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Variability of early autumn planktonic assemblages in the strait of gibraltar: a regionalization analysis

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Table S1: Average values of physical and biogeochemical parameters defining each cluster during spring and neap tides. Mean, N, standard deviation (SD) and range.

| | | | Temper- ature (°C) | Salinity | Chloro- phyll <i>a</i> (mg m ⁻³) | Chloro- phyll > 20 μm (%) | Nitrite (μM) | Nitrate (μM) | Silicate (μM) | Ammoni- um (μM) |
|--------|-----|--------------|-----------------------|------------------|--|---------------------------------|-----------------|-----------------|------------------|-----------------------|
| Spring | CL1 | Mean | 18.67 | 36.27 | 1.67 | 23.52 | 0.59 | 3.38 | 5.19 | 3.31 |
| | | N | 29 | 29 | 29 | 28 | 29 | 29 | 29 | 29 |
| | | SD | 1.31 | 0.16 | 0.72 | 16.41 | 0.15 | 4.55 | 3.02 | 1.93 |
| | | Min - Max | (15.3 - 20.6) | (35.7 - 36.6) | (0.2 - 3.3) | (8.9 - 87.7) | (0.2 - 0.8) | (0.4 - 25.4) | (1.4 - 12.0) | (0.7 - 8.1) |
| | CL2 | Mean | 18.56 | 36.53 | 0.72 | 10.05 | 0.32 | 1.37 | 3.91 | 1.51 |
| | | N | 45 | 45 | 45 | 45 | 45 | 45 | 45 | 45 |
| | | SD | 1.59 | 0.16 | 0.40 | 5.59 | 0.14 | 1.21 | 2.91 | 0.87 |
| | | Min - Max | (15.9 - 21.5) | (36.2 - 36.8) | (0.1 - 1.6) | (3.2 - 30.7) | (0.1 - 0.7) | (0.0 - 5.8) | (0.7 - 12.2) | (0.0 - 4.7) |
| Neap | CL1 | Mean | 18.44 | 36.31 | 1.63 | 24.77 | 0.52 | 2.02 | 4.43 | 3.49 |
| | | N | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 17 |
| | | SD | 1.15 | 0.13 | 1.08 | 18.39 | 0.15 | 2.39 | 2.76 | 1.42 |
| | | Min - Max | (15.9 - 20.0) | (36.0 - 36.6) | (0.4 - 4.5) | (8.3 - 66.8) | (0.3 - 0.9) | (0.2 - 10.0) | (1.1 - 10.5) | (0.6 - 6.3) |
| | CL2 | Mean | 18.47 | 36.54 | 0.65 | 11.33 | 0.26 | 0.62 | 5.20 | 1.03 |
| | | SD | 1.36 | 0.14 | 0.41 | 7.13 | 0.14 | 0.83 | 3.87 | 0.85 |
| | | N | 55 | 55 | 55 | 54 | 55 | 55 | 55 | 55 |
| | | Min - Max | (15.5 - 20.7) | (36.2 - 36.9) | (0.1 - 1.6) | (2.2 - 38.4) | (0.1 - 0.6) | (0.0 - 3.5) | (0.7 - 17.3) | (0.0 - 3.2) |
| Total | CL1 | Mean | 18.59 | 36.29 | 1.65 | 23.99 | 0.52 | 2.88 | 4.91 | 3.38 |
| | | N | 46 | 46 | 46 | 45 | 46 | 46 | 46 | 46 |
| | | SD | 1.24 | 0.15 | 0.86 | 17.03 | 0.16 | 3.95 | 2.92 | 1.75 |
| | | Min - Max | (15.3 - 20.6) | (35.7 - 36.6) | (0.2 - 4.5) | (8.3 - 87.7) | (0.2 - 0.9) | (0.2 - 25.4) | (1.1 - 12.0) | (0.6 - 8.1) |
| | CL2 | Mean | 18.51 | 36.54 | 0.68 | 10.75 | 0.28 | 0.96 | 4.62 | 1.24 |
| | | N | 100 | 100 | 100 | 99 | 100 | 100 | 100 | 100 |
| | | SD | 1.46 | 0.15 | 0.40 | 6.48 | 0.14 | 1.12 | 3.51 | 0.89 |
| | | Min - Max | (15.5 - 21.5) | (36.2 - 36.9) | (0.1 - 1.6) | (2.2 - 38.4) | (0.1 - 0.7) | (0.0 - 5.8) | (0.7 - 17.3) | (0.0 - 4.7) |

