## Supplement A. Environmental data of the sampling stations.

Table A1. Environmental data for the sampling stations. Values presented are the integrated average over the euphotic zone.

| Cruise | Station | Temperature (℃) | Salinity (psu) | PAR ($\mu$E/m$^2$/s) | Nitrite ($\mu$M) | Nitrate ($\mu$M) | Phosphate ($\mu$M) | Silicate ($\mu$M) | Chlorophyll *a* (mg/m$^3$) |
|---|---|---|---|---|---|---|---|---|---|
| May 2010 | St. 1 | 18.97 | 28.34 | 5.50 | 1.05 | 7.00 | 0.45 | 14.70 | 0.66 |
| May 2010 | St. 5 | 21.82 | 33.29 | 762.00 | 0.56 | 1.20 | 0.26 | 2.60 | 0.68 |
| May 2010 | St. 9 | 23.11 | 34.56 | 813.50 | 0.15 | 5.20 | 0.43 | 6.50 | 0.56 |
| Dec. 2010 | St. 1 | 17.42 | 29.88 | 14.10 | 0.23 | 14.80 | 0.69 | 22.80 | 0.69 |
| Dec. 2010 | St. 5 | 20.50 | 33.06 | 0.10 | 0.16 | 4.90 | 0.37 | 10.40 | 0.51 |
| Dec. 2010 | St. 7 | 20.48 | 34.09 | 0.01 | 0.15 | 4.00 | 0.47 | 9.70 | 0.96 |
| Dec. 2010 | St. 9 | 24.71 | 34.56 | 163.30 | 0.09 | 3.60 | 0.40 | 8.60 | 0.40 |
| Jun. 2011 | St. 1 | 22.87 | 33.87 | 5.39 | 0.83 | 2.52 | 0.41 | 6.31 | 1.52 |
| Jun. 2011 | St. 2 | 23.24 | 34.08 | 24.40 | 0.74 | 2.08 | 0.39 | 3.94 | 1.12 |
| Jun. 2011 | St. 5 | 24.33 | 34.21 | 82.84 | 0.14 | 0.23 | 0.08 | 1.85 | 0.47 |
| Aug. 2011 | St. 1 | 24.52 | 34.08 | 6.23 | 0.90 | 1.58 | 0.33 | 7.76 | 1.29 |
| Aug. 2011 | St. 3 | 25.19 | 33.96 | 75.97 | 0.86 | 1.17 | 0.25 | 5.62 | 0.82 |
| Aug. 2011 | St. 5 | 26.95 | 33.77 | 5.62 | 0.28 | 0.52 | 0.12 | 6.24 | 0.23 |
| Aug. 2011 | St. 11 | 22.38 | 34.41 | 15.71 | 0.14 | 3.24 | 0.30 | 6.46 | 0.42 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Jul. 2011 | St. E_1 | 22.43 | 34.24 | 5.71 | 0.18 | 9.13 | 0.33 | 7.55 | 0.38 |
| Jul. 2011 | St. E_12 | 23.01 | 34.21 | 16.00 | 0.03 | 2.97 | 0.18 | 6.04 | 0.26 |
| Jul. 2011 | St. E_19A | 19.15 | 30.52 | 12.41 | 0.46 | 22.34 | 0.85 | 27.15 | 1.49 |
| Jul. 2011 | St. E_29 | 21.16 | 32.96 | 0.04 | 0.24 | 10.17 | 0.51 | 15.44 | 1.53 |
| Jul. 2011 | St. E_30 | 20.48 | 33.47 | 0.03 | 0.28 | 12.71 | 0.97 | 20.13 | 2.55 |
| Sep. 2011 | St. E_1 | 20.63 | 34.46 | 11.95 | 0.39 | 0.08 | 4.33 | 0.42 | 7.83 |
| Sep. 2011 | St. E_24 | 22.45 | 34.19 | 0.01 | 0.79 | 0.09 | 3.32 | 0.47 | 7.77 |
| Sep. 2011 | St. E_29 | 20.73 | 33.14 | 0.01 | 1.52 | 0.47 | 14.30 | 1.44 | 32.05 |
| Sep. 2011 | St. E_30 | 21.95 | 30.85 | 1.58 | 11.56 | 0.99 | 13.51 | 0.98 | 18.05 |
| Oct. 2011 | St. 1 | 23.39 | 29.29 | 14.50 | 0.40 | 24.07 | 0.82 | 22.74 | 0.26 |
| Oct. 2011 | St. 7 | 21.02 | 34.26 | 0.01 | 0.15 | 5.05 | 0.41 | 8.85 | NA |
| Oct. 2011 | St. 9 | 20.04 | 34.41 | 32.72 | 0.06 | 5.30 | 0.30 | 8.43 | 0.27 |

