Ocean & Coastal Management 119 (2016) 135–145

Contents lists available at ScienceDirect

Ocean & Coastal Management

journal homepage: www.elsevier.com/locate/ocecoaman

Stakeholders perceptions of local environmental changes as a tool for impact assessment in coastal zones

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ARTICLE INFO

Article history:
Received 19 March 2015
Received in revised form
1 July 2015
Accepted 10 October 2015
Available online xxx

Keywords:
Stakeholders' perceptions
Integrated coastal management
Araçá Bay
Environmental impact assessment

ABSTRACT

Through history, population growth and anthropic activities have pressed and affected marine environments, causing impacts that were not always studied or reported. In this context, evaluate stakeholders perceptions of a particular region in Coastal Zones (CZs) can be useful for identifying environmental impacts that occurred in the past, especially in the absence of preterit data and effective monitoring. Engaging stakeholders in the discussion of local transformations may also contribute to the development of shared local management strategies regarding the knowledge and opinions of stakeholders about the place they live in. Thus, considering Araçá Bay as a case of study, this research aimed to understand preterit and present transformations on the Bay, through the perception of the people who live and visit the region for a long period of time. Data collected with interviews enabled the identification of events and factors that have induced changes in the region, mainly related to large enterprises and buildings that occurred from the second half of the twentieth century. Major impacts perceived by interviewees were changes in spatial configuration of the Bay, changes in hydrodynamic and sedimentary patterns, reduction of coastal vegetation areas and increased pollution. Some of these changes were also pointed by scientific studies or observed in historic aerial photographs, and were no totally predicted by EIA of related enterprise. Considering the importance of communities' perception and its use to better understand historical facts, preterit and present impacts derived from local human interventions, it is concluded that they are an important qualitative database and can be useful for the development of management strategies and for EIA analysis.

1. Introduction

Coastal Zones (CZs) are dynamic regions, located in the transition between continents and oceans that occupy about 12% of the terrestrial surface (Crossland and Baird, 2005). These areas have high primary productivity and support wide variety of ecosystems, such as beaches, mangroves, salt marshes and coral reefs (Westmacott, 2001; Martins et al., 2012), which provide food, protection and habitat for numerous species (Bijlsma et al., 1995; Burke et al., 2001). In addition to their high ecological value, they also have great social and economic relevance (Martínez et al., 2007) and their goods and services generate fundamental benefits to human life (Turner et al., 1998; Burke et al., 2001; Crossland and Baird, 2005; Beaumont et al., 2008).

However, currently there are no marine areas untouched by human action and CZs are the regions of higher pressure (Halpern et al., 2008). The intensification and diversification of human uses on these spaces have induced changes on marine life, habitats and landscapes (Crossland and Baird, 2005; Cicin-Sain and Belfiore, 2005; Atkins et al., 2011; Martins et al., 2012.). These impacts, in turn, alter the ability of marine environments to sustain human "well-being" providing livelihood, leisure and recreation opportunities, support to navigation, and climate regulation (Halpern et al., 2012).

In this context, the frequent lack of planning in the processes of occupation and urbanization of coastal areas, especially in developing countries, may also generate or aggravate environmental problems (Ernandorena, 2003; Polette and Lins de Barros, 2012). Policies for management and planning of CZs must be able to promote conservation and sustainable development in an effective and balanced way, into the scope of integrated coastal management – ICM (Cicin-Sain and Knecht, 1998; Westmacott, 2001). Different

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http://dx.doi.org/10.1016/j.ocecoaman.2015.10.005
0964-5691/

interests of political, social, economic, cultural and conservationist orders should be considered in the processes for compatibilization of use and occupation of CZs (Polette and Silva, 2003). To integrate these multiple perspectives, the adoption of participatory management practices, with strong engagement of civil society, is considered essential (GESAMP, 1996; Edwards et al., 1997; Ellsworth et al., 1997; Christie, 2005; Sousa et al., 2013).

In the ICM process, instruments focused on planning and control of uses of marine space, such as Marine Spatial Planning - MSP (Ehler, 2003; Douvere, 2008) and the establishment of Marine Protected Areas – MPAs (Mangi and Austen, 2008; Abecasis et al., 2013), together with those focused on public planning and decision making, such as Environmental Impact Assessment - EIA (Saarikoski, 2000; Saidi, 2010; Sánchez and André, 2013) and Strategic Environmental Assessment - SAE (Fischer, 2003; Bidstrup and Hansen, 2014), have been highlighted. Considering the EIA framework, the first country to establish the legal basis for its implementation was the US, by the National Environmental Policy Act in 1969 (Ortolano and Shepherd, 1995; Fischer, 2003; Saidi, 2010). After the US, many countries followed this example (Ortolano and Shepherd, 1995; Saidi, 2010) including Brazil, which established EIA as an instrument of the National Environmental Policy in 1981 (Law No. 6938, 1981).