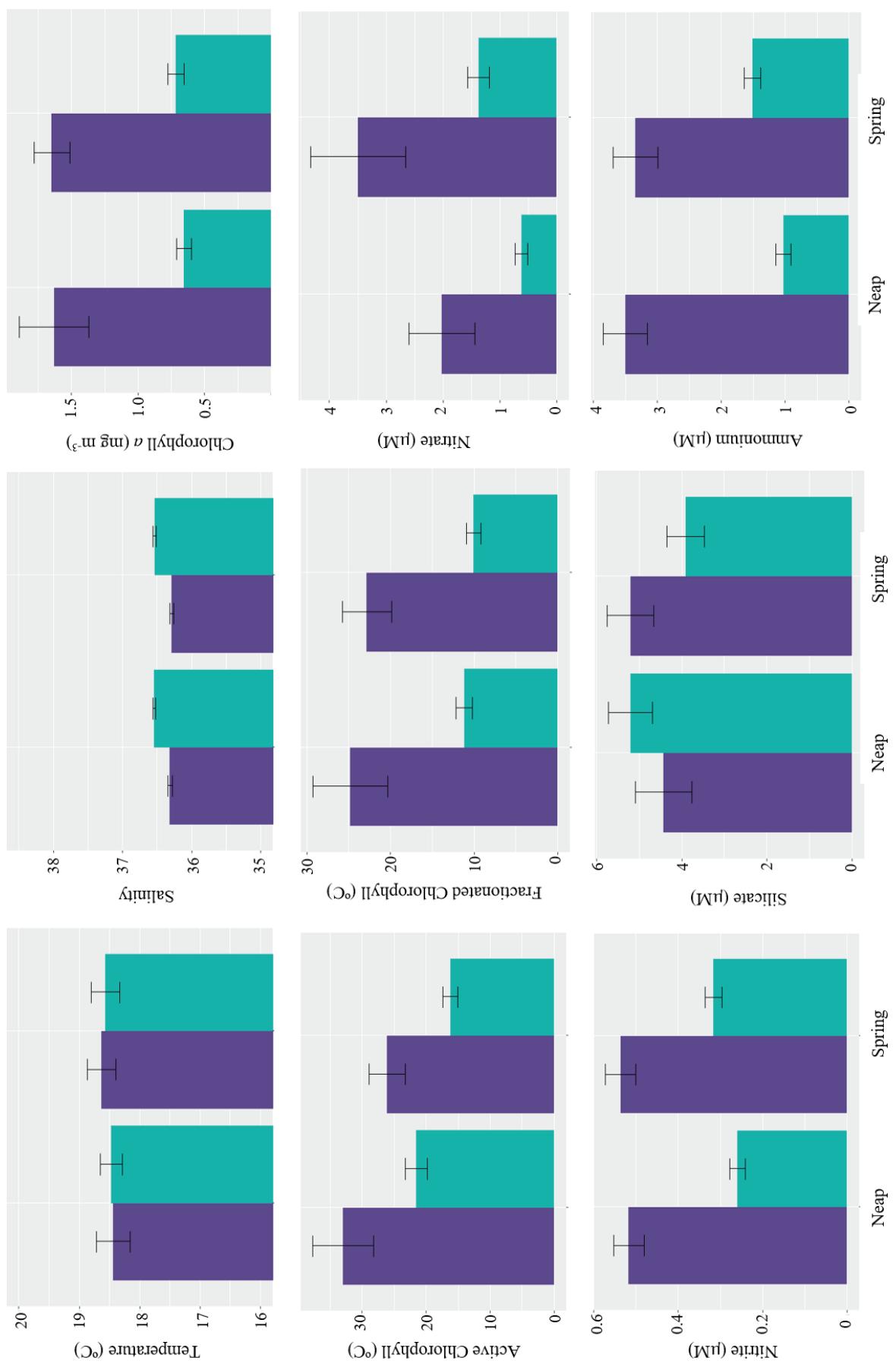


Fig. S1: Average values of physical and biogeochemical variables defining each cluster during spring and neap tides. Purple bars represent CL1, green bars for CL2.

