First of all thank you for your detailed analysis of our article. All your comments and suggestions were taken into account to improve our manuscript. The corrections of the manuscript associated with each of your comments are described below. Your comments are in bold text and our responses in plain italics. As you suggested, we separated our article in two manuscripts M1 and M2. The additional paper (M2) focused on phytoplankton distributions obtained by optical microscopy and HPLC while the M1 analyzes the impact of a physical factor, the freshening (SFL), related to the melting of ice, on primary production. Writing a paper dedicated to the distribution of phytoplankton has increased the description of the cell count, which is now presented as equal of the data pigment. The comparison of two distinct methods to characterize the phytoplankton increase the robustness of the distributions presented. Complementarity and differences of both approaches are discussed (section 3.1, M2). In one hand, the microscopy gives a precise count at the species level of the large phytoplankton (diatoms, dinoflagellates) and some nanoplancton. However, the lack of discernible morphologic features in the smaller phytoplankton (pico- nano-size phytoplankton) precludes the identification by light microscopy. In the other hand, the pigments analysis through HPLC is a rapid and suitable tool to analyze hundreds of samples. Moreover, analysis of photosynthetic pigments can identify taxonomic groups when it is difficult or impractical to identify and count individual cells. To facilitate the comparison of two methods, CHEMTAX is used to interpret the pigments in term of dominant phytoplankton taxa (Figure 7, section 3.1., M2).

Also benefit from the separation into two papers is the reduction of the text length, of the amount of information per manuscript and a well-defined focus for each manuscript. The objective of the M1 is now focused on the impact of surface freshening on productivity while the M2 concentrates on comparing the phytoplankton distributions in summer 2008 with that obtained by previous field studies in summers 1994 and 2002. The two manuscripts have been corrected from language mistakes by a native English speaker.

Overall Comments: This manuscript contains a large dataset on chlorophyll a, phytoplankton accessory pigments and carbon uptake linked to hydrographic data across the Chukchi shelf and into the Canada Basin. The data contained in this manuscript are of utmost importance to our study of this region.

However, there are several barriers to the publication of this manuscript as it stands at the moment. The first is the poor language used throughout the text, while it is obvious

that the authors do not speak English as a first language they should enlist the help of someone in correcting the mistakes.

Sincere apologies for the poor English, we have corrected the grammatical mistakes and following Referee #3's advice, we have asked an English native speaker to edit entirely both manuscripts.

Secondly, the paper gives much space over the description of CHEMTAX results and little to the actual microscopy.

Because of previous publication on the species counts during the same cruise (Joo et al., 2011), more importance was given to the pigments data. However, after the revision, we have decided to focus a paper on the results of microscopy and pigments. Thus, the importance of the microscopy data is greatly improved. We show than the two methods are complementary, the pigments analysis through HPLC provide a useful tools in Arctic basins dominated by small-size plankton hard to study through microscopy and sometimes poorly preserved by sample fixation (Gieskes and Kraay, 1983, Simon et al., 1994). CHEMTAX is used to interpret the pigments in term of dominant phytoplankton (Figure 7, section 3.1., M2) and to facilitate the comparison of both methods, microscopy and HPLC.

Overall the paper is long and filled with the description of accessory pigments, this makes it tiring to read. The authors should endeavor to tighten the main points of the paper.

Following Referee # 2 as well as Referee # 1 advice, we have decided to split the paper in two manuscripts M1 and M2. By this way, the structure is clearer and the text is shortened and the focus of each manuscript is tighter.

Strong reliance on CHEMTAX to give phytoplankton assemblage. This program must be initialized with pigment ratios that are regionally specific, these ratios then influence the outcome of the program. Given that the authors have the microscopy, I am unsure why they are using CHEMTAX. Describing the accessory pigments and linking that analysis with the microscopy would provide a much more robust result and serve the same purpose as CHEMTAX.

The microscopy gives a reliable count at the species level of the large phytoplankton

(diatoms, dinoflagellates) and some nanoplancton but identification and count of the smaller phytoplankton could be problematic because of the lack of discernible morphologic features of this fraction. Over the Arctic Basin, dominated by small-size phytoplankton, the analysis of pigments is a useful tool because many of the picoplancton and nanoplankton have distinctive suites of marker chlorophyll and carotenoids that indicate their presence and abundance in a mixed population (Jeffrey and Vesk, 1997). Moreover, because of the pigments data acquisition in contrast to microscopy which required skills and time, we are able to provide pigments data in twice more stations than microscopy (see Figure 1 in M2). CHEMTAX is used in manuscript 2 in order to interpret the pigments data in term of dominant phytoplankton taxa (Figure 7, section 3.1., M2) and compare the results with the taxonomy. In spite of CHEMTAX was not calibrated in polar ecosystems until now, the CHEMTAX approach remain a powerful tool to interpret the raw pigments data.

If the authors have HPLC data from other years, then I suggest they write a separate paper on using CHEMTAX in this region and validate the model with their data from other years.

We only use CHEMTAX as a tool to interpret the pigments data and compare it with microscopy count. Observation and discussion about the use of CHEMTAX in the investigated region will be provided in the second manuscript (section 3.1. M2). No endeavors were made to validate CHEMTAX in our manuscript. Therefore, we point out that the interpretation of phytoplankton distribution through pigments could strongly differ from microscopic observations (section 3.1. M2). A complete work on the validation of CHEMTAX is needed and will be considered in the near future thanks to the acquisition in 2009 and 2010 of pigments data in the Arctic.

Major Corrections

Figure 2,b,c&d: Using the same scale for each figure would help in comparing the different ice concentration metrics.

Figure 2d has been removed. Figures 2b and 2c have different scales because one is expressed as % ice cover and the second in days. We have put the captions directly below the graph to clarify the figure.

Figure 5 b & e: By using the same depth scale for the depth of the nutricline and the

SCM would allow for an easier comparison between the two.

The scale of the nutricline depth and the SCM depth are now in the same scale of 100m.

Figure 9: Axis should be labeled with units in all cases. Figure 9 b & c: If a regression between two variables does not turn a statistically significant regression as in these figures, there is no point in displaying the regression line. Simply state in the text that the regression was not significant.

Figure 9 has been removed, because some carotenoids and chlorophylls are shared among different algal classes (Jeffrey et al., 1999), the microalgal groups inferred from marker pigments should be contrasted with microscopy. We considered in manuscript 2, only the qualitative information obtained by CHEMTAX. The Figure 9d which dealt about the impact of irradiance on productivity has been replaced by a reference to Dr Tremblay's work which deals with the impact of irradiance on productivity (Tremblay and Gagnon, 2009).

Table 2: It would be helpful to the reader to be able to see the chl a and PP profiles in a figure. This would help with understanding the discussion about chl a and PP maximums.

The chla and PP are presented in Figure 9 (M1) following Referee #3's advice. Figure 9c allows comparison of the depths of maximum chla (SCM) and maximum PP.

We would like to sincerely thank you for your advices and constructive comments.

Sincerely,

Pierre Coupel on behalf of all the authors

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