The following supplement accompanies the article

Sponge assemblages and predicted archetypes in the eastern Canadian Arctic

Francisco Javier Murillo*, Ellen Kenchington, Gabrielle Tompkins, Lindsay Beazley, Emily Baker, Anders Knudby, Wojciech Walkusz

*Corresponding author: javier.murillo-perez@dfo-mpo.gc.ca

Marine Ecology Progress Series 597: 115–135 (2018)

Table S1. Shortened synoptic table of the diagnostic (highest fidelity, Φ) species for each of the five clusters resulting from the Isopam algorithm at the second cut off level. Results are separated into species with $\Phi \geq 0.23$ (upper) and $\Phi < 0.23$ (lower). Species are ranked by decreasing fidelities within particular clusters. Boldfaced numbers represent significant associations ($p < 0.01$). The percentage occurrence of the species in a particular cluster is shown in brackets. Only species present in more than one location are listed

	I	II.a	II.b	III.a	III.b
I					
Chondrocladia (Chondrocladia) grandis	**0.26 (15)**	–	–	<0 (2)	<0 (5)
Bathydorus sp. nov.	**0.25 (19)**	<0 (3)	<0 (1)	<0.01 (10)	<0 (3)
II.a					
Geodia atlantica	–	**0.60 (44)**	<0 (1)	–	<0 (3)
Stryphnus fortis	–	**0.51 (33)**	–	–	<0 (3)
Geodia macandrewii	–	**0.48 (37)**	<0 (2)	<0 (2)	0.01 (8)
Geodia barretti	<0 (1)	**0.38 (44)**	**0.14 (22)**	<0 (12)	<0 (3)
Stelletta normani	–	**0.32 (24)**	<0 (1)	<0.01 (6)	0.09 (11)
II.b					
Asconema foliata	<0 (1)	0.04 (31)	**0.68 (88)**	0.06 (35)	<0 (10)
III.a					
Mycale (Mycale) lingua	0.02 (22)	<0 (1)	<0 (7)	**0.47 (79)**	<0 (19)
Phakellia bowerbanki	<0 (3)	–	0.02 (9)	**0.40 (40)**	<0 (5)
Polymastia hemisphaerica	–	<0 (7)	**0.25 (31)**	**0.36 (50)**	<0 (10)
Forcepia (Forcepia) forcipula	<0 (1)	<0 (6)	0.06 (12)	**0.36 (38)**	<0.01 (8)
Iophon cf. *piceum*	<0 (1)	–	0.03 (5)	**0.29 (21)**	0.02 (5)
Polymastia cf. *uberrima*	<0 (3)	–	0.12 (18)	**0.25 (33)**	0.09 (18)
Weberella bursa	<0 (2)	<0 (6)	**0.21 (22)**	**0.24 (31)**	<0 (6)
III.b					
Geodia hentscheli	–	–	–	–	**0.74 (58)**
Geodia parva	<0 (1)	0.02 (13)	<0 (2)	<0 (2)	**0.65 (65)**
Schaudinnia sp.1	<0 (2)	–	–	<0 (6)	**0.62 (52)**
Tetillidae	<0 (2)	<0 (9)	<0 (17)	**0.22 (46)**	**0.54 (76)**
Stelletta rhaphidiophora	–	0.10 (14)	–	<0 (4)	**0.47 (40)**
Thenea spp.	<0 (23)	<0 (11)	<0 (26)	**0.39 (96)**	**0.46 (97)**
Geodia phlegraei	–	**0.16 (20)**	<0 (1)	<0 (6)	**0.42 (40)**
Desmacella inornata	<0 (3)	<0 (7)	<0 (3)	**0.20 (27)**	**0.26 (29)**
Diagnostic species with $\Phi < 0.23$					

