The following supplement accompanies the article

Phytoplankton and bacterial dynamics on the Chukchi Sea Shelf during the spring-summer transition

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Measurement of photoadaptation of incubated phytoplankton: At the beginning and end of each dilution experiment, 45 ml aliquots of unfiltered seawater were collected in darkened 50 ml conical tubes and dark-adapted for 30 min at 0°C. Samples were measured in duplicate on a custom made FRRf (Z. Kolber). Fv/Fm measurements were corrected for blank effects, with blanks for each sample prepared by filtering sample water through a 0.2 µm, polycarbonate, syringe-filter before measurement (Cullen & Davis 2003).

Measurement of bacterial production rates: ^{3}H-leucine (specific activity, 60 Ci mmol^{-1}) was added to triplicate, 1.2 ml subsamples at a final concentration of 10 nM, incubating for 2 h at *in situ* temperature, and stopping the reaction by adding trichloroacetic acid (TCA, 5% final concentration). Controls to determine background levels of ^{3}H-leucine were also prepared by adding TCA (5% final concentration) to samples immediately to kill prokaryotes. Samples were stored at −80°C until analysis. Samples were thawed at 4°C, twice centrifuged for 10 min at 14000 rpm to pellet cells, supernatant was decanted, and the pellet was rinsed with 5% TCA. The pellet was resuspended in 1.5 ml of liquid scintillation cocktail (Ecolume; MP Biomedicals, Santa Ana, CA) and radioactivity was measured using a liquid scintillation counter (PerkinElmer, Waltham, MA).

Preparation of fluorescently-labeled bacteria (FLBs): Fluorescently-labeled bacteria (FLBs) were prepared from a monoculture of *Dokdonia donghaensis* according to standard protocol (Sherr et al. 1987, Caron 2001). *D. donghaensis* was cultured in Zobell medium, then harvested by centrifugation and resuspended in 0.2 µm filtered seawater. Bacteria were incubated in the 0.2 µm filtrate for two days to induce cell shrinkage, causing the FLB to better mimic the bacterial size observed in natural assemblages (rod-shaped, average length = 1 µm). Bacteria were then stained with 5-(4,6-dichlorotriazin-2-yl) aminofluorescein (DTAF), heat-killed, rinsed three times, aliquoted, and stored at −80°C until the time of the experiment. FLB aliquots were prepared in a single batch to ensure homogeneity across experiments.

Literature Cited

Caron DA (2001) Protistan herbivory and bacterivory. In: Paul J (ed) Methods in Microbiology, Book 30. Academic Press, Cambridge, UK

Cullen JJ, Davis RF (2003) The blank can make a big difference in oceanographic measurements. Limnol Oceangr Bulletin 12:29–34 https://doi.org/10.1002/lob.200312229

Sherr BF, Sherr EB, Fallon RD (1987) Use of monodispersed, fluorescently labeled bacteria to estimate in situ protozoan bacterivory. Appl Environ Microbiol 53:958–965