## Supplement B. Biological data of the sampling stations.

Table B1. Summary statistics for the dilution experiments and Normalized Biomass Size Spectra (NBSS).

| Cruise | Station | Average particles processed in $T_0$ | Particle density (ind./ml) | Biomass ($\mu$g/L) | Average p-value of dilution exp. across size classes | NBSS slope | $r^2$ of NSSS |
|---|---|---|---|---|---|---|---|
| May 2010 | St. 1 | 6168 | 2694 | 188.539 | 0.402 | -0.727 | 0.854* |
| May 2010 | St. 5 | 7423 | 3448 | 192.977 | 0.293 | -0.664 | 0.865* |
| May 2010 | St. 9 | 5742 | 1985 | 199.861 | 0.082 | -1.064 | 0.785* |
| Dec. 2010 | St. 1 | 6563 | 2248 | 349.784 | 0.462 | -1.470 | 0.964* |
| Dec. 2010 | St. 5 | 2868 | 1071 | 161.569 | 0.264 | -1.233 | 0.922* |
| Dec. 2010 | St. 7 | 670 | 253 | 317.033 | 0.179 | -0.635 | 0.857* |
| Dec. 2010 | St. 9 | 690 | 266 | 161.564 | 0.150 | -0.785 | 0.888* |
| Jun. 2011 | St. 1 | 2771 | 735 | 1091.136 | 0.177 | -0.754 | 0.965* |
| Jun. 2011 | St. 2 | 14286 | 587 | 815.715 | 0.248 | -0.570 | 0.665* |
| Jun. 2011 | St. 5 | 443 | 130 | 763.249 | 0.074 | -0.458 | 0.882* |
| Aug. 2011 | St. 1 | 1669 | 513 | 1417.715 | 0.118 | -0.673 | 0.953* |
| Aug. 2011 | St. 3 | 1381 | 369 | 2252.591 | 0.085 | -0.497 | 0.923* |
| Aug. 2011 | St. 5 | 255 | 76 | 390.693 | 0.167 | -0.533 | 0.846* |
| Aug. 2011 | St. 11 | 468 | 169 | 76.721 | 0.128 | -0.834 | 0.943* |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Jul. 2011 | St. E_1 | 220 | 65 | 75.035 | 0.205 | -0.659 | 0.912* |
| Jul. 2011 | St. E_12 | 71 | 28 | 27.098 | 0.290 | -0.540 | 0.813* |
| Jul. 2011 | St. E_19A | 1364 | 547 | 384.590 | 0.183 | -0.880 | 0.944* |
| Jul. 2011 | St. E_29 | 922 | 369 | 349.928 | 0.068 | -0.851 | 0.893* |
| Jul. 2011 | St. E_30 | 9302 | 2939 | 4334.308 | 0.521 | -0.813 | 0.882* |
| Sep. 2011 | St. E_1 | 296 | 111 | 68.792 | 0.195 | -0.644 | 0.913* |
| Sep. 2011 | St. E_24 | 171 | 61 | 72.329 | 0.169 | -0.675 | 0.860* |
| Sep. 2011 | St. E_29 | 1299 | 450 | 299.164 | 0.460 | -0.798 | 0.905* |
| Sep. 2011 | St. E_30 | 3513 | 1243 | 281.763 | 0.089 | -1.150 | 0.895* |
| Oct. 2011 | St. 1 | 3520 | 1205 | 279.075 | 0.330 | -1.190 | 0.874* |
| Oct. 2011 | St. 7 | 946 | 342 | 105.449 | 0.224 | -1.099 | 0.962* |
| Oct. 2011 | St. 9 | 1206 | 443 | 151.017 | 0.373 | -1.183 | 0.995* |

*indicates significant NBSS slope

Table B2. Size-specific growth rate and grazing mortality scaling on body size for each sampling station.

