



*Supplement of*

## **How biogenic polymers control surfactant dynamics in the surface microlayer: insights from a coastal Baltic Sea study**

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**Table S1 Meteorological and hydrological conditions of stations sampled in summer (AL510) and autumn (AL516) and the sampling time during the day i.e. am (morning) and pm (afternoon).**

Station-ID	Station	Date	Longitude	Latitude	Wind speed	SML thickness	Daytime
		[dd.mm.yy]	[deg°min´ E]	[deg°min´ N]	[m sec <sup>-1</sup> ]	[µm]	<i>cat.</i>
AL510_9-1	1	03.06.18	10°06´	54°35´	4.0	43	pm
AL510_27-1	2	04.06.18	10°06´	54°34´	8.2	48	no
AL510_29-1	3	05.06.18	10°05´	54°32´	3.4	NA	am
AL510_31-1	4	05.06.18	10°06´	54°31´	6.5	40	pm
AL510_33-1	5	06.06.18	10°05´	54°31´	6.3	44	am
AL510_35-1	6	06.06.18	10°05´	54°31´	9.5	40	pm
AL510_37-1	7	07.06.18	10°08´	54°33´	7.2	45	am
AL510_41-1	8	07.06.18	10°09´	54°33´	4.1	41	pm
AL510_44-1	9	08.06.18	10°09´	54°35´	3.4	45	am
AL510_48-1	10	08.06.18	10°09´	54°38´	5.5	40	pm
AL510_50-1	11	09.06.18	10°09´	54°37´	3.3	39	am
AL510_52-1	12	09.06.18	10°08´	54°39´	1.2	38	pm
AL510_54-1	13	10.06.18	10°08´	54°41´	2.1	43	am
AL510_57-1	14	10.06.18	10°07´	54°42´	7.4	40	pm
AL510_60-1	15	11.06.18	10°04´	54°42´	11.4	44	am
AL510_62-1	16	11.06.18	10°06´	54°43´	11.8	NA	pm
AL510_65-1	17	12.06.18	10°06´	54°39´	7.6	43	am
AL510_68-1	18	12.06.18	10°06´	54°38´	9.3	39	pm
AL510_70-1	19	13.06.18	10°13´	54°37´	10.8	NA	am
AL510_71-1	20	13.06.18	10°08´	54°38´	11.6	NA	pm
AL510_73-1	21	14.06.18	10°06´	54°35´	8.9	39	am
AL510_75-1	22	14.06.18	10°04´	54°36´	9.8	40	pm
AL510_77-1	23	15.06.18	10°05´	54°42´	3.0	35	am
AL516_21-1	1	13.09.18	10°02´	54°31´	5.0	NA	am
AL516_23-1	2	13.09.18	10°06´	54°35´	5.3	36	pm
AL516_24-1	3	14.09.18	10°04´	54°32´	8.7	34	am
AL516_26-1	4	14.09.18	10°05´	54°31´	7.6	34	pm
AL516_28-1	5	15.09.18	10°05´	54°31´	7.6	31	am
AL516_30-2	6	15.09.18	10°03´	54°31´	7.9	34	pm
AL516_32-1	7	16.09.18	10°03´	54°32´	7.3	35	am
AL516_34-1	8	16.09.18	10°05´	54°30´	4.6	31	pm

AL516_36-1	9	17.09.18	10°04′	54°30′	8.0	33	am
AL516_38-1	10	17.09.18	10°01′	54°30′	5.3	34	pm
AL516_40-1	11	18.09.18	10°03′	54°31′	5.7	38	am
AL516_42-1	12	18.09.18	10°04′	54°31′	10.0	35	pm
AL516_44-1	13	19.09.18	10°05′	54°31′	8.2	35	am
AL516_46-1	14	19.09.18	10°06′	54°33′	9.6	33	pm
AL516_48-1	15	20.09.18	10°06′	54°33′	10.8	33	am
AL516_50-1	16	20.09.18	10°06′	54°32′	7.5	NA	pm
AL516_52-1	17	21.09.18	10°03′	54°34′	13.2	31	am
AL516_54-1	18	21.09.18	10°07′	54°39′	14.7	NA	pm
AL516_56-1	19	22.09.18	10°06′	54°43′	12.2	30	am