	I	II.a	II.b	III.a	III.b
Polymastia thielei	0.03 (17)	–	<0 (9)	**0.16 (33)**	**0.14 (29)**
Lissodendoryx (Lissodendoryx) complicata	0.11 (15)	<0 (3)	<0 (5)	<0 (4)	0.11 (19)
Demospongiae	0.12 (10)	<0 (1)	<0 (1)	0.03 (8)	<0.01 (6)
Polymastia grimaldii	0.02 (6)	–	0.11 (11)	0.04 (8)	–
Cladorhiza oxeata	<0 (4)	<0 (1)	0.02 (5)	0.12 (12)	<0 (3)
Iotrochotidae	0.01 (5)	<0 (1)	<0 (1)	0.10 (10)	0.07 (8)
Lissodendoryx (Lissodendoryx) indistincta	**0.17 (9)**	–	–	0.03 (6)	<0 (2)
Lissodendoryx (Lissodendoryx) lundbecki	0.03 (4)	–	–	**0.17 (12)**	<0.01 (3)
Biemna variantia	<0 (1)	–	<0 (2)	0.11 (8)	**0.15 (10)**
Hemigellius arcofer	0.08 (5)	–	0.04 (4)	–	<0 (2)
Artemisina arcigera	0.15 (6)	–	–	<0 (2)	<0 (2)
Tentorium semisuberites	0.07 (4)	–	<0 (1)	0.07 (6)	<0 (2)
Sphaerotylus borealis	<0 (1)	<0 (1)	–	0.13 (8)	**0.15 (8)**
Polymastia cf. *nivea*	–	–	**0.16 (6)**	0.06 (4)	<0 (2)
Forcepia (Forcepia) fabricans	<0 (1)	–	–	**0.17 (8)**	0.05 (3)
Forcepia (Forcepia) thielei	–	**0.18 (7)**	0.06 (3)	–	–
Dendoricella aff. *flabelliformis*	<0 (1)	–	–	0.13 (6)	0.06 (3)
Dendoricella flabelliformis	0.11 (3)	–	–	0.02 (2)	–
Esperiopsis cf. *villosa*	<0 (1)	–	<0 (1)	0.02 (2)	**0.16 (6)**
Polymastia andrica	–	–	**0.16 (5)**	0.07 (4)	–
Tedania cf. *suctoria*	<0.01 (2)	–	0.03 (2)	0.07 (4)	–
Calcarea	0.10 (3)	–	–	0.02 (2)	–
Lissodendoryx (Ectyodoryx) cf. *multiformis*	<0 (1)	–	0.09 (3)	0.02 (2)	0.01 (2)
Artemisina aff. *apollinis*	0.08 (2)	–	–	0.03 (2)	–
Melonanchora cf. *elliptica*	–	0.07 (3)	<0.01 (1)	0.10 (4)	–
Stylocordyla borealis	0.08 (2)	–	<0.01 (1)	–	–
Axinella arctica	–	0.03 (1)	0.13 (3)	–	–
Calthropella sp. nov.	–	**0.22 (6)**	–	–	–
Clathria (Clathria) barleei	–	0.03 (1)	0.07 (2)	0.05 (2)	–
Forcepia (Forcepia) forcipis	–	0.03 (1)	0.13 (3)	–	–
Haliclona (Flagellia) porosa	0.06 (2)	–	–	0.05 (2)	–
Lissodendoryx (Ectyodoryx) aff. *loyningi*	–	–	–	**0.20 (6)**	0.03 (2)
Mycale (Mycale) loveni	<0 (1)	–	–	**0.20 (6)**	–
Tethya norvegica	–	0.03 (1)	0.01 (1)	0.12 (4)	–
Chonelasma choanoides	–	**0.19 (4)**	–	–	–
Forcepia (Forcepia) aff. *japonica*	–	–	0.03 (1)	–	0.13 (3)
Melonanchora cf. *emphysema*	–	–	0.09 (2)	0.06 (2)	–
Myxilla brunnea	0.04 (1)	–	–	–	0.05 (2)
Spinularia sarsi	–	–	0.03 (1)	–	0.13 (3)
Suberitidae	–	0.04 (1)	0.09 (2)	–	–
Forcepia sp.2	–	–	–	–	0.17 (3)
Hemigellius cf. *pumiceus*	–	–	–	0.19 (4)	–
Hymeniacidon spp.	–	–	0.13 (2)	–	–
Janulum spinispiculum	–	0.06 (1)	0.05 (1)	–	–
Mycale (Mycale) cf. *arctica*	–	0.06 (1)	–	–	0.07 (2)
Polymastia sp.1	–	–	–	–	0.17 (3)
Rosselidae sp.1	0.01 (1)	–	–	0.09 (2)	–

