. Would these subdivisions distinguish communities that were more coherent in composition and habitat?

Line 316: change "Phaeocystis (cluster B)" to "A community dominated by diatoms and Phaeocystis (cluster B)" . This is an important consideration throughout the document —- e.g. lines 328, 329 – there is not a careful distinction between the cluster groups (communities) and the taxa comprising them. I would invent an acronym or abbreviation for each community to avoid this confusion.

Line 527: The possibility that "diatom species from both Arctic and Atlantic waters varied intrinsically in pigment composition" can be supported by consulting Table 3 of this paper, where we see that they do.

Line 551: "chlorophytes were present in high concentrations on the Labrador Shelf, which may explain the discrepancy between these results." Some more details are required to constitute an explanation.

Table 5: This table should be augmented by information on the region in which each

cluster is found, and the major taxonomic components. Also expressing the values like Temperature with standard errors is inappropriate. The values are not based on repeat measurements of a single parameter –e.g. Cluster 3b is listed as 3.4+/-0.2 C, but the actual range is from about -1.3 to +8, the widest of any group. I would be surprised if the standard error given is correct. Even if is, it is meaningless. This table should list the range for each cluster instead. Also: I didn't see any reference to the data for DT:(DT+DD) in text (nor was there any reference to how long the filters were held between sample collection and freezing. This should be < 5-10 min for this parameter to be valid).

Results: I did not notice any indication that the raw pigment data were to be included in Supplementary Material or an online databank. I would hope that this will be the case to increase the value of this data set.

TECHNICAL COMMENTS:

Line 67 and throughout: References should be cited in order of date – oldest to newest

Line 84: change "while" to "but"

Line 118: inset "wide" after "km" (twice)

Line 123: change "fresh" to "low salinity". Rest of same para: three water masses are described as "warm and salty" or "cold, low salinity" but other water masses lack these descriptions (parallel form required– see below). Also, is the warm arrow parallel to the Labrador current in Fig 1 considered to be part of that current?

Line 177: The correct reference for the method ascribed to "Coupel et al. (2015)" is Higgins et al (2011).

Line 316: Add "respectively" after "(IC)" ?

Line 325: Replace "respond strongly to" with "are associated with" and "spatial aspects of the data" with "environmental parameters"

Line 331: The description of Fig 5b could hardly be more obscure: “In Atlantic waters, temporal aspects of the data were also observed (upper and lower right quadrants (Fig. 5b)).” There is nothing in that figure that implies a temporal sequence. It was only when the Conclusions mentioned clear temporal differences that I searched the document for “temporal” to find what I had missed and came back to this figure. After some cross-referencing I realised that the description should have read, “In Atlantic waters (upper and lower right quadrants (Fig. 5b)), the phytoplankton community was composed of mixed taxa during May (orange circles), but became dominated by diatoms and dinoflagellates during the bloom in June (red circles), showing a clear temporal succession in these waters”. More generally, the authors must not rely on the reader to discern what is in a figure. The reader is not familiar with the data and may not see what the author sees, or they may see something different. Whatever story exists in the figure, it must be stated clearly in text as part of the narrative. The figure supports the narrative, it does not replace it.

Line 368: Replace “lower accessory pigments to TChla ratio” with “lower ratio of accessory pigments to Tchla”

Line 369: Replace “(Fig. 7b). Furthermore, communities from warmer waters (Irminger Current from Atlantic origin), particularly those co-dominated by diatoms and dinoflagellates had “ with “(Fig. 7b) than communities from warmer waters (Irminger Current from Atlantic origin), particularly those co-dominated by diatoms and dinoflagellates which had”

Line 376: Replace “μg C μg Chla h-1W m-2” with “μg C μg Chla h-1 W-1 m2” or “ (W m-2) -1 “ Also line 378

Lines 375 to 386. Sentences should be rearranged to “parallel form” i.e. talk about the same things in the same order for each case cited.

Line 392: Insert “Atlantic,” before “Labrador”

Lines 437 – 450: Reads like a review. Note also that the paragraph starts with “Phaeocystis and diatoms ... (Fragoso etal 2016)” but by line 441 it’s “PRESUMABLY of Phaeocystis and diatoms (Fragoso etal 2016)”. Also is “eastern central Labrador Sea” (line 437) equivalent to “West Greenland Current” (line 440)?

Line 598: Add reference e.g Gieskes and Kraay (1983) Mar. Biol. 75, 179-185.

Line 886: remove “et al” ; page numbers = 78 - 80

Figure 2 is unnecessary and should be replaced with a table including all pigments.

Figure 4b. The colours of the sectors would be much more easily interpreted if they made sense to a phycologist ! Surely cyanobacteria = Cyan, chlorophytes = Dk Green, Prasinophytes = Lt Green, Phaeocystis = Brown, etc. (Leave diatoms white)

Figure 4c. The single circle as a scale is ambiguous. Does the biomass relate to the diameter or the area of the circle? In any case it’s difficult to judge. There should be a range of circles representing a biomass scale (if circles are to be used). Also I estimate that about 20% of the data points are hidden in this diagram as they underlie another circle. This could be solved by increasing the breadth of the figure or using vertical bars instead of circles. Could the fronts be marked for each year by dotted lines?

Figure 5: It would be good to see individual taxa plotted in such diagrams.

Table 2 is unnecessary. The individual pigments are not part of the story – simply quote the references.

Table 3: The legend doesn’t make it clear that the references cited provided the starting ratios from which these data were calculated. Cyanobacteria is misspelt.

Table 4: The formatting is strange. It looks as if it should be split into A & B, horizontally.

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