Differences in resilience of benthic habitats to dredge disposal

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Introduction: The Belgian Part of the North Sea (BPNS) is characterized by different soft-sediment habitat types, each with their own physical and biological characteristics [1]. Sediments with a high mud content show a low benthic diversity and characterize the *Macoma balthica* habitat. The habitat with the highest biological diversity is found in muddy sands and is called the *Abra alba* habitat. The coastal *Nephtys cirrosa* habitat is typically found in pure sands, and is characterized by a moderate diversity.
Five dredge disposal sites are located in the BPNS, each situated in one of the above mentioned habitat types and characterized by different dumping intensities. The five sites are regularly monitored to evaluate the impact of the dumping of dredge disposal on the benthic habitat. The hypothesis is that the resilience of the benthic habitat depends on the dumping intensity and the habitat type.

Methods: Between 2004 and 2008 the benthic habitat was sampled twice a year by taking 11 to 17 Van Veen grab samples (0.1 m²) at each disposal site in a control – impact design. Benthic species richness (# species per 0.1 m²), species composition and species density (ind per m²) were recorded.
To analyse the effect of the dumping intensity on the status of the benthic community, the Benthic Ecosystem Quality Index (BEQI, www.beqi.eu) was used.

Results: The dumping intensity at the five dredge disposal sites on the BPNS varied from low-to-moderate (less than 1 million tonnes dry matter per year) to intense and continuous dumping (2 to 6 million tonnes dry matter per year). When dumping was high and continuous throughout the year, the benthic diversity and density decreased and the composition of the benthic community changed. This is illustrated by the decreasing BEQI EQR values with increasing dumping intensities (Figure 1).
Changes in the benthic environment under high dumping intensities seem to be different depending on the habitat type. In muddy sediments (*Macoma balthica* habitat), naturally characterized by a dominance of opportunistic and short living species, the changes are of a lesser magnitude than in fine, muddy sands (*Abra alba* habitat)..

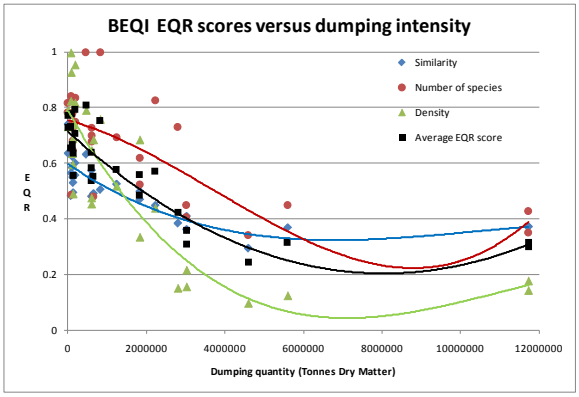

Figure 1. BEQI average score and scores for species composition (similarity), diversity (number of species) and density.

Discussion: Most benthic species can resist limited disposal intensities and are able to recover between consecutive dumping events [2]. However, their recoverability is not sufficient to withstand high and chronic dumping intensities. As the chemical impact of dredge disposal at the investigated sites was limited [3], the observed effects can solely be attributed to physical disturbance, suffocation and changes in sediment composition, related to dredge disposal activities.
The more diverse *Abra alba* habitat seems to be more susceptible to chronic dumping and changes in habitat characteristics. This is due to the fact that some important habitat structuring species (e.g. *Owenia fusiformis*) do not survive chronic dumping, leading to losses in ecosystem functioning.

Conclusion: The nature of the benthic habitat, the vulnerability of its inhabitants and the dredge dumping intensity do determine the habitat's ability to recover from chronic dumping events.

References: [1] Van Hoey et al. (2004) *Estuarine, coastal and shelf science* **59**:599-613; [2] Bolam (2010) *Environ Monit Assess* DOI10.1007/s10661-010-1809-5; [3] Van Hoey et al. (2010) *Report ILVO – Animal Science – Fisheries N°1*