Table S2. The estimated coefficients (Coeff), standard errors (SE) and relative standard errors (RSE) for the component GLMs of the best performing model used to predict each sponge species archetypes (SA). RSE is the SE of the parameter (absolute value) multiplied by 100 and divided by the estimated coefficient. avg: average; b: bottom; chl; chlorophyll *a*; max: maximum; pp: primary production; ran: range; spr: spring; sq: square; sum: summer; tmp: temperature

	(Intercept)			b_tmp_max_avg			b_tmp_max_avg.sq			chl_spr_max			depth		
	Coeff	SE	RSE	Coeff	SE	RSE	Coeff	SE	RSE	Coeff	SE	RSE	Coeff	SE	RSE
SA1	–1.31	0.07	5.32	2.13	0.41	19.38	–1.71	0.36	21.34	–0.10	0.07	69.14	2.50	0.41	16.45
SA2	–3.80	0.22	5.88	3.17	0.92	28.90	–1.32	0.76	57.85	–0.24	0.13	55.72	–1.97	0.54	27.24
SA3	–3.49	0.16	4.50	6.88	0.74	10.78	–6.37	0.66	10.40	–0.83	0.20	24.23	6.66	0.74	11.09
SA4	–2.89	0.08	2.87	–0.91	0.44	48.45	0.32	0.44	137.62	–0.17	0.12	67.57	1.22	0.38	31.27
SA5	–4.88	0.07	1.51	0.65	0.33	50.13	–0.69	0.30	44.22	–0.03	0.06	220.00	–0.55	0.35	63.75
SA6	–2.53	0.11	4.15	1.63	0.36	22.35	–1.21	0.32	26.56	0.10	0.06	59.19	–0.49	0.45	91.29
	depth.sq			pp_sum_max_avg			pp_sum_max_avg.sq			pp_sum_ran_avg			slope		
	Coeff	SE	RSE	Coeff	SE	RSE	Coeff	SE	RSE	Coeff	SE	RSE	Coeff	SE	RSE
SA1	–2.57	0.43	16.71	1.94	0.78	40.19	–3.00	0.80	26.73	0.83	0.19	22.41	0.18	0.07	38.12
SA2	2.05	0.50	24.63	1.54	1.38	89.61	–0.55	1.28	233.01	–0.63	0.32	50.56	0.17	0.18	110.45
SA3	–5.85	0.70	11.91	–3.49	0.82	23.49	3.49	0.85	24.27	–0.33	0.24	74.26	–0.24	0.11	46.67
SA4	–0.88	0.36	41.19	1.17	0.90	76.89	–1.55	0.97	62.13	0.29	0.20	67.66	–0.01	0.07	1089.41
SA5	0.03	0.39	1129.72	–0.30	0.83	278.73	0.22	0.85	389.99	0.21	0.17	80.45	–0.03	0.09	265.30
SA6	–0.58	0.56	96.94	0.64	0.96	149.60	–1.09	0.99	90.49	0.50	0.19	36.88	0.18	0.09	48.96

Table S3. Species archetype (SA) composition and measures of predictive performance per species (p: significance level; AUC: Area Under the ROC Curve). The number of occurrences (N) and species archetype membership probability (τ) to each SA is indicated for each sponge species. Significance codes: ***p < 0.001, **p < 0.01, *p <0.05

