Full text available here : http://rdcu.be/E9Su

Journal of Coastal Conservation
https://doi.org/10.1007/s11852-018-0592-2

Rapid losses of intertidal salt marshes due to global change in the Gironde estuary (France) and conservation implications for marshland passerines

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Received: 28 September 2017 / Revised: 4 January 2018 / Accepted: 7 January 2018
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Abstract
We analysed coastline movements between 2000 and 2016 along the 24.5 km of the mesohaline region of the North bank of the Gironde estuary (France). This sector is identified as hosting the largest expanse of salt marshes of the estuary and as an important breeding and stopover site for different marshland passerines of conservation concern. Our results from the study area reveal an average shore retreat of 14.74 ± 0.50 m over the period, corresponding to a loss of 49.96 ha of intertidal wetlands (i.e. 2.04 ha per kilometer of coastline) and reaching on average of more than 30 m for 42% of the coastline. This erosion dynamic, explained by a significant perturbation of the estuary's hydro-sedimentary dynamic (due to decreases in freshwater discharges and relative sea level rise) highlights the rapid disruption that can occur in estuarine eco-complexes in response to global change. Given the impacts that estuarine intertidal wetland losses have on carrying capacity for marshland passerines, experimental management approaches are being tested in the study area to compensate for losses already observed and to anticipate those expected. These approaches reveal in particular that partial reconnection of agricultural polders to tide influences with a regulation system for water ingress may allow interesting trade-off between maintaining polders with agricultural activities such as grazing and conservation plans for vegetation of intertidal salt marshes exploitable by marshland passerines.

Keywords Birds · Climate change · Coastal erosion · DSAS · Intertidal wetlands · Sea level rise

Introduction

Tidal wetlands are among the most productive ecosystems on Earth, contributing to the economic welfare of local and global communities (Costanza et al. 1997; Blankespoor et al. 2014). These ecosystems provide multiple services, including shoreline protection, storm buffering, sediment retention, water quality maintenance, as well as carbon sequestration or preservation of ecological niches exploited by several organisms (Woodward and Wui 2001). Among tidal wetlands, estuarine habitats particularly appear as highly biologically productive ecosystems (Kennish 2002; McLusky and Elliott 2004), sustaining a variety of valuable goods and services for human activities (Costanza et al. 1997). These habitats also fulfil important ecological functions for marine fish species, providing breeding grounds, nurseries or feeding areas (Beck et al. 2001), and play a key role for several species of waterbirds during different periods of their life cycle (Prater 1981; Baird et al. 1985; Yates et al. 1993; Watkinson et al. 2004). Salt marshes also provide interesting habitats for various marshland passerines, particularly for highly specialized species that exploit these habitats as breeding areas (Marshall and Reinert 1990; Musseau and Beslic 2018), stopover grounds (Musseau et al. 2014) or during particularly energy-demanding events such as moult (Musseau et al. 2017).

Increased pressures on ecosystems, habitat loss or degradation, and climate change are among the main factors impacting biodiversity in the current context of global change (Ehrlich 1988; Butchart et al. 2010; Pereira et al. 2010; Rands et al. 2010). Throughout the world, coastal ecosystem degradation is increasing at a worrying rate (Hinrichsen 1998) and 20–60% of the world's coastal wetlands are at risk of disappearing in the next 100 years (see Titus 1988; Nicholls et al. 2007; Craft et al. 2009). Among these coastal habitats, estuaries tend to be particularly

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