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TITLE: Detection of low bottom water oxygen concentrations in the North Sea; implications for monitoring and assessment of ecosystem health

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ABSTRACT:

Abstract. This paper presents new results from high temporal resolution observations over two years (2007 and 2008) from instrumented moorings deployed in the central North Sea, at the Oyster Grounds and on the northern slope of Dogger Bank (North Dogger). The water column was stratified in the summer at both sites, leading to limited exchange of the water in the bottom mixed layer. Data from these moorings revealed the variable nature of summer oxygen depletion at the Oyster Grounds. The combination of in situ and ship-based measurements allowed the physical and biological conditions leading to decreasing dissolved oxygen concentrations in bottom water to be examined. In 2007 and 2008, the concentration of dissolved oxygen in the bottom water at both sites was observed to decrease throughout the summer period after the onset of stratification. Depleted dissolved oxygen concentration (6.5 mg l?1, 71% saturation) was measured at the North Dogger, a site which is not significantly influenced by anthropogenic nutrient inputs. Lower oxygen saturation (5.2 mg l?1, 60% saturation) was measured for short durations at the Oyster Grounds. The seasonal increase in bottom water temperature accounted for 55% of the decrease in dissolved oxygen concentration at the Oyster Grounds compared to 10% at North Dogger. Dissolved oxygen concentration in bottom water at the Oyster Grounds was shown to be strongly influenced by short term events including storms and pulses of particulate organic matter input. In contrast, dissolved oxygen concentration in bottom water at the North Dogger reflected longer seasonal processes such as a gradual temperature increase over the summer and a more steady supply of particulate organic matter to the bottom mixed layer. The differences between the study sites shows the need for an improved understanding of the mechanisms driving these processes if the use of oxygen in marine management and ensuring ecosystem health is to be meaningful and successful in the future. These high frequency observations provide greater understanding of the nature of the depletion in bottom oxygen concentration in the North Sea.

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