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Interactive comment on “Nutritive and photosynthetic ecology of subsurface chlorophyll maxima in the Canadian Arctic waters” by J. Martin et al.

Anonymous Referee #1

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This manuscript assumes that subsurface chlorophyll maxima (SCM) in the Canadian Arctic waters have a large role in new production in the water columns, and reports nutritive and photosynthetic characteristics of the SCM. However, vertical maximum of nitrate uptake rate does not occur at SCM in oligotrophic tropical and subtropical oceans (e.g. Raimbault et al., 1999; Aufdenkampe et al., 2002; Kanda, 2008). The authors determined biological productivity only at the SCM and surface waters, but information of vertical profile of the biological productivity is lacking. Hence I cannot evaluate the validity of their assumption and judge their results properly. Accordingly, I am afraid the conclusions the authors reached are not solid. Furthermore, SCM has been well studied in the ocean, and light, nutrients, and temperature are well recog-

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nized to be important for the SCM communities (Lalli and Parsons, 1993). I receive the impression that their finding is lacking novelty and remains local interest.

Introduction One of the objectives in this study is to establish contemporary parameters for use in ecosystem models and remote-sensing algorithms (P6448 L9-11). However, by only reading this introduction, I cannot understand the necessary for obtaining the parameters. Therefore it is difficult to understand why the authors needed to conduct experiments for photosynthesis or nitrogen uptake–irradiance curve (P6451 L7- P6452 L5).

Materials and Methods

P6450 L18: Information of vacuum pressure is lacking.

P6452: What is N₂?

P6452 L6: Recent study demonstrated that f-ratio has been overestimated by nitrification near surface (Yool et al., 2007). Influence of nitrification on nitrate uptake and f-ratio should be addressed.

Results

P6455 L3-18 and Fig. 3: The authors estimate vertical profile of primary production and nitrate uptake on the basis of the results of uptake-irradiance parameters in the SCM and surface waters. Verifying these estimated profiles, the authors should show observed vertical profile of primary production and nitrate uptake at some stations and compare the modeled uptake rates with observed ones.

Table 1: Incubations of surface waters were only conducted in late summer-fall. The authors demonstrate that plankton community properties did not only vary between at the surface and the SCM (Fig. 2) but also with the seasons (Fig. 5 and 6). This sampling bias might influence on interpretation of obtained data.

Table B1,B2: It is difficult to understand the difference between Table B1 and B2. What

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is the difference of correlation coefficient for nitrate uptake between Table B1 and B2?

Discussion

P6460 L11-19: The authors hypothesized that the primary productivity of SCM communities was limited by irradiance due to their position in the lower euphotic zone near the nitracline and that SCM depend principally on NO₃ and mediate a large share of water-column new production. To examine these hypotheses, why the authors need to discuss (1) the relative importance of dark versus light dependent uptake for different N sources and (2) stoichiometry of C and N uptake at low irradiance? There seems to be a jump in logic.

Aufdenkampe, A.K. et al. (2002) Biogeochemical controls on new production in the tropical Pacific, *Deep-Sea Res. II* 49, 2619-2648.

Kanda, J. (2008) Vertical profiles of nitrate uptake obtained from in situ ¹⁵N incubation experiments in the western North Pacific, *J. Mar. Syst.* 71, 63-78.

Lalli, C.M., Parsons, T.R. (1993) *Biological Oceanography -an introduction*, Elsevier.

Raimbault, P. et al. (1999) Carbon and nitrogen uptake and export in the equatorial Pacific at 150°W: Evidence of an efficient regenerated production cycle, *J. Geophys. Res.* 104, 3341-3356.

Yool, A. et al. (2007) The significance of nitrification for oceanic new production, *Nature* 447, 999-1002.

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9, C2412–C2414, 2012

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