Supplement of

Population-specific responses in physiological rates of *Emiliania huxleyi* to a broad CO$_2$ range

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Table S1. Sea surface temperature (SST) at the Azores, Bergen and Canary Islands.

| Location     | Mean monthly SST range (°C) | Min. monthly SST (°C) | Max. monthly SST (°C) | References                      |
|--------------|------------------------------|-----------------------|-----------------------|---------------------------------|
| Azores       | 15.6 – 22.3                  | 12.6                  | 32.9                  | Wisshak et al., 2010            |
| Bergen       | 6.0 – 16.0                   | – 2                   | 16.6                  | Samuelsen, 1970                 |
|              |                              |                       |                       | Locarnini et al., 2006          |
| Canary Islands | 18.0 – 23.5            | 17.5                  | 24.8                  | Santana-Casiano et al., 2007    |
Table S2. Number of base pairs (bp) in the examined loci (marked with asterisk) in the alleles of individual genotypes. The numbers of base pairs in all examined loci are different, which indicates different genotypes within population. NA indicates that no alleles could be obtained.

| Genotype | P02E09 | P02B12 | P02F11 | EHMS37 | EHMS15 |
|----------|--------|--------|--------|--------|--------|
| A23      | 97     | 97     | 207    | 207    | 101    | 105    | 281    | 283    | 206    | 210    |
| A22      | 99     | 99     | 209    | 211    | 103    | 105    | 197    | 197    | 206    | 206    |
| A21      | 97     | 101    | 207    | 209    | 101    | 137    | 269    | 273    | 206    | 210    |
| A19      | 99     | 101    | 207    | 207    | 103    | 131    | 273    | 283    | 206    | 206    |
| A13      | 95     | 97     | 213    | 223    | 127    | 129    | 297    | 301    | 206    | 206    |
| A10      | 99     | 101    | 207    | 207    | 127    | 127    | 241    | 273    | 206    | 206    |
| B95      | 95     | 99     | 209    | 209    | 101    | 101    | 201    | 205    | 206    | 210    |
| B63      | 97     | 97     | 207    | 207    | 101    | 103    | 203    | 209    | 206    | 210    |
| B62      | 97     | 99     | 207    | 207    | 101    | 103    | 205    | 211    | 206    | 210    |
| B51      | 95     | 97     | 207    | 207    | 101    | 103    | 205    | 205    | 206    | 210    |
| B41      | 97     | 101    | 207    | 207    | 101    | 101    | 201    | 211    | 206    | 210    |
| B17      | 97     | 101    | 207    | 207    | 101    | 103    | 205    | 205    | NA     | NA     |
| C98      | 104    | 124    | 209    | 211    | 111    | 135    | 233    | 287    | 95     | 95     |
| C91      | 86     | 142    | 219    | 219    | 131    | 141    | 207    | 209    | 89     | 135    |
| C90      | 104    | 106    | 268    | 268    | 125    | 135    | NA     | NA     | 139    | 189    |
| C41      | 104    | 106    | 268    | 268    | 125    | 135    | NA     | NA     | 139    | 189    |
| C35      | 96     | 96     | 215    | 219    | 131    | 131    | 245    | 245    | NA     | NA     |
Table S3. Calculated optimum $p$CO$_2$, maximum value ($V_{\text{max}}$) and relative sensitivity ($rs$, %) of POC and PIC quotas of each *E. huxleyi* strain.