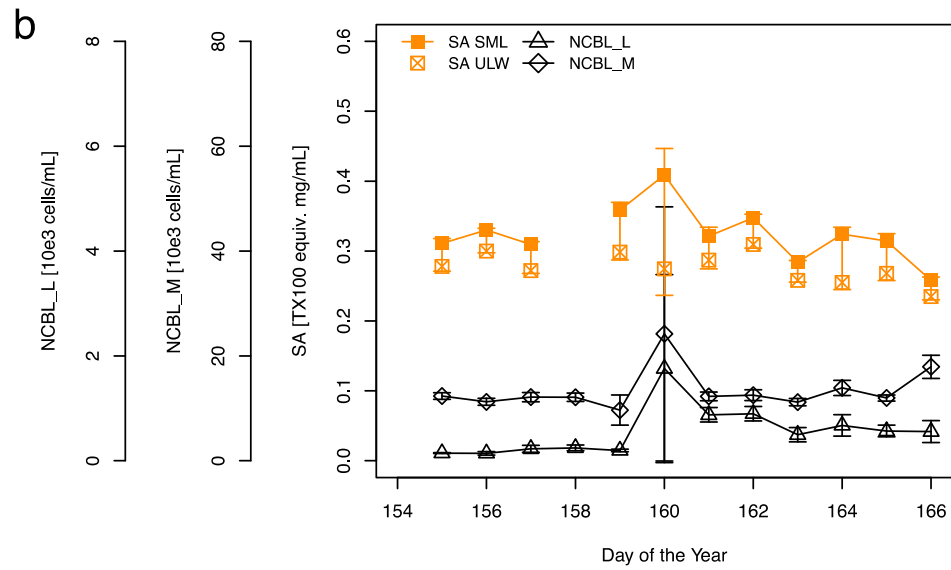
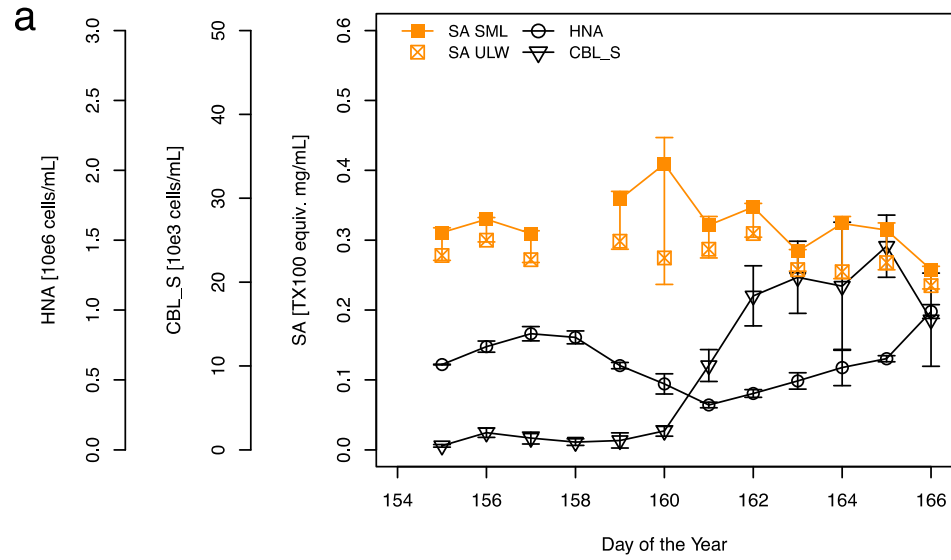
**Table S2 Correlation of enrichment factors (EF) with wind speed ( $\text{m sec}^{-1}$ ) based on Spearman rank correlation test indicated by the coefficient rho. Significances are marked by asterisks.**