The main objective of the EIA is to provide information to public planning processes and decision-making considering projects (or enterprises) proposed to a specific region, its alternatives and environmental impacts caused by its implementation (Ortolano and Shepherd, 1995; Saidi, 2010). Although this instrument has been successfully implemented in several countries, there are failures, difficulties and limits related to its use. In many cases, the elaboration of EIA lacks of preterit data, time to support the necessary studies and effective monitoring programs (Ortolano and Shepherd, 1995; Oliveira and Bursztyn, 2001). Additionally, it is also unable to assess cumulative and synergistic impacts generated by different enterprises (Oliveira and Bursztyn, 2001; Teixeira, 2013). Beside these problems, public participation in EIA and the integration of EIA into the public planning process occurs belatedly, which hinders the proposition of alternatives for a given project and the consideration of opinions, perceptions and values from affected actors in this process (Ortolano and Shepherd, 1995; Oliveira and Bursztyn, 2001). In many cases, EIA works only as a formality of the licensing process and is used just to legitimize already taken decisions, or to pretend that the local population's claims will be considered through the public consultation process (Ortolano and Shepherd, 1995; Oliveira and Bursztyn, 2001).

In areas where scientific data about CZs are scarce, as in tropical and developing countries, the absence of environmental data becomes a particularly significant problem (Ruddle, 2000; Diegues, 2004). As Jung et al. (2011) highlight, in the absence of time series of quantitative data, which can support the evaluation of changes that have occurred in a particular region, the importance of qualitative information such as those from perceptions of local communities has increased attention as they allow at least a brief description of the environmental changes that have occurred. Understanding perceptions and opinions about the past, present and future state of coastal environments and its resources (GESAMP, 1996), in addition to local knowledge of actors who live in these regions (Webler et al., 1995), can be critical for the development of public policies and for the application of tools such as EIA, into the ICM processes. Moreover, it can reveal people's opinions and knowledge in a suitable way to democratic decision-making.

Conceptually, environmental perception can be understood as the awareness and the human understanding of the environment in a general way (Whyte, 1977). This wide definition allows to comprehend the perceptive process without establishing differences between sensations – which refers to kinetic and biochemical relationship among an individual and the world around him – and cognitions – which refers to mental process mediated by personal culture and knowledge (Whyte, 1977). Many authors have addressed the concept of environmental perception linked to environmental problems, changes and management approaches in coastal and marine areas. Some examples are: Tran et al. (2002), who investigated coastal changes as perceived by residents from Holbox Island (Mexico); Peterlin et al. (2005), who evaluated differences between the perceptions of workers from Port of Koper (Slovene) and the remaining local population, regarding sources of marine pollution, air pollution and noise generation; Friesinger and Bernatchez (2010), who analyzed people perceptions about coastal erosion, decrease of ice cover and increase of storms in the Gulf of St. Lawrence (Canada); and Jung et al. (2011), who observed changes in fish fauna since 1950s, analyzing the perceptions of fishermen and divers in Port Phillip Bay (Australia).

All these authors had success in accessing local stakeholders' perceptions and translating it to valuable and useful information for coastal conservation and management. In this work, we aimed to reinforce this usefulness in ICM, in a specific case, applying it to provide preterit data to EIA process. For that, perceptions from local stakeholders who live near to and have been visiting the Araçá Bay (northeast coast of São Paulo State, Brazil) for a long period of time were used to obtain qualitative preterit data about local environmental changes and impacts related to enterprises that were implemented in Araçá Bay's vicinities. After data analysis, results of stakeholder's perceptions were compared to available documents that registered environmental impacts for the same area (e.g.: the first EIA made in the region in 1987, as part of the local port expansion). Through this approach, we expected to provide information both for impact assessment, coastal planning and management in a local scale.

2. Materials and methods

2.1. Study area

The Araçá Bay (Fig. 1) is a small bay which comprises an area of approximately 550,000 m^2 located next to the urban city center of São Sebastião, on the north coast of São Paulo State (Brazil). This area contains one of the last remnants of mangrove forests in the region, and support great environmental complexity and high biological diversity, where more than 700 species were identified up to 2010 (Amaral et al., 2010). Considering the ecological importance of the bay, its space was inserted into the Marine Protected Area of the Northern Coast of São Paulo State created in 2008. Despite being a spot of high ecological value and considered to be a “opencast” laboratory (Amaral et al., 2010), the bay suffered interventions and anthropogenic impacts that were intensified after the middle of the twentieth century (Cunha, 2003; Francisco and Carvalho, 2003). Although scientific research in the bay dates back to 1950, studies were limited to few sites and they were concentrated in specific areas of knowledge (Amaral et al., 2010). Thus, they do not support a broad understanding of the environmental status of Araçá Bay previously to human interventions; nor do they report the many environmental changes derived from such interventions and anthropogenic impacts.

2.1.1. Historical reconstruction: local events (buildings and enterprises) that had affected the Araçá Bay in the past years

The beginning of the occupation of the region, where is currently the city of São Sebastião, occurred during Brazil's colonization, in the mid-sixteenth century (Ressurreição, 2002).