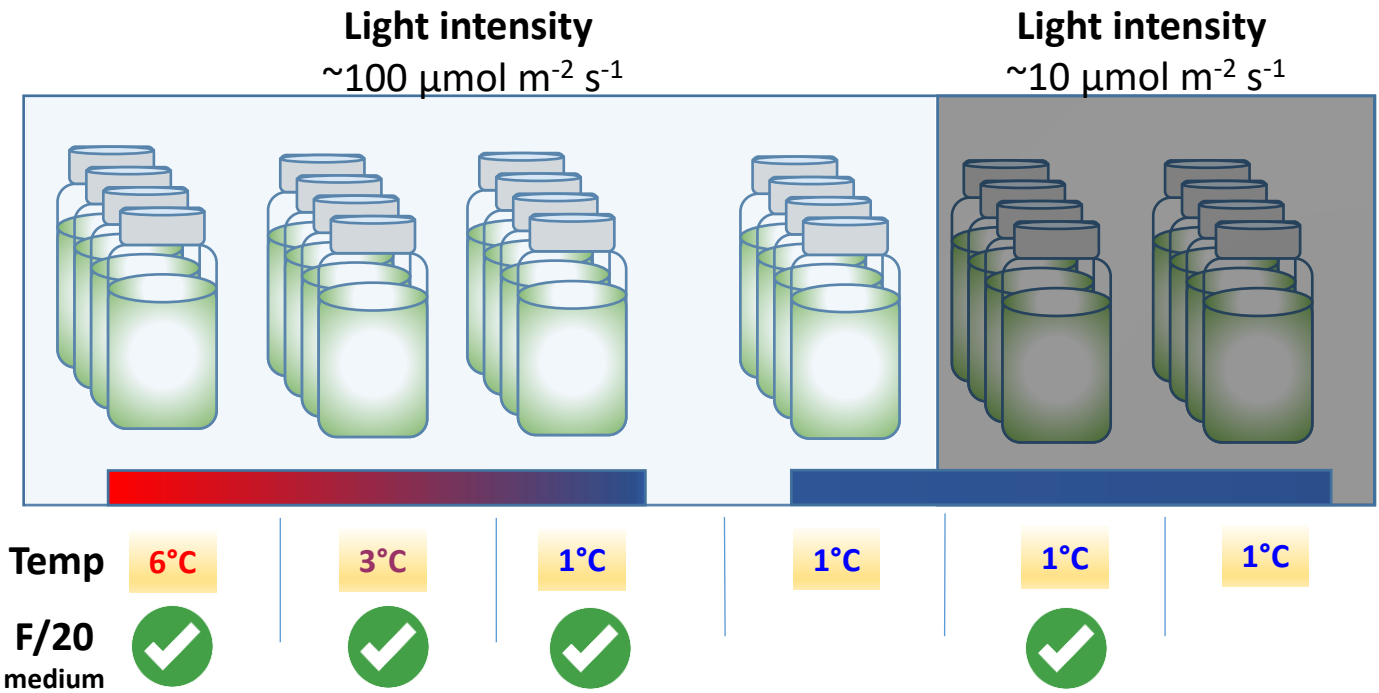


Fig. S1 Schemata of the *Melosira arctica* culture experiments.
The experiments were conducted under six different combinations of light intensity, temperature and nutrient supply, with each 4 biological replicates.

