



Is the governance of the Thau coastal lagoon ready to face climate change impacts?



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ABSTRACT

The present paper provides a reflection on threats to integrated management of the Thau coastal lagoon due to climate change and the multi-scalar water scarcity adaptation strategy. This study proposes first to depict the Thau water governance assessed through a water use and social network analysis and its capacity to manage water quality. Next, this paper provides a downscaled study on the climate change impacts on the hydrological budget of the entire Thau catchment in 2041–2070 compared with the 1971–2000 reference period, a methodology developed during the CLIMB EU research program. Following local climate change impacts, the importation of a new water resource to secure water uses is presented in regards to the capacity of local water governance to maintain coherence between integrated land planning and integrated water management planning based on water quality issues of the Thau coastal lagoon. The study underlines that although the water uses are currently secured thanks to the regional transfer of water, they are not coherent with local water management and create new vulnerabilities in the context of climate change. Moreover, the regional decision to end financial support for the more efficient, existing network for the water quality survey of regional coastal lagoons breaks up the local water governance. This paper demonstrates why keeping this network would have been absolutely necessary for encouraging a governance capable of proposing sustainable solutions to water quality challenges induced by climate change.

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1. Introduction

According to the IPCC climate model projections, Mediterranean countries are at high risk for pronounced susceptibility to changes in temperature in the hydrological budget and in the occurrence and magnitude of extreme conditions (IPCC, 2007; Giorgi and Lionello, 2008). Moreover, the increase in temperature of marine waters and its interaction with acidification may induce an amplification of eutrophication and hypoxia (Bijma et al., 2013).

It can be foreseen that the changes in the hydrologic cycle will

give rise to an increasing potential for conflicts (Ludwig et al., 2011), or at least rivalries (Bressers and Kuks, 2004; Aubin, 2008; La Jeunesse et al., 2013), and possible tensions among the political and economic actors. To provide expertise and adaptation strategies, multidisciplinary research is needed to tackle the multi-facet complexity of climate change impacts on water resources (Quevauviller et al., 2012) a fortiori in the Mediterranean (Santos et al., 2014). In this context, the cluster of three EU projects CLI-WASEC is tackling the ‘climate change – water – security’ nexus. One of those, the CLIMB project, is focusing on inter-linkages and interdisciplinary analyses around the quantification of uncertainties in climate change impact and risk assessment (Ludwig et al., 2010).

Several empirical and simulation studies support the idea of increased eutrophication with climate change which contradict the expectations of reductions in nutrient loading from catchments in

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drier climates and greater stability of the water column in warmer climates (IPCC, 2007). Because of the already high anthropogenic pressures coming from both coastal and continental areas, transitional waters and a fortiori coastal lagoons, as semi-enclosed ponds, are the ecosystems particularly exposed to the impacts of climate change.

Following this list of impacts, effective adaptation measures require multi-disciplinary preparation and efficient water governance (Ostrom, 1990). “Governance refers to all processes of governing [...], it focuses not only on the State and its institutions but also the creation of rule and order in social practices” (Bevir, 2013). Thus, governance is a mix of procedures (hierarchical, networked, or market-oriented) which involves public and private stakeholders in the management of an issue of public interest. The focus here is on the local networks of public and private water users and managers and the ways these stakeholders manage water-related issues and problems. In particular, transitional waters at the confluence of continental and marine issues are complex ecosystems with important anthropogenic pressures sometimes exacerbated by inappropriate management in diverse chains of cause–effect relationships (Newton et al., 2014).

The European Union started to define rules for Integrated Coastal Zone Management (ICZM, Cicin-Sain and Knecht, 1998) first through the Water Framework Directive (WFD), which covers the transitional and coastal waters up to 1 nautical mile from the continental baseline. The ICZM has been completed for marine waters by a marine policy initiated in 2008 with its environmental part represented by the Marine Strategy Framework Directive (Borja et al., 2010, 2013; Elliott, 2013).

Nationally, France has a history of using coastal spatial planning instruments with a regulation tool called ‘Schéma de Mise en Valeur de la Mer’ (SMVM). The key features of this marine spatial planning process was based on the cooperation of multiple partners including a development phase in which elected officials and all stakeholders (sector representatives and experts) are involved, with final approval by State representatives.

