

# MONITORING OF ENVIRONMENTAL IMPACTS IN WORLDWIDE BEACH NOURISHMENT PRACTICE

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The growing pressure on the coastal ecosystem, e.g. through fisheries, tourism or maritime traffic demands the careful balancing of activities and developments in the coastal zone. Strategies and planning tools like Integrated Coastal Zone Management (UNEP/MAP/PAP, 2008) or the ecosystem approach (which is planned to be implemented in the EU through the Marine Strategy Framework Directive, European Commission, 2008) aim at a holistic, environmentally friendly and sustainable development of the world's coastlines. Especially in view of rising sea levels, coastal protection becomes crucial for many densely populated coastlines. For the past few decades beach nourishments have been carried out in many coastal regions as "environmentally friendly" alternative to hard coastal protection structures, such as groins, revetments or breakwaters (Hamm et al, 2002). However, the extraction, transport and deposition of sediment can have (long-term) impacts on the environment, which are often not completely understood. Subsequently, these impacts cannot be fully taken into account in national and local nourishment practice, leading to an insufficient implementation of the ecosystem approach.

Worldwide, there are several differences in beach nourishment practice, e.g. regarding motivation, strategies and environmental monitoring. The usual motivation for beach nourishment activities is the prevention or mitigation of coastal erosion, yet in some regions tourism and beach amenity are among the main goals. Strategies vary from detailed national coastal management plans to small-scale nourishments which are carried out by local authorities or even individual landowners as one-off activities, e.g. compensating beach erosion after a storm surge. In some countries beach nourishment projects (i.e. both the offshore extraction of marine sand and deposition on the shore) require a permission of the responsible environmental authorities, which is based on careful evaluation of expected impacts and alternatives. However, these environmental impact assessments (EIA) differ in extent and quality and are not capable of stopping the project or impeding the environmental impacts, which has often been criticized. A study analyzing the EIA procedures of nourishment activities in the USA has found significant flaws in methodology or interpretation of results in many EIA reports (Peterson, Bishop, 2005). In addition, small-

scale remedial nourishment activities are often conducted without detailed documentation and environmental impact assessments (e.g. Moses, Williams, 2008; Cooke et al., 2012).

Regular beach nourishment activities, usually conducted with fill material slightly coarser than the original sand, imply long-term changes of local sediment characteristics, hydro- and morphodynamics as well as benthic communities (Peterson, Bishop, 2005), which also affect the species feeding on benthic organisms. In most cases except for a few large-scale pilot projects, monitoring of such long-term changes is left to academic studies alone - however, the scientific state-of-the-art methods and results only slowly find their way into practice. No unified nourishment practice exists and in many areas the environmental impacts are mostly unknown because they are not monitored on a broad spatial and temporal scale (Peterson, Bishop, 2005).

The goal of this study is a comprehensive comparison of the current shore nourishment practice in Germany, Denmark, the Netherlands, Belgium, Spain, England and Wales, the USA and Australia. Emphasis will be laid on the consideration and monitoring of environmental impacts during planning, construction and maintenance. The results of the study present a first step towards a recommendation for shore nourishment practice which complies with the ecosystem approach to coastal management.

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