Supplementary materials to: Sensitivity of plankton assemblages to hydroclimate variability in the Barents Sea.

Elliott L. Price[1*], Rowena F. Stern[2], Claire Mahaffey[1], Claudia Castellaini[3] and Rachel M. Jeffreys[1]

[1]School of Environmental Sciences, University of Liverpool, 4 Brownlow St, Liverpool, L69 3GP, UK.

[2]Marine Biological Association, Citadel Hill, The Hoe, Plymouth, PL1 2PB, UK.

[3]Plymouth Marine Laboratory, Prospect Place, Plymouth, PL1 3DH, UK.

Corresponding Author: Elliott L. Price (elliott.price@liverpool.ac.uk).

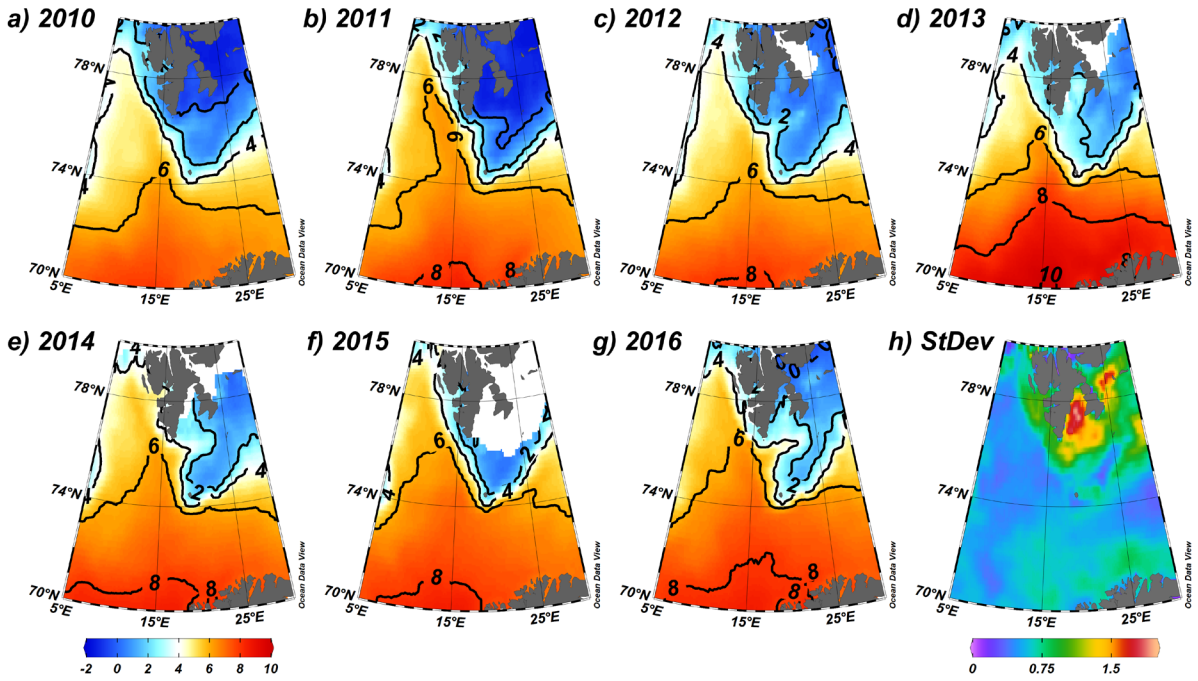

Figure S1: Average June SST (a-g) and standard deviation of these averages (h) in the Barents Sea Opening. Black lines represent the two-degree isoclines. White regions denote missing data.

