Appendix

Supplementary materials – 1

Tables S1 – S2

Article:

Wide ecological niches ensure frequent harmful dinoflagellate blooms

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Supplementary Table S1.

Dinoflagellate biovolume (BV, $mm^3 L^{-1}$) classification (**A**) and representation (Number of datasets, n) of the most abundant species in the database (**B**).

A. Biovolume classification of dinoflagellates		
BV class number	BV classes	BV class limits ($mm^3 L^{-1}$)
1	rare	< 0.044
2	present	0.044 – < 0.12
3	abundant	0.12 – < 0.4
4	very abundant	0.4 – < 1.0
5	plentiful	1.0 – < 3.0
6	blooming	≥ 3.0
B. Representation of species in the database		
Number of datasets (n)	Species	Maximum BV class
448	*Prorocentrum cordatum*	4
354	*Ceratium tripos*	6
257	*Ceratium fusus*	6
246	*Dinophysis norvegica*	6
243	*Prorocentrum micans*	5
232	*Dinophysis acuminata*	5
229	*Kryptoperidinium triquetrum*	5
185	*Protoperidinium pellucidum*	5
126	*Amphidinium crassum*	5
116	*Protoperidinium bipes*	5
112	*Ceratium lineatum*	6
103	*Protoperidinium steinii*	5
98	*Protoperidinium brevipes*	5
94	*Proterythropsis vigilans*	5
93	*Gyrodinium spirale*	6
60	*Protoperidinium conicum*	6
52	*Ceratium furca*	6

Supplementary Table S2.

Results of the Principal Component Analysis showing contribution of 12 main environmental variables to preferable ecological conditions (niches) for major bloom-forming dinoflagellate species in the Baltic coastal waters. Maximum Eigenvectors are highlighted in bold font.

A. PCA results for a total of 14 species

Total (altogether 14 species)

Data worksheet
Name: Data22
Data type: Other
Sample selection: All
Variable selection: All

Eigenvalues

PC	Eigenvalues	%Variation	Cum.%Variation
1	5,12	42,7	42,7
2	1,77	14,7	57,4
3	1,57	13,1	70,5
4	0,868	7,2	77,7
5	0,733	6,1	83,9

Eigenvectors
(Coefficients in the linear combinations of variables making up PC's)

Variable	**PC1**	**PC2**	**PC3**	**PC4**	**PC5**
T water	0,050	**-0,515**	0,080	0,385	**0,615**
Salinity	0,258	0,185	-0,431	-0,006	0,214
Secchi depth	0,273	0,253	-0,329	0,177	-0,169
Chl a	-0,289	-0,154	0,247	-0,384	0,230
PO4	-0,279	-0,273	**-0,455**	0,029	-0,204
Total P	-0,339	-0,269	-0,289	0,030	-0,035
Total N	**-0,413**	0,129	0,069	0,117	0,076
DIN	-0,355	0,371	0,086	0,304	0,057
NO2	-0,313	0,397	0,242	0,266	0,003
NO3	-0,150	0,334	-0,298	**-0,557**	0,518
NH4	-0,265	0,024	-0,429	0,329	0,126
SiO4	-0,305	-0,204	-0,064	-0,276	-0,398

B. PCA results for individual species

Amphidinium crassum

Data worksheet
Name: Data1
Data type: Other
Sample selection: All
Variable selection: All

Eigenvalues

PC	Eigenvalues	%Variation	Cum.%Variation
1	6,18	51,5	51,5
2	2,06	17,2	68,7
3	1,21	10,1	78,8
4	0,989	8,2	87,0
5	0,606	5,0	92,1

Eigenvectors
(Coefficients in the linear combinations of variables making up PC's)

Variable	**PC1**	**PC2**	**PC3**	**PC4**	**PC5**
T water	0,116	0,311	**-0,576**	-0,522	-0,172
Salinity	0,224	0,263	-0,325	0,449	**-0,497**
Secchi depth	0,294	0,058	-0,081	**0,532**	-0,160
Chl a	-0,303	-0,196	-0,433	-0,059	-0,119
PO4	-0,259	0,442	0,303	-0,022	-0,186
Total P	-0,330	0,352	0,003	-0,056	-0,109
Total N	-0,364	0,014	-0,176	0,084	0,152
DIN	**-0,365**	-0,167	-0,221	0,170	-0,013
NO2	-0,280	-0,439	-0,220	0,129	-0,138
NO3	-0,320	0,105	0,050	0,381	0,179
NH4	-0,261	**0,470**	-0,074	0,112	0,228
SiO4	-0,261	-0,140	0,375	-0,160	-0,715

Ceratium fusus

Data worksheet
Name: Data3
Data type: Other
Sample selection: All
Variable selection: All

Eigenvalues

PC	Eigenvalues	%Variation	Cum.%Variation
1	3,77	31,4	31,4
2	2,03	16,9	48,3
3	1,68	14,0	62,3
4	1,12	9,3	71,7
5	1,03	8,6	80,3

Eigenvectors
(Coefficients in the linear combinations of variables making up PC's)

Variable	**PC1**	**PC2**	**PC3**	**PC4**	**PC5**
T water	0,244	-0,232	0,144	-0,282	-0,460
Salinity	-0,124	**0,443**	-0,084	**0,417**	0,028
Secchi depth	0,081	-0,202	**-0,608**	0,127	0,328
Chl a	-0,106	0,328	0,535	0,300	-0,092
PO4	-0,232	-0,414	0,254	-0,064	0,425
Total P	-0,304	-0,316	0,060	0,260	0,133
Total N	-0,388	-0,111	0,275	-0,387	0,073
DIN	**-0,429**	0,237	-0,236	-0,256	-0,100
NO2	-0,267	-0,173	-0,252	0,252	**-0,533**
NO3	-0,285	0,434	-0,153	-0,361	0,220
NH4	-0,386	-0,125	-0,154	-0,117	-0,352
SiO4	-0,353	-0,166	0,076	0,382	0,033

Ceratium lineatum

Data worksheet
Name: Data5
Data type: Other
Sample selection: All
Variable selection: All

Eigenvalues

PC	Eigenvalues	%Variation	Cum.%Variation
1	4,48	40,7	40,7
2	1,64	14,9	55,6
3	1,48	13,4	69,0
4	1,36	12,4	81,4
5	0,7	6,4	87,8

Eigenvectors
(Coefficients in the linear combinations of variables making up PC's)

Variable	**PC1**	**PC2**	**PC3**	**PC4**	**PC5**
T water	0,275	0,196	**0,383**	0,213	-0,592
Salinity	-0,147	-0,192	-0,552	-0,118	**-0,700**
Secchi depth	-0,093	0,530	-0,485	0,054	0,062
Chl a	0,029	**-0,630**	0,044	-0,395	-0,006
Total P	-0,329	0,137	0,036	**-0,497**	-0,159
Total N	-0,352	-0,221	0,324	0,277	-0,079
DIN	**-0,451**	0,039	0,064	0,188	-0,029
NO2	-0,257	0,359	0,276	-0,477	0,053
NO3	-0,342	-0,142	-0,188	0,433	0,089
NH4	-0,393	0,092	0,279	0,073	-0,245
SiO4	-0,346	-0,144	-0,112	-0,041	0,230

Ceratium tripos

Data worksheet
Name: Data6
Data type: Other
Sample selection: All
Variable selection: All

Eigenvalues

PC	Eigenvalues	%Variation	Cum.%Variation
1	3,39	28,2	28,2
2	2,18	18,2	46,4
3	1,5	12,5	58,9
4	1,17	9,8	68,6
5	1,01	8,4	77,1

Eigenvectors
(Coefficients in the linear combinations of variables making up PC's)

Variable	**PC1**	**PC2**	**PC3**	**PC4**	**PC5**
T water	-0,239	0,311	0,194	**-0,413**	0,029
Salinity	0,174	-0,423	0,004	0,339	-0,001
Secchi depth	-0,113	0,114	**-0,663**	0,302	-0,186
Chl a	0,163	-0,318	0,539	0,234	0,211
PO4	0,233	**0,464**	0,155	0,253	-0,255
Total P	0,295	0,277	-0,020	0,253	0,195
Total N	0,357	0,240	0,248	-0,258	-0,254
DIN	**0,465**	-0,188	-0,221	-0,282	-0,029
NO2	0,229	0,058	-0,235	-0,129	0,760
NO3	0,332	-0,355	-0,108	-0,176	**-0,414**
NH4	0,373	0,129	-0,164	-0,280	0,055
SiO4	0,292	0,279	0,061	0,411	0,003

Dinophysis acuminata

Data worksheet
Name: Data8
Data type: Other
Sample selection: All
Variable selection: All

Eigenvalues

PC	Eigenvalues	%Variation	Cum.%Variation
1	4,56	41,5	41,5
2	2,77	25,2	66,7
3	1,28	11,6	78,3
4	0,764	6,9	85,2
5	0,59	5,4	90,6

Eigenvectors
(Coefficients in the linear combinations of variables making up PC's)

Variable	**PC1**	**PC2**	**PC3**	**PC4**	**PC5**
T water	-0,225	-0,295	-0,108	**-0,619**	-0,180
Salinity	0,328	0,214	-0,208	-0,071	-0,532
Secchi depth	0,312	-0,072	0,251	-0,397	**0,674**
Chl a	-0,396	-0,113	-0,282	0,163	0,005
Total P	-0,423	-0,063	-0,136	-0,114	0,106
Total N	**-0,444**	-0,002	-0,184	0,000	0,219
DIN	-0,105	**0,576**	-0,007	-0,039	0,120
NO2	-0,209	0,239	**0,688**	0,058	-0,157
NO3	-0,015	0,496	-0,328	0,192	0,318
NH4	-0,048	0,442	-0,126	-0,611	-0,131
SiO4	-0,393	0,122	0,391	-0,015	-0,119

Dinophysis norvegica

Data worksheet
Name: Data9
Data type: Other
Sample selection: All
Variable selection: All

Eigenvalues

PC	Eigenvalues	%Variation	Cum.%Variation
1	3,65	33,2	33,2
2	1,8	16,4	49,6
3	1,6	14,6	64,1
4	1,12	10,2	74,3
5	0,79	7,2	81,5

Eigenvectors
(Coefficients in the linear combinations of variables making up PC's)

Variable	**PC1**	**PC2**	**PC3**	**PC4**	**PC5**
T water	-0,181	0,007	-0,387	-0,485	**0,626**
Salinity	0,248	0,303	-0,272	-0,223	-0,406
Secchi depth	-0,219	0,319	0,493	-0,257	-0,013
Chl a	0,243	-0,015	**-0,514**	0,455	-0,079
Total P	0,246	**0,477**	0,059	-0,094	-0,159
Total N	0,383	-0,389	0,020	-0,056	0,267
DIN	**0,460**	-0,173	0,254	-0,149	0,013
NO2	0,306	0,256	0,112	0,091	0,369
NO3	0,423	-0,064	0,341	0,093	0,156
NH4	0,186	-0,342	-0,132	**-0,607**	-0,376
SiO4	0,269	0,460	-0,235	-0,148	0,196