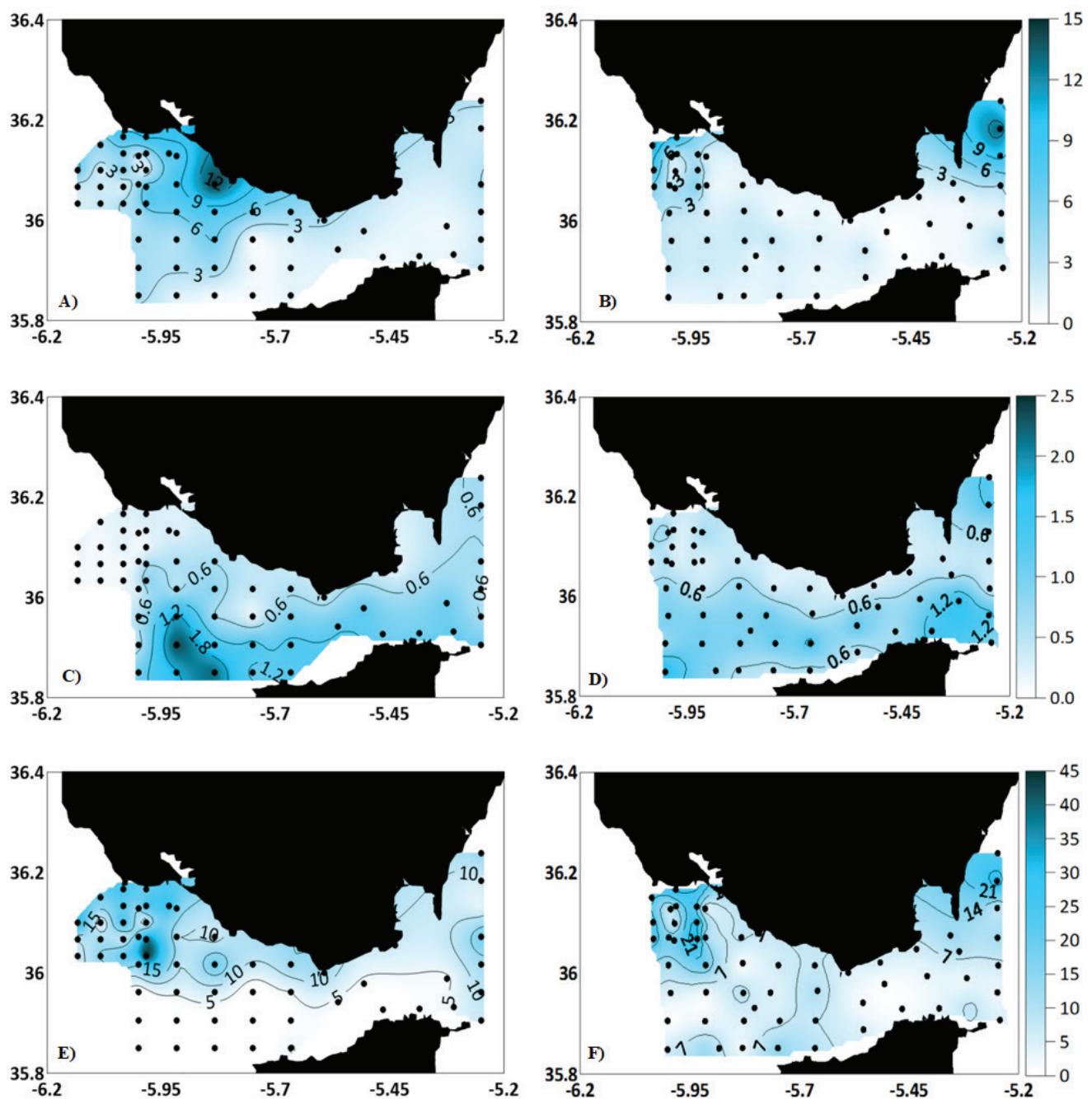


Fig. S2: Picoplankton groups biomass distribution. *Synechococcus* (A-B), *Prochlorococcus* (C-D) and *Cryptophytes* (E-F) biomass (mgC m⁻³) during spring (A, C, E) and neap tides (B, D, F).