Thau has also been a leader in France for ICZM planning with the first implemented SMVM in 1995 (Trouillet et al., 2011). In fact, the benefits of maintaining the water quality of the Thau lagoon have been evident since the ecological crisis of the 1970s, when 100% of the Thau lagoon waters suffered from an anoxic crisis due to eutrophication, which destroyed 100% of the shellfish farming stocks. To implement the WFD in transitional waters along the coastline and as stakeholder involvement in water management planning and public consultation has become mandatory for member states, the Languedoc-Roussillon (LR) region initiated in 2000 a new network to address eutrophication for coastal lagoons under the name Lagoon Monitoring Network (LMN). This network, with steering committee composed of five stakeholders of water and marine production management (the LR region, the water agency of the Rhône-Méditerranée-Corse basin, the DREAL as the state representative for environmental management, the Cepelmar as the regional institute created in 1981 for promoting marine production that drives the LMN, and Ifremer as the partner for scientific research expertise), launched two 6-year contracts. The objectives were to build a eutrophication monitoring program of the lagoons of the LR region to deliver an operational Decision Support System (DSS) to local stakeholders to support their decentralized management of the lagoons.

In the meantime, the creation through a bottom-up strategy of SAGE-Thau (Schéma d’Aménagement et de Gestion des Eaux as the Thau River Basin Management Plan), driven by a local public body called the SMBT (Syndicat Mixte du Bassin de Thau), which acts on the behalf of the two largest intercommunalities of the Thau lagoon – CABT (Communauté d’Agglomération du Nord du Bassin de Thau)

and CCNBT (Communauté des Communes du Nord du Bassin de Thau), has permitted the development of an integrated management of water quality in the Thau lagoon.

In fact, it is now well known worldwide and even locally that a common knowledge base between stakeholders, expert and scientists is requisite for implementing more elaborate forms of participation (Loubier et al., 2005; Rinaudo and Garin, 2005). The water quality restoration of the Thau coastal lagoon is the result of twenty years of several multi-disciplinary investigation programs alternately conducted by scientists and the local public bodies (e.g., OxyThau, EcoThau, PNEC, Omega-Thau, SPICOSA and so forth). DSS tools provided by the synthesis of these programs are currently used by the SMBT to produce indicators of water quality vulnerability (Mongruel et al., 2013). Some DSSs on lagoon water quality are provided, such as the one related to eutrophication, O’GAME-LAG, or others related more to microbial contamination such as VigiThau. In parallel, other tools under development propose to model how local territories, such as the Thau coastal lagoon, have promoted endogenous development based on Socio-Technical Information and Communication Arrangements at the scale of inter-municipal authorities to support mediation between heterogeneous actors which drives territorial intelligence (Bertacchini et al., 2013; Maurel et al., 2014; Plant et al., 2014).

Furthermore, the Thau coastal lagoon has kept its ‘status’ as a pilot site for ICZM through its nomination by the DATAR (Délégation interministérielle à l’Aménagement du Territoire et à l’Attractivité Régionale) interministerial delegation as a pilot site for the implementation of community regulations for integrated coastal management strategies. Thus, in April 2013, an Integrated Management Contract (IMC) was signed for the Thau territory for the period 2012–2017. Its main objective was to provide coordination of all the management tools implemented in the territory including the preservation of Thau coastal lagoon water quality as the support of marine production.

Therefore, this paper aims to provide a reflection on climate-induced threats to integrated management of the Thau coastal lagoon and the multi-scalar adaptation strategy. It proposes first to depict the Thau water governance assessed through a water use and social network analysis and its capacity to manage water quality. Then, this paper provides a study of the downscaled climate change impacts on the hydrological budget of the entire Thau catchment in 2041–2070 compared with the 1971–2000 reference period. Following local climate change impacts, the importation of new waters to secure water uses is presented in regards to the capacity of local water governance to maintain coherence between integrated land planning and integrated water management planning based on the water quality issues of the Thau coastal lagoon.

2. Material and methods

2.1. The Thau catchment – coastal lagoon hydrosystem

2.1.1. The coastal lagoon

The Thau lagoon is located in the LR region in the Hérault Department in the south of France. It is a 75 km² water body 19.5 km long and 4.5 km wide with a mean depth of 4 m and a high variability of salinity. Approximately one fifth of the lagoon's area (1500 ha) is farmed for shellfish production, with shellfish farming occurring in three zones on the lagoon (Fig. 2). It is also used for fishing.

The lagoon is in connection with the Thau karstic system which is made of complex karstic networks of Jurassic limestone with several inland and submarine springs (Fig. 2). The latter plays an important economical role since it supplies water for fish breeding, for the spa in Balaruc-les-Bains, and most importantly, for local

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