

Oxygen deficiencies in the Schelde and Elbe estuary: same difficulties, different causes

Lindsay Geerts¹, Soetaert Karline², Maris Tom¹, Kirsten Wolfstein³ and Patrick Meire¹

¹ University of Antwerp, Department of Biology, Willaard 17, 2640 Mortsel, Belgium
E-mail: lindsay.geerts@uantwerpen.be

² Royal Netherlands Institute for Sea Research (NIOZ)

³ Hamburg Port Authority

The expansion of oxygen minimum zones (OMZ's) in estuaries, sometimes also referred to as 'dead zones', is catastrophic for ecology and economy (e.g. Diaz, 2001; Conley *et al.*, 2009). At low oxygen levels, benthic invertebrates and fish are physiologically stressed (e.g. Vaquer-Sunyer & Duarte, 2008) while estuarine biogeochemistry is drastically changed (e.g. Middelburg & Levin, 2009). In the Elbe estuary a minimum oxygen zone can be found around 50 km downstream the weir at Geesthacht (Amann *et al.*, 2012), while in the Schelde two minimum oxygen zones can be found, one around 20 km downstream the sluice of Merelbeke, and another one around 70 km downstream the sluice (Soetaert *et al.*, 2006).

When studied over a time period of six years (2004 - 2009), oxygen conditions have greatly improved in the Schelde estuary, while in the Elbe estuary, the existence of this oxygen minimum zone seems to persist. This while biochemical oxygen demand measurements are about two times lower in the Elbe than in the Schelde estuary. To understand which processes are causing these different oxygen dynamics, we applied a one-dimensional reactive transport model to both estuaries. In the Schelde we found oxygen problems to be mainly related to organic matter input from the major tributaries, while in the Elbe oxygen dynamics were found to be more influenced by estuarine morphology. This implies that water quality management will be more effective to remediate hypoxia related problems in the Schelde than in the Elbe.