We are very grateful for the detailed review of our manuscript you provided and attention taken to address these errors. We agree with your comments and we have responded point by point below. Your comments are in bold text and our responses in plain italics. To clarify the manuscript, we have followed your suggestion to split the paper in two parts as mentioned in the introductive general answer to referees. Thanks to the separation into two manuscripts, one on the impact of freshening on primary production and biomass (M1) and the other focused on the distribution of phytoplankton determined by optical microscopy and HPLC (M2). In fact, we're allowed to bring a more detailed and accurate description of the species specific data obtained by light microscopy. Particular care has been taken to make the figures more clear and legible. Abbreviations, too many in the first draft, were reduced in number and reported in a table (Table 1, M1) for easy reading. More literature was considered as the work of Shimada's group on Pacific waters or of Tremblay's group on the impact of light and nutrients on the Arctic Ocean productivity. English has been corrected with the help of an English speaking person.

The greatest draw back is the English. Now, as I do not have English as my mother tongue I am certainly aware of the challenge and I am off course in a similar situation when I publish. However, this rather long manuscript is full of mistakes and unusual (may be French?) wording. Some of the expressions are directly scientifically wrong. It takes a lot of time to read and to correct some of the phrasing. The authors make a disservice for themselves as they drain the enthusiasm of the referee. This has to be changed before one can talk about publishing.

Examples. Unproductive phytoplankton communities (they may have a low productivity, but they are not unproductive). Stratification starts off. Nutrient availability drives the highest biomass.. heavy ice Condition… allowing light limitation. The poverty and the richness…of a shelf. The 2008 obtained phytoplankton abundance… Basis for the marine trophic chain. In the high Arctic latitudes, mainly composed of deep basins. Yielding a high statio-temporal variability (creating the base for…?). these ecological patters will be reorganising. The spring bloom of phytoplankton (the spring bloom is based upon phytoplankton. The warmed environments. Samples…presentd a heavy ice pack… Last objective will be assessed… Is based upon the method described by (why not "according to"?). and edged by a continental slope. Stations presented ice free conditions. Pigment agency of polar species. Collocated comparisons. PP/Chl a is called the productivity index or specific

productivity, not the productivity ratio. Efficiency to draw down carbon and export it. These conditions are characteristic of new production together with efficient transfer to the upper trophic level and important carbon export (cite Parson et al here????). nutrient rich waters coud be uplifted in surface. New type of water. At the opposite… conducting to important sea ice formation. Ordinary associated. Why nutrients are still in enough concentrations. Has been already evidenced. At the opposite. Carbon biological pump. The ice decline year. Provides us evidences. In a close future. No enrichment of surface layers by sediments.

Sincere apologies for the poor English, we have corrected all grammatical mistakes and have asked an English native speaker to edit entirely both manuscript.

I wish to oppose the use of the term Western (or Eastern) Arctic Ocean. This is North American jargon that is utterly unprecise. It means west of the USA and Canada. However, the Chukchi Sea is to the east of Russia and do we expect that Russians also call it the Western Arctic? At latitudes above 70 degrees the ocean gets more and more curved and east and west do not explain much as long as one does not uses latitudes. And the western latitudes start at the Greenwich meridian. May be the authors have been both at W and E latitudes during their expedition? I advise to go for geographic terms so that all know where the investigation took place. You could for example write "in the Pacific sector".

We fully agree, Western Arctic Ocean has been replaced in both manuscripts by "Pacific Arctic Ocean", "Pacific sector of the Arctic Ocean" as proposed by Referee #1. We intend here to mark the distinction between the Western Arctic Ocean connected with the Pacific Ocean through the Bering Strait and the Eastern Arctic Ocean connected to the Atlantic Ocean through the Fram Strait.

There is an extensive use of abbreviations and I am not always sure f the authors apply internationally applied ones or invent their owns. In understand why abbreviations are used, but may be you could make a table that eases the reader through the text. Is the active melting zone (AZM) a colloquial term? Is it not the Marginal Ice Zone (MIZ) or the Seasonal Ice Zone (SIZ)?

The number of abbreviations has been greatly decreased and some of have been replaced by more commonly used ones. The AMZ has been replaced by the MIZ as defined by Carmack

and Wassmann (2006). All the abbreviations are now reported in Table 1 of M1.

Considerable emphasis is provided to CHEMTAX and that is fine. However, much less evidence is provided to calibrate against direct microscopic counts. What endeavors were made to quantify microscopically the smallest fraction? At time the manuscript reads like discussion of the CHEMTAX methodology.

The taxonomy of phytoplankton determined through pigments and microscopy is now detailed in the manuscript M2. The results section of the M2 included a specific section about the results from pigments (section 2.2.2.) as well as a section describing the microscopic count (section 2.2.3). The conclusions derived from microscopic count and pigments are face in the section 3.1. of the discussion to highlight the main features of the phytoplankton distribution. 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). A combination of light and epifluorescence microscopy was use to quantify the smallest fraction; however for a large proportion of nanoplankton and picoplankton, the type of phytoplankton remains unidentified. The pigments analysis helps us to identify this unidentified picoplankton as mainly belonging to the prasinophytes.

2008 was not a summer of exceptional ice retreat. Since 2007 all summers had a major retreat of ice in the Canadian Basin. You should rather write "during the recent ice conditions".

The use of "exceptional ice retreat" has been replaced by "recent ice conditions" as suggested by Referee # 1.

4.1.1. is a part of the discussion, but what is carried out is a comparison of results.

The discussion about the microscopy, pigments and CHEMTAX have been completely changed as explained just above.