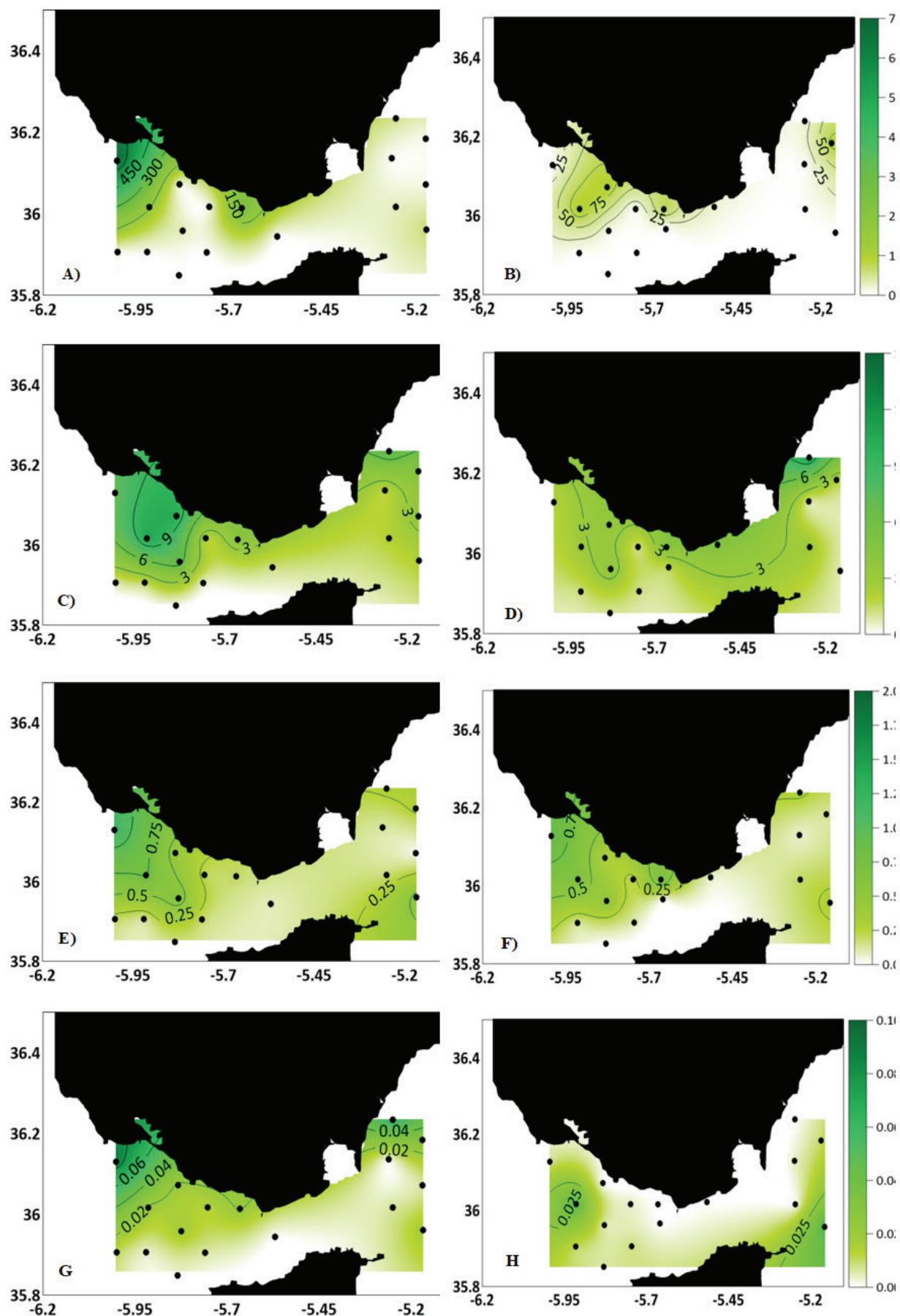


Fig. S3: Main microplankton groups biomass (mgC m⁻³) distribution during spring (A, C, E, G) and neap (B, D, F, H) tides. A and B represent diatoms, C and D correspond to dinoflagellates, E and F correspond to tintinnids, and G and F for silicoflagellates. Note different scales among groups.

Table S2. Main pico and nanoplankton groups cell densities (cell mL⁻¹) and biomass

| | Spring tides | | Neap tides | | Total | |
|------------------------|---------------------------------------|-----------------------------------|---------------------------------------|-----------------------------------|---------------------------------------|-----------------------------------|
| | Abundance (cell mL ⁻¹) | Biomass (mgC m ⁻³) | Abundance (cell mL ⁻¹) | Biomass (mgC m ⁻³) | Abundance (cell mL ⁻¹) | Biomass (mgC m ⁻³) |
| | Mean ± SD (min - max) | Mean ± SD (min - max) | Mean ± SD (min - max) | Mean ± SD (min - max) | Mean ± SD (min - max) | Mean ± SD (min - max) |
| <i>Synechococcus</i> | 18258 ± 15337 (394 - 84299) | 3.3 ± 2.7 (0.1 - 15.0) | 5928.5 ± 15149.9 (0 - 65839) | 2.8 ± 3.2 (0.1 - 13.5) | 11336.2 ± 16362.3 (0 - 84299) | 3.0 ± 3.0 (0.1 - 15.0) |
| <i>Prochlorococcus</i> | 27066 ± 18878 (2877 - 84989) | 0.8 ± 0.5 (0.1 - 2.4) | 2110.5 ± 4893.2 (0 - 20603) | 0.7 ± 0.4 (0.2 - 1.8) | 13055.7 ± 17960.8 (0 - 84989) | 0.7 ± 0.5 (0.1 - 2.4) |
| <i>Cryptophytes</i> | 180.8 ± 127.9 (2 - 575) | 14.9 ± 10.6 (0.2 - 47.6) | 146.9 ± 127.0 (3 - 531) | 14.2 ± 11.2 (1 - 47.2) | 164.1 ± 128.1 (2 - 575) | 14.6 ± 10.9 (0.2 - 47.6) |

Table S3. Microplankton abundance (cell mL⁻¹) and biomass (mgC m⁻³) by major groups during neap and spring tides.

