

Summertime oxygen depletion and acidification in Bohai Sea, China

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Increasing attention has recently been drawn to oxygen depletion and ocean acidification in coastal seas and their impacts on the marine ecosystem. Intensive organic matter degradation combined with weak water exchange is considered to be mainly responsible for bottom water oxygen depletion and acidification. Hypoxia and acidification in the bottom water of Bohai Sea have been frequently observed in August over the past decade. In this study, monthly investigations were conducted along an inshore-offshore transect in the north Bohai Sea from May to August in 2017 and 2018. The physical structure of the water column in the study area was characterized by a well-mixed surface layer and an essentially homogeneous deep layer that were separated by a strong pycnocline over the period from mid-June to late August in both years. Dissolved oxygen (DO), pH and dissolved inorganic carbon (DIC) in the water column were also split into two layers by the pycnocline and varied little in each layer. No significant interannual variations were observed for the temporal progressions of DO, pH and DIC in the bottom water. Average DO concentration and pH in the bottom water linearly decreased with time from May to August while DIC presented an opposite trend. DO became increasingly unsaturated from mid-June to late August when DO decreased to 96 mmol L^{-1} and pH to 7.74. The molar ratio of net oxygen consumption to DIC production was 1.42, similar to the Redfield ratio (1.30). The degradation of sedimentary organic matter was estimated to contribute ~30% of the oxygen depletion and acidification observed. Pelagic oxygen consumption due to degradation of fresh organic matter thus dominated the oxygen depletion. The duration and intensity of oxygen depletion and acidification in the study area were strongly affected by stormy weather events such as typhoons.

Keywords: oxygen depletion, acidification, dissolved inorganic carbon, organic matter degradation, typhoon, Bohai Sea