Species	n	SA1 τ	SA2 τ	SA3 τ	SA4 τ	SA5 τ	SA6 τ	Kendall cor.	p	AUC
SA1										
Geodia parva	54	1	0	0	0	0	0	0.327	***	0.857
Desmacella inornata	45	1	0	0	0	0	0	0.196	***	0.732
Geodia phlegraei	43	1	0	0	0	0	0	0.198	***	0.739
Schaudinnia sp.1	38	1	0	0	0	0	0	0.312	***	0.899
Stelletta rhaphidiophora	37	1	0	0	0	0	0	0.252	***	0.826
Geodia hentscheli	36	1	0	0	0	0	0	0.337	***	0.942
SA2										
Iophon cf. *piceum*	18	0	0.983	0.0169	0	0	0	0.172	***	0.813
Lissodendoryx (Lissodendoryx) indistincta	16	0	1	0	0	0	0	0.184	***	0.853
Biemna variantia	14	0	0.9979	0	0	0	0.0021	0.098	*	0.701
Tentorium semisuberites	13	0	0.9999	0	0	0	0.0001	0.102	**	0.716
Artemisina arcigera	11	0	1	0	0	0	0	0.094	*	0.716
Hemigellius arcofer	11	0	1	0	0	0	0	0.074	–	0.671
Sphaerotylus borealis	11	0	1	0	0	0	0	0.070	–	0.661
Polymastia cf. *nivea*	9	0	1	0	0	0	0	0.036	–	0.592
Forcepia (Forcepia) thielei	8	0	0.9999	0	0.0001	0	0	–0.046	–	0.625
Dendoricella aff. *flabelliformis*	7	0	0.9999	0	0	0	0.0001	–0.037	–	0.606
Dendoricella flabelliformis	7	0	1	0	0	0	0	0.027	–	0.578
Esperiopsis cf. *villosa*	7	0	1	0	0	0	0	0.055	–	0.659
Forcepia (Forcepia) fabricans	7	0	1	0	0	0	0	0.098	*	0.780
Polymastia andrica	7	0	1	0	0	0	0	0.066	–	0.689
Lissodendoryx (Ectyodoryx) cf. *multiformis*	6	0	1	0	0	0	0	0.079	*	0.746
Tedania cf. *suctoria*	6	0	1	0	0	0	0	0.090	*	0.778
Artemisina aff. *apollinis*	5	0	1	0	0	0	0	0.014	–	0.546
Melonanchora cf. *elliptica*	5	0	1	0	0	0	0	0.008	–	0.473
Stylocordyla borealis	5	0	1	0	0	0	0	–0.074	–	0.752

Species	n	SA1 τ	SA2 τ	SA3 τ	SA4 τ	SA5 τ	SA6 τ	Kendall cor.	p	AUC
Axinella arctica	4	0	1	0	0	0	0	0.053	–	0.699
Calcarea	4	0	1	0	0	0	0	0.127	***	0.981
Calthropella sp. nov.	4	0	1	0	0	0	0	–0.025	–	0.594
Clathria (Clathria) barleei	4	0	1	0	0	0	0	0.046	–	0.675
Forcepia (Forcepia) forcipis	4	0	1	0	0	0	0	0.025	–	0.594
Lissodendoryx (Ectyodoryx) aff. *loyningi*	4	0	1	0	0	0	0	0.059	–	0.724
Mycale (Mycale) loveni	4	0	1	0	0	0	0	–0.004	–	0.516
Tethya norvegica	4	0	1	0	0	0	0	0.053	–	0.699
Chonelasma choanoides	3	0	1	0	0	0	0	–0.059	–	0.756
Forcepia (Forcepia) aff. *japonica*	3	0	1	0	0	0	0	0.001	–	0.506
Melonanchora cf. *emphysema*	3	0	1	0	0	0	0	0.043	–	0.690
Myxilla brunnea	3	0	1	0	0	0	0	0.081	*	0.854
Spinularia sarsi	3	0	1	0	0	0	0	0.023	–	0.603
Suberitidae	3	0	1	0	0	0	0	0.007	–	0.531
Forcepia sp.2	2	0	1	0	0	0	0	0.022	–	0.616
Haliclona (Flagellia) porosa	2	0	1	0	0	0	0	0.077	*	0.910
Hemigellius cf. *pumiceus*	2	0	1	0	0	0	0	0.062	–	0.834
Hymeniacidon spp.	2	0	1	0	0	0	0	0.067	–	0.858
Janulum spinispiculum	2	0	1	0	0	0	0	0.026	–	0.641
Mycale (Mycale) cf. *arctica*	2	0	1	0	0	0	0	–0.009	–	0.546
Polymastia sp.1	2	0	1	0	0	0	0	0.000	–	0.502
Rosselidae sp.1	2	0	1	0	0	0	0	0.016	–	0.587
cf. Axinellidae sp.1	1	0	1	0	0	0	0	–0.024	–	0.684
cf. *Chaunangium* sp.1	1	0	1	0	0	0	0	–0.011	–	0.582
cf. Crellidae sp.1	1	0	1	0	0	0	0	–0.001	–	0.506
cf. Myxillidae sp.1	1	0	1	0	0	0	0	0.016	–	0.620
Crella (Yvesia) pyrula	1	0	1	0	0	0	0	0.066	–	1.000
Esperiopsis sp.1	1	0	1	0	0	0	0	0.000	–	0.501
Forcepia sp.1	1	0	1	0	0	0	0	0.016	–	0.618
Forcepia sp.3	1	0	1	0	0	0	0	0.048	–	0.864