<i>Correlation of EFs with wind speed</i>	<b>June (AL510)</b>	<b>September (AL516)</b>
Parameters	<b>excl. sick (incl. slick)</b> N=19	<b>All stations</b> N=18
	[rho, <i>p</i> -value < ]	[rho, <i>p</i> -value < ]
<b>DOC</b> [ $\mu\text{M}$ ]	0.32 (0.19)	0.18
<b>Semi-labile DOC</b> [ $\mu\text{MC}\%$ ]	NA	NA
<b>Degradation Index</b>	NA	NA
<b>DAA</b> [ $\mu\text{M}$ ]	-0.02 (-0.16)	0.29
<b>PAA</b> [ $\mu\text{M}$ ]	0.16 (0.01)	0.39
<b>DCHO</b> [ $\mu\text{M}$ ]	0.19 (0.02)	0.01
<b>PCHO</b> [ $\mu\text{M}$ ]	0.30 (0.12)	-0.05
dissolved <b>Glucose</b> [nM]	0.31 (0.12)	-0.05
particulate <b>Glucose</b> [nM]	0.39 (0.20)	0.10
<b>Surfactants</b> [ $\mu\text{g L}^{-1}$ ]	0.22 (0.05)	-0.15
pico- <b>CBL</b> [ $10^3$ cells $\text{ml}^{-1}$ ]	0.36 (0.17)	0.44
nano- <b>CBL</b> [ $10^3$ cells $\text{ml}^{-1}$ ]	-0.24 (-0.35)	0.14
pico- <b>NCBL</b> [ $10^3$ cells $\text{ml}^{-1}$ ]	0.28 (0.10)	0.37
nano- <b>NCBL (M)</b> [ $10^3$ c. $\text{ml}^{-1}$ ]	0.29 (0.11)	0.05
nano- <b>NCBL (L)</b> [ $10^3$ c. $\text{ml}^{-1}$ ]	0.24 (0.06)	0.20
<b>LNA</b> [ $10^3$ cells $\text{ml}^{-1}$ ]	-0.46 (-0.54 *)	0.23
<b>HNA</b> [ $10^3$ cells $\text{ml}^{-1}$ ]	0.10 (-0.06)	-0.11

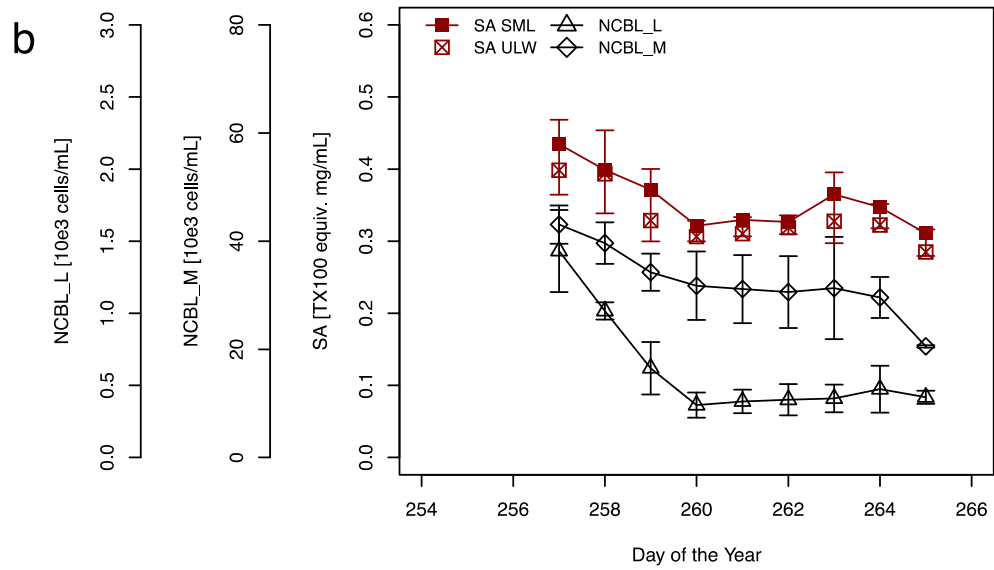
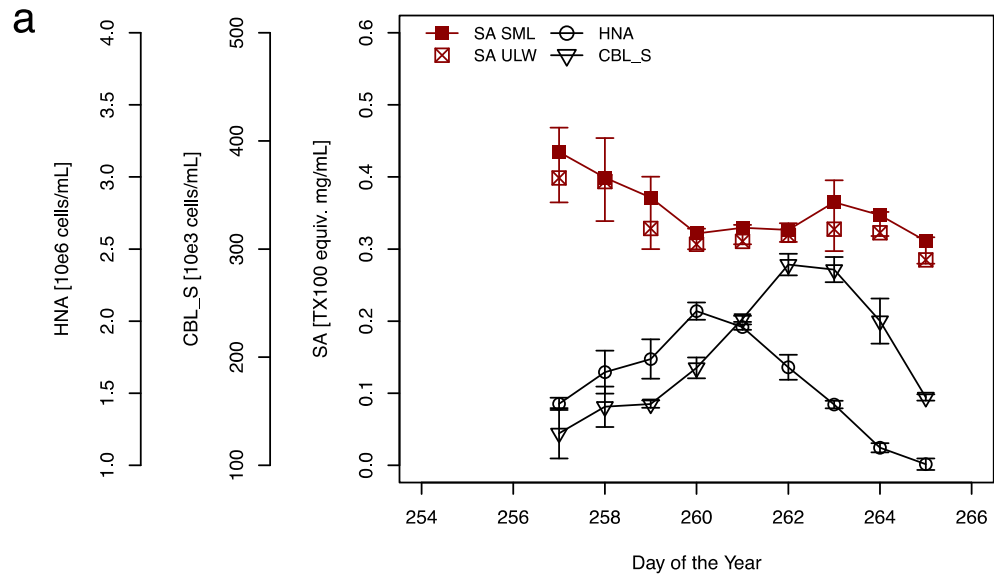
**Table S3 Correlation between surfactants concentration and organic matter concentration, molecular fractions, and organism classes divided into the particulate and dissolved pool subclasses. Statistics are based on Spearman Rank Correlations and indicated by the coefficient rho. Asterisks represent the level of significance. Significant positive and negative correlations are highlighted in orange and blue, respectively.**