On page 6937 the authors discuss the primary production in the SCM. They write: too low or too high irradiance strongly reduces the productivity. Such issues are presented in textbooks, not in a paper of this level. Further, there is a lot of literature about these aspects and it would be good to know if the authors know these papers? Any other investigation of phytoplankton in the Arctic Ocean over the last 20 years that could illuminate these issues? Along these lines is the application of the term specific primary

production or productivity index. Could it be that the authors have not read enough of the dedicated literature?

The figure showing the relationship between irradiance and productivity was removed. References to previous publications on the role of light on primary production in the Arctic are now cited (Tremblay and Gagnon, 2009).

How do Prymnesiophytes and Prasinophytes adapt to feed on regenerated matter, brought up by turbulent processes?

We made a mistake. We meant remineralized matter from the deeper layers brought in surface by turbulent mixing. The turbulence we mention here has been previously highlighted by Pickart et al. (2005) who discussed the role of the flow of dense waters from the Chukchi shelf and through the channel and its implications for the ventilation of the upper halocline (see section 3.1.2. in M1).

How can the PWW sink deeper by density and carry their nutrient contents?

The formulation has been changed into: "Another possible explanation of the contrasted freshening between the Canada Abyssal Plain and the Chukchi Borderland has been advanced by Nishino et al. (2008), who suggest the higher buoyancy of the PWW (Pacific Winter Water) branch spreading west in comparison to the PWW branch injected in the Canada Abyssal Plain. The Alaskan Coastal Current (ACC) could contribute to the higher buoyancy of the PW flowing in the Canada Abyssal Plain (Woodgate et al., 2010). During the CHINARE cruise, the near-freezing temperature and high silicate concentrations, representative of the PWW core, were observed between 100m and 200m in the Canada Abyssal Plain and between 50m and 200m in the Chukchi Borderland (Fig. 10b, 10c). This results in a nutrient reservoir lying 50m to 100m deeper in the Canada Abyssal Plain than in the Chukchi Borderland (Fig. 10c)." (section 3.3. in M1). We would explain here that the depth of the PWW nutrients reservoir over the basins is dictating by the buoyancy of the PWW. But the buoyancy of the PW may be modified during its way over the Chukchi shelf.

On page 6940 the authors introduce a 4th category of headlines. I think this is too much.

The 4th category of headlines has been removed due to the splitting in two manuscripts.

In 4.3 the authors make a significant mistake my mixing up climate variability with

climate change. It is tempting, indeed, but if one has few measurements in a region subjected to climate change one should describe the variability before interpreting that the variability was so much bigger then "normal" that it must be climate change.

We will precise that conditions described in 2008 are only a snapshot. We will point out the differences of phytoplankton distribution between the 2008 campaign and the previous oceanographic cruises in the same areas and will advance some hypothesis that could explain the observed differences. Note that there are very few historical phytoplankton data in the Pacific Arctic Ocean (see section 3.2.2 in M2)

Along these lines is the "exceptional" ice retreat in 2008.

The use of "exceptional ice retreat" has been replaced by "recent ice conditions" or "recent strong ice melting" as suggested by Referee # 1.

Page 6947. Are there no publications anywhere else in the Arctic Ocean that suggest similar conclusions? Essential work from the Beaufort Sea such as that of Tremblay is missing and that is a crucial lack.

Dr Tremblay's work is now included in the manuscript, the reference being added dealing with the role of light and nutrients on productivity (Tremblay and Gagnon, 2009).

Where is a discussion of the extremely detailed work of Koji Shimadas group in the Canada Basin? What about work carried out by David Barbers group recently?

The work of Dr Shimada's group is now referred in the section related to the upper and lower halocline characteristics. We also referred to these works in order to explain the oligotrophy of the Canadian basin and the link with the circulation of PSW (Pacific Summer Water) and PWW (Pacific Winter Water).

The figures were difficult to study due to their format and size. If they do not get significant bigger in the publication then they will be of no big use. They can hardly be evaluated by a referee because of their size. Figs. 8, 11 and 12 are a nightmare, indicating that the authors never thought about the reader.

Figures 11 and 12 have been replaced by the Figure 10 and 11 in M1. The CHEMTAX output previously presented in Figure 8 is now synthetize in a histogram in Figure 7k of M2.

To summarise, while I strongly support the publication of this extremely valuable data set I must say that the format, the style and may be even the focus are not appropriate for publication as yet. One gets overwhelmed by the wealth of data and looks for the specific focus that could guide one through the manuscript. Here is enough for two manuscripts that could be tightly linked to each other and published face to face.

Considering the splitting into two manuscripts, we decided to follow Referee # 1 advices. The focus of this revised manuscript 1 (M1) is on the effect of the freshening on the primary producers while the focus of the second manuscript (M2) will be on the main phytoplankton group analysis of the CHINARE 2008 cruise. The two approaches presented, microscopy and pigments, will provide a solid and complementary description of the phytoplankton distribution in very poorly documented areas (section 3.1., M2).

The authors should read more literature and consider that also some relevant research has done in the European sector or the adjacent Beaufort shelf of the Arctic Ocean.

Several references to studies in the Beaufort Sea have been added (Tremblay and Gagnon, 2009). More detailed comparison with the phytoplankton communities of others Arctic sectors as the European sector is provide in the first manuscript (section 3.1.2., M1). In the manuscript 2, comparison of the 2008 taxonomy and pigments are compared with historical cruise from two programs in the Arctic Ocean: the Arctic Ocean Section (AOS in 1994) and the Shelf-Basin Interaction programs (SBI, 2002-2004).

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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