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Supplementary Material

Sea Ice and Water Mass Influence Dimethylsulfide Concentrations in the Central Arctic Ocean

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1 Methodological considerations regarding our method of DMS measurement

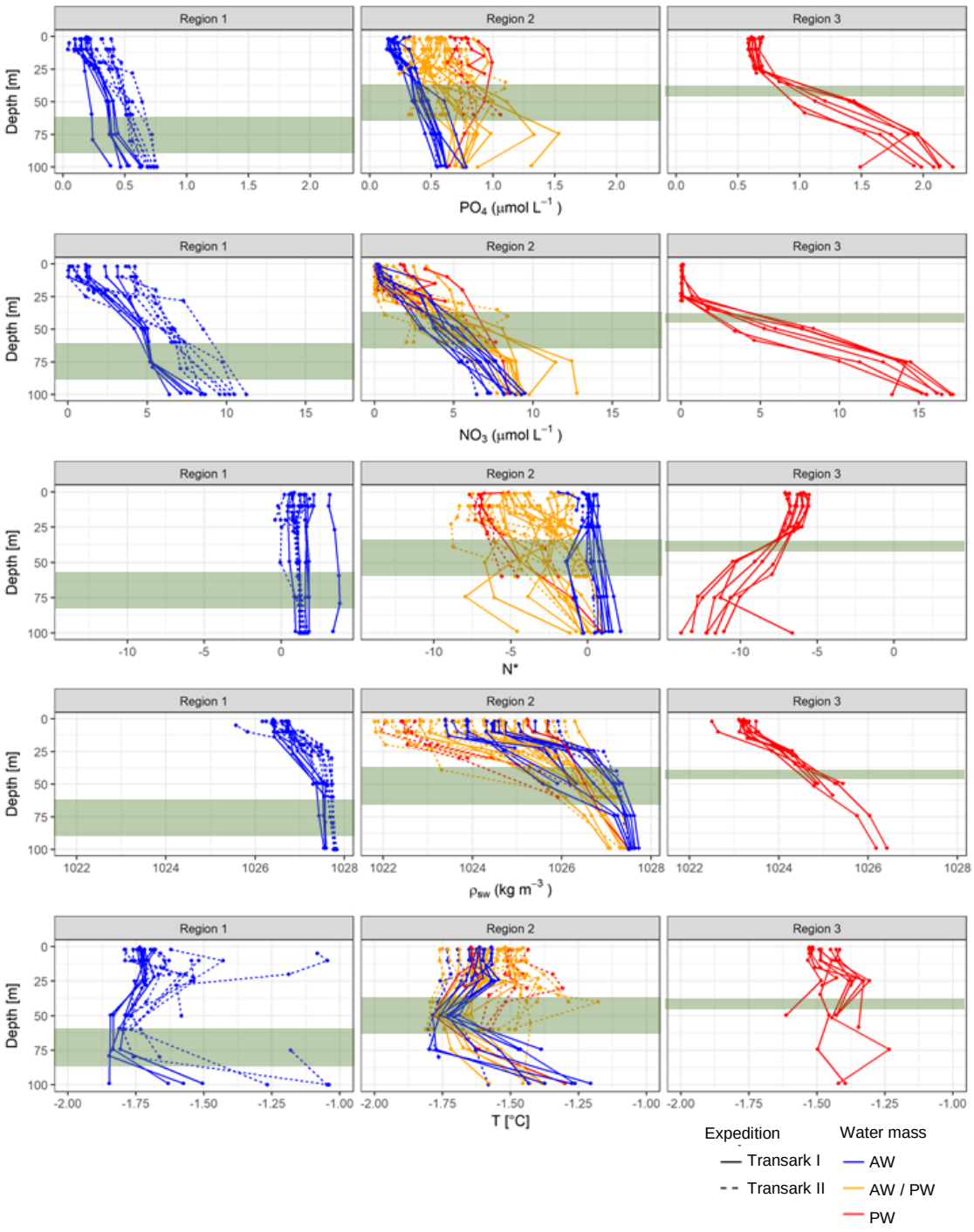
Since samples were not filtered prior to determination of DMS concentration, we cannot exclude that fragile phytoplankton cells like prymnesiophytes might have been disrupted during purging. This might have led to a release of DMSP followed by conversion to DMS.