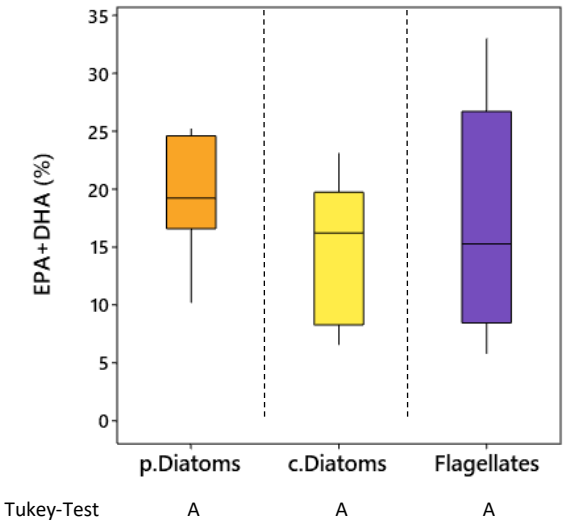


Fig. S2 Cultured cold-water microalgae. Box plots of summed EPA and DHA proportions (% of TFA) in pennate (p) diatoms (n=7), centric (c) diatoms (n=13) and flagellates (n=11) represent no phylogenetic differences under standardised culturing conditions (ANOVA with Tukey test, p = 0.344).

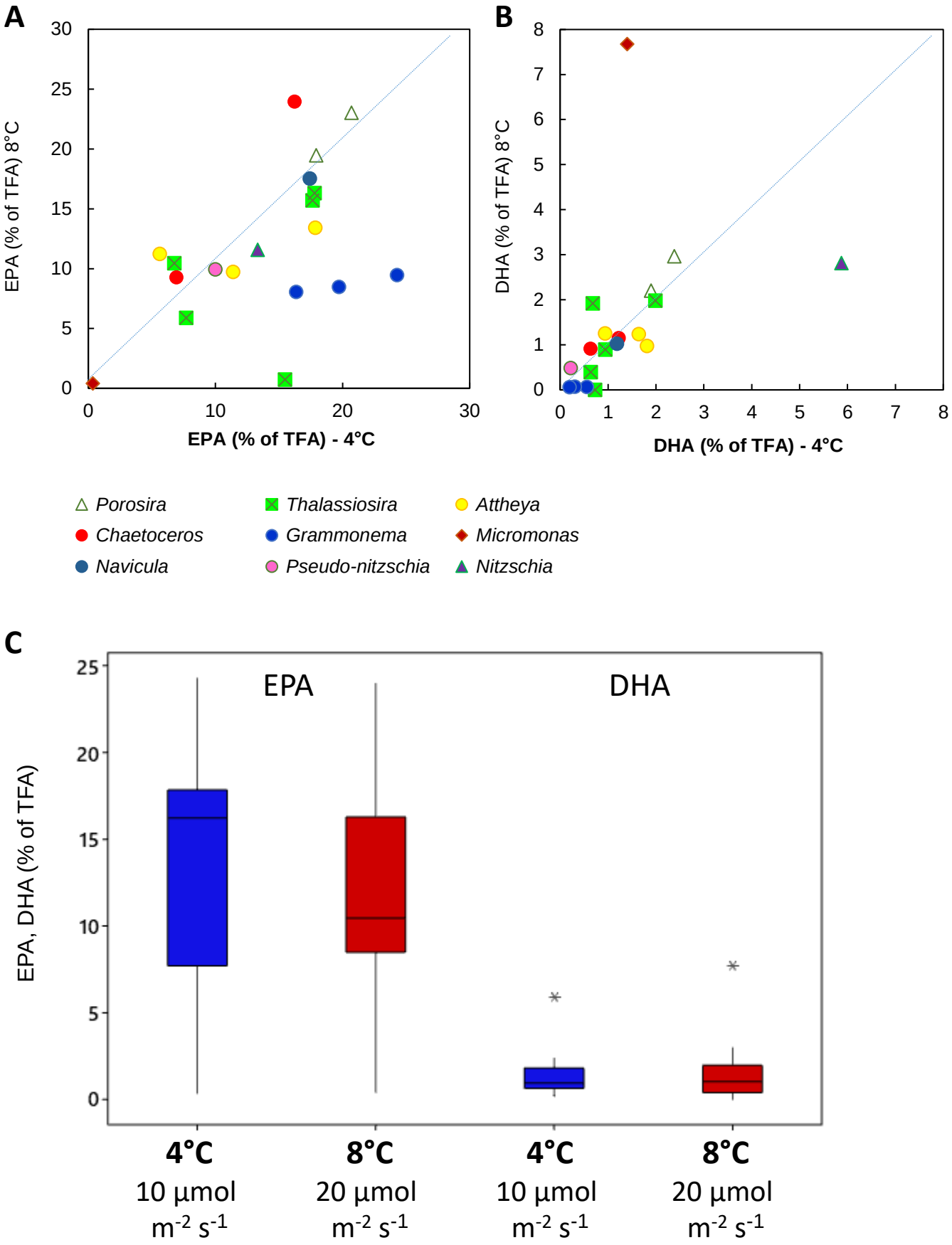
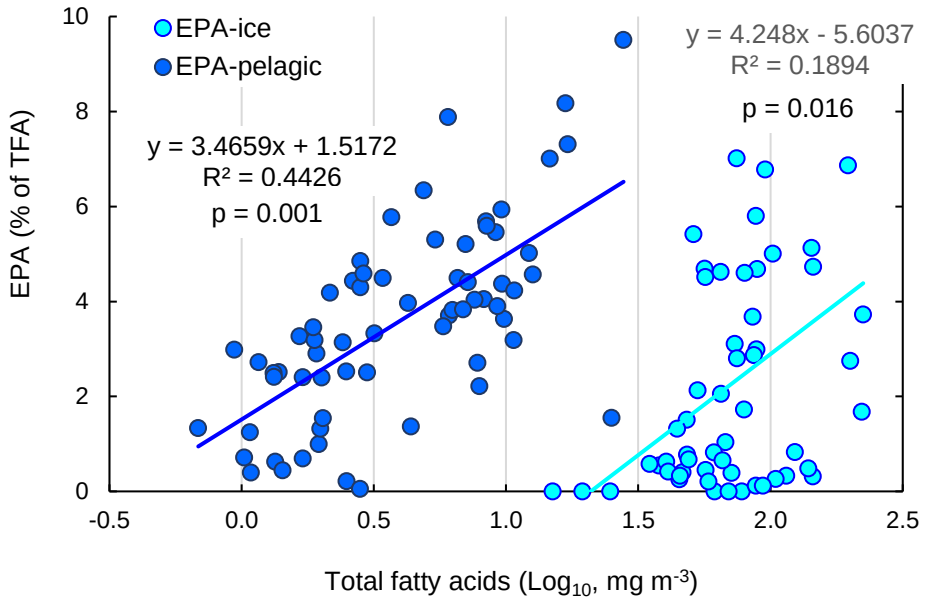