| | Spring tides | | Neap tides | | Total | |
|--|---------------------------------------|--|---------------------------------------|--|---------------------------------------|--|
| | Abundance (cell mL ⁻¹) | Biomass (mgC m ⁻³) | Abundance (cell mL ⁻¹) | Biomass (mgC m ⁻³) | Abundance (cell mL ⁻¹) | Biomass (mgC m ⁻³) |
| | Mean ± SD | Mean ± SD | Mean ± SD | Mean ± SD | Mean ± SD | Mean ± SD |
| | (Min - Max) | (Min - Max) | (Min - Max) | (Min - Max) | (Min - Max) | (Min - Max) |
| Diatoms | 6.15 ± 11.99 (0 - 50.99) | 77.18 ± 70.12 (0.83 - 86.91) | 2.80 ± 3.22 (0 - 11.36) | 25.36 ± 37.15 (0.07 - 95.79) | 4.53 ± 8.93 (0.06 - 51) | 52.06 ± 125.73 (0.07 - 686.91) |
| Single rounded cells | 0.16 ± 0.24 (0 - 1.03) | 0.25 ± 0.45 (0 - 1.93) | 0.06 ± 0.05 (0 - 0.17) | 0.11 ± 0.09 (0 - 0.29) | 0.11 ± 0.18 (0 - 1.03) | 0.18 ± 0.33 (0 - 1.93) |
| Pennates | 0.02 ± 0.02 (0 - 0.06) | 0.07 ± 0.12 (0 - 0.48) | 0.01 ± 0.02 (0 - 0.08) | 0.09 ± 0.13 (0 - 0.47) | 0.01 ± 0.02 (0 - 0.08) | 0.08 ± 0.12 (0 - 0.48) |
| <i>Skeletonema</i> like | 0.18 ± 0.14 (0 - 0.45) | 0.12 ± 0.15 (0 - 0.59) | 0.15 ± 0.13 (0 - 0.43) | 0.08 ± 0.12 (0 - 0.43) | 0.16 ± 0.14 (0 - 0.45) | 0.10 ± 0.13 (0 - 0.59) |
| Lineal chains and <i>Rhizosolenia</i> like | 0.80 ± 1.49 (0.07 - 6.31) | 5.8 ± 11.96 (0.17 - 47.92) | 0.09 ± 0.08 (0 - 0.33) | 0.42 ± 0.41 (0 - 1.26) | 0.46 ± 1.11 (0 - 6.31) | 3.19 ± 8.89 (0 - 47.92) |
| Helical chains | 4.71 ± 9.79 (0.01 - 41.49) | 68.02 ± 151.53 (0.23 - 610.44) | 2.43 ± 2.98 (0 - 10.39) | 23.89 ± 35.94 (0 - 92.04) | 3.61 ± 7.31 (0 - 41.5) | 46.63 ± 112.2 (0 - 610.44) |
| Other diatoms | 0.27 ± 0.43 (0 - 1.75) | 2.92 ± 6.23 (0 - 25.99) | 0.07 ± 0.09 (0 - 0.36) | 0.78 ± 0.87 (0 - 2.43) | 0.17 ± 0.33 (0 - 1.75) | 1.88 ± 4.58 (0 - 25.99) |
| Dinoflagellates | 0.41 ± 0.29 (0 - 1.07) | 3.83 ± 3.33 (0.19 - 10.48) | 0.45 ± 0.28 (0 - 0.98) | 2.72 ± 2.49 (0.67 - 10.63) | 0.43 ± 0.28 (0.07 - 1.07) | 3.29 ± 2.97 (0.19 - 10.62) |
| Peridiniales | 0.39 ± 0.28 (0.1 - 1.06) | 0.76 ± 0.58 (0.16 - 2.18) | 0.44 ± 0.28 (0.06 - 0.97) | 1.03 ± 0.66 (0.09 - 2.17) | 0.41 ± 0.28 (0.06 - 1.06) | 0.89 ± 0.62 (0.09 - 2.18) |
| <i>Ceratium/Neoceratium</i> | 0.01 ± 0.01 (0 - 0.04) | 3.05 ± 3.07 (0 - 9.78) | 0.01 ± 0.01 (0.001 - 0.03) | 1.68 ± 2.08 (0.23 - 8.84) | 0.01 ± 0.01 (0 - 0.04) | 2.39 ± 2.69 (0 - 9.78) |
| Other dinoflagellates | 0.003 ± 0.01 (0 - 0.03) | 0.03 ± 0.07 (0 - 0.24) | 0.01 ± 0.01 (0 - 0.02) | 0.01 ± 0.04 (0 - 0.15) | 0 ± 0 (0 - 0) | 0.02 ± 0.06 (0 - 0.24) |
| Tintinnids | 0.02 ± 0.02 (0.001 - 0.09) | 0.32 ± 0.3 (0.02 - 1.16) | 0.02 ± 0.02 (0 - 0.08) | 0.29 ± 0.27 (0 - 0.89) | 0.02 ± 0.02 (0 - 0.1) | 0.31 ± 0.28 (0 - 1.16) |
| Silicoflagellates | 0.04 ± 0.05 (0 - 0.2) | 0.02 ± 0.02 (0 - 0.09) | 0.016 ± 0.02 (0 - 0.09) | 0.01 ± 0.02 (0 - 0.05) | 0.03 ± 0.04 (0 - 0.2) | 0.01 ± 0.02 (0 - 0.09) |
| Foraminiferans | 0.003 ± 0.006 (0 - 0.023) | 0.02 ± 0.05 (0 - 0.17) | 0.0001 ± 0.0004 (0 - 0.001) | 0.19 ± 0.45 (0 - 1.85) | 0.001 ± 0.004 (0 - 0.023) | 0.1 ± 0.32 (0 - 1.85) |
| Coccolithophores | 0.001 ± 0.002 (0 - 0.011) | 0 ± 0 (0 - 0.01) | 0.0015 ± 0.003 (0 - 0.01) | 0 ± 0 (0 - 0.01) | 0 ± 0 (0 - 0.01) | 0.001 ± 0.002 (0 - 0.007) |
| Others | 0.07 ± 0.12 (0 - 0.45) | 0.27 ± 0.37 (0 - 1.38) | 0.008 ± 0.01 (0 - 0.05) | 0.27 ± 0.38 (0 - 1.02) | 0.04 ± 0.09 (0 - 0.45) | 0.27 ± 0.37 (0 - 1.38) |