We performed several calculations to estimate the error this might introduce in our dataset. We assumed DMSP to DMS conversion rates in natural seawater samples of 2.8 nM day^{-1} (at 3.5°C, 50 nM DMSP, Labrador Current; Wolfe et al (1999)), to 10 nM h^{-1} (at 10°C, 250 Labrador Sea; Schultes et al. (2000)). At maximal $DMSP_{gross}$ concentration of 227 nM, a rate constant of 0.04 h^{-1} and a 10 minute purge, we calculate a production of 0.02 to 1.5 nM DMS. These values are negligible compared to the high DMS concentrations presented in this study.

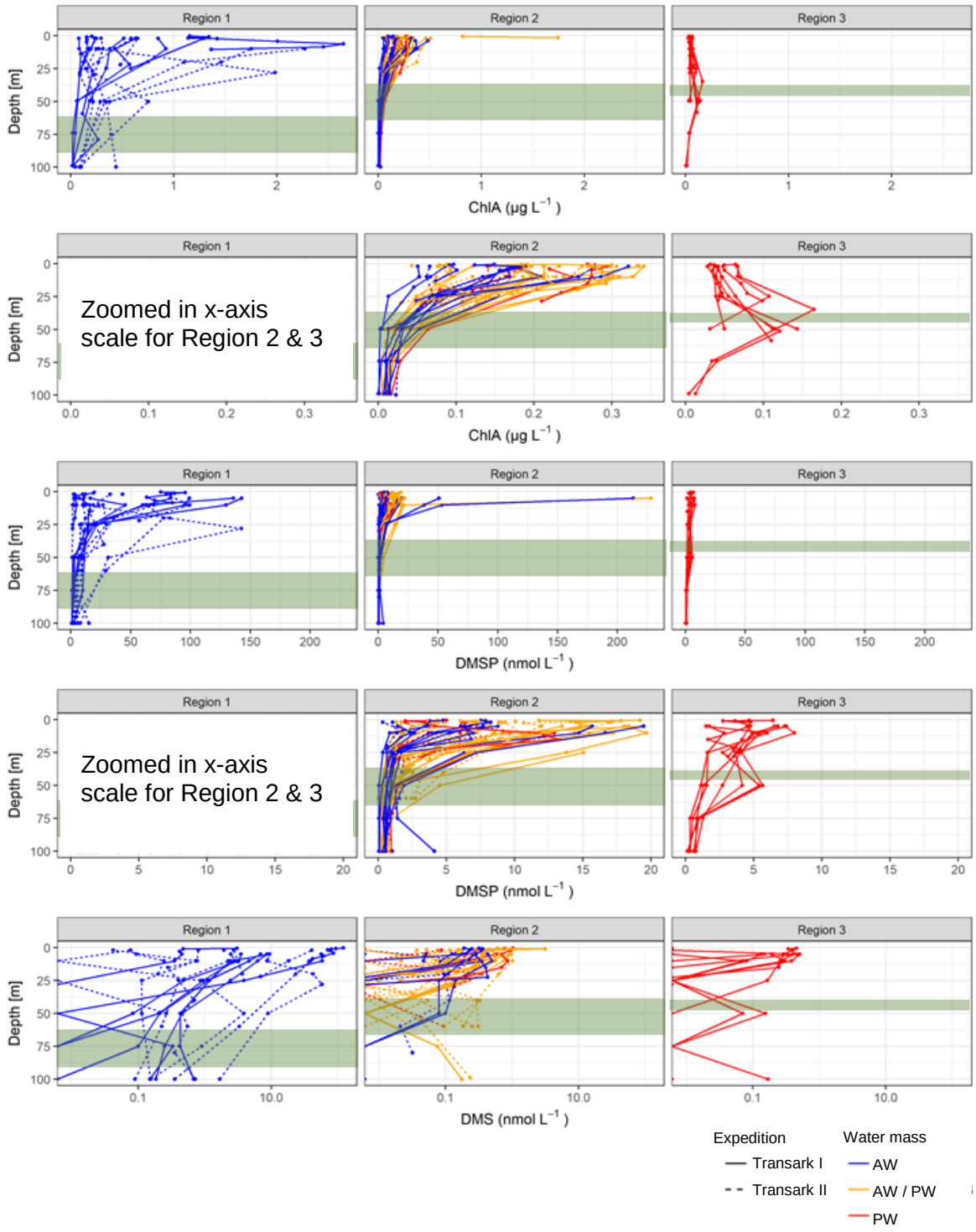
Few data points in our study would be affected by this error. Only 3% of the samples have a fraction of haptophytes larger 30% (expressed as 19 Hex / Chl *a* ratio). Further, 15% of the samples have a haptophyte fraction >10%, while in the remaining 85% of the samples average at 0.8%.