Species	n	SA1 τ	SA2 τ	SA3 τ	SA4 τ	SA5 τ	SA6 τ	Kendall cor.	p	AUC
Haliclona (Gellius) varia	1	0	1	0	0	0	0	0.063	–	0.976
Hamacantha (Vomerula) aff. *falcula*	1	0	1	0	0	0	0	–0.023	–	0.677
Iotrochotidae sp.1	1	0	1	0	0	0	0	–0.010	–	0.576
Isodictya aff. *palmata*	1	0	1	0	0	0	0	0.066	–	0.996
Lissodendoryx (Lissodendoryx) stipitata	1	0	1	0	0	0	0	0.053	–	0.897
Lycopodina cupressiformis	1	0	1	0	0	0	0	0.064	–	0.982
Mycale (Mycale) cf. *toporoki*	1	0	1	0	0	0	0	0.051	–	0.888
Myxilla (Myxilla) fimbriata	1	0	1	0	0	0	0	0.045	–	0.842
Poecilosclerida e sp.1	1	0	1	0	0	0	0	–0.008	–	0.563
Polymastia mamillaris	1	0	1	0	0	0	0	–0.021	–	0.657
Rhizaxinella sp.1	1	0	1	0	0	0	0	–0.007	–	0.552
Semisuberites cribrosa	1	0	1	0	0	0	0	0.026	–	0.699
Sphaerotylus capitatus	1	0	1	0	0	0	0	0.005	–	0.534
Spinularia cf. *sarsi*	1	0	1	0	0	0	0	–0.057	–	0.934
Tedania sp.1	1	0	1	0	0	0	0	0.030	–	0.725
SA3										
Mycale (Mycale) lingua	98	0	0	1	0	0	0	0.251	***	0.716
Polymastia hemisphaerica	64	0	0	1	0	0	0	0.311	***	0.817
Polymastia cf. *uberrima*	48	0	0	1	0	0	0	0.225	***	0.759
Weberella bursa	47	0	0	1	0	0	0	0.251	***	0.791
Forcepia (Forcepia) forcipula	38	0	0	1	0	0	0	0.209	***	0.768
Phakellia bowerbanki	35	0	0	1	0	0	0	0.192	***	0.754
SA4										
Geodia barretti	62	0	0	0	1	0	0	0.358	***	0.869
Geodia atlantica	34	0	0	0	1	0	0	0.327	***	0.940
Geodia macandrewii	34	0	0	0	1	0	0	0.292	***	0.893
Stelletta normani	28	0	0	0	1	0	0	0.211	***	0.811
Stryphnus fortis	25	0	0	0	1	0	0	0.268	***	0.915
SA5										
Thenea spp.	184	0	0	0	0	1	0	0.390	***	0.781

Species	n	SA1 τ	SA2 τ	SA3 τ	SA4 τ	SA5 τ	SA6 τ	Kendall cor.	p	AUC
Asconema foliata	130	0	0	0	0	1	0	0.314	***	0.746
Tetillidae	94	0	0	0	0	1	0	0.365	***	0.819
Polymastia thielei	73	0	0	0	0	0.9999	0.0001	0.165	***	0.659
SA6										
Lissodendoryx (Lissodendoryx) complicata	50	0	0	0	0	0	1	0.247	***	0.779
Bathydorus sp. nov.	47	0	0	0	0	0	1	0.245	***	0.785
Chondrocladia (Chondrocladia) grandis	30	0	0	0	0	0	1	0.216	***	0.808
Demospongiae	28	0	0	0	0	0	1	0.107	**	0.658
Polymastia grimaldii	24	0	0	0	0	0	1	0.005	–	0.492
Cladorhiza oxeata	21	0	0	0	0	0	1	0.020	–	0.534
Iotrochotidae	21	0	0	0	0	0	1	0.066	–	0.611
Lissodendoryx (Lissodendoryx) lundbecki	16	0	0.0083	0	0	0	0.9917	0.071	–	0.636