Table S4. Mesoplankton abundance (ind m⁻³) and biomass (mgC m⁻³) by major groups during neap and spring tides.

| | Spring | | Neap | | Total | |
|------------------|-------------------------------------|-----------------------------------|-------------------------------------|-----------------------------------|-------------------------------------|-----------------------------------|
| | Abundance (ind m ⁻³) | Biomass (mgC m ⁻³) | Abundance (ind m ⁻³) | Biomass (mgC m ⁻³) | Abundance (ind m ⁻³) | Biomass (mgC m ⁻³) |
| | Mean ± SD (Min - Max) | Mean ± SD (Min - Max) | Mean ± SD (Min - Max) | Mean ± SD (Min - Max) | Mean ± SD (Min - Max) | Mean ± SD (Min - Max) |
| Amphipods | 0.06 ± 0.18 (0 - 0.56) | 0.26 ± 0.06 (0.21 - 0.30) | 0.18 ± 0.31 (0 - 0.53) | 0 | 0.09 ± 0.20 (0 - 0.56) | 0.17 ± 0.16 (0 - 0.30) |
| Appendicularians | 29.33 ± 43.95 (1.14 - 141.31) | 0.72 ± 1.13 (0 - 3.76) | 35.25 ± 10.96 (22.85 - 43.65) | 3.85 ± 2.40 (1.38 - 6.18) | 30.70 ± 38.41 (1.14 - 141.32) | 1.44 ± 1.95 (0 - 6.18) |
| Ascidians | 0.01 ± 0.03 (0 - 0.09) | 0 | 0.33 ± 0.58 (0 - 1.00) | 0 | 0.08 ± 0.28 (0 - 1.00) | 0 |
| Bryozoans | 1.31 ± 2.02 (0 - 6.15) | 0.03 ± 0.05 (0 - 0.12) | 1.89 ± 2.23 (0.18 - 4.41) | 0.03 ± 0.04 (0 - 0.08) | 1.45 ± 1.99 (0 - 6.15) | 0.03 ± 0.05 (0 - 0.12) |
| Chaetognats | 25.19 ± 33.92 (2.38 - 95.38) | 9.66 ± 14.61 (0.44 - 45.95) | 16.73 ± 13.71 (5.43 - 31.98) | 46.36 ± 75.73 (1.74 - 133.80) | 23.24 ± 30.14 (2.39 - 95.38) | 18.13 ± 37.08 (0.45 - 133.80) |
| Cirripedis | 3.54 ± 5.56 (0 - 18.46) | 0.04 ± 0.09 (0 - 0.26) | 2.14 ± 2.73 (0 - 5.21) | 0.01 ± 0.01 (0 - 0.01) | 3.21 ± 4.98 (0 - 18.46) | 0.03 ± 0.08 (0 - 0.26) |
| Cladocerans | 204.78 ± 243.19 (7.74 - 697.93) | 7.99 ± 15.18 (0 - 49.11) | 32.74 ± 23.11 (9.84 - 56.06) | 1.29 ± 1.03 (0.10 - 1.89) | 165.08 ± 223.91 (7.74 - 697.93) | 6.44 ± 13.48 (0 - 49.11) |
| Small Copepods | 183.34 ± 255.10 (0 - 883.07) | 0.74 ± 0.91 (0 - 3.08) | 101.28 ± 106.44 (13.52 - 219.67) | 1.25 ± 1.17 (0.14 - 2.48) | 164.41 ± 228.02 (0 - 883.08) | 0.86 ± 0.95 (0 - 3.08) |
| Medium Copepods | 110.04 ± 133.17 (0.75 - 403.49) | 4.90 ± 5.20 (0.05 - 12.55) | 89.78 ± 117.01 (11.64 - 224.31) | 4.14 ± 1.92 (2.47 - 6.24) | 105.36 ± 125.15 (0.75 - 403.49) | 4.72 ± 4.58 (0.05 - 12.55) |
| Large Copepods | 25.09 ± 34.25 (0.15 - 98.69) | 16.18 ± 32.14 (0.61 - 104.20) | 10.19 ± 6.65 (3.11 - 16.30) | 55.36 ± 51.74 (20.29 - 114.78) | 21.65 ± 30.49 (0.15 - 98.70) | 25.22 ± 38.93 (0.61 - 114.78) |
| Cumaceans | 1.01 ± 0.02 (0 - 0.07) | 0.01 | 0 | 0 | 0.01 ± 0.02 (0 - 0.07) | 0.01 ± 0 (0.01 - 0.01) |
| Decapods | 9.89 ± 17.65 (0 - 56.39) | 22.23 ± 47.50 (0 - 139.00) | 1.28 ± 2.21 (0 - 3.83) | 0.23 | 8.24 ± 14.47 (0 - 56.40) | 20.23 ± 45.55 (0 - 139.00) |
| Doliolids | 4.82 ± 8.43 (0 - 28.27) | 0.54 ± 0.51 (0 - 1.34) | 1.10 ± 0.60 (0.41 - 1.47) | 0.33 ± 0.41 (0.07 - 0.81) | 3.96 ± 15.72 (0 - 28.28) | 0.48 ± 0.47 (0 - 1.34) |
| Scaphopods | 0.19 ± 0.49 (0 - 1.53) | 0 | 0.72 ± 0.63 (0 - 1.16) | 0.02 ± 0.03 (0 - 0.04) | 0.31 ± 0.55 (0 - 1.54) | 0.01 ± 0.02 (0 - 0.04) |
| Euphausiaceans | 12.34 ± 6.29 (2.33 - 24.44) | 13.58 ± 30.56 (0.02 - 97.66) | 9.78 ± 6.16 (5.04 - 16.75) | 35.16 ± 59.85 (0.56 - 104.27) | 11.75 ± 6.10 (2.34 - 24.45) | 18.56 ± 37.24 (0.02 - 104.27) |
| Gastropods | 0.40 ± 1.26 (0 - 3.99) | 0.04 | 0 | 0 | 0.31 ± 1.11 (0 - 3.99) | 0.04 |
| Medusas | 0.08 ± 0.20 (0 - 0.61) | 0.05 ± 0.07 (0 - 0.10) | 0.02 ± 0.04 (0 - 0.07) | 0.03 | 0.07 ± 0.17 (0 - 0.61) | 0.04 ± 0.05 (0 - 0.10) |
| Limacinidae | 0.40 ± 1.26 (0 - 3.99) | 0.01 | 0.74 ± 1.27 (0 - 2.21) | 0.02 ± 0 (0.02 - 0.02) | 0.48 ± 1.22 (0 - 3.99) | 0.01 ± 0.01 (0.01 - 0.02) |