2 Supplementary Figures and Tables

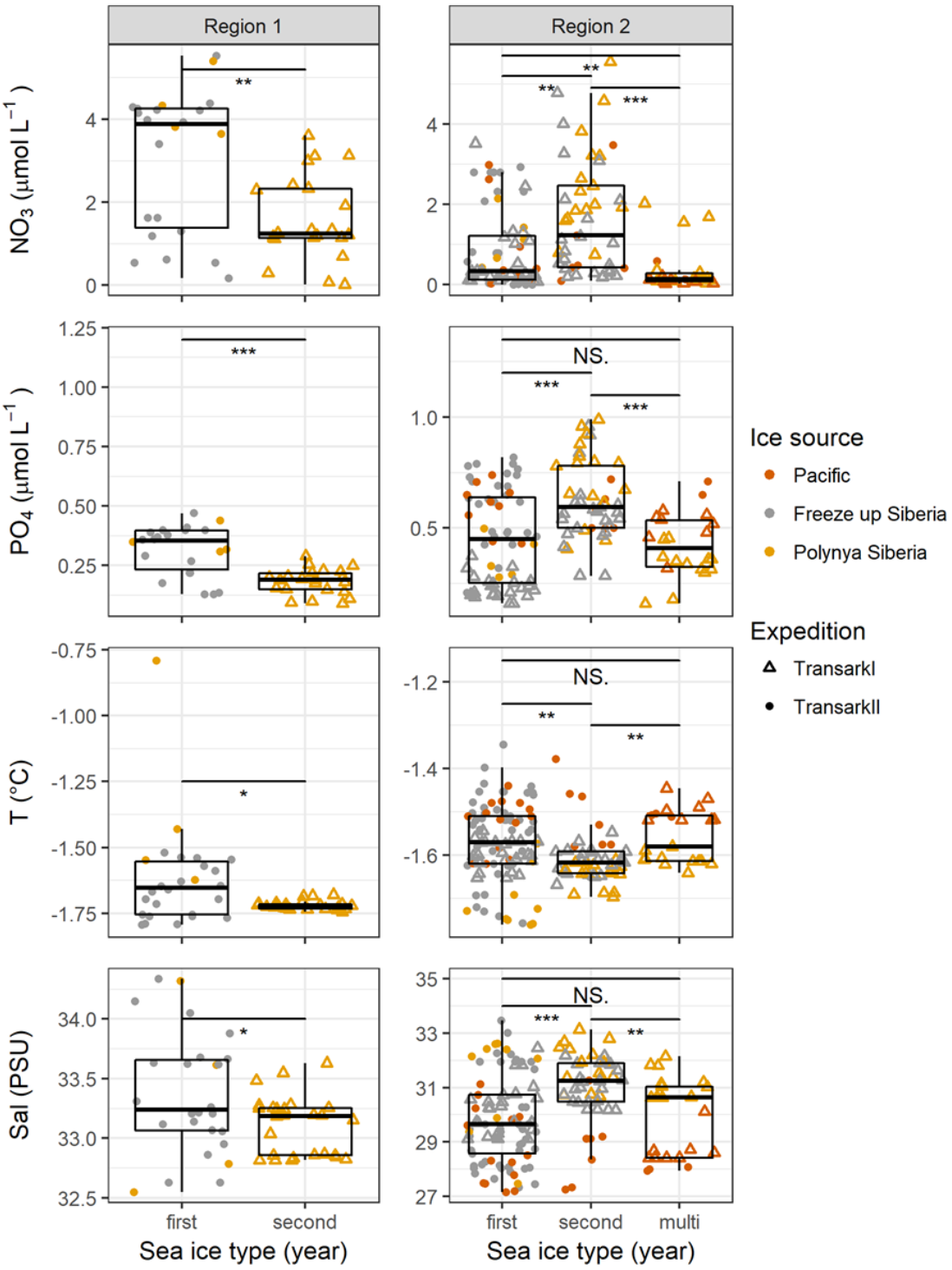
2.1 Supplementary Figures



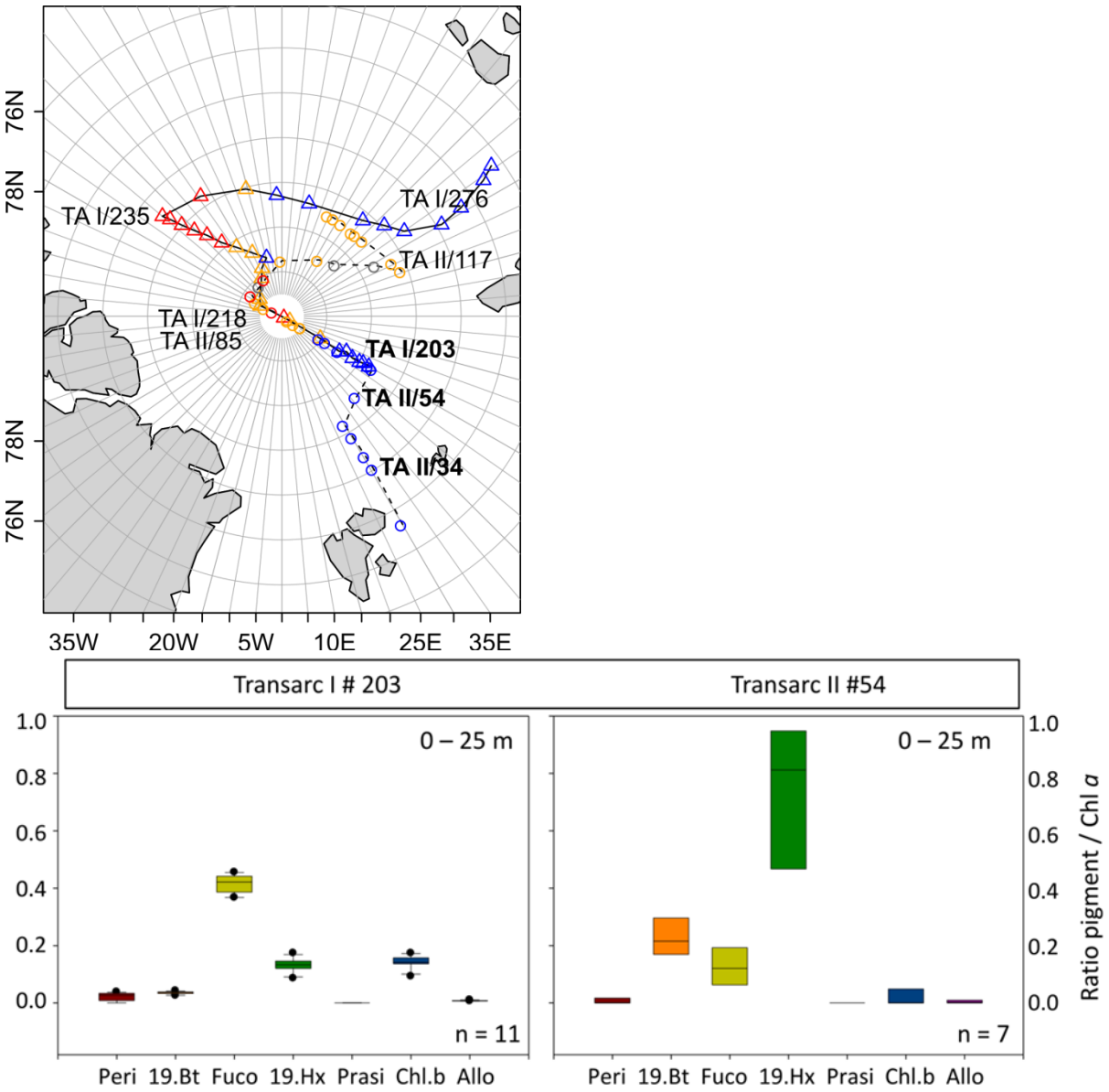
Supplementary Figure 1A. Depth profiles, phosphate, nitrate, N*, density, temperature. Lines connect discrete sampling depths indicated by symbols. Winter Mixed Layer depths shaded in green: Region 1 = 75 ± 15 m, Region 2 = 51 ± 15 m, Region 3 = 44 ± 3 m. If there was both sampling by CTD and Kemmerer bottle at one station, the profiles are plotted separately. Temperature and density profiles are the depths matching DMS/DMSP sampling depths.