Fig. S3 Cultured cold-water microalgae.
EPA and DHA proportions (% of TFA) in 19 algae strains cultured in two different temperature-light-regimes, either lower temperature-lower light intensity (4°C, 10 µmol m^{-2} s^{-1}) or higher temperature-higher light intensity (8°C, 20 µmol m^{-2} s^{-1}). **A)** EPA on x-y axis, **B)** DHA on x-y axis, **C)** box plots of EPA and DHA proportions in the two temperature-light-regimes. Further details in Table S1 and S2.

A



B

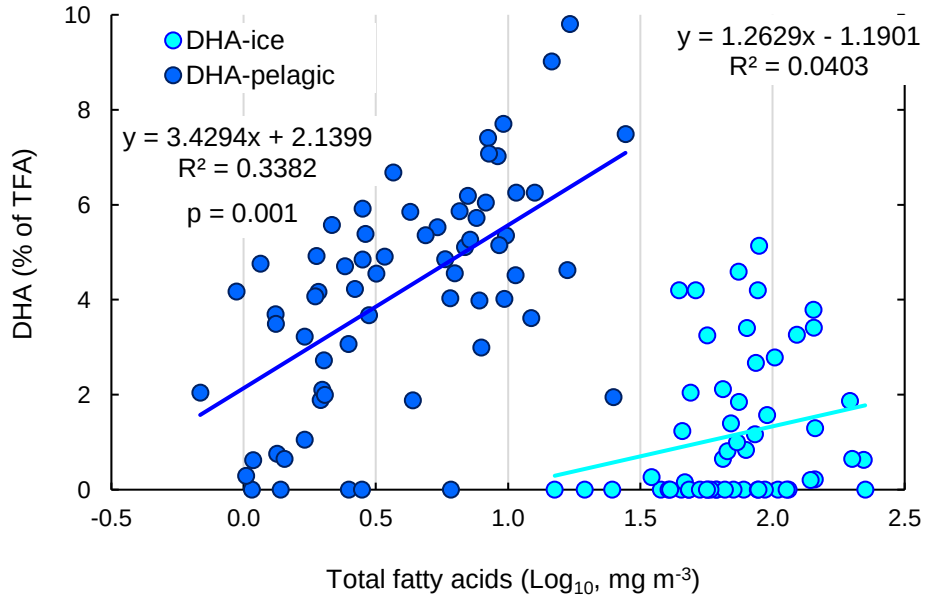


Fig. S4 MOSAiC expedition.
Relationship between A) EPA and B) DHA proportion and the total FA concentrations in sea ice and pelagic POM.