Kryptoperidinium triquetrum

Data worksheet
Name: Data10
Data type: Other
Sample selection: All
Variable selection: All

Eigenvalues

PC	Eigenvalues	%Variation	Cum.%Variation
1	6,95	58,0	58,0
2	1,88	15,7	73,6
3	1,25	10,4	84,0
4	0,85	7,1	91,1
5	0,389	3,2	94,3

Eigenvectors
(Coefficients in the linear combinations of variables making up PC's)

Variable	**PC1**	**PC2**	**PC3**	**PC4**	**PC5**
T water	-0,117	**0,553**	-0,266	-0,379	0,137
Salinity	0,222	-0,428	-0,072	0,345	-0,202
Secchi depth	0,251	-0,372	-0,117	-0,004	**0,829**
Chl a	-0,199	0,319	0,361	**0,620**	0,174
PO4	-0,345	-0,164	-0,281	0,063	0,010
Total P	-0,346	-0,085	-0,306	0,145	-0,023
Total N	**-0,368**	-0,069	-0,145	0,117	0,005
DIN	-0,355	-0,207	-0,027	-0,176	0,068
NO2	-0,253	-0,086	**0,495**	-0,379	0,279
NO3	-0,215	-0,359	0,469	-0,217	-0,277
NH4	-0,337	-0,204	-0,304	-0,042	-0,013
SiO4	-0,333	0,108	0,168	0,301	0,252

Prorocentrum micans

Data worksheet
Name: Data12
Data type: Other
Sample selection: All
Variable selection: All

Eigenvalues

PC	Eigenvalues	%Variation	Cum.%Variation
1	3,53	29,4	29,4
2	2,74	22,9	52,3
3	1,46	12,2	64,4
4	1,19	9,9	74,3
5	0,817	6,8	81,1

Eigenvectors
(Coefficients in the linear combinations of variables making up PC's)

Variable	**PC1**	**PC2**	**PC3**	**PC4**	**PC5**
T water	-0,194	0,400	-0,073	0,128	0,454
Salinity	0,382	-0,225	-0,003	-0,300	0,027
Secchi depth	0,381	-0,086	-0,391	-0,125	0,215
Chl a	-0,314	0,068	0,501	-0,271	-0,224
PO4	-0,212	0,000	**-0,626**	-0,297	-0,170
Total P	-0,294	0,030	0,133	-0,470	0,457
Total N	**-0,460**	-0,131	-0,070	-0,054	-0,026
DIN	-0,106	-0,577	0,058	0,060	0,088
NO2	-0,226	-0,134	-0,101	**0,656**	-0,109
NO3	0,013	**-0,531**	0,143	-0,117	-0,130
NH4	-0,213	-0,355	-0,105	0,131	**0,556**
SiO4	-0,349	-0,017	-0,362	-0,170	-0,335

Prorocentrum cordatum
Data worksheet
Name: Data14
Data type: Other
Sample selection: All
Variable selection: All

Eigenvalues

PC	Eigenvalues	%Variation	Cum.%Variation
1	3,93	32,8	32,8
2	2,26	18,8	51,6
3	1,32	11,0	62,6
4	1,1	9,2	71,8
5	0,937	7,8	79,6

Eigenvectors
(Coefficients in the linear combinations of variables making up PC's)

Variable	**PC1**	**PC2**	**PC3**	**PC4**	**PC5**
T water	0,095	-0,157	0,088	**-0,720**	**-0,485**
Salinity	0,184	0,403	-0,184	0,172	-0,453
Secchi depth	0,289	**0,423**	-0,098	-0,054	0,072
Chl a	-0,260	-0,355	0,015	0,323	-0,283
PO4	-0,217	0,053	**-0,641**	-0,181	0,228
Total P	-0,251	-0,188	-0,342	-0,136	-0,444
Total N	**-0,456**	-0,008	0,013	0,029	0,018
DIN	-0,367	0,369	0,294	-0,165	-0,012
NO2	-0,322	0,297	0,475	-0,125	-0,059
NO3	-0,144	0,363	-0,144	0,392	-0,406
NH4	-0,282	0,306	-0,297	-0,284	0,212
SiO4	-0,386	-0,145	0,013	0,125	0,107

Proterythropsis vigilans (version 1)
Data worksheet
Name: Data21
Data type: Other
Sample selection: All
Variable selection: All

Eigenvalues

PC	Eigenvalues	%Variation	Cum.%Variation
1	5,01	45,6	45,6
2	2,00	18,2	63,8
3	1,68	15,3	79,0
4	0,725	6,6	85,6
5	0,595	5,4	91,0

Eigenvectors
(Coefficients in the linear combinations of variables making up PC's)

Variable	**PC1**	**PC2**	**PC3**	**PC4**	**PC5**
T water	0,197	0,302	0,225	**0,681**	**-0,573**
Salinity	-0,278	-0,038	0,288	-0,573	-0,568
Secchi depth	-0,048	**0,615**	-0,176	-0,152	0,154
Chl a	-0,015	-0,540	0,383	0,122	0,050
Total P	-0,247	0,345	0,439	-0,123	-0,055
Total N	-0,406	-0,130	-0,093	0,263	0,120
DIN	**-0,422**	-0,040	-0,203	0,148	-0,056
NO2	-0,388	-0,042	-0,089	0,081	-0,206
NO3	-0,390	-0,155	-0,272	0,142	-0,153
NH4	-0,374	0,265	0,025	0,121	0,227
SiO4	-0,188	0,055	**0,603**	0,148	0,429

Protoperidinium bipes

Data worksheet
Name: Data16
Data type: Other
Sample selection: All
Variable selection: All

Eigenvalues

PC	Eigenvalues	%Variation	Cum.%Variation
1	5,00	45,4	45,4
2	2,25	20,4	65,9
3	1,35	12,3	78,1
4	1,09	9,9	88,1
5	0,428	3,9	92,0

Eigenvectors
(Coefficients in the linear combinations of variables making up PC's)

Variable	**PC1**	**PC2**	**PC3**	**PC4**	**PC5**
T water	0,112	0,206	-0,073	**-0,822**	-0,441
Salinity	-0,311	-0,323	0,201	-0,135	0,260
Secchi depth	0,087	0,554	0,367	0,051	0,146
Chl a	-0,139	**-0,601**	0,041	-0,084	-0,137
Total P	-0,349	-0,138	0,347	-0,190	0,072
Total N	-0,379	0,002	-0,392	-0,021	-0,158
DIN	**-0,404**	0,208	-0,228	-0,006	0,027
NO2	-0,323	0,199	0,199	0,378	-0,365
NO3	-0,384	0,146	-0,175	0,140	-0,371
NH4	-0,320	0,236	-0,277	-0,248	**0,627**
SiO4	-0,284	0,082	**0,587**	-0,189	-0,054

Protoperidinium brevipes

Data worksheet
Name: Data18
Data type: Other
Sample selection: All
Variable selection: All

Eigenvalues

PC	Eigenvalues	%Variation	Cum.%Variation
1	3,79	34,4	34,4
2	2,52	22,9	57,4
3	1,28	11,7	69,0
4	1,19	10,8	79,9
5	0,814	7,4	87,3

Eigenvectors
(Coefficients in the linear combinations of variables making up PC's)

Variable	**PC1**	**PC2**	**PC3**	**PC4**	**PC5**
T water	0,248	-0,193	0,215	-0,142	**-0,823**
Salinity	-0,086	-0,474	0,361	0,176	0,040
Secchi depth	0,260	0,215	**0,578**	0,187	0,192
Chl a	-0,154	-0,443	-0,471	0,047	-0,113
Total P	0,076	-0,486	0,040	-0,004	0,365
Total N	-0,472	-0,062	0,000	-0,198	-0,138
DIN	**-0,488**	0,057	0,184	-0,083	0,064
NO2	-0,348	0,011	0,286	0,428	-0,298
NO3	-0,481	0,076	0,089	0,155	0,057
NH4	-0,116	-0,045	0,309	**-0,810**	0,078
SiO4	0,093	**-0,494**	0,217	0,052	0,129

Protoperidinium pellucidum

Data worksheet
Name: Data19
Data type: Other
Sample selection: All
Variable selection: All

Eigenvalues

PC	Eigenvalues	%Variation	Cum.%Variation
1	7,05	58,7	58,7
2	2,01	16,8	75,5
3	1,3	10,9	86,4
4	0,759	6,3	92,7
5	0,491	4,1	96,8

Eigenvectors
(Coefficients in the linear combinations of variables making up PC's)

Variable	**PC1**	**PC2**	**PC3**	**PC4**	**PC5**
T water	-0,062	0,111	**-0,671**	**0,654**	0,213
Salinity	0,084	**-0,553**	-0,029	0,353	**-0,678**
Secchi depth	0,161	0,477	0,330	0,182	-0,430
Chl a	-0,142	-0,479	-0,312	-0,462	-0,058
PO4	-0,369	0,109	-0,006	-0,083	-0,053
Total P	-0,353	0,043	-0,013	0,075	-0,317
Total N	**-0,372**	-0,009	0,072	0,024	0,097
DIN	-0,360	-0,068	0,205	0,151	0,075
NO2	-0,371	0,097	0,013	-0,069	-0,050
NO3	-0,064	-0,432	0,540	0,387	0,409
NH4	-0,368	0,071	0,041	0,096	-0,078
SiO4	-0,371	0,080	-0,034	-0,026	-0,112

Protoperidinium steinii

Data worksheet
Name: Data20
Data type: Other
Sample selection: All
Variable selection: All

Eigenvalues

PC	Eigenvalues	%Variation	Cum.%Variation
1	4,7	42,7	42,7
2	2,24	20,3	63,1
3	1,09	9,9	72,9
4	1,04	9,5	82,4
5	0,579	5,3	87,7

Eigenvectors
(Coefficients in the linear combinations of variables making up PC's)

Variable	**PC1**	**PC2**	**PC3**	**PC4**	**PC5**
T water	0,052	-0,366	**-0,661**	-0,286	0,306
Salinity	-0,235	-0,382	0,105	-0,456	0,129
Secchi depth	0,058	0,499	0,239	**-0,468**	0,166
Chl a	-0,040	**-0,522**	0,337	0,323	0,130
Total P	-0,306	-0,149	0,522	-0,167	0,374
Total N	-0,389	0,003	-0,221	0,393	0,202
DIN	**-0,437**	0,168	-0,065	0,093	0,036
NO2	-0,352	0,185	-0,157	-0,076	-0,155
NO3	-0,401	0,185	0,000	0,253	-0,018
NH4	-0,375	0,075	-0,168	-0,255	0,159
SiO4	-0,276	-0,275	0,052	-0,249	**-0,783**

Supplementary Table S3.

