RSPB Briefing Note: Nutrient and Sediment Flows on The Wash

The Wash with a total area of around 70,000ha is the largest estuary in Great Britain, although it is already massively reduced in size due to reclamation activities beginning in Roman times. About half of the Wash area is now intertidal, and 90km is tidal channels (Davidson et al., 1991, Jickells et al., 2014). Tidal channels, and the surrounding areas, are known to be particularly important for foraging wading birds (Lourenco et al 2005). Any disruption to water and sediment flows would inevitably change the distribution pattern of intertidal channels, but it may also create wider changes in the Wash system.

Sedimentation rates of fine-grained sediment in the Wash are estimated at about 800 x 103 tonnes/year with only about 10-15% of this supplied by Wash rivers. The remainder of this sediment is derived from cliff erosion in the North Norfolk and Holderness region which is subsequently transported from offshore into the Wash (McCave 1987, Ke et al., 1996, Jickells et al., 2014, Andrews et al ., 2023, Sediment Transport Study 2002). Sediment Transport into the Wash during storm events may be particularly important (Sediment Transport Study 2002) Even a partial barrier across the Wash will slow tidal currents into the estuary, and thereby may reduce suspended sediment transport from offshore. This would mean that the Wash sedimentation rate fails to keep pace with relative sea level, which is rising rapidly in this area (Andrews et al., 2023), a situation that will be compounded by any subsequent compaction of the existing sediments within the Wash. This could mean the loss of intertidal area within the Wash and the associated bird feeding grounds.

The Wash also traps 25-30% of riverine nutrients currently flowing into into via burial of organic matter and, for nitrogen, by sedimentary denitrification (Jickells et al., 2013). This trapping of riverine nutrients in the Wash reduces eutrophication pressure on the wider North Sea. This valuable ecosystem service is also threatened by any barrage across the Wash which reduces sediment supply.

The rivers draining into the Wash, dominated by the Great Ouse and Nene, have some of the highest nutrient concentrations of any UK rivers (Neal and Robson, 2000). These high nutrient concentrations currently lead to seasonally high levels of phytoplankton (algae) in the slow flowing lower reaches of the Great Ouse and the Nene (Balbi 2000, Fichez et al 1992), but these phytoplankton blooms do not at present extend into the Wash because of dispersion and dilution there, due to rapid tidal exchange (Fichez et al., 1992). While these detailed studies of these river systems are from several years ago, the UK government's most recent report demonstrates that, for nitrate at least, there has been little change in average concentrations in English rivers since that time (GOV.UK 2023).

A barrage across the Wash must inevitably reduce the amount of mixing between the waters of the open North Sea and the Wash and may create a shallow lake behind the barrage into which these nutrients rich rivers will drain. The resulting conditions of high nutrient concentrations and slow flushing would encourage algal blooms generally, and in certain situations harmful algal blooms (von Glasow et al., 2013) which can affect wildlife and recreational water users. Proliferations of macro-algal mats on intertidal mud flats may also develop, as happens now in some other UK south coast systems (Aldridge and Trimmer 2009). These mats have been demonstrated reduce overall invertebrate prey abundance in estuarine habitats, and have been recorded persisting into autumn, overlapping with a key wading bird migration period (Thornton et al., 2020). This would have major implications for the Wash bird populations and designated sites.

Such enrichment of nutrient supply is generally termed "anthropogenic eutrophication" and leads to major ecological impacts, but also economic impacts on fisheries and tourism and potentially even to impacts on human health (Le Moal M et al 2019, Horta et al., 2021).

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