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Pan-European management of coastal lagoons: A science-policy-stakeholder interface perspective

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ABSTRACT

The main objective of the work carried out in the scope of a three years collaborative research project was to develop science-based strategies and a decision support framework for the integrated management of coastal lagoons and their catchments and, in this context, to enhance connectivity between research and policymaking. In this paper our main objective is to share the lessons learned from the innovative methodology used throughout the project. To achieve the proposed objectives, the multi-disciplinary scientific knowledge in the project team was combined and integrated with the knowledge and views of local stakeholders of four selected European coastal lagoons, using a three step participatory approach. With this innovative approach, which included the usage of eco-hydrological and water quality-modelling tools, the team developed and analyzed integrated scenarios of possible economic development and environmental impacts in four European lagoons and their catchments. These scenarios were presented and discussed with stakeholders, giving rise to management recommendations for each case study lagoon. Results show that some management options might be transferrable to other European lagoons having similar climatic, geophysical and socio-economic settings. In management terms, the project output provides a set of policy guidelines derived from the different analyses conducted and proposes initiatives concerning management implementation in a local-regional-national-European setting.

1. Introduction

Human activities and well-being in coastal areas, including coastal lagoons, are possible through the natural capital of the area, including the variety of ecosystem services and biodiversity. Moreover, human well-being results from natural capital combined with social capital, which includes human capital (i.e. human education, skills, culture and knowledge) and built capital (e.g. infrastructures, tools and other artifacts) (Constanza et al., 2014). The human well-being and the economic viability of coastal lagoons depend therefore on the preservation of their bio-physical characteristics, natural resources, biodiversity, land-sea interaction processes, landscape and cultural heritage (e.g. Newton et al., 2014; Constanza et al., 2014; Cataudella et al., 2015). In addition, coastal lagoons constitute important buffering zones between catchment area and sea/ocean with respect to water quantity and quality (e.g. Miththapala, 2013; Umgiesser et al., 2015). Due to this, they are subject to multiple forms of stress and have to cope with the variability of water inflow and nutrient loads from drainage areas, extreme weather events in the lagoon, and influence from open marine waters, all of which affect the ecological and environmental status (e.g. Kennish and Paerl, 2010; Lillebø et al., 2011; Umgiesser et al., 2015). This complexity implies that the management of these systems involves a wide variety of institutions and administrative units, and should be based on knowledge produced by a range of scientific disciplines, combined with the active participation of

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stakeholders dealing with the lagoon (Gooch and Lillebø, 2015).

The main objective of this three years collaborative research project was to develop science-based strategies and a decision support framework for the integrated management of coastal lagoons and their catchments (Lillebø and Stålnacke, 2015). This paper will showcase some of the main lessons learnt from this applied innovative methodology. The main policy field considered is the EU Water Framework Directive (2000/60/EC) and the activities related to its implementation in the Member States and in candidate countries. In this context, transboundary lagoons form a special case in which national legislation and international conventions meet each other within specific institutional contexts (Bielecka and Różyński, 2014).

2. Material and methods

2.1. Case study lagoons

Four case study lagoons were selected to reflect a wide and balanced geographical distribution of coastal lagoons in Europe. The selected lagoons were: Vistula Lagoon (Baltic Sea), located in the South Baltic, being separated from the Gulf of Gdansk by the Vistula Spit; Ria de Aveiro (Atlantic Ocean), a shallow mesotidal lagoon located on the north-west coast of Portugal; Tyligulskyi Liman (Black Sea), one of the largest, longest and deepest lagoons located between the Dnieper and Danube rivers in the Ukrainian part of the north-west coast of the Black Sea; and Mar Menor (Mediterranean Sea), a hypersaline lagoon located in a semi-arid region of south-east Spain, and one of the largest coastal lagoons in the Mediterranean. Further and more detailed information about the physiographic description and management of the lagoons is published in the book edited by Lillebø and co-workers (Lillebø et al., 2015), whilst a summary of each lagoon characteristics is presented in Table 1.

