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Research paper

Marine ecosystem services in urban areas: Do the strategic documents of Polish coastal municipalities reflect their importance?

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HIGHLIGHTS

- The ecosystem services approach helps to create ecologically sustainable urban areas.
- The documents we analyzed do not mention marine ecosystem services (MES) directly.
- However, the indirect inclusion of MES may facilitate their future use in planning.
- MES were considered mainly in the context of tourism, port industry and fishing.
- Better awareness of MES may minimize the 'environment or development' dilemma.

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ABSTRACT

Marine ecosystem services (MES) condition the development of coastal urban areas, but their benefits are often taken for granted. The purpose of this study is to test how MES are perceived in the practice of urban planning and long-term management. We searched for MES recognition in 63 strategic documents of the 10 largest Polish seaside towns and cities. The criteria we used in analyzing the documents included (i) the character of references to local seaside conditions, (ii) the priority of local development objectives related to the sea, (iii) references to marine ecosystem services and disservices, (iv) references to trade-offs between ecosystem services, and (v) postulates for environmental protection. Our analysis reveals that MES are acknowledged, but their recognition is partial and limited to the services which are already captured by market mechanisms. Limited identification of MES leads to insufficient discussion of current and future trade-offs, even though the 'environment or development' dilemma is commonly emphasized. Low levels of inclusion of MES in the strategic documents of Polish municipalities may be caused by (i) low environmental awareness, (ii) underdeveloped institutions, and (iii) poor implementation of sustainable development principles.

1. Introduction

The sea has played a significant role in the development of cities (Fujita & Mori, 1996; Konvitz, 1978) and modern urban civilization in general. In the early 2000s, about 12% of world population lived in cities located in coastal zones (McGranahan et al., 2005). The share of urban population in coastal zones was 65%, with cities covering over 10% of coastal land area (McGranahan et al., 2005). At the same time, about 3 billion people lived within 200 km of a coastline, a figure that is expected to double by 2025 (Creel, 2003). As a result, coastal areas are heavily affected by urban development, a problem that is even more severe because of the high vulnerability of coastal ecosystems, such as wetlands, dune systems and coral reefs (Adger, Hughes, Folke, Carpenter, & Rockström, 2005; Folke, Hammer, & Jansson, 1991; McGranahan et al., 2005; SEPA, 2009). And yet, with the recent surge of interest in ecosystem services (Fisher, Turner, & Morling, 2009), two observations pertaining to the relevant international literature are striking:

1. urban ecosystem services have rarely been discussed with reference to the sea (e.g., there were almost no references to the sea in the following prominent publications on urban ecosystem services: Bolund and Hunhammar (1999); McGranahan et al. (2005) in the Millennium Ecosystem Assessment (MEA); Robrecht et al.

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(2010) in The Economics of Ecosystems and Biodiversity (TEEB)); and
2. marine ecosystem services have rarely been discussed with reference to cities (the authors who focused on marine ecosystem services, such as Peterson and Lubchenco (1997) and Beaumont et al. (2007), neglected the urban context).

The objective of this article is to examine how marine ecosystem services are perceived in the practice of urban planning. We searched for references to marine ecosystem services in the strategic documents of ten Polish seaside towns and cities. We investigated whether they acknowledged the importance of the sea and consequently, at least to some extent, of marine ecosystem services. In Poland the concept of ecosystem services has only recently appeared outside of scientific discourse and thus we can see how benefits provided by ecosystems have been understood before this concept gains popularity. This provides an opportunity to study some common, non-academic understanding of the importance of the environment, conversely to a situation in some other countries where an inclusion of ecosystem services into strategic documents is more likely to be motivated by the popularity of this concept as a catchword.

Before we move to a detailed description of our study in Sections 2 and 3, we first identify ecosystem services generated by the marine environment in the urban context. Finally, in Section 4, we also investigate the potential of using the marine ecosystem services concept for urban planning and management.

Combining the above two strands of literature (marine and urban ecosystem services), we can identify a broad diversity of marine ecosystem services that are generated and used within urban borders (Table 1). As a foundation, we follow the standard classification put forward in the MEA (Hassan, Scholes, & Ash, 2005) with its four categories of services: provisioning, regulating, supporting, and cultural. Others have provided modified classification schemes (e.g., Beaumont et al., 2007; Haines-Young & Potschin, 2010) and indeed different classification systems may be relevant to different policy and management needs (Fisher et al., 2009). Therefore, to obtain the broadest picture of how the sea is represented in strategic documents, we complement the classical four categories of ecosystem services with two other important aspects:

- risks (or disservices) that illustrate problems related to the sea (Adger et al., 2005); and
- benefits which are not associated with biological processes and thus are independent of the healthy functioning of ecosystems (abiotic benefits).