The list of most common dinoflagellate species with the widest ecological niches in the Baltic coastal waters. The width of temperature (T), salinity (S), total nitrogen (TN) and total phosphorus (TP) niches of each species is ranked from 1 to 5 based on the data given in **Table 2**. Species are ranked (№) according to the number (n) of the widest niches that they occupy in the study region. The top-5 species with the highest number of the widest individual niches are highlighted in bold.

№	Dinoflagellates	Species niche-width rank (1–5)				Number of widest niches, n (%)
		T niche	S niche	TN niche	TP niche	
1	***Dinophysis acuminata***	2	2	5	3	**4 (100)**
2	***Prorocentrum cordatum***	1		4	2	**3 (75)**
3	***Amphidinium crassum***		3	1	1	**3 (75)**
4	***Ceratium tripos***	5		3	5	**3 (75)**
5	***Prorocentrum micans***		1		4	**2 (50)**
6	*Proterythropsis vigilans*	3				1 (25)
7	*Dinophysis norvegica*	4				1 (25)
8	*Protoperidinium brevipes*		4			1 (25)
9	*Ceratium lineatum*		5			1 (25)
10	*Ceratium furca*			2		1 (25)

Supplementary materials – 2

Figures S1 – S3

Article:

Wide ecological niches ensure frequent harmful dinoflagellate blooms

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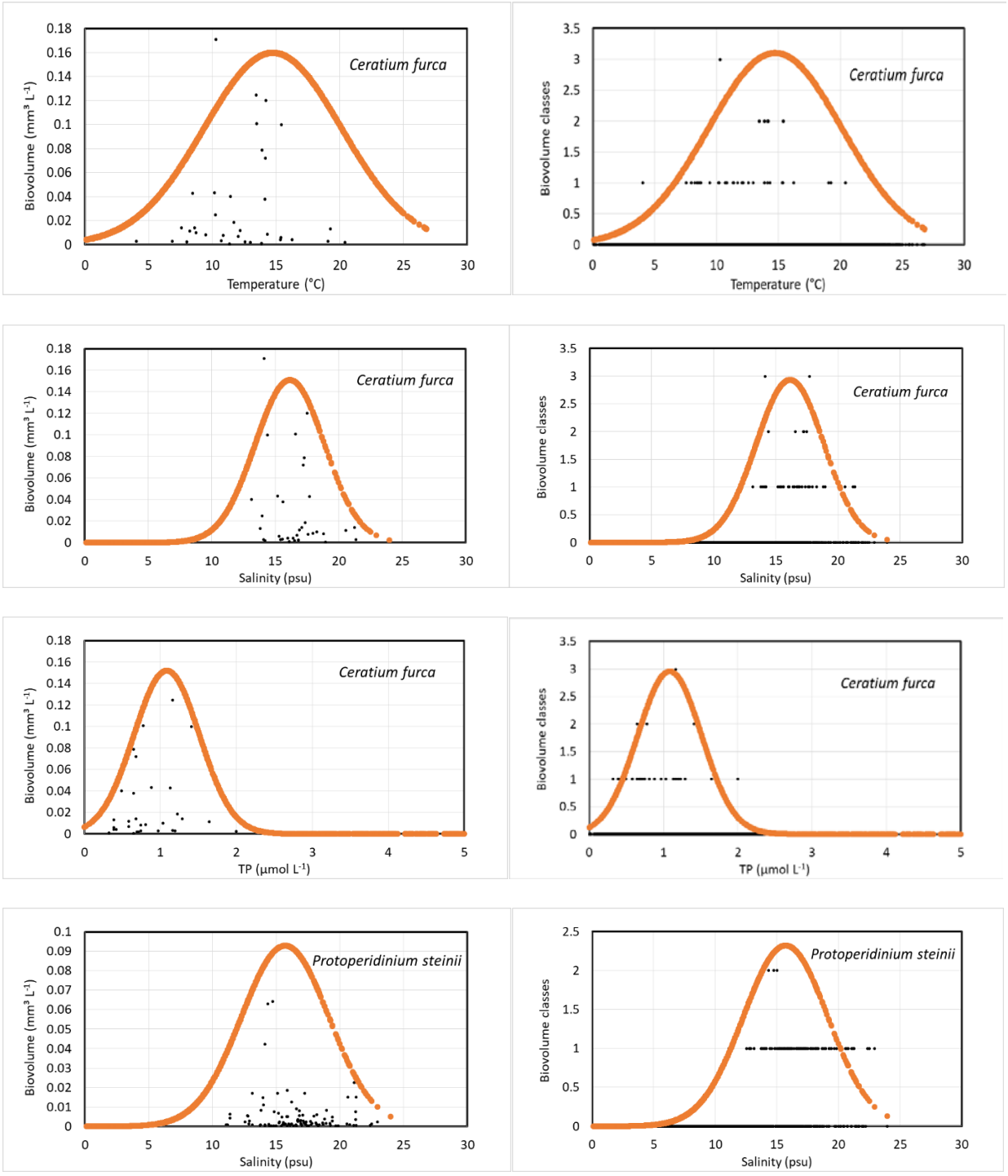
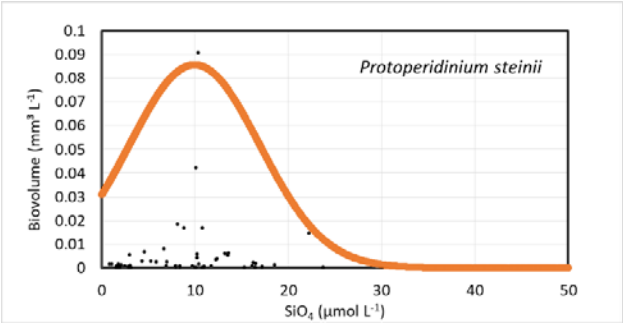
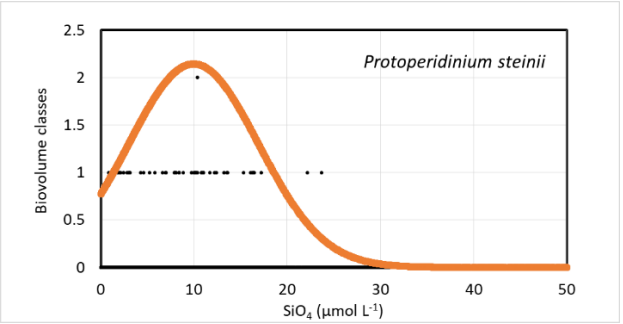
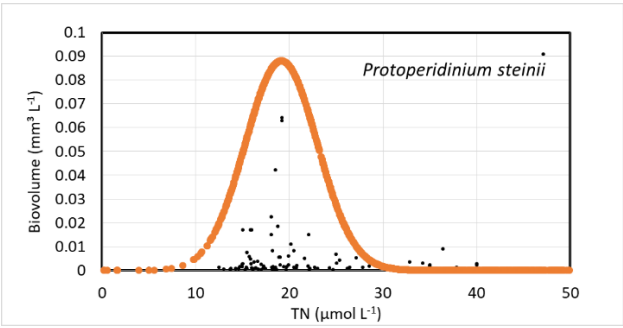
Supplementary Figure S1.

The Gaussian-model approach: conformity of the original field data on the species' biovolume (upper panels) and biovolume-class distribution (lower panels) of the selected bloom-forming dinoflagellate species to the Gaussian distribution model (curve) in the gradients of environmental parameters (T water, salinity, total P, total N, NO_3^-, NH_4^+, PO_4^{3-} and SiO_4^{4-}).




Protoperidinium steinii
Biovolume (mm³ L⁻¹)
SiO4 (µmol L⁻¹)


Protoperidinium steinii
Biovolume classes
SiO4 (µmol L⁻¹)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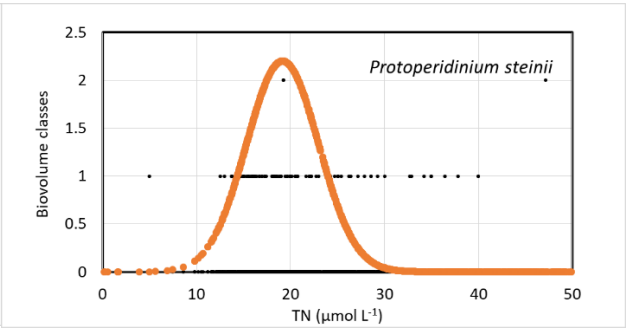
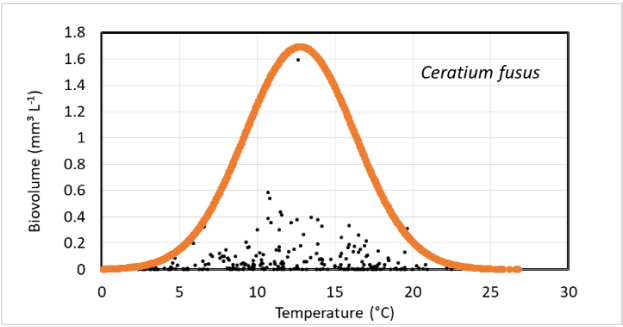
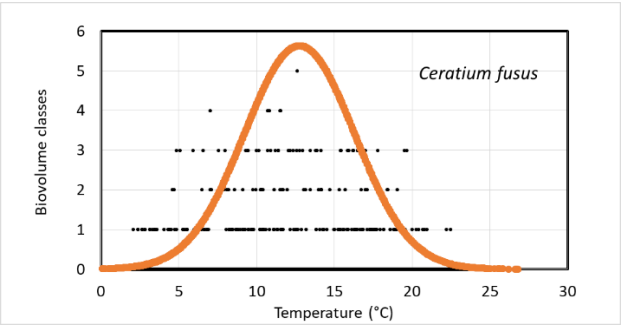
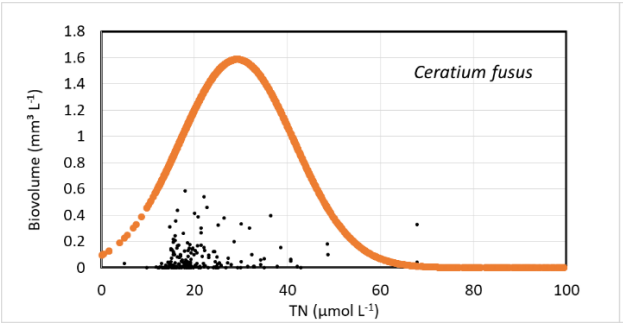
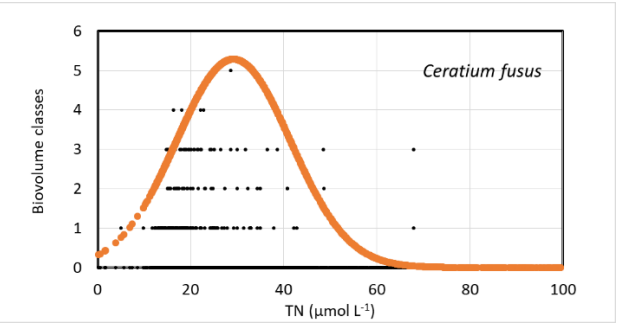
Biovolume (mm³ L⁻¹)
TN (µmol L⁻¹)

