

## Reviewer 1

In general, the authors have improved the manuscript by incorporating the comments suggested by the reviewers. The new introduction and methodological sections and the use of the standardized abbreviations for pigments make the manuscript easier to read in its present form. The initial matrices used for the CHEMTAX analyses and the RMS are now presented. However I still have a few comments on the manuscript in its present form:

### Abstract

Line 26, do the authors mean 70% of total chl a (TChla)?

### Methods

Line 140, first time referring to chlorophyll a, add the abbreviation after chlorophyll a (chl a) and use the abbreviation through the rest of the manuscript. Please check through the manuscript for usage of Tchla or chl a (e.g. line 254, the abbreviation should be Tchla). Similarly, when the authors refer to the photosynthetically active radiation (PAR, line 481), please first define the abbreviation then use it through the manuscript, not the other way around.

Line 143, add extracted “in the dark“ for 24 h-

Line 152, remove samples and change to chl a fluorescence of water samples was determined on board after...

Line 186, do the authors refer to the daily incident irradiance (integrated irradiance) averaged per month? Unclear.

### Table 2

Chl c3: diatoms type 2 contain this pigment (see Higgins et al. 2011, Coupel et al. 2015).

TChl a row change the Chlide “alpha” to Chlide a.

Last row of the table, please change CHLA to Chl a.

### Table 3

Why are chlorophytes (CHLORO-1) and haptophytes (HAPTO-6) in capital letters?

According to Higgins et al. 2011, dinoflagellates containing peridinin should be named type 1, please change Dinoflagellates to dino-1 in your matrices. The use of dinoflagellates and then dino-2 is confusing otherwise.

Why did you assume that the diatoms present in your study did not contain chl c3? I think you should re-consider this. At least for the communities that are located in the shelves where the authors found high concentration of fucoxanthin together with high chl c3 and diatoms dominated the community.

Seeing the variety of diatom species found in the previous study (lines 565-570), it seems reasonable to think that some of the chl c3 to the total chl a should be attributed to the presence of diatoms type 1 (containing chl c3) and not only to diatoms type-2.

Line 621, change Front with Font. If you cite this work you need to add the reference in the list.

Spring phytoplankton communities of the Labrador Sea (2005- 2014): pigment signatures, photophysiology and elemental ratios

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#### GENERAL COMMENTS

This paper has been greatly improved from the previous version. Issues that other reviewers picked up issues with pigment analysis and CHEMTAX appear to have been sorted and I am happy with responses to my comments for the most part. I reiterate my earlier comment that this is a useful study that should be published, but unfortunately my major concern, the structure of the manuscript, is not quite there yet – in particular, the Aims are wrong\* – they are too vague and do not fully cover the material presented. They should be re-written as clear EXPLICIT goals for the paper, and other sections should be checked to ensure that the findings are clearly reported. A simple strategy is suggested below that would greatly improve the paper.

\*I make that provocative assertion deliberately to focus the following discussion and hopefully (if I may be so bold) to offer some practical guidance to a young scientist. Given that the previous version lacked an aim, and the problems with the aim of the current version (discussed below), I think a fuller explanation of the problem is warranted in the hope of improving subsequent papers as well as this one. Of course I know that in this case, the Aim was written after the rest of the paper, which is exactly what not we are supposed to do. Ideally the Aim (or far preferably, the Hypothesis) should be rigorously defined before designing the experiment, and the content of the resultant paper(s) should be planned as part of the research proposal. It makes the papers much easier to write. Of course that doesn't always happen, and it certainly didn't in many of my experimental papers. Often for surveys or monitoring programs, such as in the current study, the story is discovered as part of the analysis. Nevertheless the paper must be structured as clearly as if the Aim or Hypothesis was clear from the outset.

The Aim or Hypothesis is the single most important statement in a paper – not only does it dictate the content of the entire paper, but it also tells the reader what to expect, and primes him or her to recognise the importance of results as they are presented and the relevance of discussion. Thus it is critical that it is VERY carefully considered, explicit, and crystal clear.