| Cruise | Station | $\mu$ scaling slope | SE of $\mu$ scaling slope | p-value of $\mu$ scaling slope | $m$ scaling slope | SE of $m$ scaling slope | p-value of $m$ scaling slope |
|---|---|---|---|---|---|---|---|
| May 2010 | St. 1 | 0.112 | 0.053 | 0.077 | 0.247 | 0.150 | 0.151 |
| May 2010 | St. 5 | 0.057 | 0.123 | 0.667 | 0.010 | 0.266 | 0.971 |
| May 2010 | St. 9 | 0.379 | 0.091 | 0.006 | 0.092 | 0.036 | 0.042 |
| Dec. 2010 | St. 1 | 0.180 | 0.019 | <0.001 | 0.298 | 0.133 | 0.066 |
| Dec. 2010 | St. 5 | 0.129 | 0.045 | 0.036 | -0.199 | 0.351 | 0.596 |
| Dec. 2010 | St. 7 | 0.076 | 0.046 | 0.159 | -0.347 | 0.185 | 0.119 |
| Dec. 2010 | St. 9 | 0.206 | 0.066 | 0.014 | 0.116 | 0.060 | 0.089 |
| Jun. 2011 | St. 1 | -0.023 | 0.030 | 0.461 | 0.135 | 0.067 | 0.081 |
| Jun. 2011 | St. 2 | -0.054 | 0.009 | <0.001 | 0.000 | 0.117 | 0.997 |
| Jun. 2011 | St. 5 | 0.014 | 0.021 | 0.525 | 0.094 | 0.060 | 0.170 |
| Aug. 2011 | St. 1 | -0.014 | 0.020 | 0.485 | -0.036 | 0.040 | 0.393 |
| Aug. 2011 | St. 3 | -0.026 | 0.022 | 0.267 | -0.116 | 0.064 | 0.100 |
| Aug. 2011 | St. 5 | -0.344 | 0.209 | 0.200 | -0.223 | 0.167 | 0.275 |
| Aug. 2011 | St. 11 | 0.196 | 0.048 | 0.010 | 0.027 | 0.026 | 0.344 |
| Jul. 2011 | St. E_1 | 0.070 | 0.169 | 0.702 | 0.187 | 0.113 | 0.175 |
| Jul. 2011 | St. E_12 | 0.082 | 0.015 | 0.005 | -0.118 | 0.049 | 0.073 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Jul. 2011 | St. E_19A | 0.085 | 0.052 | 0.151 | 0.076 | 0.141 | 0.611 |
| Jul. 2011 | St. E_29 | 0.086 | 0.057 | 0.182 | 0.003 | 0.051 | 0.961 |
| Jul. 2011 | St. E_30 | -0.010 | 0.067 | 0.894 | 0.569 | 0.577 | 0.380 |
| Sep. 2011 | St. E_1 | -0.056 | 0.084 | 0.534 | 0.147 | 0.107 | 0.220 |
| Sep. 2011 | St. E_24 | 0.079 | 0.055 | 0.193 | 0.244 | 0.087 | 0.026 |
| Sep. 2011 | St. E_29 | 0.352 | 0.144 | 0.092 | 0.595 | 0.355 | 0.192 |
| Sep. 2011 | St. E_30 | 0.415 | 0.130 | 0.085 | 0.526 | 0.111 | 0.041 |
| Oct. 2011 | St. 1 | 0.388 | 0.030 | <0.001 | 0.223 | 0.129 | 0.145 |
| Oct. 2011 | St. 7 | 0.267 | 0.032 | <0.001 | 0.415 | 0.081 | 0.001 |
| Oct. 2011 | St. 9 | 0.021 | 0.101 | 0.852 | 0.370 | 0.089 | 0.026 |

**Supplement C. Results of analysing the six reduced data sets.**

Table C1. Results of analyzing the six reduced data sets showing the general scaling relationship of size specific growth rate ($\mu'$) and grazing mortality ($m$) versus body size. In addition, the coupling of grazing mortality and growth rate is also examined. All the data sets show qualitatively consistent results as the whole data set. Reduced data set 1: removing size classes with the regression p-value larger than 0.25 in dilution experiments; Reduced data set 2: removing stations with the regression p-value for the whole community larger than 0.25; Reduced data set 3: first removing the stations with the regression p-value for the whole community larger than 0.25 and then removing the size classes with the regression p-value larger than 0.25 in the remaining stations; Reduced data set 4: removing the stations with average regression p-value of all size classes larger than 0.25; W/O "colony small cells": removing colony small cells from calculation; W/O "chain-forming diatom": removing chain-forming diatom from calculation.