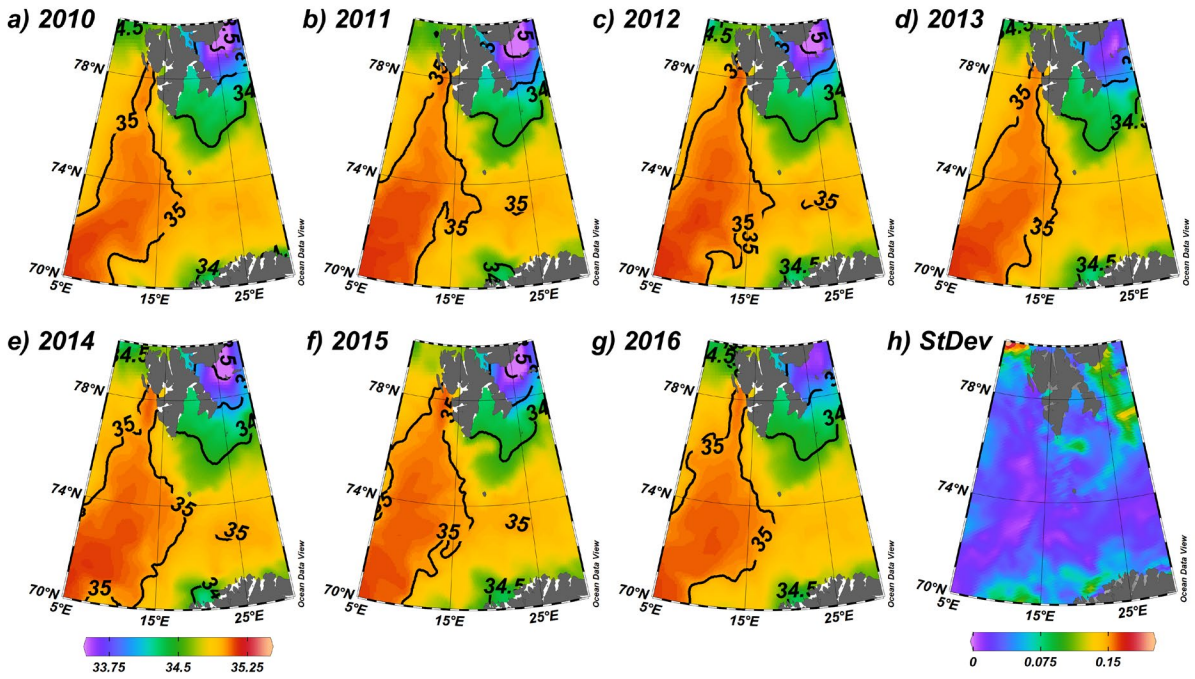

Figure S2: Average June Sea Surface Salinity (a-g) and standard deviation of these averages (h) in the Barents Sea Opening. Black lines represent the 0.5-PSU isoclines. White regions denote missing data.

