

Sandy coastline ecosystem management – Bridging sustainability and productivity of sandy beaches

Marcin Filip Jędrzejczak

Academy of Ecology and Management
Wawelska 14, Warsaw, Poland
E-mail: humbak@praeter.pl

Abstract

Scientists, resource managers and medical experts today widely accept the idea that human society is dependent upon a healthy environment and that continued environmental degradation threatens the quality of life (Bickham *et al.*, 2000). Although direct links between ecological effects and human health have proven difficult to establish, the use of wildlife species as sentinels of environmental problems is the conceptual basis for this connection (Colborn, 1994). Furthermore, considering the principles of sustainable management of marine and coastal areas, defined in the Rio conference of 1992 (Chapter 17, Agenda XXI), the topic of sustainable management has acquired a fundamental role in the country policies all over the world, and must be faced at an international and multidisciplinary level. The intervention through management plans and the use of supporting tools in decision-making acquires particular importance for relatively fragile ecosystems such as sandy beaches.

Keywords: Sustainability and productivity of sandy beaches; Sandy shoreline ecosystem health and stability; Human impact; Integrated Coastal Zone Management; Integrated assessment.

Recommendations

Exposed sandy beaches are highly hydrodynamic. These ecosystems usually present low biodiversity and high specialization, due to the regime of permanent abiotic changes that governs their functioning. The tiny number of species, however, hide high biomass and production rates along all the trophic web, and the surf zone has been recognized as a nursery for many marine fish species (Brown and McLachlan, 1990). The biodiversity of, and the impact of tourism on, sandy beach biodiversity is a subject currently generating great scientific interest in Europe. It is the key topic of the international research programme "Sandy", which involves scientists from 12 European countries and has recently been funded by the European Commission (e.g. MECO, MEDCORE, COSA, BaltCoast/IKZM-Oder). Part of this concern is expressed in initiatives like the SCOR Working Group 114 on permeable sediments (SCOR, 1998; <http://www.scor-wg114.de>). The Importance of Critical Transition Zones (including sandy beaches) was the focus of the SCOPE meeting (Levin *et al.*, 2001). To meet the challenge of progressing Integrated Coastal Zone Management (ICZM) and governance, baseline

interdisciplinary research is required (Emeis *et al.*, 2001). The importance of those ecosystems for the countries in different regions (*e.g.* Europe, South America, South Africa, Australia) has been pointed out in the workshop “Beaches: what future?” (Florence, 2001; Proceedings in Scapini *et al.*, 2003). This focused on adaptation of communities and populations along the world’s coasts and it highlighted the need of common protocols and frequent exchanges between the partners of the research network on beaches (Scapini, 2002). It set out to fill important gaps in our knowledge concerning sandy beach biodiversity in Europe, and to link beach biodiversity to tourist impacts, using both a descriptive and an experimental approach.

ESF Marine Board (2002) recommends integrated marine science to be needed to describe the polyfunctional properties, carrying capacities and limits of marine ecosystems. Integrated coastal zone and ocean governance policies and management are also needed to properly evaluate and sustainably extract the marine environment’s multitude of benefits for society creative fusion of marine science and environmental economics sets a new generic knowledge-based framework for delivering the practical policies, investment strategies and management actions needed for sustainable use of marine and coastal resources. The studies, proposed to be financed, should intend to confront a problem of fundamental importance in the environmental field of study, as the evaluation of the quality of the coastal environment, and its sustainable management is surpassing the local level to consider its general value. The beach ecosystem, in fact, has a strong relationship with the sea, which permits a communication between different beaches, over natural and political boundaries: the quality assessment has to be built under this global point of view, with a strong attention on the repercussions on local sustainable development. A number of levels and subject areas should be shown as related to each other in the ICZM projects.

Currently, some authors believe that studies – based on functional analysis of ecosystems – are better tools for scientific research and conservation purposes (Walker, 1992), considering functional diversity as a fundamental concept to be added to the traditional levels of biodiversity (genetic diversity, specific diversity, ecosystem diversity; Setälä *et al.*, 1998). This concept is particularly suitable to low biodiversity beaches, which are important as transition environments. The functional approach to the study of the ecosystem leads to an understanding of relationships between biotic and abiotic components, allowing the identification of matter fluxes and energetic relationships that govern the development and the functionality of the system. The same approach also permits one to follow the organisms’ adaptation and their role in fluxes control. Besides the functional analysis applied to the beach system represents an instrument for coastal management, providing useful information on ecosystem health to identify eligible interventions.

References

- Bickham J.W., S. Sandhu, P.D.N. Hebert, L. Chikki and R. Athwal. 2000. Effect of chemical contaminants on genetic diversity in natural populations: implications for biomonitoring and ecotoxicology. *Mut. Res.* 463:33-51.

- Brown A.C. and A. McLachlan. 1990. Ecology of sandy shores. Elsevier. Amsterdam – Oxford – New York – Tokyo. 328p. ISBN 0-444-88661-3
- Colborn T. 1994. The wildlife/human connection: modernizing risk decisions. Environ. Health Persp. 102:55-59.
- Emeis K.Ch., J.R. Benoit, L.A. Deegan, A.J. Gilbert, V. Lee, J.M. McGlade, M. Meybeck, S.B. Olsen and B. von Bodungen. 2001. p.341-364. In: Group report: Unifying concepts for integrated coastal Management. Science and Integrated Coastal Management. Dahlem University Press.
- ESF Marine Board. 2002. Integrating marine science in Europe. European Science Foundation Marine Board Position Paper 5. 148p.
- Levin L.A., D.F. Boesch, A. Covich, C. Dahm, Ch. Erséus, K.C. Ewel, R.T. Kneib, A. Moldenke, M.A. Palmer, P. Snelgrove, D. Strayer and J.M. Węsławski. 2001. The function of marine critical transition zones and the importance of sediment biodiversity. Ecosystems 4:430-451.
- Scapini F. (Ed.). 2002. Baseline research for the integrated sustainable management of Mediterranean sensitive coastal ecosystems. A manual for coastal managers, scientists and all those studying coastal processes and management in the Mediterranean. Istituto Agronomico per l'Oltremare. 223p.
- Scapini F., J.C. Marques, A. McLachlan and E. Naylor (Eds). 2003. Beaches – what future? An integrated approach to the ecology of sand beaches. Proceedings of the international workshop held in Florence, Italy, 18–23 October 2001 – Supplementary Issue of Estuarine, Coastal and Shelf Sciences 58S:218p.
- Setälä H., J. Laakso, J. Mikola and V. Huhta. 1998. Functional diversity of decomposer organisms in relation to primary production. Appl. Soil Ecol. 9:25-31.
- Walker B.H. 1992. Biodiversity and ecological redundancy. Biol. Conserv. 6:18-23.