Supplementary Figure 1B. Depth profiles chlorophyll a, DMSP, DMS. Lines connect discrete sampling depths indicated by symbols. Winter Mixed Layer depths shaded in green: Region 1 = 75 ± 15 m, Region 2 = 51 ± 15 m, Region 3 = 44 ± 3 m. If there was both sampling by CTD and Kemmerer bottle at one station, the profiles are plotted separately.



Supplementary Figure 2. Nitrate and phosphate concentrations as well as temperature and salinity for the upper 25 m water column under different sea ice types in Region 1 and 2. Confidence levels of Welch-test for significant differences between sample groups: $0.0001 \leq ***p < 0.001 \leq **p < 0.01 \leq *p \leq 0.05 < NS \leq 1$



Supplementary Figure 3. Station map (A) and marker pigment ratio to Chl *a* (B) for stations with high DMS. (A) Station map with selected station numbers for Transark I (TA I) and Transark II (TA II), bold stations are stations with high DMS. (B) Marker pigment ratio to Chl *a* in the upper 25 m of the water column; Peri = Peridinin; 19.Bt =19-Butanoyloxyfucoxaanthin; Fuco = Fucoxanthin; 19.Hx = 19-Hexanoyloxyfucoxanthin; Prasi = Prasinoxanthin; Chl.b = Chloropyll *b*; Allo = Alloxanthin indicative for Dinoflagellates, Crysophytes, Diatoms, Prymnesiophytes, Prasinophytes, Chlorophytes and Cryptophytes, respectively.

2.2 Supplementary Tables

Supplementary Table 1. Station list with ice source region, age of sea ice, PW fractions, offset from sea ice minimum.

See separate SupplementaryTable1.xlsx file

Supplementary Table 2. Number of samples (N) and percentage (%) of $DMSP_{gross}$ (DMSP not corrected for DMS) and DMS samples below the limit of quantification (LOQ)

	Depth	$\mathbf{N_{DMSPgross}}$	$\mathbf{N_{DMSPgross<LOQ}}$	$\mathbf{\%_{DMSP<LOQ}}$	$\mathbf{N_{DMS}}$	$\mathbf{N_{DMS<LOQ}}$	$\mathbf{\%_{DMS<LOQ}}$
Region 1	0 - 25 m	62	0	0.0	60	15	25.0
Region 1	25 - 50 m	15	0	0.0	14	7	50.0
Region 1	50 - 100 m	37	1	2.7	29	20	69.0
Region 2	0 - 25 m	180	3	1.7	169	108	63.9
Region 2	25 - 50 m	55	4	7.3	43	43	100.0
Region 2	50 - 100 m	67	19	28.4	54	53	98.1
Region 3	0 - 25 m	32	0	0.0	32	19	59.4
Region 3	25 - 50 m	8	0	0.0	8	8	100.0
Region 3	50 - 100 m	16	2	12.5	16	15	93.8