| Reduced data set 1 | Estimate | SE | p-value | Reduced data set 2 | Estimate | SE | p-value |
|---|---|---|---|---|---|---|---|
| $\mu$ - size GLMM | 0.094 | 0.015 | <0.001 | $\mu$ - size GLMM | 0.094 | 0.017 | <0.001 |
| $m$ - size GLMM | 0.137 | 0.018 | <0.001 | $m$ - size GLMM | 0.124 | 0.026 | <0.001 |
| $m - \mu'$ GLMM | 0.777 | 0.086 | <0.001 | $m - \mu'$ GLMM | 0.865 | 0.095 | <0.001 |
| residuals of $m$ - size GLMM~ residuals of $\mu'$ - size GLMM | 0.441 | 0.065 | <0.001 | residuals of $m$ - size GLMM~ residuals of $\mu'$ - size GLMM | 0.359 | 0.045 | <0.001 |
| Reduced data set 3 | Estimate | SE | p-value | Reduced data set 4 | Estimate | SE | p-value |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| $\mu$ - size GLMM | 0.090 | 0.017 | <0.001 | $\mu$ - size GLMM | 0.078 | 0.018 | <0.001 |
| $m$ - size GLMM | 0.138 | 0.019 | <0.001 | $m$ - size GLMM | 0.091 | 0.025 | <0.001 |
| $m - \mu'$ GLMM | 0.778 | 0.092 | <0.001 | $m - \mu'$ GLMM | 0.798 | 0.098 | <0.001 |
| residuals of $m$ - size GLMM~ residuals of $\mu'$ - size GLMM | 0.480 | 0.073 | <0.001 | residuals of $m$ - size GLMM~ residuals of $\mu'$ - size GLMM | 0.382 | 0.050 | <0.001 |
| W/O "colony small cells" | Estimate | SE | p-value | W/O "chain-forming diatom" | Estimate | SE | p-value |
| $\mu$ - size GLMM | 0.049 | 0.017 | 0.004 | $\mu$ - size GLMM | 0.082 | 0.016 | <0.001 |
| $m$ - size GLMM | 0.101 | 0.031 | 0.001 | $m$ - size GLMM | 0.122 | 0.030 | <0.001 |
| $m - \mu'$ GLMM | 0.518 | 0.118 | <0.001 | $m - \mu'$ GLMM | 0.792 | 0.117 | <0.001 |
| residuals of $m$ - size GLMM~ residuals of $\mu'$ - size GLMM | 0.614 | 0.093 | <0.001 | residuals of $m$ - size GLMM~ residuals of $\mu'$ - size GLMM | 0.658 | 0.008 | <0.001 |

Table C2. Results of univariate model analyses for the six reduced data sets. The results here are qualitatively the same as the results of the whole data set.

| | Independent variables | Biological anticipation | Reduced data set 1 | | Reduced data set 2 | | Reduced data set 3 | | Reduced data set 4 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Coefficient | p-value | Coefficient | p-value | Coefficient | p-value | Coefficient | p-value |
| Model 1 | $m_S$ | + | 0.024 | 0.654 | 0.197 | 0.337 | 0.193 | 0.611 | -0.006 | 0.515 |
| Model 2 | $m_L$ | - | -0.073 | 0.082 | -0.019 | 0.492 | -0.045 | 0.090 | -0.028 | 0.163 |
| Model 3 | $\mu_S'$ | - | 0.163 | 0.997 | 0.342 | 0.990 | 0.245 | 0.924 | 0.196 | 0.928 |
| Model 4 | $\mu_L'$ | + | -0.090 | 0.929 | -0.049 | 0.950 | -0.077 | 0.995 | -0.062 | 0.999 |
| Model 5 | $I_S'$ | + | -0.057 | 0.909 | -0.302 | 0.951 | -0.257 | 0.904 | -0.249 | 0.910 |
| Model 6 | $I_L'$ | - | -0.051 | 0.367 | 0.016 | 0.552 | -0.047 | 0.748 | 0.023 | 0.598 |
| Model 7 | $m_S/m_L$ | + | 0.085 | 0.035* | 0.403 | 0.027* | 0.415 | 0.061 | 0.277 | 0.058 |
| Model 8 | $\mu_S'/\mu_L'$ | - | 0.149 | 1.000 | 0.698 | 0.999 | 0.745 | 0.999 | 0.556 | 0.999 |
| Model 9 | $I_S'/I_L'$ | + | -0.028 | 0.736 | -0.072 | 0.912 | -0.097 | 0.866 | -0.022 | 0.745 |