Correlations with surfactants	Spearman Rank Correlation							
	<i>Surfactant concentrations were correlated to variables of the particulate and dissolved pool.</i>							
	Seasonal data				All data			
Parameters	June (AL510) (N=39)		September (AL516) (N=36)		Effect of Seasons Included (N=75)		Effect of Seasons Excluded (N=75)	
	Particulate	Dissolved	Particulate	Dissolved	Particulate	Dissolved	Particulate	Dissolved
	[rho]	[rho]	[rho]	[rho]	[rho]	[rho]	[rho]	[rho]
DOC [ $\mu$ M]	NA	<b>0.36 *</b>	NA	0.32	NA	-0.11	NA	<b>0.33 **</b>
semi-labile DOC [Mol-C%]	NA	-0.29	NA	-0.13	NA	<b>0.35 **</b>	NA	<b>-0.25 *</b>
Degradation Index	NA	-0.01	NA	0.07	NA		NA	
Amino acids [ $\mu$ M]	-0.08	0.01	0.14	0.06	-0.18	<b>0.24 *</b>	-0.01	0.02
Aspartic acid [Mol%]	-0.21	-0.26	<b>-0.61 ***</b>	0.24	<b>-0.50 ***</b>	-0.20	<b>-0.33 **</b>	-0.10
Glutamic acids [Mol%]	0.08	0.13	-0.11	<b>0.54 ***</b>	0.22	0.20	-0.01	0.29
Serine [Mol%]	<b>0.50 **</b>	0.30	<b>0.46 **</b>	0.08	<b>0.38 ***</b>	<b>0.46 ***</b>	<b>0.50 ***</b>	0.18
Glycine [Mol%]	0.27	0.23	0.00	0.17	<b>0.49 ***</b>	0.04	0.14	0.22
Threonine [Mol%]	-0.12	0.06	-0.07	-0.09	-0.09	<b>0.34 **</b>	-0.07	-0.09
Arginine [Mol%]	-0.23	0.15	<b>0.39 *</b>	<b>-0.55 ***</b>	<b>0.35 **</b>	0.08	0.02	<b>-0.26 *</b>
Alanine [Mol%]	-0.23	-0.16	<b>0.42 **</b>	<b>-0.51 ***</b>	-0.19	<b>-0.43 ***</b>	0.16	-0.34
GABA [Mol%]	NA	-0.03	NA	<b>0.38 *</b>	NA	<b>-0.27 *</b>	NA	<b>0.27 *</b>
Tyrosine [Mol%]	0.11	-0.04	-0.15	0.20	0.18	<b>0.39 ***</b>	-0.02	0.07
Valine [Mol%]	-0.19	<b>-0.33 *</b>	-0.18	0.11	<b>-0.38 ***</b>	0.05	<b>-0.24 *</b>	-0.04
Isoleucine [Mol%]	-0.12	-0.04	<b>-0.52 ***</b>	<b>0.48 **</b>	<b>-0.37 **</b>	<b>0.36 **</b>	<b>-0.35 **</b>	0.22
Phenylalanine [Mol%]	<b>-0.32</b>	-0.06	-0.24	0.03	-0.02	<b>0.30 *</b>	<b>-0.29 *</b>	-0.02
Leucine [Mol%]	-0.17	0.09	-0.01	0.04	-0.15	<b>0.26 *</b>	-0.11	0.08
Carbohydrates [ $\mu$ M]	<b>0.32 *</b>	-0.19	0.32	0.13	<b>0.42 ***</b>	<b>0.38 ***</b>	<b>0.29 *</b>	-0.06