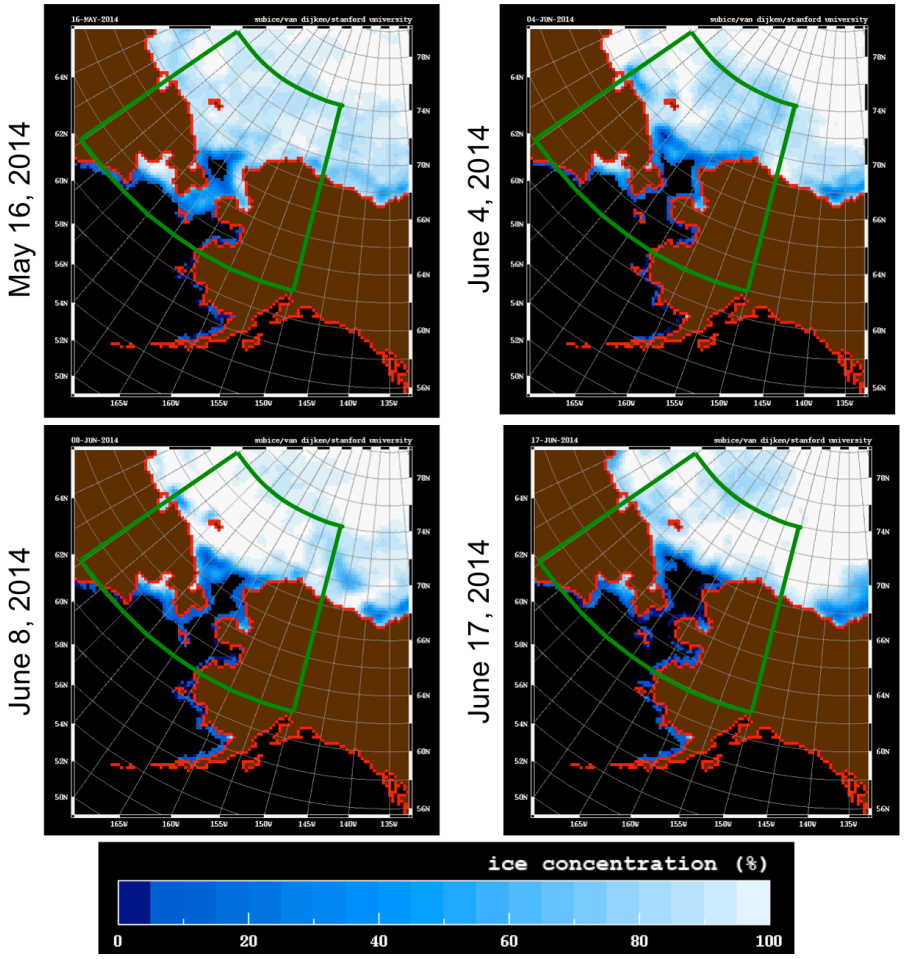

Figure S1. Daily SSM/I satellite images of sea ice concentrations (color bar) on four sampling dates (May 16th, June 4th, June 8th, and June 17th, 2014). Green boxes denote the area depicted by the map in Figure 1 in the main article. Samples for microbial community composition and trophic activities were taken from one station in the Bering Strait (station 8) and nine stations on the Chukchi Shelf (see Figure 1 in the main article). Note the depletion in sea ice cover into early June, followed by a heavy snowfall on June 8th, which recoated the ice-pack of the central Chukchi Shelf.

Table S1. The maximum efficiency of photosystem II (F_v/F_m) as measured from discrete samples at the beginning (T_0) and end (T_f) of each dilution experiment. The amount of incident light that reached the phytoplankton through the neutral density screening (%) and length of the incubation (h) are also reported.

Station	T_0 F_v/F_m	T_f F_v/F_m	Percent Incident Light (%)	Incubation Length (h)
8	---	---	60	24
29	0.558	0.577	15	24
42	0.303	0.393	15	72
64	---	---	15	72
93	0.394	0.423	15	72
105	0.452	0.484	15	72
132	0.529	0.458	60	24
151	0.493	0.520	15	48
186	0.509	0.480	15	48
209	0.506	0.544	15	48

Table S2. Spearman's rank correlation coefficients (rho values) between environmental factors and population abundances, unenriched growth rates or production rates, and grazing mortality rates of the microbial assemblages. P-values were adjusted using Bonferroni Correction for Multiple Tests, with a corrected $\alpha = 0.00625$. Significant values are bolded. Microbial assemblages include: BACT (bacteria), PEUK (phototrophic picoeukaryotes), PMNANO (phototrophic/mixotrophic nanoplankton), HNANO (heterotrophic nanoplankton), CILIATE (ciliates), DINO (dinoflagellates), DIATOM (diatoms), and PHYTO (total phytoplankton assemblage). Growth (unenriched (μ_0) and enriched (μ_n) and mortality rates (m) have the units of "d^{-1}", while production and carbon consumption (Consump.) rates have the units of "$\mu g\ C\ l^{-1}\ d^{-1}$".

