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*Supplement of*

# Effects of fluctuating hypoxia on benthic oxygen consumption in the Black Sea (Crimean shelf)

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## Supplement Figures and Tables

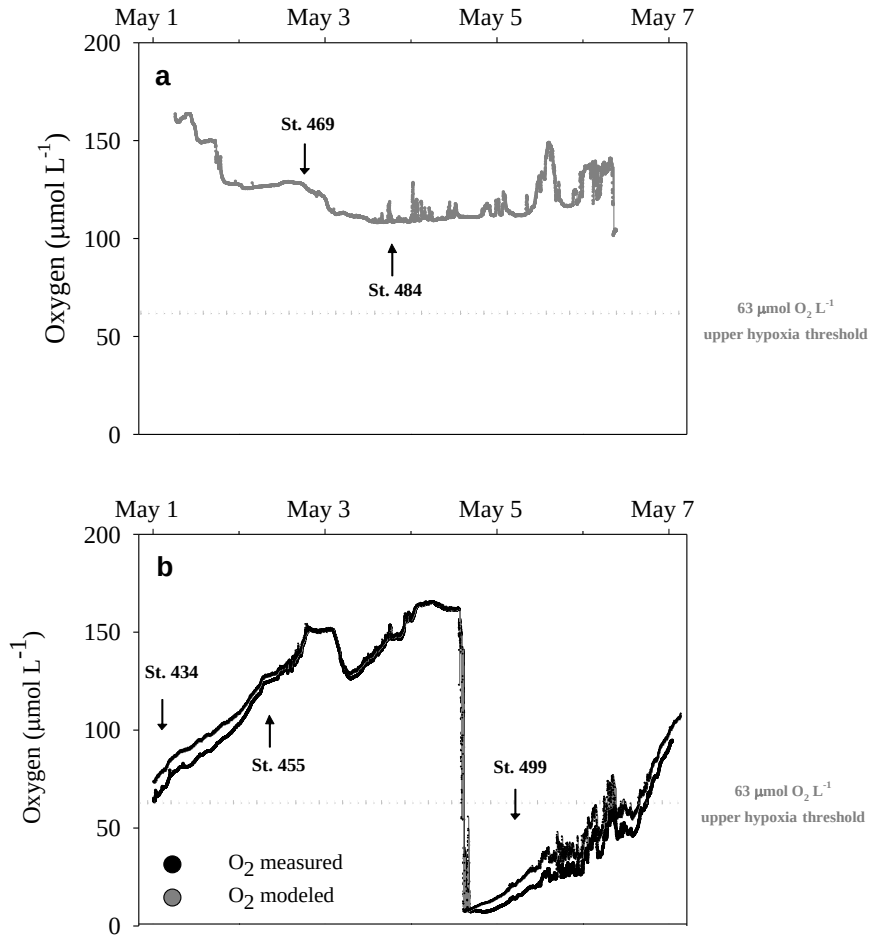


Fig. S1: Stationary moorings with sensors measuring one meter above the sediment over a time period of 7 days; a) the oxygen concentration from the mooring at 100 m was modeled from recorded density data; bottom water was always oxic during the measurements, still strong variations (up to 60 µmol $O_2$ $L^{-1}$) were visible during the deployment time; b) at the mooring at 135 m water depth, measuring 1.5 m above the sediment, the water-column oxygen concentration strongly varied between oxic and hypoxic conditions, dropping to nearly anoxic conditions on May 5$^{th}$. Time points where oxygen consumption was measured at these two water depths are indicated. The horizontal line indicates the conventional hypoxia threshold concentration of 63 µmol $O_2$ $L^{-1}$.