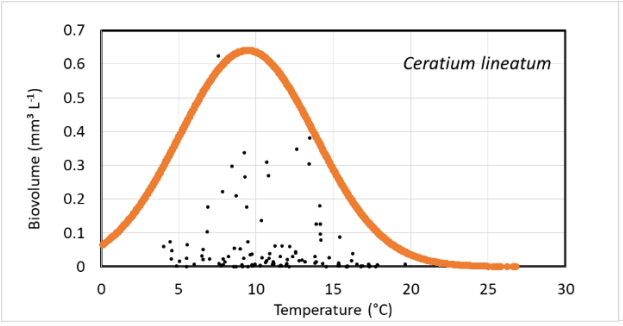

Protoperidinium steinii
Biovolume classes
TN (µmol L⁻¹)

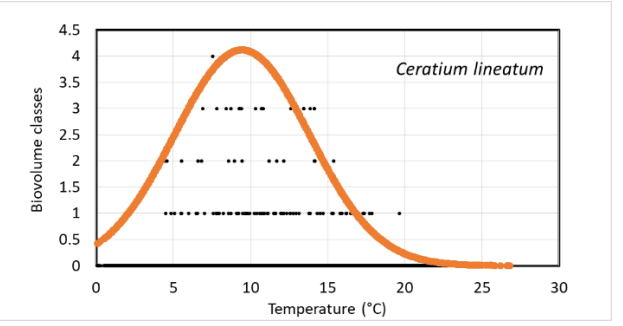

Ceratium fusus
Biovolume (mm³ L⁻¹)
Temperature (°C)

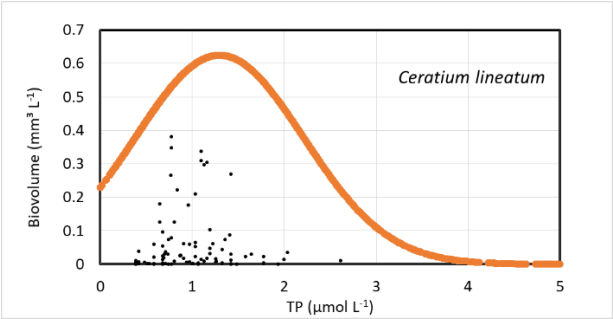

Ceratium fusus
Biovolume classes
Temperature (°C)

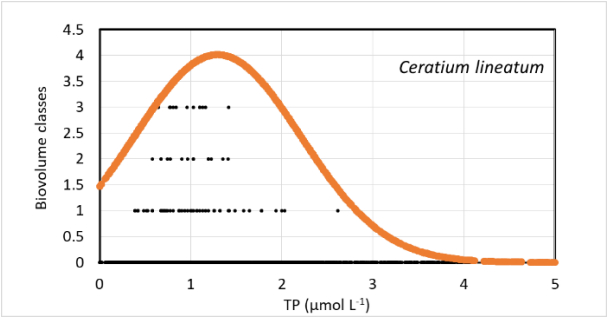

Ceratium fusus
Biovolume (mm³ L⁻¹)
TN (µmol L⁻¹)


Ceratium fusus
Biovolume classes
TN (µmol L⁻¹)


Ceratium lineatum
Biovolume (mm³ L⁻¹)
Temperature (°C)


Ceratium lineatum
Biovolume classes
Temperature (°C)


Ceratium lineatum
Biovolume (mm³ L⁻¹)
TP (µmol L⁻¹)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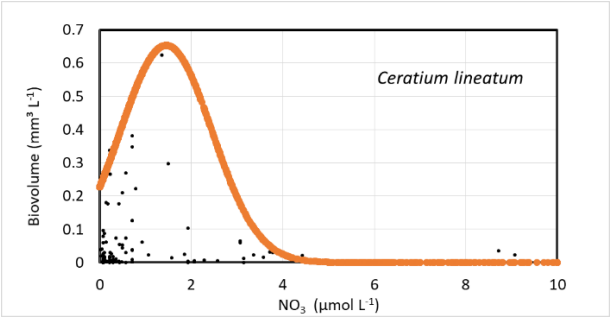
Biovolume classes
TP (µmol L⁻¹)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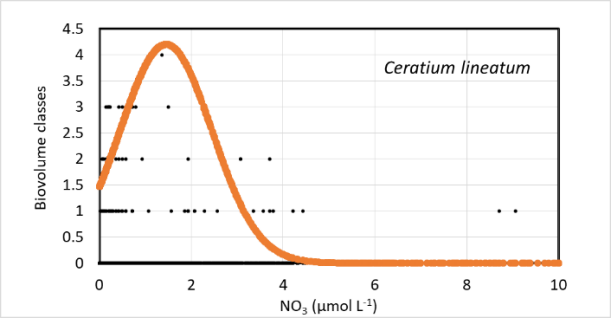
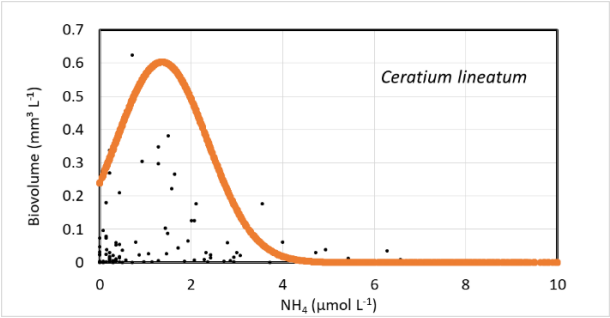
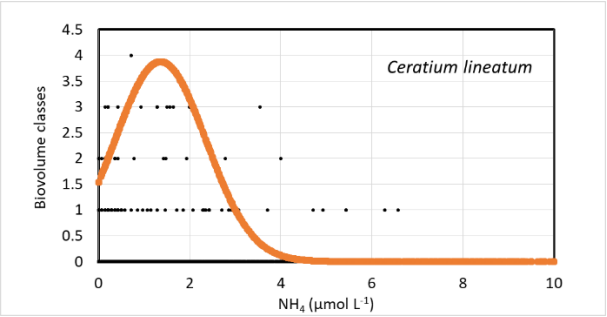
Biovolume (mm³ L⁻¹)
NO3 (µmol L⁻¹)


Ceratium lineatum
Biovolume classes
NO3 (µmol L⁻¹)


Ceratium lineatum
Biovolume (mm³ L⁻¹)
NH4 (µmol L⁻¹)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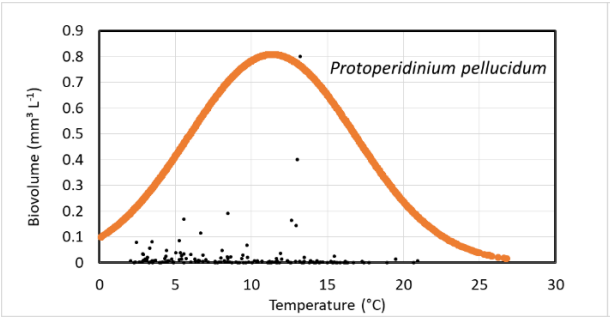
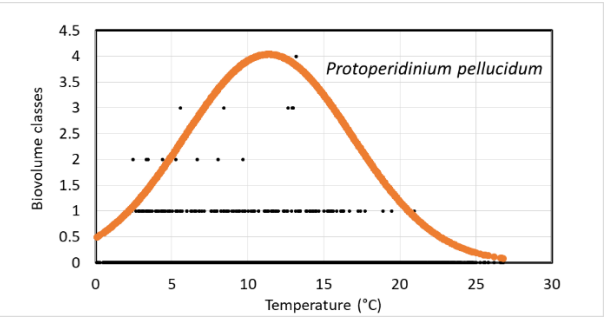
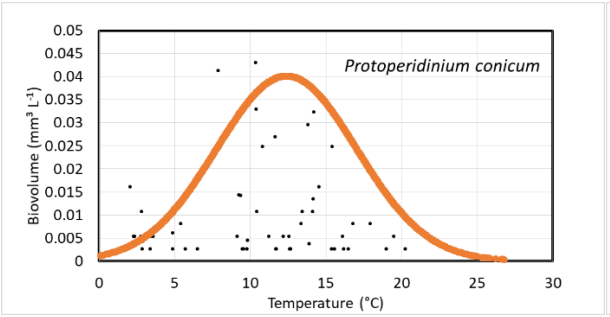
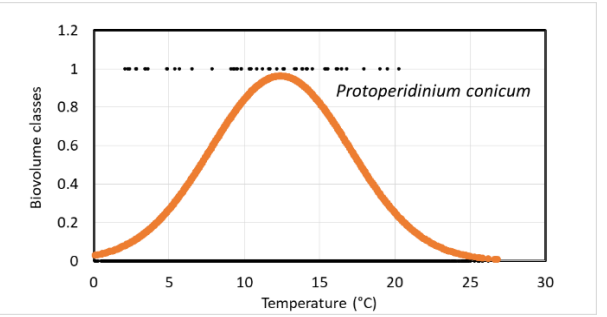
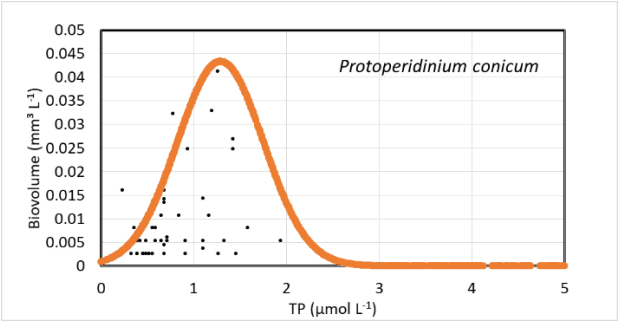
Biovolume classes
NH4 (µmol L⁻¹)


Protoperidinium pellucidum
Biovolume (mm³ L⁻¹)
Temperature (°C)


Protoperidinium pellucidum
Biovolume classes
Temperature (°C)


Protoperidinium conicum
Biovolume (mm³ L⁻¹)
Temperature (°C)