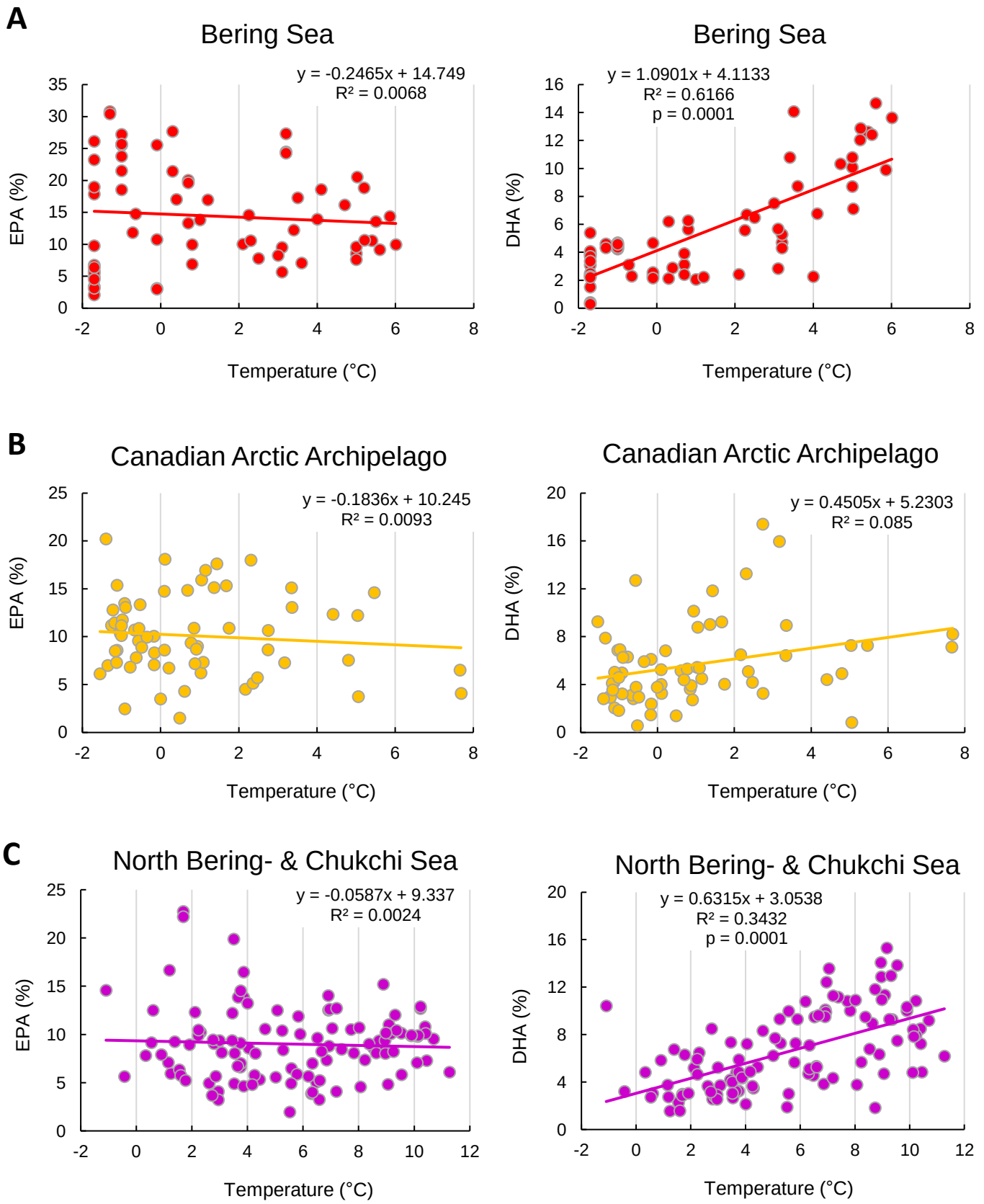


Fig. S5 Relationship between EPA, DHA proportions in pelagic POM and surface water temperature. **A)** Bering Sea. **B)** Canadian Arctic Archipelago. **C)** North Bering- & Chukchi Sea.

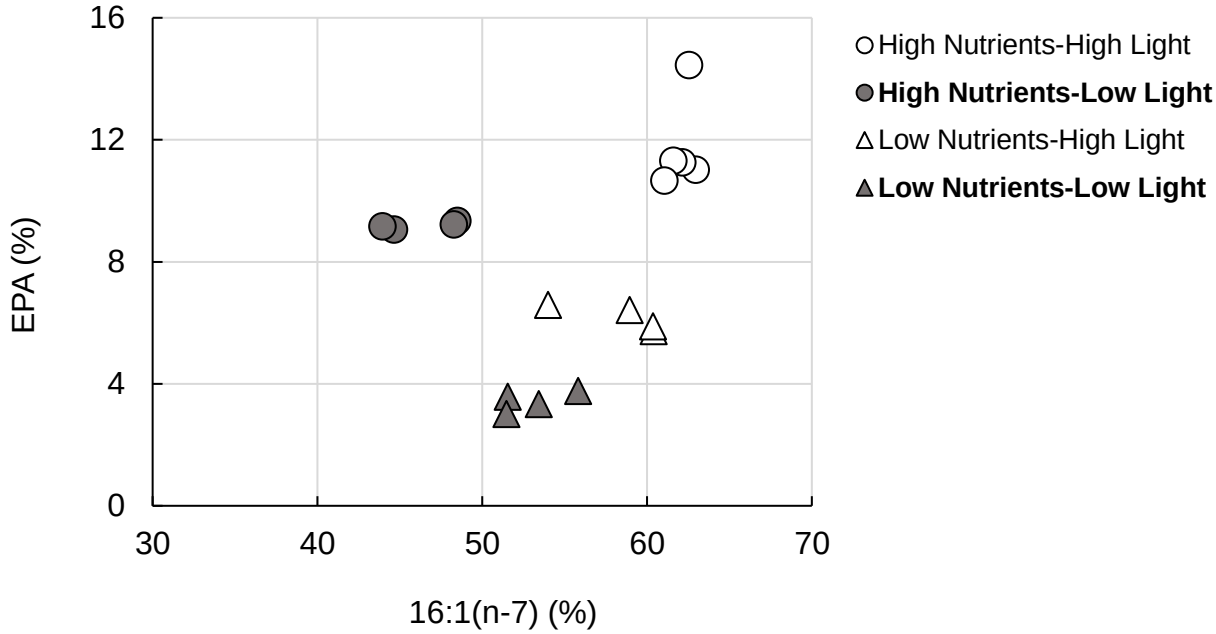


Fig. S6 *Melosira arctica* culture experiments: Differences in the co-occurrence of EPA and the diatom biomarker FA, 16:1(n-7), depending on light intensity and nutrient availability. 'High Nutrients': with F/20 medium; 'Low Nutrients': without F/20 medium; 'High Light': 100 µmol m^2 s^{-1}; 'Low Light': 10 µmol m^2 s^{-1}