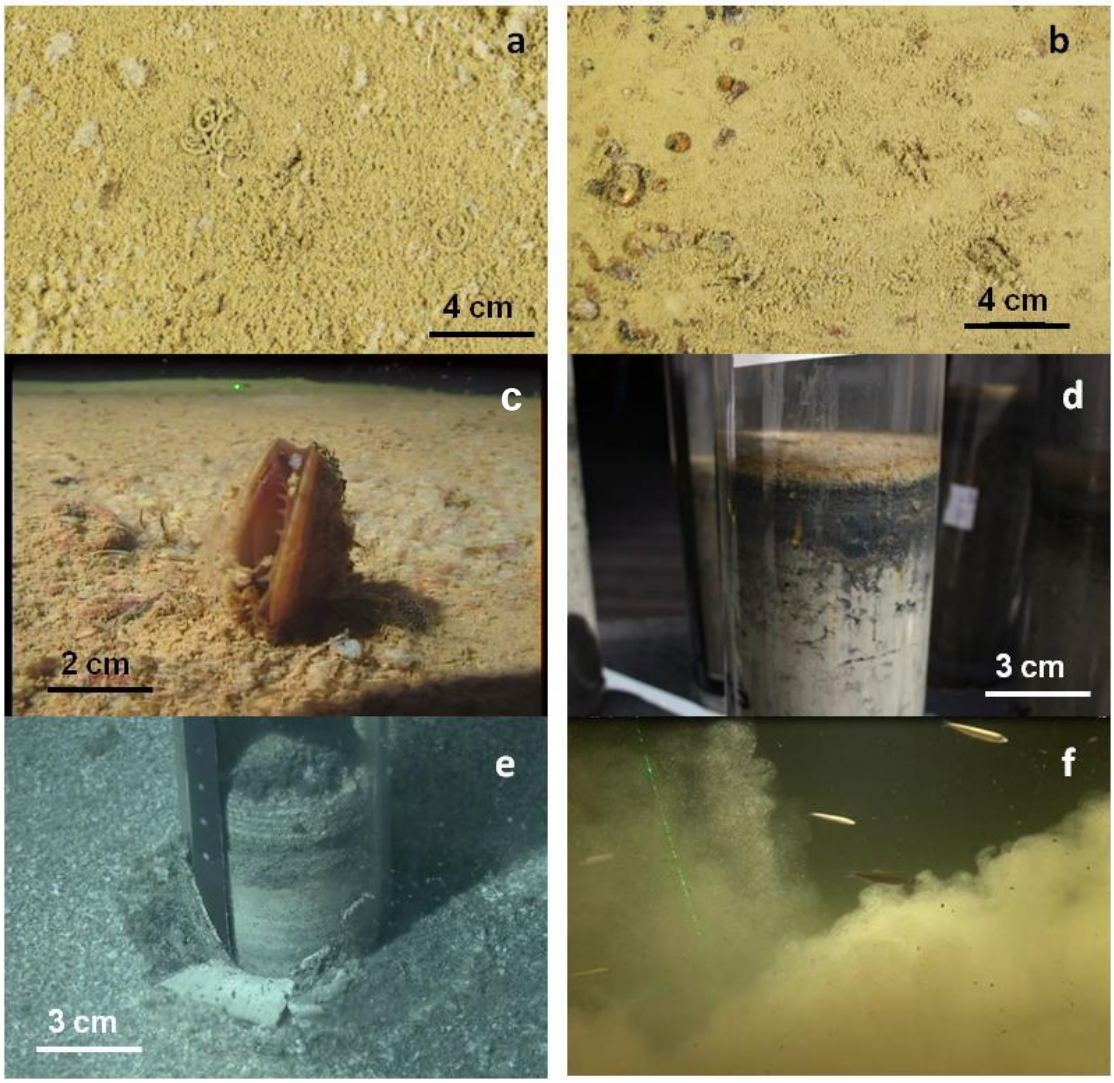


Fig. S2: Images of seafloor and sediments; a) fecal structures on top of the sediment in the oxic zone, b) brown iron-encrusted shells in the oxic zone, c) living bivalve on top of the sediment in the oxic zone; d) vertical layering of the sediment with oxygenated sediment on top in the oxic zone; e) vertical layering of the sediment during coring, f) fish at >145 m and $O_2$ concentrations below 25 µmol $L^{-1}$; photographs are copyright JAGO-Team GEOMAR.