Continued

Table S4 continued

| | Spring | | Neap | | Total | |
|---------------|-------------------------------------|-----------------------------------|-------------------------------------|-----------------------------------|-------------------------------------|-----------------------------------|
| | Abundance (ind m ⁻³) | Biomass (mgC m ⁻³) | Abundance (ind m ⁻³) | Biomass (mgC m ⁻³) | Abundance (ind m ⁻³) | Biomass (mgC m ⁻³) |
| | Mean ± SD (Min - Max) | Mean ± SD (Min - Max) | Mean ± SD (Min - Max) | Mean ± SD (Min - Max) | Mean ± SD (Min - Max) | Mean ± SD (Min - Max) |
| Molluscs | 0.16 ± 0.27 (0 - 0.72) | 0.02 ± 0.02 (0 - 0.06) | 0.53 ± 0.53 (0 - 1.05) | 0.01 ± 0.02 (0 - 0.02) | 0.25 ± 0.36 (0 - 1.05) | 0.01 ± 0.02 (0 - 0.06) |
| Mysidaceans | 0.25 ± 0.34 (0 - 1.03) | 28.24 ± 53.16 (0.04 - 122.24) | 0 | 0 | 0.19 ± 0.31 (0 - 1.03) | 28.24 ± 53.16 (0.04 - 122.24) |
| Nauplii | 2.30 ± 4.91 (0 - 15.96) | 0.03 ± 0.05 (0 - 0.14) | 0.59 ± 0.49 (0.12 - 1.10) | 0.01 ± 0.01 (0 - 0.02) | 1.91 ± 4.33 (0 - 15.96) | 0.02 ± 0.04 (0 - 0.14) |
| Ophiuroideans | 0.15 ± 0.48 (0 - 1.52) | 1.40 ± 2.21 (0 - 5.28) | 0 | 1.57 | 0.12 ± 0.42 (0 - 1.52) | 1.43 ± 1.98 (0 - 5.28) |
| Ostracods | 14.33 ± 23.21 (0 - 64.61) | 0.24 ± 0.63 (0.01 - 1.79) | 4.30 ± 6.79 (0.14 - 12.13) | 0.06 ± 0.09 (0 - 0.16) | 12.02 ± 20.76 (0 - 64.62) | 0.19 ± 0.53 (0 - 1.79) |
| Polychaets | 1.30 ± 1.70 (0 - 5.67) | 0.07 ± 0.10 (0 - 0.28) | 0.37 ± 0.59 (0 - 1.05) | 0 | 1.08 ± 1.55 (0 - 5.68) | 0.06 ± 0.09 (0 - 0.28) |
| Pteropods | 0.02 ± 0.07 (0 - 0.21) | 0 | 0 | 0 | 0.02 ± 0.06 (0 - 0.21) | 0 |
| Stomatopoda | 0.04 ± 0.05 (0 - 0.12) | 13.84 ± 26.40 (0.02 - 53.42) | 0 | 0 | 0.03 ± 0.05 (0 - 0.12) | 13.84 ± 26.40 (0.02 - 53.42) |
| Unidentified | 2.48 ± 2.73 (0 - 9.23) | 0.12 ± 0.16 (0 - 0.41) | 1.61 ± 1.57 (0 - 3.13) | 0.01 ± 0.01 (0 - 0.01) | 2.28 ± 2.48 (0 - 9.23) | 0.10 ± 0.15 (0 - 0.41) |

