

***Interactive comment on “Dissolved organic matter composition and bioavailability reflect ecosystem productivity in the Western Arctic Ocean” by Y. Shen et al.***

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We thank Dr. Stubbins for his valuable suggestions and comments. Please see our replies to comments below.

- 1). Page 9573, line 19: Revised.
- 2). Page 9574, line 5: The following citation was added (Davis and Benner 2007).
- 3). Page 9574, line 24: The following citations were added (Kirchman et al., 1993, Carlson and Ducklow, 1995). We further clarified our use of the terms “labile” and “bioavailable” in our response to reviewer #4.

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4). Page 9576, line 7: Reference standards were obtained from the University of Miami. Blanks were negligible and values for reference standards were within 5% of reported values.

5). Page 9579, line 15: This paragraph was revised (see below) to explain inconsistencies between the two indicators and to clarify why TDAA yields are better indicators of bioavailable DOM.

Average amino acid degradation index (DI) values for the four cruises ranged from -1.58 to 1.08 (Table 1). During SBI 2002, 2004, and MAL 2009, DI values decreased from shelf waters to slope-basin surface waters, and with depth (Table 1). An opposite trend was observed during CFL 2008. In general, DI values were lower in the Chukchi Sea (SBI 2002, 2004) than in the Beaufort Sea (CFL 2008, MAL 2009) (Table 1). The variable DI values reflect amino acid compositional heterogeneity, which is influenced by source as well as diagenetic alterations. It appears source plays an important role in shaping DI values in these margin waters, which can have high and variable contributions of riverine DOM. The DI values for Mackenzie River DOM in 2008 and 2009, 1.34 and -0.37, respectively, were very different indicating large variability in TDAA composition in riverine DOM. In contrast, the TDAA yields for Mackenzie River DOM in 2008 and 2009, 0.44 and 0.38 %DOC, respectively, indicating minimal variability in TDAA yields in riverine DOM. Correlations between DI values and TDAA yields were quite variable among cruises (SBI 2002:  $r = 0.9064$ ,  $p < 0.001$ ; SBI 2004:  $r = 0.4694$ ,  $p < 0.001$ ; CFL 2008:  $r = -0.2537$ ,  $p = 0.2945$ ; MAL 2009:  $r = 0.6838$ ,  $p < 0.001$ ), and it appears the influence of riverine DOM on DI values contributes to the weak correlation between DI and TDAA yield during the CFL cruise in 2008. Based on these observations, TDAA yields were considered better indicators of DOM bioavailability than DI values. In addition, bioassay experiments with a variety of substrates in waters from the Chukchi Sea concluded DI values are not reliable indicators of labile DOM (Davis et al., 2009).

Additional references:

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Carlson, C. A., and Ducklow, H. W.: Dissolved organic carbon in the upper ocean of the central equatorial Pacific Ocean, 1992: Daily and finescale vertical variations, Deep-Sea Res. Part II Top. Stud. Oceanogr., 42, 639-656, doi: 10.1016/0967-0645(95)00023-J, 1995.

Kirchman, D., Lancelot, C., Fasham, M., Legendre, L., Radach, G., and Scott, M.: Dissolved organic matter in biogeochemical models of the ocean, in: Towards a model of ocean biogeochemical processes, edited by: Evans, G., and Fasham, M., Springer-Verlag, Berlin, 209-225, 1993.

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