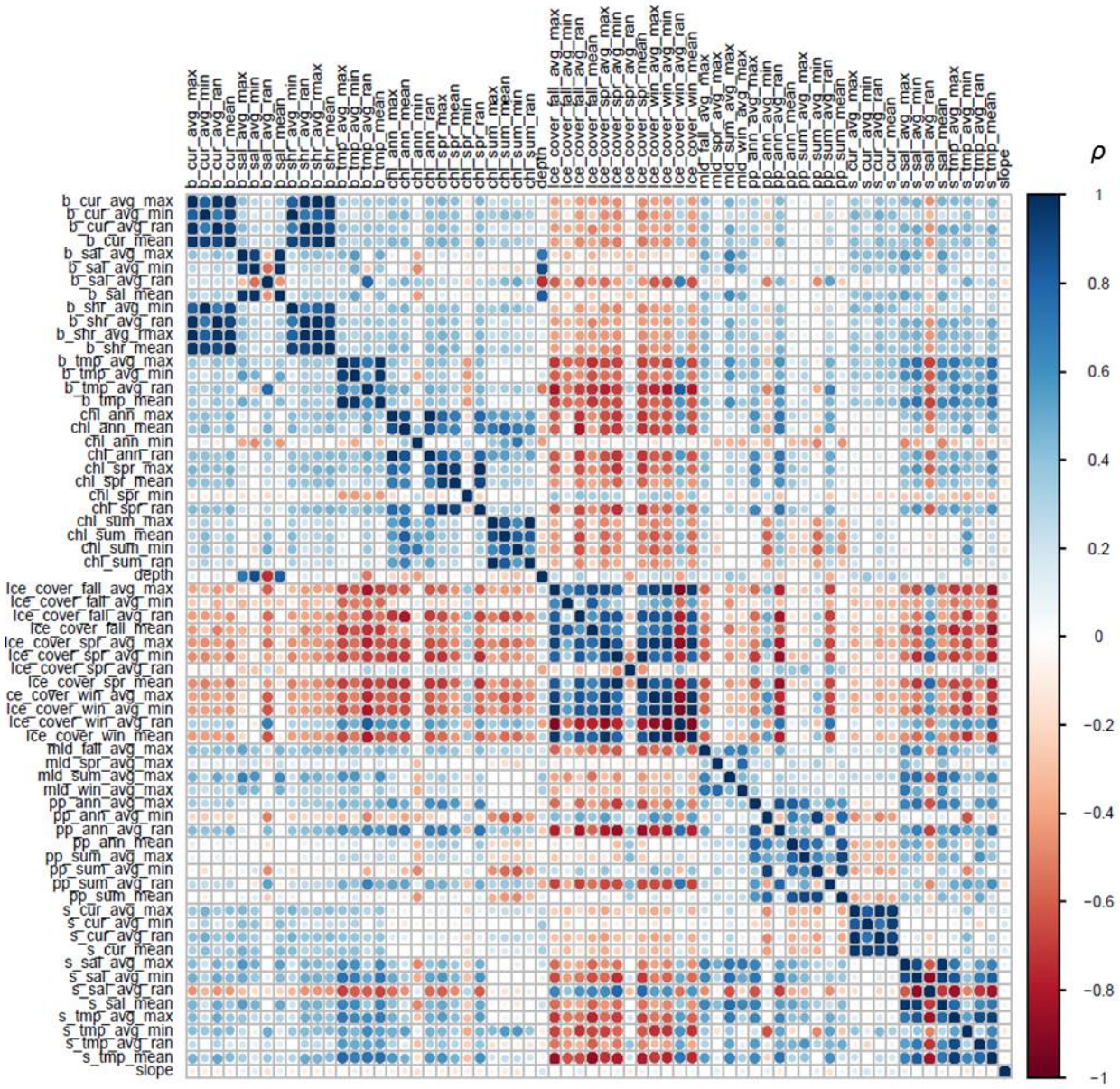

Fig. S1. Correlation matrix based on Spearman's rank correlation coefficient (ρ) between all predictor variables available in the eastern Canada Arctic. ann: annual; avg: average; b: bottom; chl; chlorophyll *a*; cur: current; max: maximum; min: minimum; mld: mixed layer depth; pp: primary production; ran: range; s: surface; sal: salinity; shr: shear; spr: spring; sum: summer; tmp: temperature; win: winter