Protoperidinium conicum
Biovolume classes
Temperature (°C)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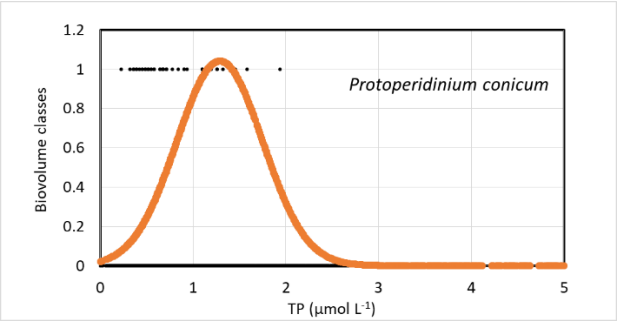
Biovolume (mm³ L⁻¹)
TP (µmol L⁻¹)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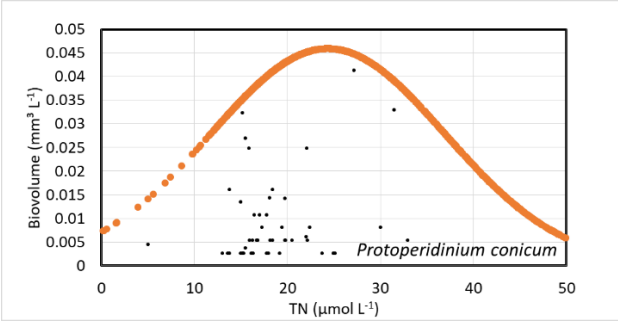
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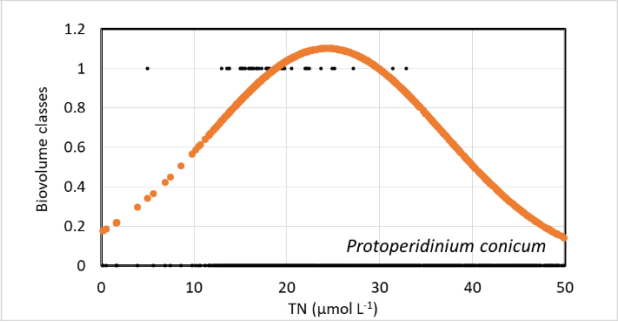
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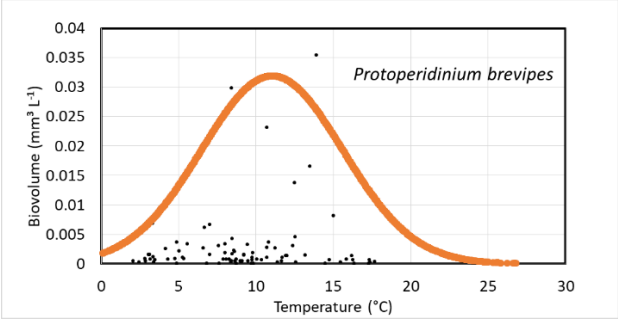
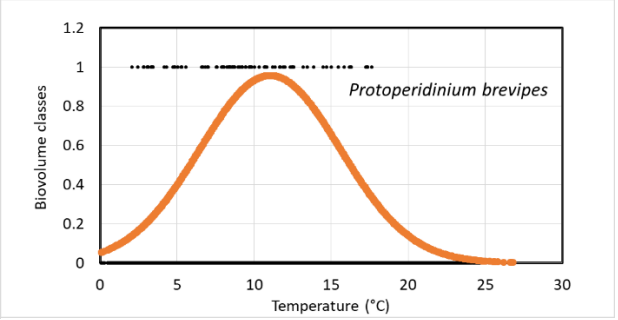
TN (µmol L⁻¹)


Protoperidinium brevipes
Biovolume (mm³ L⁻¹)
Temperature (°C)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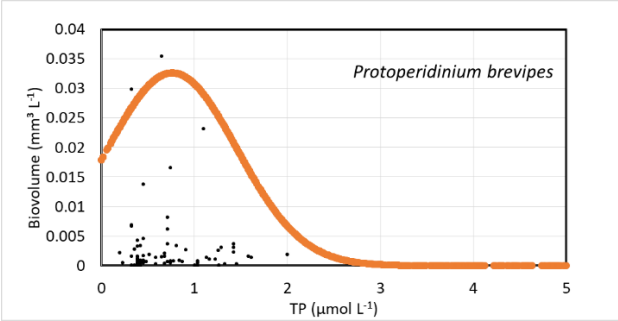
Biovolume classes
Temperature (°C)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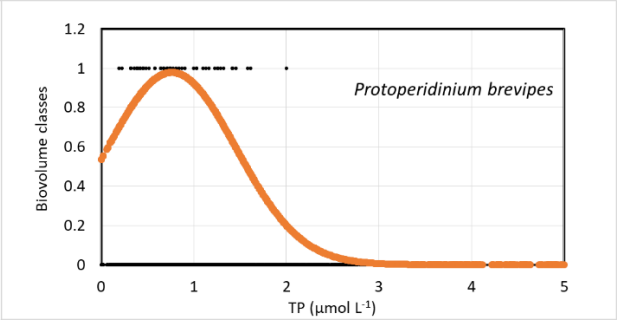
Biovolume (mm³ L⁻¹)
TP (µmol L⁻¹)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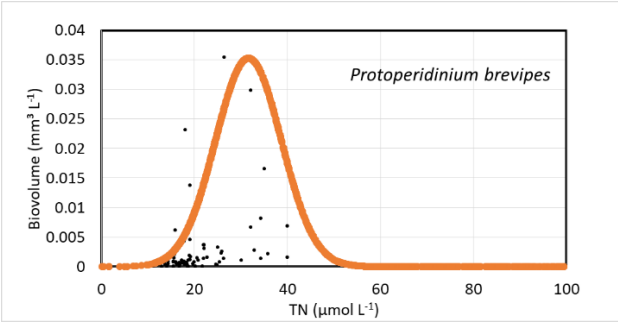
Biovolume classes
TP (µmol L⁻¹)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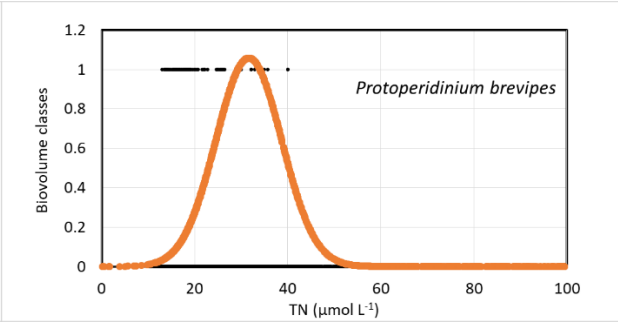
Biovolume (mm³ L⁻¹)
TN (µmol L⁻¹)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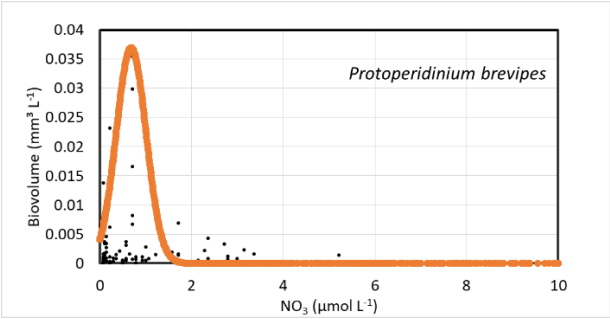
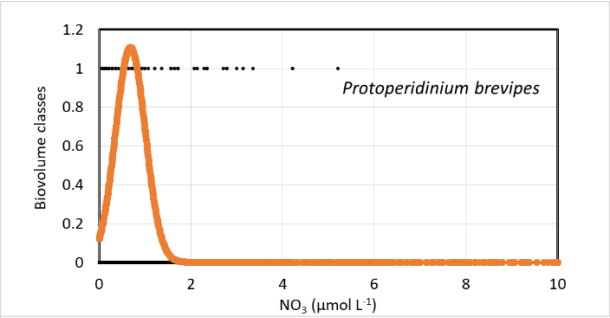
Biovolume classes
TN (µmol L⁻¹)


Protoperidinium brevipes
Biovolume (mm³ L⁻¹)
NO3 (µmol L⁻¹)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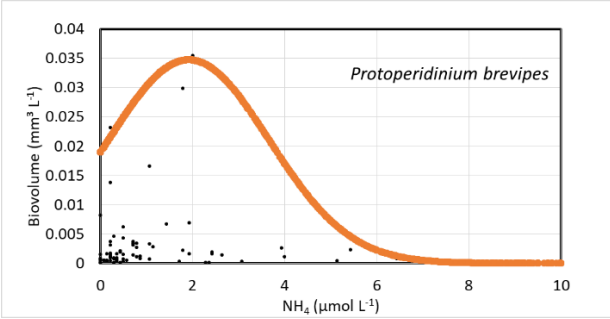
Biovolume classes
NO3 (µmol L⁻¹)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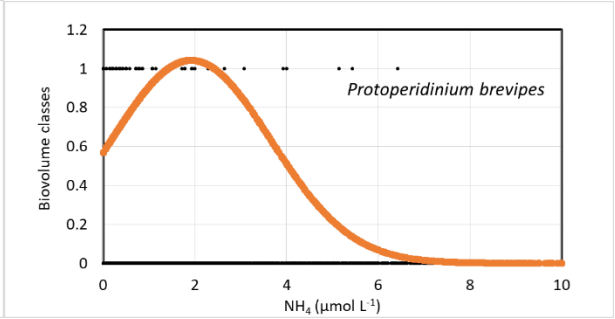
Biovolume (mm³ L⁻¹)
NH4 (µmol L⁻¹)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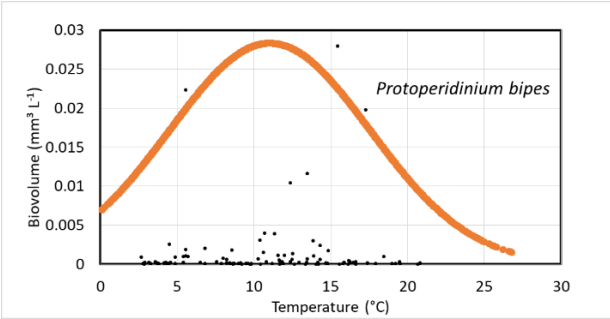
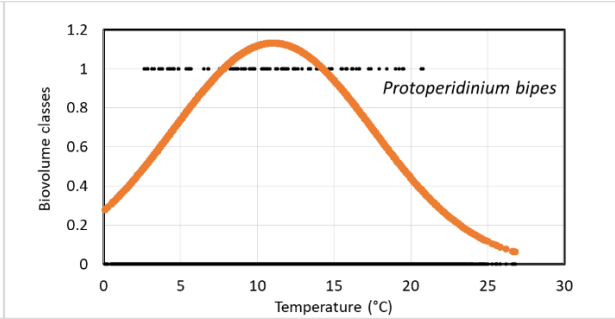
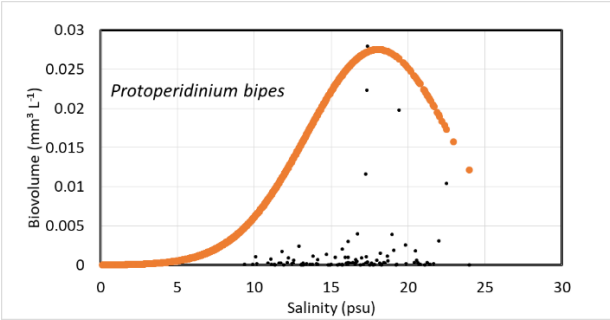
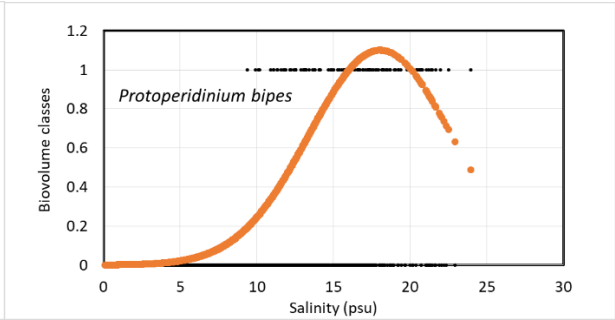
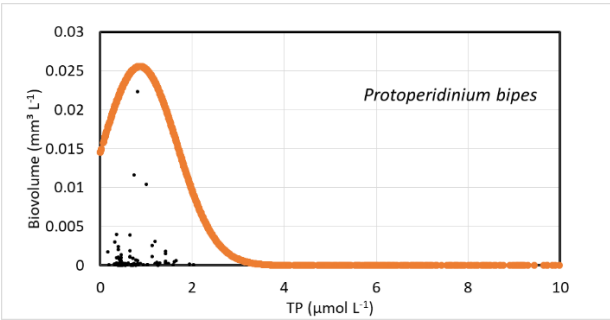
Biovolume classes
NH4 (µmol L⁻¹)