Fucose [Mol%]	0.17	-0.20	0.17	-0.21	-0.14	-0.16	0.14	-0.17
Rhamnose [Mol%]	-0.09	-0.05	0.15	0.08	<b>-0.29 *</b>	-0.05	0.02	0.06
Arabinose [Mol%]	-0.31	-0.12	0.20	<b>-0.50 **</b>	<b>-0.48 ***</b>	0.09	-0.09	<b>-0.25 *</b>
Mannose/Xylose [Mol%]	0.09	<b>-0.42 **</b>	0.20	-0.29	-0.10	<b>-0.43 ***</b>	0.16	<b>-0.36 **</b>
Galactose [Mol%]	-0.06	-0.25	-0.05	<b>-0.45 **</b>	-0.18	<b>0.29 *</b>	-0.12	<b>-0.27 *</b>
Glucose [Mol%] ( <i>nM</i> )	0.04 ( <i>0.19</i> )	0.28 ( <i>0.01</i> )	-0.04 ( <i>0.20</i> )	<b>0.62 *** (0.49)</b>	<b>0.28 * (0.38)</b>	<b>0.29 * (0.47)</b>	-0.03 ( <i>0.17</i> )	<b>0.44 *** (0.24)</b>
Galactosamine [Mol%]	0.06	-0.03	-0.20	<b>0.37 *</b>	-0.11	<b>0.35 **</b>	-0.08	0.19
Glucosamine [Mol%]	0.12	-0.27	-0.02	0.05	-0.01	-0.19	0.05	-0.18
Galacturonic acid [Mol%]	0.06	-0.03	-0.19	-0.32	-0.19	-0.07	0.02	0.03
Glucuronic acid [Mol%]	-0.23	0.05	0.02	-0.08	<b>-0.34 **</b>	<b>0.36 **</b>	-0.05	-0.02
pico-CBL [ $10^3$ cells ml <sup>-1</sup> ]	-0.31	NA	<b>-0.38 *</b>	NA	<b>0.32 **</b>	NA	<b>-0.33 **</b>	NA
nano-CBL [ $10^3$ cells ml <sup>-1</sup> ]	-0.26	NA	<b>0.38 *</b>	NA	<b>-0.34 **</b>	NA	-0.06	NA
pico-NCBL [ $10^3$ cells ml <sup>-1</sup> ]	-0.14	NA	0.09	NA	<b>-0.33 **</b>	NA	-0.01	NA
nano-NCBL (M) [ $10^3$ c. ml <sup>-1</sup> ]	<b>-0.36 *</b>	NA	<b>0.62 ***</b>	NA	<b>0.49 ***</b>	NA	0.20	NA
nano-NCBL (L) [ $10^3$ c. ml <sup>-1</sup> ]	-0.16	NA	<b>0.59 ***</b>	NA	0.23	NA	<b>0.24 *</b>	NA
LNA [ $10^3$ cells ml <sup>-1</sup> ]	-0.07	NA	-0.02	NA	<b>-0.47 ***</b>	NA	-0.03	NA
HNA [ $10^3$ cells ml <sup>-1</sup> ]	-0.23	NA	-0.23	NA	<b>0.35 **</b>	NA	<b>-0.26 *</b>	NA



**Figure S1** Temporal development of daily averaged a) HNA and pcio-CBL abundance- and b) nano-NCBL abundance in concert with surfactant concentrations in June (AL510). Cyanobacteria-like cells (CBL) contain the pigment phycoerythrine. Non-CBL (NCBL) contain solely Chlorophyll *a*. Bacteria are categorized according to high or low nucleic acid content (HNA and LNA).