| Strain | POC quota | PIC quota |
|--------|-----------|-----------|
|        | optimum $p$CO$_2$ | $V_{\text{max}}$ (pg C cell$^{-1}$) | $rs$ | optimum $p$CO$_2$ | $V_{\text{max}}$ (pg C cell$^{-1}$) | $rs$ |
| A23    | 788 (µatm) | 10.75 (pg C cell$^{-1}$) | 0.34 | 266 (µatm) | 11.33 (pg C cell$^{-1}$) | 0.25 |
| A22    | 657 (µatm) | 14.12 (pg C cell$^{-1}$) | 0.23 | 706 (µatm) | 10.17 (pg C cell$^{-1}$) | 0.44 |
| A21    | 873 (µatm) | 13.05 (pg C cell$^{-1}$) | 0.35 | 306 (µatm) | 12.92 (pg C cell$^{-1}$) | 0.90 |
| A19    | 644 (µatm) | 13.43 (pg C cell$^{-1}$) | 0.41 | 528 (µatm) | 15.41 (pg C cell$^{-1}$) | 0.59 |
| A13    | 860 (µatm) | 9.69 (pg C cell$^{-1}$) | 0.52 | 505 (µatm) | 11.09 (pg C cell$^{-1}$) | 0.53 |
| A10    | 568 (µatm) | 11.22 (pg C cell$^{-1}$) | 0.46 | 345 (µatm) | 9.20 (pg C cell$^{-1}$) | 0.17 |
| B95    | 925 (µatm) | 10.86 (pg C cell$^{-1}$) | 0.10 | 549 (µatm) | 7.33 (pg C cell$^{-1}$) | 0.25 |
| B63    | 715 (µatm) | 13.39 (pg C cell$^{-1}$) | 0.17 | 630 (µatm) | 10.38 (pg C cell$^{-1}$) | 0.36 |
| B62    | 1639 (µatm) | 14.06 (pg C cell$^{-1}$) | 0.05 | 486 (µatm) | 10.96 (pg C cell$^{-1}$) | 0.35 |
| B51    | 635 (µatm) | 13.01 (pg C cell$^{-1}$) | 0.30 | 470 (µatm) | 9.28 (pg C cell$^{-1}$) | 0.39 |
| B41    | 930 (µatm) | 14.73 (pg C cell$^{-1}$) | 0.30 | 517 (µatm) | 7.62 (pg C cell$^{-1}$) | 0.29 |
| B17    | 812 (µatm) | 11.69 (pg C cell$^{-1}$) | 0.31 | 635 (µatm) | 9.80 (pg C cell$^{-1}$) | 0.37 |
| C98    | 685 (µatm) | 8.47 (pg C cell$^{-1}$) | 0.46 | 459 (µatm) | 6.30 (pg C cell$^{-1}$) | 0.20 |
| C91    | 410 (µatm) | 5.20 (pg C cell$^{-1}$) | 0.69 | 184 (µatm) | 11.97 (pg C cell$^{-1}$) | 0.30 |
| C90    | 600 (µatm) | 8.76 (pg C cell$^{-1}$) | 0.28 | 284 (µatm) | 8.90 (pg C cell$^{-1}$) | 0.46 |
| C41    | 675 (µatm) | 7.71 (pg C cell$^{-1}$) | 0.37 | 623 (µatm) | 11.16 (pg C cell$^{-1}$) | 0.20 |
| C35    | 720 (µatm) | 8.89 (pg C cell$^{-1}$) | 0.39 | 538 (µatm) | 12.47 (pg C cell$^{-1}$) | 0.26 |
Each strain was incubated for 4 to 6 days at 11 CO₂ levels ranging from 115 to 3070 μatm with no replicate. At the end of the incubations, growth, POC and PIC production rates were measured.

**Figure S1.** A flow chart for the experimental processes.
Figure S2. Optimum curve responses of POC and PIC quotas of three *E. huxleyi* populations to a $p\text{CO}_2$ range from 120 µatm to 2630 µatm. Responses of POC quota (a) and PIC quota (b) to $p\text{CO}_2$. Responses of relative POC quota (c) and relative PIC quota (d) to $p\text{CO}_2$. For more detail information, see Figure 1.
Figure S3. Calculated optimum $p$CO$_2$, calculated maximum value and fitted relative sensitivity constant of POC and PIC quotas of each population. (a) optimum $p$CO$_2$ of POC quota; (b) optimum $p$CO$_2$ of PIC quota; (c) maximum POC quota; (d) maximum PIC quota; (e) relative sensitivity constant of POC quota; (f) relative sensitivity constant of PIC quota. For more detail information, see Figure 2.
Figure S4. Optimum curve responses of POC and PIC quotas of individual *E. huxleyi* strains in the Azores (left), Bergen (medium) and Canary Islands (right) populations to a CO₂ range from 115 µatm to 3070 µatm. POC quota of each strain as a function of *p*CO₂ within the Azores (a), Bergen (b) and Canary Islands (c) populations. PIC quota of each strain as a function of *p*CO₂ within the Azores (d), Bergen (e) and Canary Islands (f) populations. For more detail information, see Figure 3.
Figure S5. Increased growth rates of 17 *E. huxleyi* strains with increasing POC production rates (a) or POC quotas (b).
Figure S6. Responses of PIC : POC ratio of the Azores (square), Bergen (circular) and Canary Islands (diamond) populations to a CO2 range from 120 µatm to 2630 µatm.
Figure S7. Responses of PIC : POC ratio of individual *E. huxleyi* strains in the Azores (a), Bergen (b) and Canary Islands (c) populations to a CO$_2$ range from 115 µatm to 3070 µatm.
References

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