Interreg Synthesis report - Executive summary

ENGLISH

The undesirable accumulation of nutrients (eutrophication) remains a problematic issue in many European coastal waters, although measures taken in recent decades have already led to a decrease in nutrient river loads and coastal nutrient concentrations and thus to a reduction of impacts on coastal ecosystems such as the Wadden Sea UNESCO World Heritage Site.

Currently, phytoplankton biomass (measured as chlorophyll) serves as a key indicator of the extent of eutrophication. Since the previous assessment of phytoplankton in the German-Dutch coastal waters in the course of the Water Framework Directive (WFD) resulted in conflicting results, this Dutch/German Interreg research project was started to contribute to a more comprehensive understanding of the Wadden Sea ecosystem and a harmonized assessment of phytoplankton.

This project took an innovative perspective by adopting a multi-causal research approach and considered different parameters affecting phytoplankton and eutrophication in a transboundary analysis of long-term monitoring data and by ecosystem modelling. The latest scientific findings and results of the monitoring data analyses were combined and incorporated in the different ecosystem models to achieve the most realistic representation of the Wadden Sea system.

Data analyses and modelling results show that there are no major differences in chlorophyll concentrations between the German and Dutch Wadden Sea. The difference in levels of chlorophyll thresholds currently in place in Germany and the Netherlands are not supported by our scientific understanding of the natural conditions in the Wadden Sea. Further modelling results show that the required nitrogen reductions in the rivers to achieve the river management objective of annual mean total nitrogen concentrations of 2.8 mg/l at the limnic/marine border may not be enough to achieve good ecological status for phytoplankton in the water bodies of the Wadden Sea. Model results and data analyses indicate that chlorophyll does not react linearly to nitrogen reductions and that nitrogen is not the sole factor determining phytoplankton biomass in the coastal waters of the Wadden Sea.

Two ecosystem models were used to simulate pre-eutrophic, historic reference conditions as a basis to derive thresholds for the assessment of chlorophyll in the Wadden Sea. This approach (with more ecosystem models involved) was also used by OSPAR to derive harmonized chlorophyll thresholds for the eutrophication assessment for the Marine Strategy Framework Directive (MSFD) in the North-East Atlantic. The model results do not support the current differences in chlorophyll thresholds for the WFD Good/Moderate boundaries between the Netherlands and Germany. The thresholds calculated from this pre-eutrophic references, are, in all water bodies, higher than the current WFD thresholds. Differences in outcomes between the models reflect uncertainty in our understanding of the highly dynamic Wadden Sea system and hamper our ability to define accurate chlorophyll thresholds for the status assessment of phytoplankton.

The various analyses of the German and Dutch long-term plankton data have led to the new insight that the visible changes in the phytoplankton community are not exclusively based on changes in the eutrophication situation in the Wadden Sea, but also reflect a continuous, natural shift towards new communities. Changes in individual plankton parameters are very closely related to changes in environmental conditions, but since environmental conditions are in a constant state of flux (changes in nutrient levels, climate change), it is difficult to describe and assess a reference status for phytoplankton. The lack of a stable status quo therefore makes it difficult to set thresholds for different plankton parameters to assess its ecological status. However, parameters that describe community dynamics (such as multivariate biodiversity indicators) can be used to reveal trends in phytoplankton composition and evaluate the influence of environmental factors. These should be

taken into account in an extended and holistic approach to phytoplankton assessment within the WFD.

One of the main goals of this project was to develop an alternative assessment approach for phytoplankton in the Wadden Sea. During the course of the project, this turned out to be a complex task where we managed to address some basic principles. Nevertheless, this project provides an fundamental basis for a scientifically based system understanding of the Wadden Sea. The outcomes of this project contribute important findings to current assessment procedures on phytoplankton and eutrophication and are a good starting point for further discussions and developments at scientific and policy levels in the context of the WFD, MSFD and with regard to future work within OSPAR. Moreover, his project has strengthened the cooperation and exchange between the German and Dutch authorities and research institutions and promoted a common understanding of the cross-border issue of eutrophication in the Wadden Sea ecosystem.