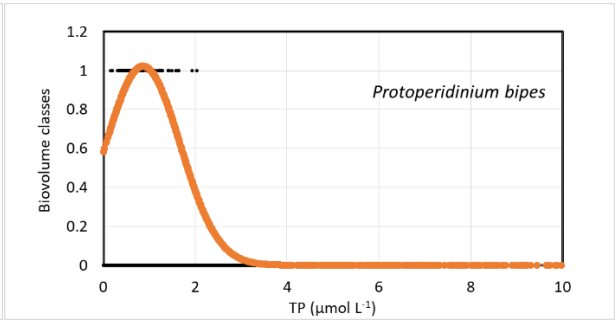

Protoperidinium bipes
Biovolume (mm³ L⁻¹)
Temperature (°C)

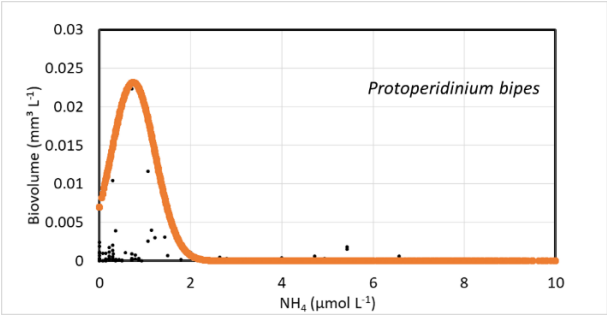

Protoperidinium bipes
Biovolume classes
Temperature (°C)

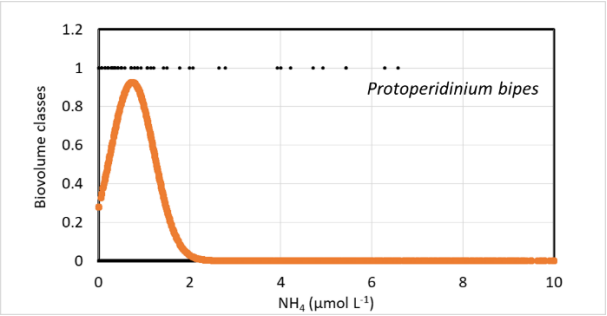

Protoperidinium bipes
Biovolume (mm³ L⁻¹)
Salinity (psu)

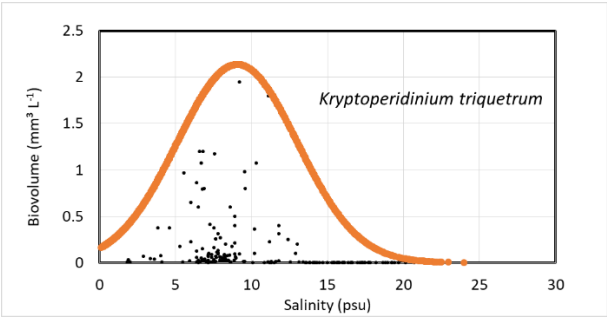

Protoperidinium bipes
Biovolume classes
Salinity (psu)

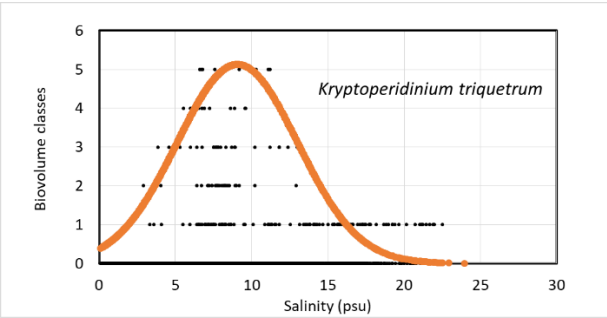

Protoperidinium bipes
Biovolume (mm³ L⁻¹)
TP (µmol L⁻¹)

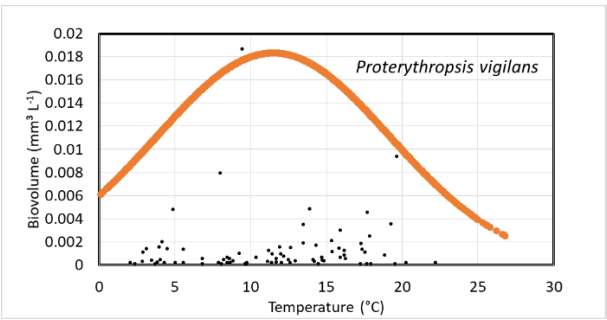

Protoperidinium bipes
Biovolume classes
TP (µmol L⁻¹)

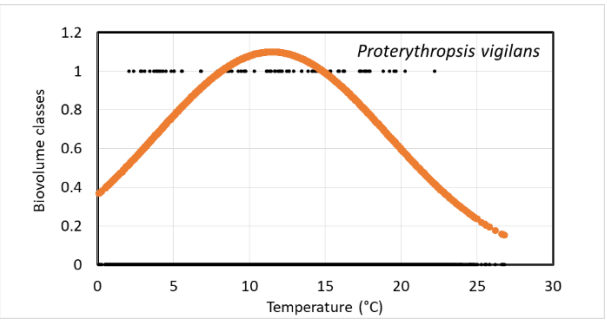

Protoperidinium bipes
Biovolume (mm³ L⁻¹)
NH4 (µmol L-1)

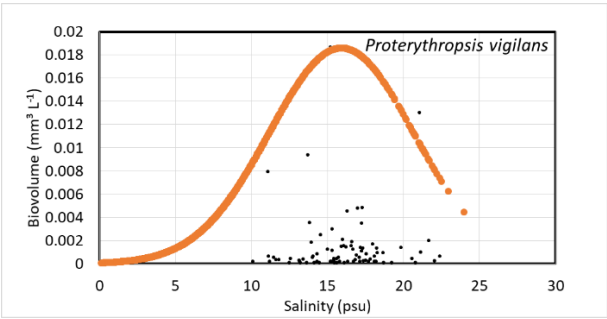

Protoperidinium bipes
Biovolume classes
NH4 (µmol L-1)

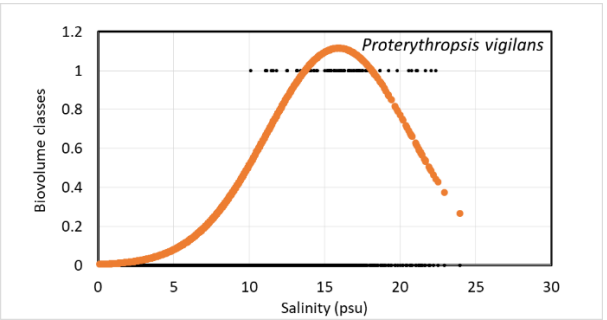

Kryptoperidinium triquetrum
Biovolume (mm³ L⁻¹)
Salinity (psu)

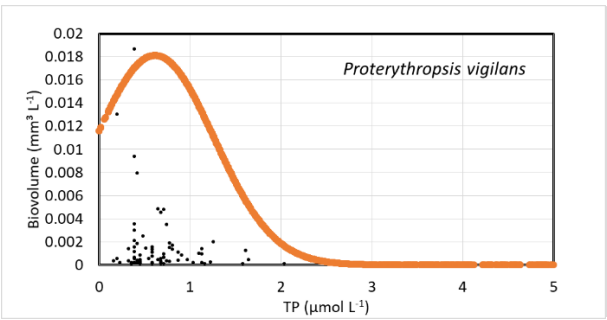

Kryptoperidinium triquetrum
Biovolume classes
Salinity (psu)

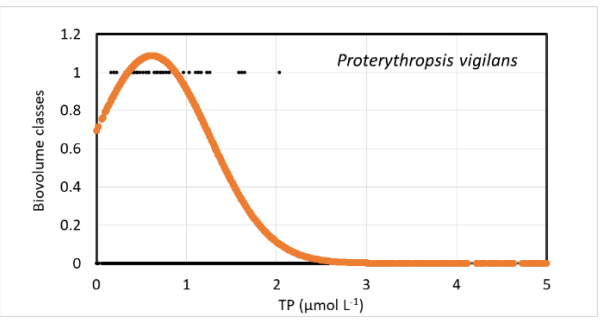

Proterythropsis vigilans
Biovolume (mm³ L⁻¹)
Temperature (°C)