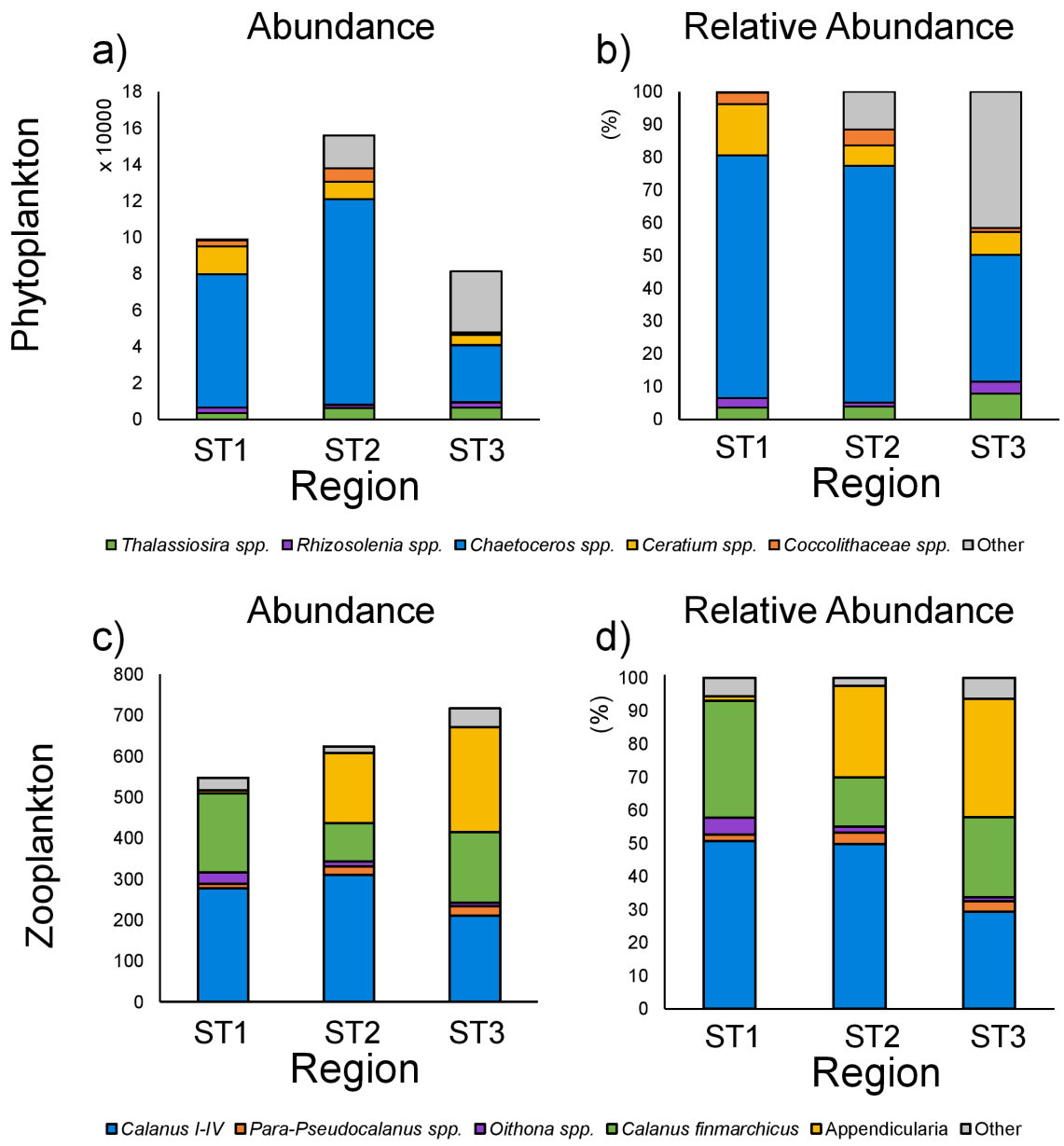

Figure S3: Averaged species abundance and relative abundance (%) for phytoplankton (a and b, respectively) and zooplankton (c and d, respectively) counts across all years from 2010 to 2016 in the different latitudinal regions along the Svalbard-Tromso CPR route. Y axis values in panel 'a' represent thousands.

Table S1: Hydroclimate variables. Averages and standard errors calculated from remote sensing (SST, Salinity, Density, Chlorophyll-a) and modelled (MLD, PO4, NO3, Sil, O2, pH) data points that were in closest proximity to CPR samples in each latitudinal region and year.

Region	Year	SST (°C)	Salinity (PSU)	Density (kg m^{-3})	MLD (m)	Chlorophyll-a (mg m^{-3})	PO4 (mg m^{-3})	NO3 (mg m^{-3})	Sil (mg m^{-3})	O2 (µmol kg^{-1})	pH
ST1	2010	6.95 ± 0.02	34.78 ± 0.02	1027.25 ± 0.02	50.21 ± 1.2	0.59 ± 0.07	NA	NA	NA	NA	NA
	2011	7.37 ± 0.04	34.59 ± 0.04	1027.04 ± 0.03	36.71 ± 0.88	1.06 ± 0.05	NA	NA	NA	NA	NA
	2013	9.14 ± 0.06	34.63 ± 0.04	1026.81 ± 0.04	15.04 ± 0.44	0.6 ± 0.04	NA	NA	NA	NA	NA
	2014	7.77 ± 0.05	34.67 ± 0.05	1027.05 ± 0.04	59.33 ± 2.34	0.93 ± 0.02	NA	NA	NA	NA	NA
	2015	7.62 ± 0.02	34.68 ± 0.03	1027.08 ± 0.03	148.78 ± 12.14	0.72 ± 0.02	NA	NA	NA	NA	NA
	2016	8.03 ± 0.04	34.78 ± 0.03	1027.09 ± 0.03	142.7 ± 3.42	1.01 ± 0.04	NA	NA	NA	NA	NA
ST2	2010	6.18 ± 0.08	34.98 ± 0	1027.39 ± 0.01	56.63 ± 0.96	0.45 ± 0.03	0.32 ± 0	2.43 ± 0.04	3.62 ± 0.04	331.5 ± 0.29	8.12 ± 0
	2011	6.68 ± 0.04	34.98 ± 0	1027.32 ± 0.01	48.3 ± 0.97	0.82 ± 0.03	0.29 ± 0.01	2.01 ± 0.12	3 ± 0.08	330.01 ± 0.65	8.12 ± 0
	2013	8 ± 0.07	34.94 ± 0.01	1027.1 ± 0.01	19.68 ± 0.55	0.49 ± 0.01	0.32 ± 0.01	2.46 ± 0.11	3.36 ± 0.09	330.81 ± 0.66	8.12 ± 0
	2014	6.95 ± 0.04	34.99 ± 0.01	1027.29 ± 0.01	93.99 ± 5.14	0.56 ± 0.03	0.37 ± 0	3.13 ± 0.06	3.89 ± 0.08	328.15 ± 0.67	8.11 ± 0
	2015	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	2016	7.42 ± 0.06	34.97 ± 0.01	1027.21 ± 0.01	109.64 ± 6.45	1.01 ± 0.05	0.33 ± 0.01	2.61 ± 0.15	3.55 ± 0.13	328.37 ± 0.46	8.12 ± 0
ST3	2010	6.05 ± 0.04	34.89 ± 0	1027.33 ± 0.01	74.62 ± 4.78	1.19 ± 0.03	0.38 ± 0	3.18 ± 0.02	4.11 ± 0.03	339.74 ± 1.31	8.11 ± 0
	2011	6.39 ± 0.02	34.99 ± 0.01	1027.36 ± 0.01	43.6 ± 2.69	0.66 ± 0.03	0.37 ± 0	3.04 ± 0.02	4.29 ± 0.03	337.87 ± 0.72	8.12 ± 0
	2013	5.97 ± 0.13	34.99 ± 0	1027.42 ± 0.02	34.69 ± 1.18	0.8 ± 0.03	0.35 ± 0	2.66 ± 0.06	3.84 ± 0.07	346.65 ± 1.93	8.12 ± 0
	2014	6.38 ± 0.03	34.99 ± 0	1027.37 ± 0	78.41 ± 0.71	0.71 ± 0.03	0.37 ± 0	3.08 ± 0.07	4.32 ± 0.04	346.17 ± 1.88	8.12 ± 0
	2015	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	2016	5.01 ± 0.09	34.94 ± 0.01	1027.5 ± 0	78.22 ± 1.97	0.75 ± 0.04	0.36 ± 0	2.87 ± 0.04	4.04 ± 0.01	346.27 ± 1.61	8.13 ± 0