	Temperature	**Salinity**	**Ammonium**	**Nitrate**	**Phosphate**	**Silicate**	**T0 Chl**	**Percent Ice Cover**
Bact Abundance	-0.19	0.25	-0.31	-0.23	-0.53	-0.36	0.51	0.00
Peuk Abundance	0.30	0.25	-0.70	-0.53	-0.73	-0.70	**0.91**	0.08
Pnano Abundance	0.12	0.33	-0.66	-0.36	-0.16	-0.51	0.65	-0.30
Hnano Abundance	0.39	0.18	**-0.83**	-0.13	-0.52	-0.44	0.60	-0.60
Ciliate Abundance	-0.07	0.52	-0.52	-0.38	**-0.77**	-0.66	0.68	-0.05
Dino Abundance	-0.17	-0.08	-0.13	-0.56	-0.04	-0.40	0.32	-0.01
Diatom Abundance	0.32	0.12	**-0.79**	-0.56	**-0.89**	**-0.89**	**0.97**	-0.14
PHYTO m	-0.05	0.00	-0.18	-0.26	-0.26	-0.37	0.35	0.13
PHYTO μn	-0.07	0.06	0.28	-0.10	0.14	0.04	-0.38	-0.03
PHYTO μ0	-0.16	0.18	0.02	-0.20	-0.21	-0.33	0.13	0.17
PHYTO C Consump.	0.06	-0.12	-0.44	-0.54	-0.66	-0.69	0.63	-0.20
PEUK m	-0.15	-0.23	0.45	-0.06	0.35	0.21	-0.46	0.19
PEUK μn	0.46	-0.47	-0.30	-0.34	-0.26	-0.39	0.06	-0.58
PEUK μ0	0.47	-0.60	-0.16	-0.36	-0.15	-0.31	-0.04	-0.61
BACT m	0.35	-0.49	-0.60	-0.49	-0.63	-0.78	0.76	-0.21
BACT C Consump.	0.27	-0.22	-0.56	-0.38	-0.51	-0.61	0.64	-0.41
BACT Production	0.27	-0.52	**-0.70**	-0.52	-0.72	-0.68	**0.81**	-0.02

Table S3. The impact of nutrient-enrichment and removal of metazoan grazers on the apparent growth rates (μ; d^{-1}) of the total phytoplankton (based on chlorophyll *a*) and the phototrophic picoeukaryotes in the dilution experiments. Apparent growth rates were calculated from three bottles and averaged for each treatment: the nutrient-enriched, 100% unfiltered seawater (WSW) treatment, the unenriched, 100% WSW treatment, and the unenriched, < 200 μm filtered treatment. Welch two-sample t-tests were used to compare mean growth rates in the nutrient-enriched and unenriched treatments and in the WSW and <200 μm filtered treatments. Bold values indicate a significant difference between the apparent growth rates of the denoted treatments at $p \leq 0.05$.

Station	**Mean apparent μ (d^{-1}) of treatment**			**T-test p-value**	
	100% WSW enriched	100% WSW unenriched	<200 μm unenriched	Enriched vs. Unenriched	WSW vs. <200 μm
Total phytoplankton (chlorophyll a)					
8	0.17	0.40	0.46	0.08	0.28
29	−0.02	−0.03	0.04	0.77	0.19
42	0.24	**0.22**	**0.36**	0.76	**0.01**
64	0.19	0.25	0.23	0.48	0.77
93	0.46	0.47	0.47	0.68	1.00
105	0.16	0.08	0.21	0.35	0.21
132	**0.03**	**−0.25**	−0.11	**0.05**	0.20
151	**0.25**	**0.37**	0.32	**0.04**	0.44
186	0.21	0.20	0.09	0.69	0.10
209	0.32	0.35	0.22	0.71	0.12
Phototrophic picoeukaryotes					
8	0.38	0.37	0.33	0.96	0.61
29	−0.48	−0.62	−0.28	0.40	0.06
42	−0.1	−0.12	−0.12	0.72	0.93
64	−0.34	−0.07	0.14	0.29	0.37
93	0.02	0.26	0.43	0.08	0.08
105	0.02	0.06	−0.05	0.61	0.18
132	0.16	0.42	0.30	0.13	0.27
151	−0.13	−0.05	−0.02	0.34	0.76
186	−0.31	**−0.38**	**−0.08**	0.57	**0.03**
209	0.11	**0.13**	**0.28**	0.72	**0.01**