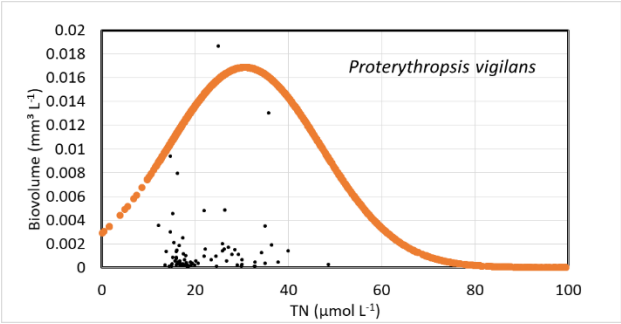

Proterythropsis vigilans
Biovolume classes
Temperature (°C)

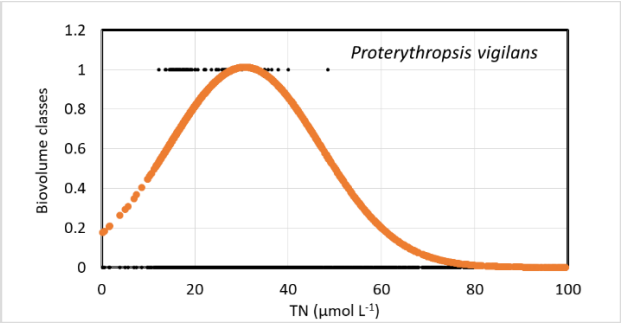

Proterythropsis vigilans
Biovolume (mm³ L⁻¹)
Salinity (psu)

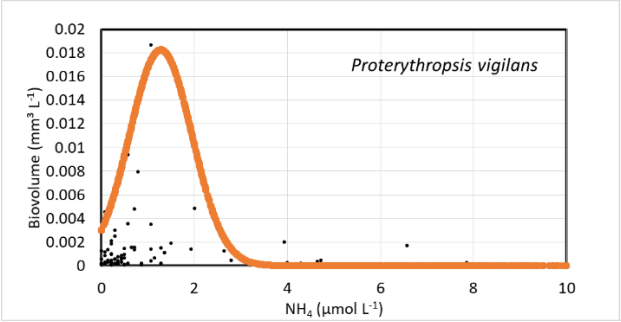

Proterythropsis vigilans
Biovolume classes
Salinity (psu)

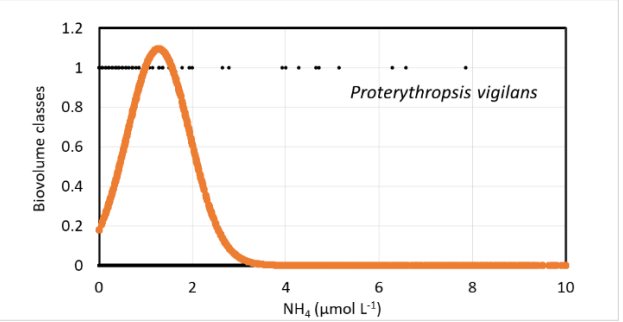

Proterythropsis vigilans
Biovolume (mm³ L⁻¹)
TP (µmol L-1)

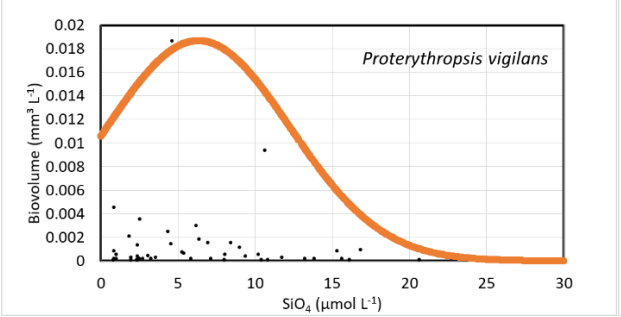

Proterythropsis vigilans
Biovolume classes
TP (µmol L-1)

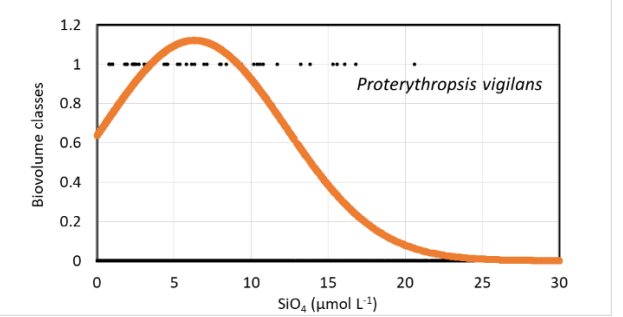

Proterythropsis vigilans
Biovolume (mm³ L⁻¹)
TN (µmol L⁻¹)

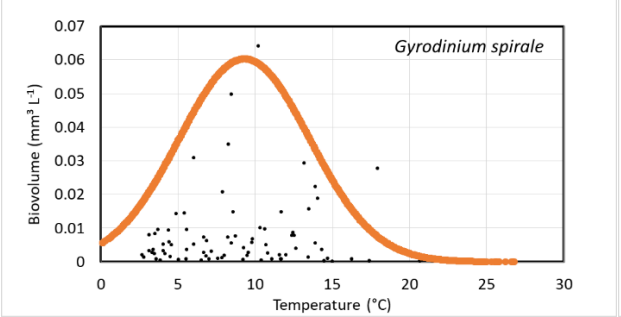

Proterythropsis vigilans
Biovolume classes
TN (µmol L⁻¹)

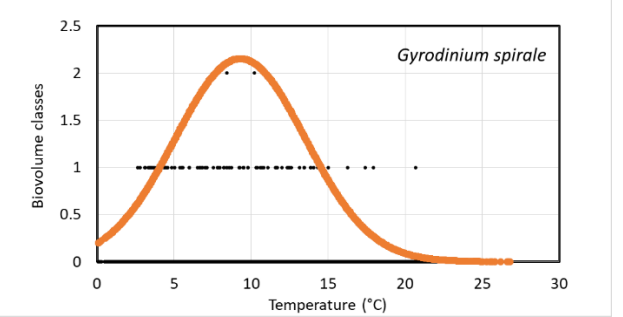

Proterythropsis vigilans
Biovolume (mm³ L⁻¹)
NH4 (µmol L⁻¹)

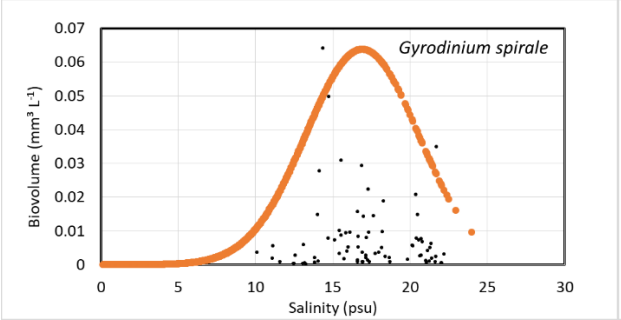

Proterythropsis vigilans
Biovolume classes
NH4 (µmol L⁻¹)

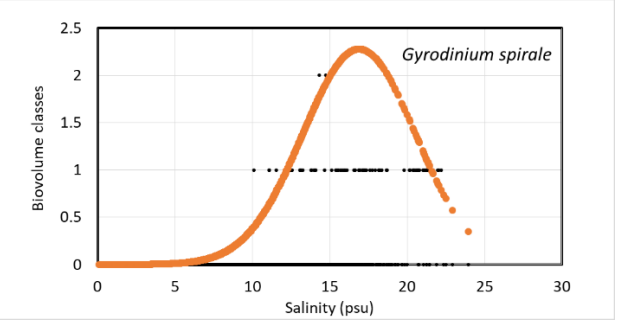

Proterythropsis vigilans
Biovolume (mm³ L⁻¹)
SiO4 (µmol L⁻¹)

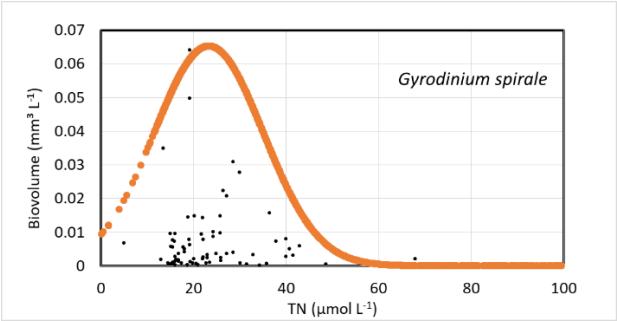

Proterythropsis vigilans
Biovolume classes
SiO4 (µmol L⁻¹)

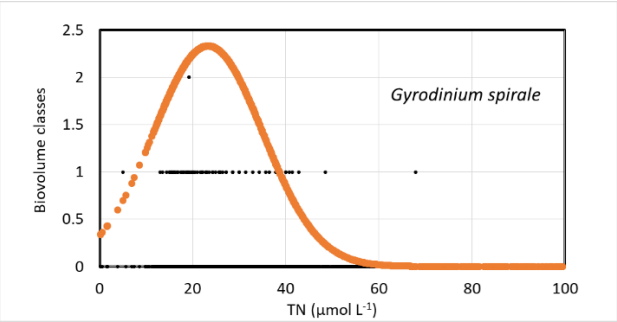

Gyrodinium spirale
Biovolume (mm³ L⁻¹)
Temperature (°C)

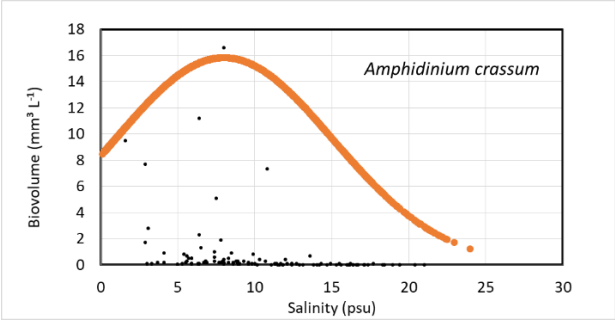

Gyrodinium spirale
Biovolume classes
Temperature (°C)

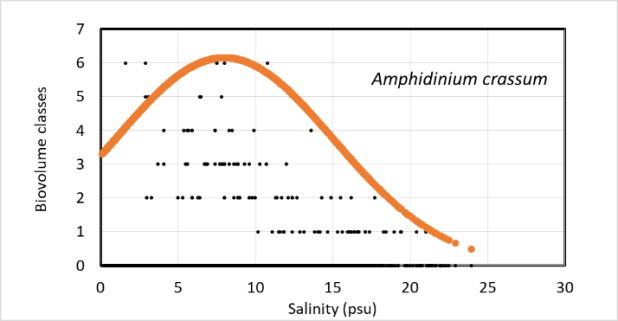

Gyrodinium spirale
Biovolume (mm³ L⁻¹)
Salinity (psu)