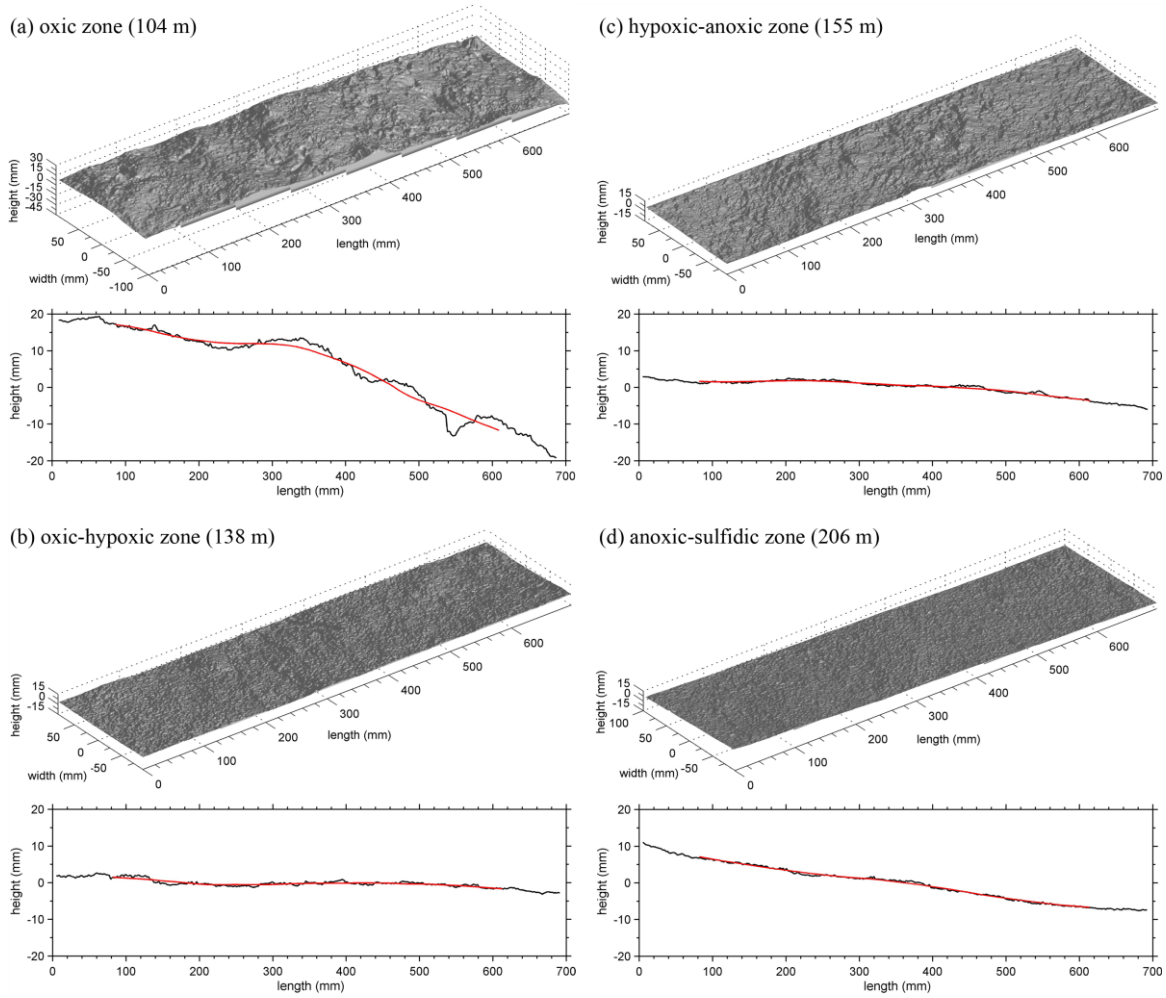


Fig. S3: Shaded 3D surfaces showing examples of micro-topography measurements obtained at (a) 104, (b) 138, (c) 155, and (d) 206 m water depth. The 2D plots show topography profiles extracted along the center line of the respective surfaces (black line). The red line shows the running average of the same profile (155 mm averaging window). Deviations of the profile from profiles smoothed at different window sizes were used to compare roughness between stations (see section 2.3 and 3.5)