2.2. Stakeholders engagement and scenario building

A three stage participatory process was used to provide stakeholders with an opportunity to provide their input into the process of creating possible scenarios for the future development and management of their lagoons (Baggett and Gooch, 2015). The stakeholders participatory process consisted of three consecutive forms of engagement and deliberation: Focus Groups (FGs), Citizens Juries (CJs) and Final Workshops. In each case study lagoon, the FGs were carried out from spring to autumn 2012, the CJs in spring/summer 2013 and the final workshops in spring/summer 2014. The entire process was preceded by a preliminary stakeholder and social group mapping in order to identify the key stakeholder groups in each case study lagoon. All participants signed a written informed consent, authorizing the use of the results from each participatory process. As the same methodology had to be carried out in parallel in each lagoon and in local languages, case study team members (mostly from natural sciences) attended specific 'role-play training' organised by the members of the research group with the relevant skills before each step of stakeholder engagement.

The FGs approach was used to initiate the communication with small groups of stakeholders and to obtain knowledge of their experiences, opinions, wishes and concerns. FGs facilitated the identification of the main features of each lagoon, namely the driving forces, and the stakeholders concerns and expectations. The FGs also helped to identify the stakeholders' suggested responses to mitigate those concerns. The FGs meetings also included maps for spatial visualization of the results within each case study lagoon. Participants were invited to indicate on the maps the areas in which they felt that there were positive aspects (green stickers) and the areas of notable concern (red stickers). This information was also important for the modelling teams to later in the process spatially detail the models for scenario simulations. The results of the FGs also identified the main fields of expertise that needed to be addressed and represented during the CJs, the following step in the participatory process. The CJs methodology follows a similar format to that used in criminal courts in the UK or the US, with the major and significant difference that the aim of the CJs is to produce informed opinions and recommendations, not to decide whether a part is guilty or not. In each case study lagoon, 12–24 randomly chosen citizens were invited to hear the evidence presented by a number of invited expert witnesses on each of the major drivers previously identified. They were then asked to deliberate on their visions for their own case study lagoon in the year 2030. During the process the citizens were also invited to ask questions to the experts in order to clarify any unclear issues before presenting their recommendations and common vision for the period around 2030. Based on the analysis of FGs and CJs outputs (Sousa et al., 2013; Bielecka and Różyński, 2014), on modelling of present reference condition, and on existing Eurostat data, four different socio-economic scenarios for each lagoon were formulated for the period around 2030. The qualitative storylines produced by the stakeholders were organised into a matrix of four different possible futures, following the combinations of high or low economic development, and high or low environmental quality (Fig. 1). These were used to produce the following possible scenarios for the period around 2030: i) Business as Usual (BAU) – development based on known changes and past trends; ii) Managed Horizons (MH) – to provide tangible human benefits in a sustainable way; iii) Set Aside (SET) – may provide indirect economic and environmental benefits; iv) Crisis (CRI) – negative impact on the well-being and livelihoods. The development of qualitative scenarios followed the methodology outlined by Gooch et al. (2010), and these scenarios were used as inputs for catchments and lagoons modelling and impact assessment (Hesse et al., 2015a; Bielecka et al., 2015). The results of impact assessment were presented to the stakeholders at the final workshops and discussed with them. Each scenario was presented at these final meetings in the form of posters containing the possible future scenarios resulting from the developed and quantified storylines (e.g. population and tourism growth; land use, water management, lagoon management) and the projected climate for the considered period. The results presented at the final meetings also included the outputs from the models (see detailed information on the models in the next section), presented as graphs and/or maps, regarding water quality and quantity. The assumptions that could not be modelled (e.g. trends for invasive species, trends for fishing activities) were presented as qualitative information in maps or illustrations.

All workshops were conducted in local languages, and the results were stakeholder recommendations as to how to achieve the most desirable aspects and proposed recommendation and how to avoid the most undesirable aspects for each case study lagoon for the period around 2030. Fig. 2 illustrates the steps taken under the social and natural sciences perspectives, and their interactions to reach the integrated recommendations.

2.3. Catchment to coast and lagoons modelling

The eco-hydrological model SWIM (Soil and Water Integrated Model, Krysanova et al., 2000) was used for modelling the catchment areas of four selected European lagoons. Results from the catchment modelling were coupled to the lagoons models in order to assess the lagoons' responses to climate and land sea processes (e.g. land use, water quality and availability). For the modelling of

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