In my review of the previous version of this manuscript, I commented: *“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.”*

The authors responded: **AC2.3 - Clear aims have now been added in the last paragraph of the introduction and the Results, Discussion and Conclusions all link to these aims.**

These aims are set out in the Introduction (lines 88-93):

**The aim of this study is to provide a baseline description of the current distributions and biogeochemical traits of phytoplankton communities from distinct biogeographical regions of the**

**Labrador Sea. .... In addition, we also examine the overall photophysiological and biogeochemical traits associated with these different phytoplankton communities.**

So what is wrong with this Aim? First, it is not clear. It is jargon – general hand-waving. Secondly, it is not explicit. What exactly is meant by terms like baseline description? What photophysiological and biogeochemical traits are examined? (Note the repetition of biogeochemical as well). These general terms should be replaced by explicit reference to P-E curves, fluorometry, POC/PON analysis etc. (many photophysiological and biogeochemical traits were NOT examined!). Thirdly, it is incomplete. There is no mention of the analysis of hydrographic variables that explain the distribution of phytoplankton communities, and thus technically these sections are irrelevant to the paper. In this regard, the Aims have failed the authors because if such an aim was explicitly identified, then they would have mentioned the fact that environmental variables explained 99.8 % of the variability in phytoplankton communities in the Conclusions and the Abstract, which they did not. Thus, what I consider to be an important result of the paper will not be apparent if I read the Title, Abstract, keywords, Aim and Conclusions.

My suggestion for this type of paper, involving post-hoc analysis of a data set, is to set out the Aims as a series of detailed questions that will be addressed in the paper. A useful strategy is to set out, in plain language, what questions the authors asked themselves when they were setting up the statistical analyses presented. Did they say, “Can we provide a baseline description of the current distributions and biogeochemical traits of phytoplankton communities from distinct biogeographical regions of the Labrador Sea”? I doubt it. How about, “Are there distinct communities of phytoplankton within the study region and if so, what are their main constituents? Where do these communities occur and are they stable year-to-year? Can the variability in phytoplankton communities be explained by environmental factors? *Et cetera*”? I hope it is obvious that clear explicit aims like these make it easier for the reader to understand the paper (and thus more likely to cite it), but also make it easier for the authors to write a clear, focused paper in the first place.

(By the way, for my students, I normally suggest writing the questions for each test clearly while doing the analyses, as well as their results. Doing it at the time while immersed in the data simplifies the write-up. I also recommend that the statement of Aims in the Introduction should be followed by a brief paragraph describing the approach taken and another outlining the major findings.)

This can be fixed fairly easily without much rewriting. I suggest going through the paper, listing the major results, framing them as questions in the Aims, ensuring that the answers are clear in the Results, and highlighted in the Conclusions and Abstract, then getting on with the next paper and thesis!

I would discard the first sentence of the Aims (Line 88). Start the para, “Here, we investigate the multi-year (2005-2014) distributions” etc using the second and third sentences. Even though I complained about the third sentence, it can be used because it will be explained and expanded in the following sentence: “We address the following questions:” or similar, using the questions as above. The further hand-waving in the final sentence should be replaced by a brief synopsis of the major findings: e.g. “ We show that several distinct communities exist ... etc. “

More generally, beware of jargon and nominalization – they reduce readability and clarity.

## OTHER COMMENTS

1. In my previous review, I asked: *RC2.19 -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?* The authors responded: **AC2.19 - Cluster C3b had the highest level of internal Bray-Curtis similarity in terms of sample composition (i.e. samples in this group were more similar (73%) to one another than to other groups). Hence, we decided not to further divide it as we could in theory continue to subdivide until each subgroup contains very few samples.** This is the authors' decision of course. My question was raised out of curiosity. However, I will make the more general point that with this sort of analysis, I suggest exploring the patterns and fully understand what they are showing about the data, rather than sticking to arbitrary cutoffs. Then, having understood the data, decide what groupings are appropriate to address the aims of the paper.

2. Line 74: Change "has" to "have"

3. Line 154 "pelletised" misspelt

4. Line 215 and elsewhere: There is a problem with the statement "Zea + Lut is not only found in prasinophytes-type 2, but is also the major accessory pigment of cyanobacteria". It is important to note that Zeaxanthin and Lutein are two separate pigments, despite the fact that they cannot be resolved in the author's HPLC system and elute as a single peak. It is wrong to say THE major accessory pigment of cyanobacteria, first because Zea + Lut is not a single pigment, but also because Cyanobacteria have Zeaxanthin but no Lutein. Likewise, it would be better to say Zea is also a minor pigment in chlorophytes, while Lutein is often the dominant carotenoid (Line 216). Note also that Zeax may be derived from non-photosynthetic bacteria (e.g. Flavobacteria)

5. Line 323: "in the Labrador Sea during spring and early summer (2005-2014)" could be replaced by "defined above" (this redundant detail just makes it harder to read)

6. Line 331: Shouldn't the sigma theta be greater than 27 kg m<sup>-3</sup> rather than less than?

7. Line 352: Comma after variance

8. Line 604: Presumably "relies" should not be italicised

9. Line 621: Alou-Front et al (2016) is not in References, and presumably should be Alou-Font

10. Line 750: Gieskes and Kraay (1983) missing