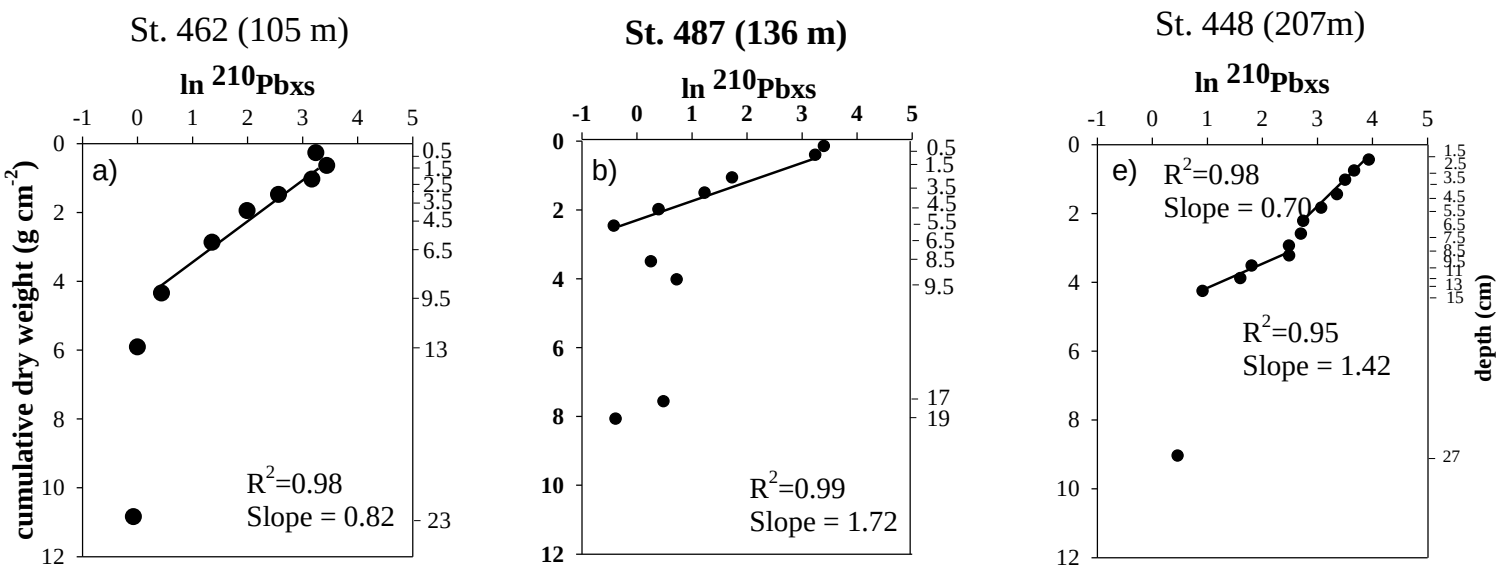


Fig. S4: Profiles of excess $^{210}$Pb activity, cumulative dry weight (left y-axis) and depth (right y-axis). Regression lines are plotted for data that were included in calculations of sediment accumulation rates.

Table S1: Macrofauna composition and abundance (x $10^3$ individuals $m^{-2}$) per sampling depth (m) at the outer Western Crimean Shelf (not quantitative for the entire size class). Results were grouped according to bottom-water oxygenation zones and integrated over the upper 5 cm.

