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UNDERSTANDING BENTHIC, PELAGIC AND AIRBORNE ECOSYSTEM INTERACTIONS IN SHALLOW COASTAL SEAS



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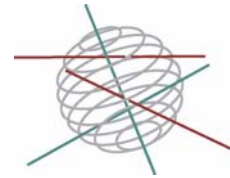
BIODIVERSITY

ATMOSPHERE AND TERRESTRIAL AND MARINE ECOSYSTEMS

TRANSVERSAL ACTIONS

SCIENCE FOR A SUSTAINABLE DEVELOPMENT

(SSD)



Marine Ecosystems & Biodiversity



FINAL REPORT PHASE 1
SUMMARY

**UNDERSTANDING BENTHIC, PELAGIC AND AIRBORNE
ECOSYSTEM INTERACTIONS IN SHALLOW COASTAL SEAS**



SD/BN/01A

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Vanaverbeke J, Braeckman U, Cuveliers E, Courtens W Huyse T, Lacroix G, Larmuseau MHD, Maes G, Provoost P, Rabaut M, Remerie T, Savina M, Soetaert K , Stienen EWM, Verstraete H, Volckaert F, Vincx M. ***Understanding benthic, pelagic and airborne ecosystem interactions in shallow coastal seas “WESTBANKS”*** Final Report Summary Brussels : Belgian Science Policy 2009 – 4 p. (Research Programme Science for a Sustainable Development).

Within the WestBanks project, we investigate interactions between sediment, water and air at the species and population level in the Western Coastal Banks area of the Belgian Part of the North Sea. This area was chosen because of its ecological importance for macrobenthos, fish and seabirds, which is reflected in its protection status by the Habitat and Bird Directive. We collect ecological data that should support a sound sustainable management of the area of the Western Coastal Banks.

Our results reflected the importance of functional identity and densities of macrobenthic organisms for ecosystem functioning. Three key species for the Western Coastal Banks area, belonging to three different functional groups (e.g. *Abra alba* – biodiffuser, *Lanice conchilega* – piston pumper and *Nephtys* sp. – gallery diffuser) were incubated at different density levels (natural, lower and very low) in lab experiments, where bioturbation and ecosystem processes were measured. Benthic respiration, a proxy for mineralisation and hence ecosystem functioning was related to temperature, food availability, species identity and densities. Hence, a decline in species densities due to human disturbance will most probably result in a lowered level of ecosystem functioning. Each species has a different impact on the ecosystem functioning and hence a decrease of one functional group will not be counteracted for by another functional group.

Lanice conchilega is shown to be a very important benthic organism in the area of the Western Coastal Banks since its presence in ambient densities doubled the nitrogen mineralisation rates compared to situations where it is absent. Moreover, our results showed that *L. conchilega*-patches classify as biogenic reefs in the framework of the Habitat Directive. The presence of *L. conchilega* in increased densities is linked with an increased diversity and densities of other macrobenthic organisms. We further showed that *L. conchilega* and its associated fauna are vulnerable to beam trawling activities.

The molecular analyses of dispersal dynamics revealed that the distribution of *L. conchilega* results from large-scale dispersal events in the North Sea and local dispersal off Brittany. Similar research on sole (*Solea solea*) resulted in the development of markers discriminating between the temporal and the spatial scale. This made it possible to detect an exchange of populations throughout the year on the BPNS. This observation is new, and more samples will be processed in the second phase of WestBanks to validate this result.

The modeling of the larval transport revealed that passive transport of larvae is influenced by local circumstances (e.g. passive transport is not the same at different places on the BPNS). Active vertical movements of larvae in the water column decrease the transport and horizontal dispersion of larvae as well, but again the effect of the active movements on the dispersion is site specific. This result in a low connectivity between the areas considered which might be the explanation for the presence of subpopulations of sole in the Eastern Channel and the southern North Sea.

In order to assess the health of the pelagic ecosystem, we investigate whether marine top-predators (seabirds) can be used as indicators. In order to do so, there is a need to increase the knowledge of the links between these seabirds and their prey: pelagic fish. Therefore, pelagic fish was sampled in the Westdiep and the Wenduinebank, which are two key locations for seabirds. Both locations harboured different pelagic fish communities and energetically more favourable fish were encountered in the Westdiep. However, during the breeding season there was a higher availability of potential prey near the Wenduinebank. Research on foraging activities of terns revealed that the Wenduinebank is indeed a very important feeding ground for breeding terns. Both adult Common Terns and chicks feed on clupeid fish while adults also feed on polychaete worms (Nereidae). These nereids were also encountered in the faeces of Sandwich Tern suggesting the presence of this worm in the pelagic realm during restricted periods of the year. Adult Sandwich Terns feed on Ammodytidae, while Sandwich Tern chicks depend on the presence of suitable Clupeidae. Hence, changes in availability of clupeid fish of suitable size leads to a decrease in chick survival of both tern species. Prey length distribution may thus be a good candidate to serve as indicator for the health of the pelagic ecosystem.