Table C2. (Continued)

| | Independent variables | Biological anticipation | Data set W/O "colony small cells" category | | Data set W/O "chain-forming diatom" category | |
|---|---|---|---|---|---|---|
| | | | Coefficient | p-value | Coefficient | p-value |
| Model 1 | $m_S$ | + | 0.139 | 0.444 | 0.141 | 0.394 |
| Model 2 | $m_L$ | - | -0.024 | 0.436 | -0.028 | 0.194 |
| Model 3 | $\mu_S'$ | - | -0.021 | 0.774 | 0.226 | 0.984 |
| Model 4 | $\mu_L'$ | + | 0.032 | 0.242 | -0.040 | 0.963 |
| Model 5 | $I_S'$ | + | -0.103 | 0.730 | -0.251 | 0.940 |
| Model 6 | $I_L'$ | - | -0.015 | 0.902 | -0.187 | 0.862 |
| Model 7 | $m_S/m_L$ | + | 0.303 | 0.044* | 0.321 | 0.023* |
| Model 8 | $\mu_S'/\mu_L'$ | - | 0.404 | 0.967 | 0.587 | 0.999 |
| Model 9 | $I_S'/I_L'$ | + | 0.004 | 0.939 | -0.013 | 0.592 |

* indicates the model that gives biologically reasonable and significant result.

**Supplement D. Relationship between NBSS slope and relative grazing mortality of small versus large phytoplankton ($m_S/m_L$)**

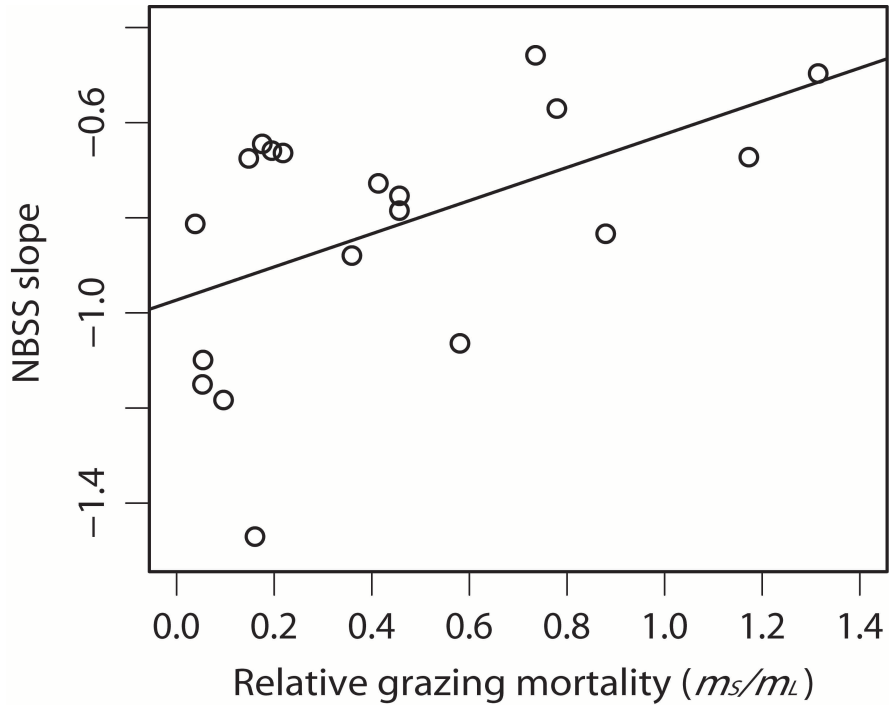


Figure D1. Scatter plot showing the relationship between NBSS slope and relative grazing mortality of small versus large microphytoplankton ($m_S/m_L$). The solid line indicates the significant regression line (slope=0.348; $p$=0.026)