| **Taxa (x $10^3$ individuals $m^{-2}$)** | **101** | **104** | **105** | **117** | **120** | **129** | **138** | **138** | **145** | **151** | **155** | **162** | **163** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Ascidiacea** | 0.2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Bivalvia** | 0.1 | 0.4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Cnidaria** | 2.1 | 0.4 | 1.4 | 7.5 | 50.1 | 53.1 | 35.4 | 23.4 | 1.7 | 0 | 1.4 | 1 | 0 |
| **Gastropoda** | 0 | 0.4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.2 | 0 |
| **Nemertini** | 0 | 0 | 0.5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Oligochaeta** | 0.8 | 0.3 | 3.1 | 1.6 | 0.6 | 0.7 | 14.3 | 2.6 | 0.7 | 0 | 0 | 0 | 0.1 |
| **Polychaeta** | 1.6 | 0.8 | 1.7 | 0.7 | 0.1 | 0 | 1.7 | 0.3 | 0 | 0 | 0 | 0 | 0 |
| **Porifera** | 0.2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Σ** | 5 | 1.9 | 6.7 | 9.8 | 50.8 | 53.8 | 51.4 | 26.3 | 2.4 | 0 | 1.4 | 1.2 | 0.1 |
| **Zone** | **oxic** | | | | | | **oxic-hypoxic** | | **hypoxic-anoxic** | | | | |

Table S2: Meiofauna composition and abundance (x$10^4$ individuals $m^{-2}$) per sampling depth (m) at the outer Western Crimean Shelf. Results were grouped according to bottom-water oxygenation zones and integrated over the upper 5 cm.

| **Taxa (x$10^4$ individuals $m^{-2}$)** | **101** | **104** | **105** | **117** | **120** | **129** | **138** | **138** | **145** | **151** | **155** | **162** | **163** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Acari** | 0 | 0.26 | 0 | 0 | 0.01 | 0.04 | 0.05 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Amphipoda** | 0 | 0 | 0 | 0.02 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Bivalvia** | 0.45 | 0.2 | 0.74 | 0.17 | 0.16 | 0.08 | 0.29 | 0.23 | 0.88 | 0 | 0.04 | 0.31 | 0.06 |
| **Ciliophora** | 1.52 | 0.16 | 3.08 | 0.81 | 1.52 | 4.91 | 0.79 | 3.55 | 3.49 | 12.41 | 1.02 | 3.32 | 0.97 |
| **Cnidaria** | 0.59 | 0.03 | 0.29 | 0.07 | 1.14 | 0.63 | 0.02 | 3.8 | 0.98 | 0.14 | 0 | 1.36 | 0.04 |
| **Forams hard shelled** | 0.25 | 0.09 | 0.05 | 0.05 | 0.16 | 7.39 | 13.39 | 15.42 | 2.49 | 0.24 | 0.23 | 1.05 | 0.01 |
| **Forams soft shelled** | 1.05 | 0.37 | 2.8 | 2.22 | 3.56 | 7.17 | 13.27 | 7.68 | 17.88 | 10.45 | 1.28 | 3.83 | 0.19 |
| **Gastropoda** | 0.01 | 0.03 | 0 | 0.02 | 0.01 | 0.04 | 0 | 0.01 | 0 | 0 | 0.01 | 0 | 0 |
| **Gromia** | 1.13 | 0.66 | 0.53 | 2.36 | 3.32 | 2.01 | 4.57 | 2.28 | 0.6 | 1.24 | 1.41 | 0.81 | 0 |
| **Harpacticoida** | 1.7 | 1.3 | 3.99 | 0.66 | 0.76 | 1.45 | 7.91 | 3.46 | 0.14 | 0 | 0.27 | 0.02 | 0.19 |
| **Kinorhyncha** | 0.41 | 0.12 | 0.62 | 0.11 | 0.32 | 0.05 | 0.17 | 0.01 | 0 | 0 | 0 | 0 | 0 |
| **Nauplia Decapoda** | 0.93 | 0.26 | 0.12 | 0 | 0 | 0.02 | 0 | 0.43 | 0 | 0 | 0 | 0 | 0 |
| **Nematoda** | 221.5 | 128.75 | 248.78 | 91.98 | 183.06 | 131.62 | 183.82 | 134.44 | 82.78 | 30.66 | 25.03 | 31.23 | 3.36 |
| **Nemertini** | 0 | 0.01 | 0 | 0 | 0 | 0 | 0 | 0.01 | 0 | 0 | 0 | 0 | 0 |
| **Oligochaeta juvenile** | 0.02 | 0.32 | 0 | 0 | 0.01 | 0.38 | 0.98 | 0.04 | 0 | 0 | 0 | 0 | 0 |
| **Ostracoda** | 2.88 | 2.8 | 6.74 | 0.05 | 0 | 0 | 0.14 | 0.01 | 0 | 0 | 0 | 0 | 0 |
| **Polychaeta** | 1.12 | 0.66 | 1.86 | 0.23 | 0.58 | 0.92 | 0.74 | 0.42 | 0.22 | 0.12 | 0.16 | 0.19 | 0.18 |
| **Tardigrada** | 1.11 | 0.57 | 1.55 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Turbellaria** | 0.69 | 1.38 | 2.18 | 1.66 | 4.33 | 0.07 | 0.12 | 0.33 | 0.02 | 0.02 | 0.04 | 0 | 0 |
| **Others** | 0.65 | 0 | 0.05 | 0 | 0.51 | 0 | 0 | 0.04 | 0.02 | 0 | 0.03 | 0 | 0 |
| **Σ** | **236.0** | **138.0** | **273.4** | **100.4** | **199.5** | **156.8** | **226.3** | **172.2** | **109.5** | **55.3** | **29.5** | **42.1** | **5.0** |
| **Zone** | | | | **oxic** | | | **oxic-hypoxic** | | | | **hypoxic-anoxic** | | |