Table S5. Summary scheme signing main features defining each cluster.

| Cluster 1 | Cluster 2 |
|---|---|
| > Chlorophyll <i>a</i> > Chlorophyll > 20 µm > Active Chlorophyll > Nitrate > Nitrite > Ammonium > Particles biomass > Presence <i>Synechococcus</i> > Presence of coastal diatoms: <i>Guinardia striata</i> and <i>Chaetoceros debilis</i> , <i>Rhizosolenia setigera</i> , etc. > Meroplankton | > Salinity > Silicate > Prochlorococcus > Foraminiferans > Appendicularians |

Table S6. Total abundance of copepods orders (ind m⁻³).

| | Abundance (ind/m ³) (min – max) |
|--------------------|--|
| Calanoida | 197.04 (26.61 - 690.77) |
| Cyclopoida | 45.25 (1.61 - 286.15) |
| Harpacticoida | 13.56 (0 - 96.92) |
| Poecilostomatoidea | 35.79 (0 - 179.6) |
| Other Copepoda | 3.35 (0 - 14.49) |

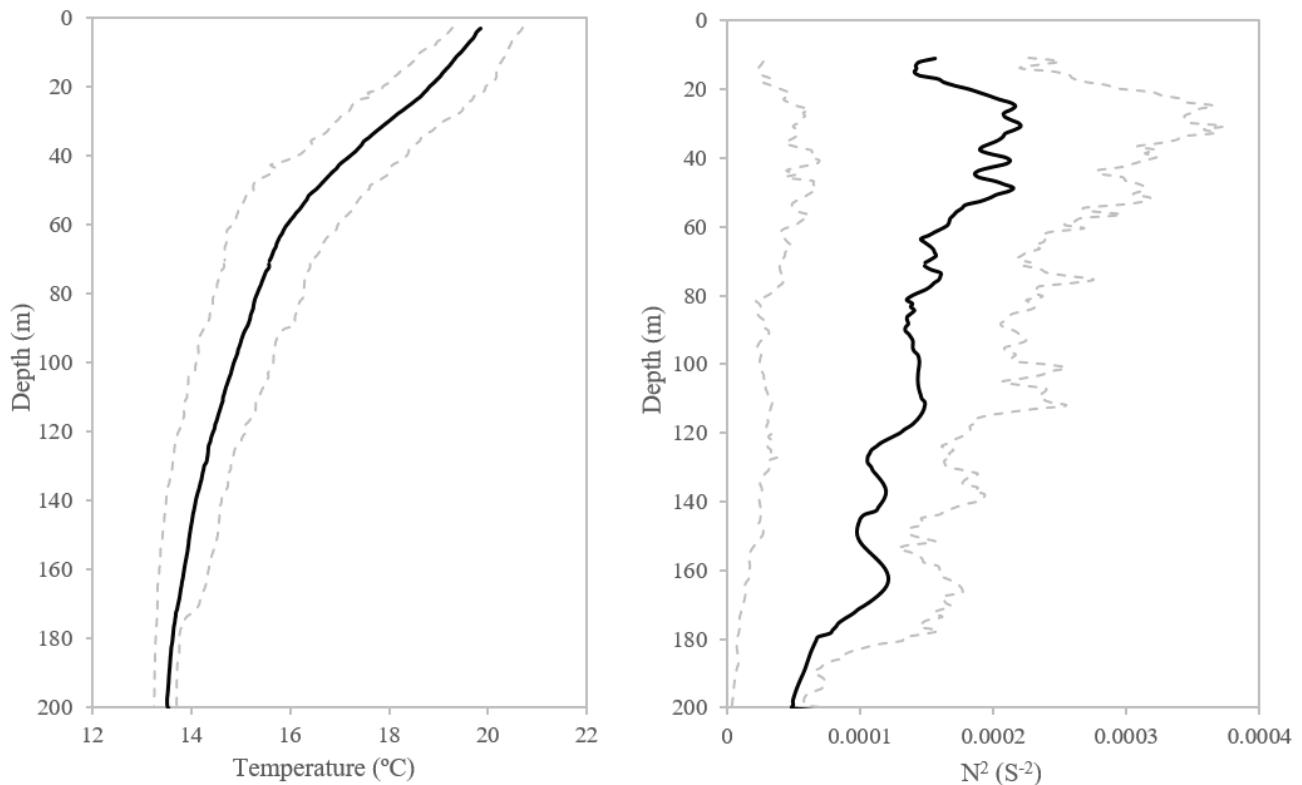


Fig. S4: Mean temperature, (A) and N² (B) profiles averaged for all the stations. The dashed lines represent the 20th and 80th percentiles in both plots.