The former term *disservices* is used in the literature on ecosystem services (e.g., Lyytimäki, Petersen, Normander, & Bezak, 2008; Swinton, Lupi, Robertson, & Hamilton, 2007; Zhang, Ricketts, Kremen, Carney, & Swinton, 2007), being defined as those aspects of ecosystem functioning that negatively affect human activity, such as bringing about reduced productivity or increased production costs. In the case of coastal cities these disservices include storms, erosion, and salt wedge intrusions into groundwater. Furthermore, human-induced threats (e.g., algal blooms caused by nitrogen and phosphorus pollution or flooding resulting from sea level rise) are becoming increasingly important (Hallegatte et al., 2011; Nicholls, 1995). Indeed eutrophication is one of the most critical challenges in the management of the Baltic Sea marine ecosystem (Backer et al., 2010). As demonstrated by HELCOM thematic assessment on eutrophication (HELCOM, 2009), only 2 out of 17 open areas, and 11 out of 172 coastal areas were classified as not affected by eutrophication (HELCOM, 2009).

The concept of abiotic benefits points out to some problems in the classification of ecosystem services. The MEA definition of ecosystem services is most widely used, but it makes no distinction between biotic and abiotic processes and refers to all benefits that people obtain from ecosystems (Hassan et al., 2005). However, further discussions have narrowed ecosystem services down to ecological phenomena (Boyd & Banzhaf, 2007; Fisher et al., 2009). Even the MEA emphasized biological processes as reflected in its overarching preoccupation with the 'increasingly serious degradation [limiting] the capability of ecosystems to provide these services' (Hassan et al., 2005, p. 27). This can perhaps be considered as an assumption that only ecological processes can deliver ecosystem services. However, seaside locations provide a number of additional benefits that solely depend on a place (i.e., on the sea) and are clearly associated with the natural properties of this environment. But at the same time these benefits do not depend on the state of marine and coastal ecosystem (Węsławski et al., 2006). As long as the sea exists (regardless of its ecological quality), it can be used for transportation, construction, shipbuilding, offshore wind generation, etc. Indeed, to obtain these benefits, one may even need to alter or destroy a natural ecosystem, which clearly illustrates the problem of trade-offs between various benefits to be obtained from the environment. Interestingly, some authors have also included these benefits among ecosystem services (e.g., Atkins, Burdon, Elliott, & Gregory, 2011; Garpe, 2008), classifying them

Table 1
Marine ecosystem services in urban areas.

Category	Examples
Provisioning	Fishing and other sources of seafood
	Amber and other ornamental products (e.g., shells)
	Biotechnological and pharmaceutical use of marine resources (as an option)
Regulating	Microclimate regulation
	Marine aerosols (iodine)
	Cleaning the air
	Flood and storm prevention
	Sediment retention
Supporting	Resilience of ecosystems (ability to cope with natural and anthropogenic change)
	Maintenance of biodiversity
	Maintenance of habitats
	Supporting pollination with a sea breeze (Gassmann, Pérez, & Gardiol, 2002)
Cultural	Tourism and recreation (beach tourism, sunbathing, yachting, diving, wind- and kite-surfing, sport fishing, spa and wellness, birdwatching)
	Cognitive development (education and science, research material, ocean literacy for all ages, school excursions)
	Cultural inspiration (books, poetry, movies, music, inspiration for local products, paintings, postcards, jewellery)
	The legacy of the sea (folklore, traditional way of life, cultural identity, historic districts related to sea, museums, symbolism, city coats or arms)
	Aesthetic beauty (landscape)
	Tranquilizing effect (positive effects on individuals and reducing the city noise)
Abiotic	Wind, wave and tidal power
	Marine sediment extraction
	Desalinization of sea water for use in urban areas (as an option)
	Space for port industry and infrastructure
	Space for transportation (seaways)
	Development of residential areas (especially apartments and hotels)
Disservices (risks)	Flooding resulting from sea level rise
	Storms, tsunamis and hurricanes
	Transmission of marine-related infectious diseases
	Algal blooms
	Salt wedge intrusions into groundwater
	Erosion

Adapted from Adger et al. (2005), Beaumont et al. (2007), Garpe (2008), Gassmann, Pérez, and Gardiol (2002), Rönnbäck et al. (2007) and Węsławski et al. (2006).