Supplementary Table 3. Pearson correlation coefficients (r) for correlations between DMSP and DMS to pigment-to-chlorophyll *a* (Chl *a*) and pigment-to-chlorophyll *a* ratios for the three regions at 0 – 50 m depth. Confidence intervals as follows: 0 ≤ ****p < 0.0001 ≤ ***p < 0.001 ≤ **p < 0.01 ≤ *p ≤ 0.05 < ns ≤ 1. No or few data points are indicated by ´n < 3´. Peri = Peridinin; 19.Bt = 19-Butanoyloxyfucoxaanthin; Fuco = Fucoxanthin; 19.Hx = 19-Hexanoyloxyfucoxanthin; Prasi = Prasinoxanthin; Chl.b = Chloropyll *b*; Allo = Alloxanthin indicative for Dinoflagellates, Crysophytes, Diatoms, Prymnesiophytes, Prasinophytes, Chlorophytes and Cryptophytes, respectively.

		log(Chl *a*)[1]	log(Peri/Chl *a*)	log(19 But/Chl *a*)	log(Fuco/Chl *a*)
Region 1	log(DMSP)	0.68****	-0.60**	-0.39**	ns
Region 2	log(DMSP)	0.79****	ns	ns	-0.42****
Region 3	log(DMSP)	0.52**	n < 3	-0.56*	-0.57****
Region 1	log(DMS)	0.76****	ns	ns	ns
Region 2	log(DMS)	0.33**	ns	ns	ns
Region 3	log(DMS)	ns	n < 3	n < 3	ns

[1]The slightly different correlation coefficients for log(Chl *a*) compared to Figure 4 result from different sample sizes. Here only 0 – 50 m depth were considered, while Figure 4 shows 0 – 100 m depth.

Supplementary Table 3 continuing

		log(19 Hex/Chl *a*)	log(Prasi/Chl a)	log(Chl b/Chl a)	log(Allo/Chl a)
Region 1	log(DMSP)	ns	ns	ns	ns
Region 2	log(DMSP)	ns	-0.41****	0.22**	-0.38****
Region 3	log(DMSP)	ns	ns	ns	ns
Region 1	log(DMS)	ns	ns	0.35*	ns
Region 2	log(DMS)	ns	ns	ns	ns
Region 3	log(DMS)	n < 3	ns	ns	ns

Supplementary Table 4. Ratios of DMSP to Chl *a* and DMS to DMSP and Chl *a* (mean ± standard deviation)

	Depth	DMSP/ Chl *a*	DMS/ Chl *a*	DMS/DMSP
Region 1	0 - 25 m	66.31 ± 71.21	20.40 ± 28.11	2.08 ± 6.53
Region 1	25 - 50 m	25.42 ± 17.05	4.53 ± 4.86	0.30 ± 0.48
Region 1	50 - 100 m	42.62 ± 31.08	6.74 ± 12.32	0.40 ± 1.00
Region 2	0 - 25 m	50.06 ± 71.21	1.37 ± 2.18	0.05 ± 0.13
Region 2	25 - 50 m	38.53 ± 48.75	0.36 ± 0.85	0.02 ± 0.06
Region 2	50 - 100 m	99.54 ± 122.15	1.16 ± 2.22	0.05 ± 0.11
Region 3	0 - 25 m	88.64 ± 39.20	3.56 ± 4.40	0.04 ± 0.06
Region 3	25 - 50 m	36.82 ± 16.75	0.45 ± 0.86	0.01 ± 0.03
Region 3	50 - 100 m	42.25 ± 26.87	0.00 ± 0.00	0.02 ± 0.08

3 References

Schultes, S., Levasseur, M., Michaud, S., Cantin, G., Wolfe, G., Gosselin, M., et al. (2000). Dynamics of dimethylsulfide production from dissolved dimethylsulfoniopropionate in the Labrador Sea. *Mar. Ecol. Prog. Ser.* 202, 27–40. doi:10.3354/meps202027.

Wolfe, G., Levasseur, M., Cantin, G., and Michaud, S. (1999). Microbial consumption and production of dimethyl sulfide (DMS) in the Labrador Sea. *Aquat. Microb. Ecol.* 18, 197–205. doi:10.3354/ame018197.