Supplementary Information S1: Environmental dataset collection

Sea surface temperature data spanning from 2010 to 2016 was sourced from the OSTIA project. The OSTIA product is an interpolation of microwave and infrared satellite measurement coupled with in-situ observations at a grid resolution of 1.5 km x 5.6 km for the Barents Sea (Donlon et al. 2012). Surface salinity was sourced from the TOPAZ4 system produced by the Arctic Marine Forecasting Centre (MFC) of the MyOcean project (http: //www.myocean.eu.org). The TOPAZ4 system uses the Hybrid Coordinate Ocean Model (HYCOM v2.2.) and assimilates ocean and ice observations on a large scale using an ensemble Kalman filter (EnKF) to provide salinity estimates at a resolution of 12.5 km x 12.5 km (Sakov et al. 2012). Average monthly surface temperature and salinity datasets for June in our study region were downloaded from https://marine.copernicus.eu/.

Mixed layer depths were extracted from the HYbrid Coordinate Ocean Model (HYCOM) global 1/12th degree simulation and downloaded from http://orca.science.oregonstate.edu/1080.by.2160.monthly.hdf.mld.hycom.php. Mixed layer depths are defined as the depth at which density increases by 0.03 kg m-3 relative to the surface. Nutrients, dissolved oxygen and pH data were extracted from hindcast simulations performed using the Pelagic Interactions Scheme for Carbon and Ecosystem Studies version 2 (PISCES-v2) biogeochemical model, attached to the Nucleus for European Modelling of the Ocean version 4.0 (NEMOv4) general ocean circulation model (Aumont et al. 2015). Horizontal model resolution varied between ~0.5° at the equator and poles and 2° in the subtropics, while vertical resolution varied between 10 and 500 metres thickness over 31 levels. All output on the NEMO curvilinear, tripolar grid was re-gridded onto a regular 1° by 1° horizontal grid prior to data extraction. We used the June monthly average for years 2010 to 2016 and extracted values from the closest grid cells where samples were taken.

References

Aumont, O., C. Ethé, A. Tagliabue, L. Bopp, and M. Gehlen. 2015. PISCES-v2: An ocean biogeochemical model for carbon and ecosystem studies. Geosci. Model Dev. **8**: 2465–2513. doi:10.5194/gmd-8-2465-2015

Donlon, C. J., M. Martin, J. Stark, J. Roberts-Jones, E. Fiedler, and W. Wimmer. 2012. The Operational Sea Surface Temperature and Sea Ice Analysis (OSTIA) system. Remote Sens. Environ. **116**: 140–158. doi:10.1016/j.rse.2010.10.017

Sakov, P., F. Counillon, L. Bertino, K. A. Lister, P. R. Oke, and A. Korablev. 2012. TOPAZ4: An ocean-sea ice data assimilation system for the North Atlantic and Arctic. Ocean Sci. **8**: 633–656. doi:10.5194/os-8-633-2012

Supplementary Information S2: Species assemblage

By analysing the common taxa that constituted >5% of the total cell and individual counts for phyto- and zooplankton, respectively, in four of the five years between 2010 and 2016, the phytoplankton assemblage was dominated by *Chaetoceros* spp. diatoms in all three regions and their abundance was 3.5x lower in ST3 (cell count = 31500) than the mid latitude ST2 (cell count = 112941). *Ceratium* spp. dinoflagellates and *Thalassiosira* spp. diatoms contributed significantly to the phytoplankton communities across all regions. In the northern most region (ST3) the dominant species were reduced in abundance, replaced by a mixture of 'Other' species that included *Pseudo-nitzschia* spp. and *Corethron hystrix* and silicoflagellates. *Calanus* I-IV stages and adult *Calanus finmarchicus* combined to form 86% (ST1), 65% (ST2) and 53% (ST3) of the zooplankton assemblage. While the abundance of *Calanus* I-IV and *C. finmarchicus* stayed relatively stable between regions, an increasing number of zooplankton were observed from the southern to the northern region, driven by the prevalence of appendicularians in the mid and northern regions which constituted 28% and 36% of the species assemblage.