Table S3: Meiofauna community dissimilarity per sampling depths. Upper triangle: dissimilarity (based on Bray-Curtis), values closer to 1 represent high dissimilarity. Lower triangle: percentage of shared taxa. Colors depict oxygenation regimes, oxic (blue), oxic-hypoxic (pink), hypoxic-anoxic (red).

| | 101 | 104 | 105 | 117 | 120 | 129 | 138 | 138 | 145 | 151 | 155 | 162 | 163 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 101 | | 0.1 | 0.1 | 0.2 | 0.2 | 0.2 | 0.3 | 0.3 | 0.3 | 0.4 | 0.2 | 0.3 | 0.4 |
| 104 | 89 | | 0.1 | 0.2 | 0.2 | 0.3 | 0.3 | 0.3 | 0.4 | 0.5 | 0.3 | 0.4 | 0.4 |
| 105 | 88 | 78 | | 0.2 | 0.2 | 0.3 | 0.3 | 0.3 | 0.3 | 0.4 | 0.2 | 0.3 | 0.3 |
| 117 | 76 | 68 | 75 | | 0.1 | 0.2 | 0.2 | 0.2 | 0.3 | 0.3 | 0.2 | 0.3 | 0.3 |
| 120 | 76 | 78 | 65 | 75 | | 0.2 | 0.2 | 0.2 | 0.3 | 0.3 | 0.2 | 0.3 | 0.3 |
| 129 | 82 | 83 | 71 | 71 | 93 | | 0.1 | 0.1 | 0.2 | 0.3 | 0.1 | 0.2 | 0.3 |
| 138 | 76 | 78 | 75 | 75 | 87 | 81 | | 0.1 | 0.2 | 0.3 | 0.2 | 0.2 | 0.3 |
| 138' | 88 | 89 | 76 | 76 | 76 | 82 | 76 | | 0.2 | 0.3 | 0.2 | 0.2 | 0.3 |
| 145 | 62 | 56 | 71 | 71 | 71 | 67 | 71 | 62 | | 0.2 | 0.2 | 0.1 | 0.3 |
| 151 | 50 | 44 | 57 | 57 | 57 | 53 | 57 | 50 | 80 | | 0.3 | 0.2 | 0.3 |
| 155 | 62 | 56 | 60 | 71 | 71 | 67 | 60 | 62 | 82 | 64 | | 0.2 | 0.3 |
| 162 | 56 | 50 | 64 | 64 | 64 | 60 | 64 | 56 | 90 | 70 | 73 | | 0.2 |
| 163 | 50 | 44 | 57 | 57 | 57 | 53 | 57 | 50 | 80 | 60 | 64 | 89 | |