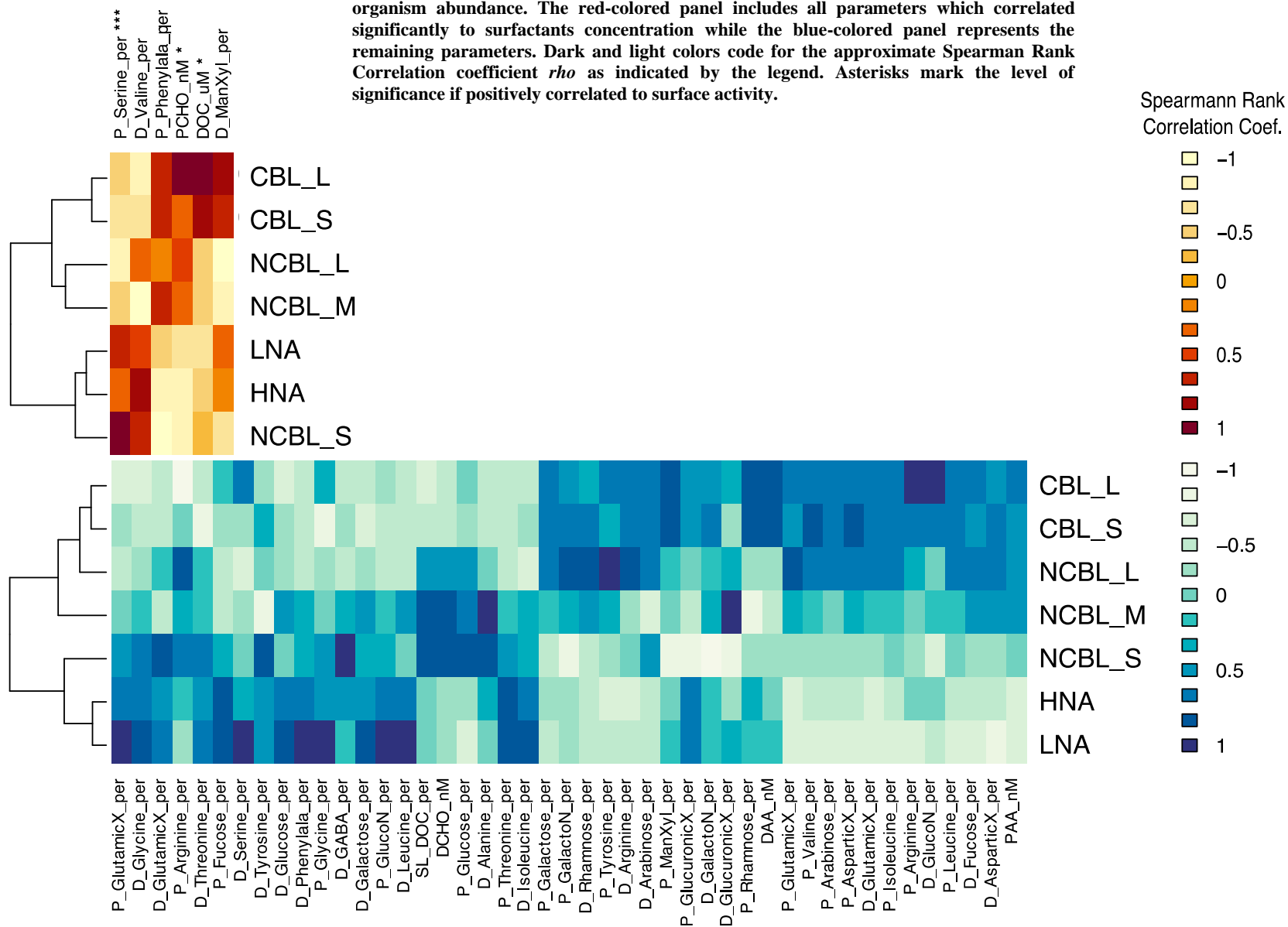


**Figure S2** Temporal development of daily averaged a) HNA and pcio-CBL abundance- and b) nano-NCBL abundance in concert with surfactant concentrations in September (AL516, red). Cyanobacteria-like cells (CBL) contain the pigment phycoerythrine. Non-CBL (NCBL) contain solely Chlorophyll *a*. Bacteria are categorized according to high or low nucleic acid content (HNA and LNA).



# June (AL510)

**Figure S3 Intercorrelation matrices between the molecular fractions of the particulate and dissolved pool of amino acids and carbohydrates, bulk organic matter concentration and organism abundance. The red-colored panel includes all parameters which correlated significantly to surfactants concentration while the blue-colored panel represents the remaining parameters. Dark and light colors code for the approximate Spearman Rank Correlation coefficient  $\rho$  as indicated by the legend. Asterisks mark the level of significance if positively correlated to surface activity.**



# September (AL516)