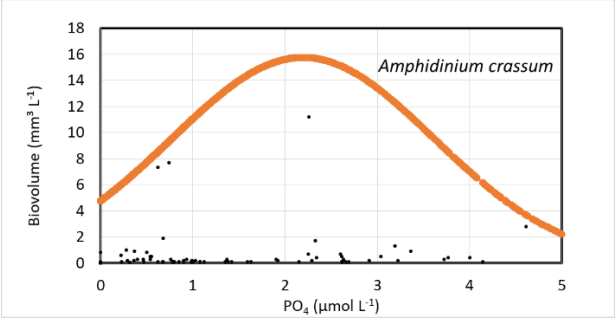

Gyrodinium spirale
Biovolume classes
Salinity (psu)

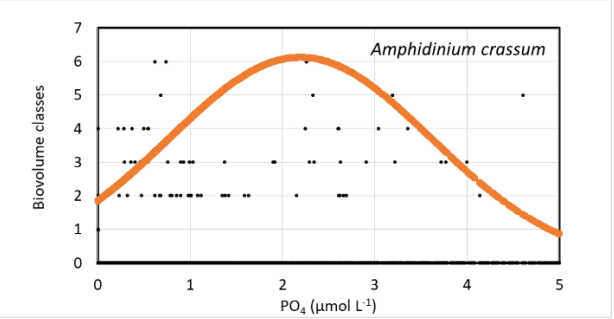

Gyrodinium spirale
Biovolume (mm³ L⁻¹)
TN (µmol L⁻¹)

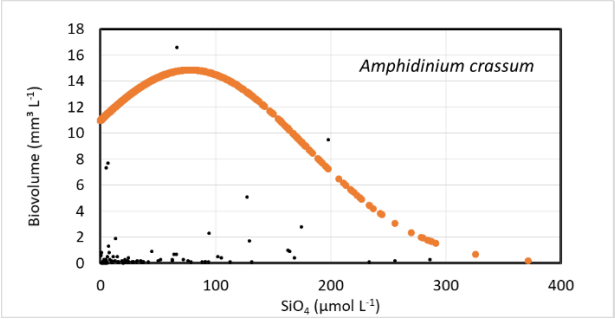

Gyrodinium spirale
Biovolume classes
TN (µmol L⁻¹)

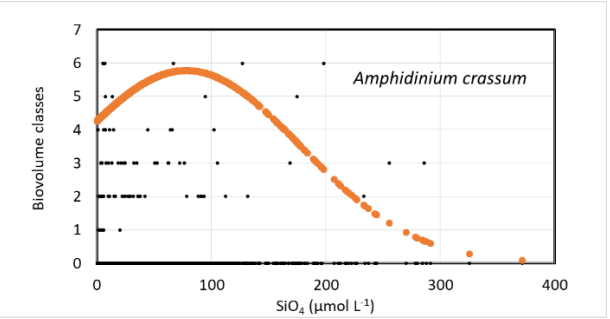

Amphidinium crassum
Biovolume (mm³ L⁻¹)
Salinity (psu)


Amphidinium crassum
Biovolume classes
Salinity (psu)


Amphidinium crassum
Biovolume (mm³ L⁻¹)
PO4 (µmol L⁻¹)

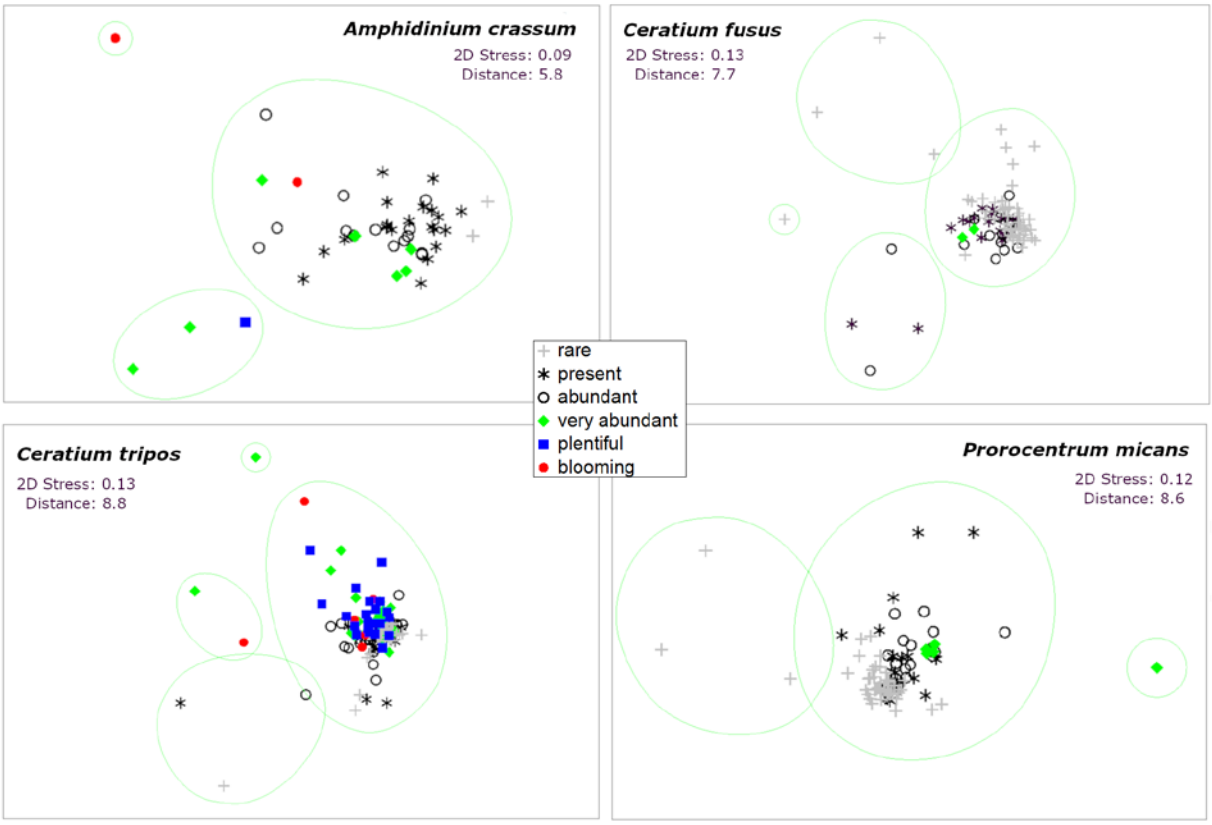

Amphidinium crassum
Biovolume classes
PO4 (µmol L⁻¹)


Amphidinium crassum
Biovolume (mm³ L⁻¹)
SiO4 (µmol L⁻¹)


Amphidinium crassum
Biovolume classes
SiO4 (µmol L⁻¹)

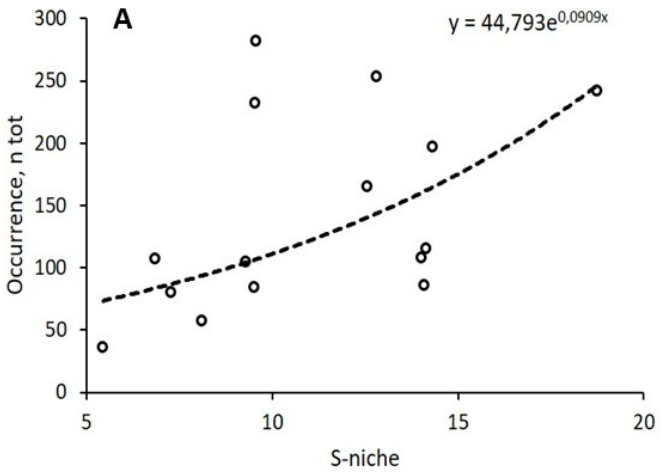
Supplementary Figure S2.

The MDS plots showing the clustering of the obtained results at different Euclidian distances for the dinoflagellates *Amphidinium crassum, Ceratium fusus, Ceratium tripos* and *Prorocentrum micans*.

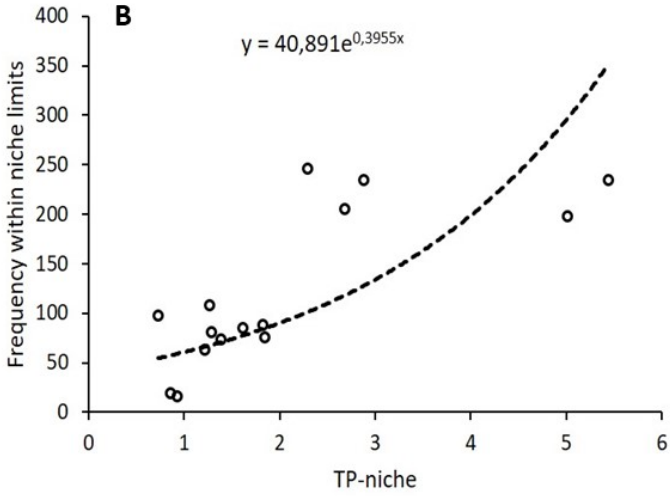


Supplementary Figure S3.

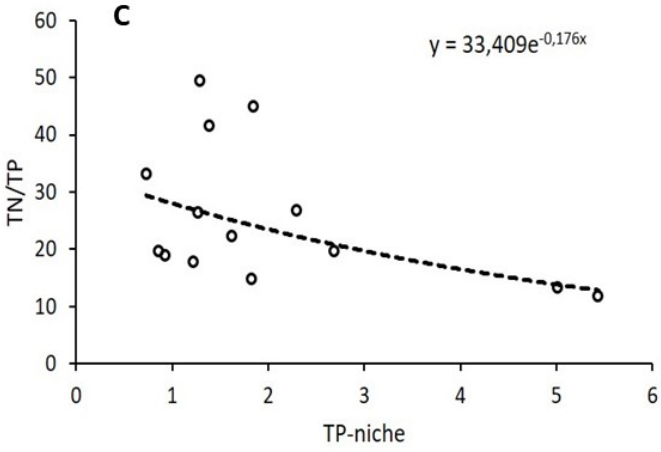
Correlations between occurrence of the bloom-forming dinoflagellates at different concentrations and the sizes of their ecological niches in the Baltic Sea.
A: Dependence of the overall frequency of occurrence (Occurrence, n_{tot}) of dinoflagellates on the salinity (S) niche width. **B**: Dependence of the frequency of occurrence of the dinoflagellate species within their individual niche limits and the total phosphorus (TP) niche width. **C**: Correlation between TN/TP ratio and the TP-niche width for all dinoflagellate species studied here.



n	15
m	1,095
se	0,038
r2	**0,3053**
F	**5,714**
ss(reg)	1,527



n	15
m	1,4851
se	0,111
r2	**0,4553**
F	**10,866**
ss(reg)	4,4489



n	14
m	0,8385
se	0,0733
r2	**0,3251**
F	**5,7817**
ss(reg)	0,6817