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# Why do we decide to live with risk at the coast?

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ABSTRACT

Coastal communities have been repeatedly threatened by the ephemeral character of the coast. Morphological changes derived from climate events and sea level oscillations forced the relocation of coastal communities over the past, but never prevented the occupation of this fragile source of wealth. Moreover, the socio-economic impact of high energy events is dramatically increasing due to the growing occupation of the coast, raising the need for rethinking the way disaster risk reduction measures are implemented to ensure effectiveness and acceptance.

To illustrate this conflict (occupation *versus* risk), we explore risk perception in a population located in a fragile segment of the southern coast of Portugal, Praia de Faro, in order to identify the factors shaping risk perception and to understand the reasons behind the occupation of risky coastal areas. The selected community consists of two different populations (a fishermen community and a tourism-related community) sharing the risk associated with storm impacts and coastal retreat. For that, we examine the socio-economic and environmental frameworks and run a set of in depth interviews to provide a frame for understanding the culture of risk in a system with multiple stakeholders and planned measures of relocation.

Interviews in Praia de Faro suggest that citizens using the beach as their first residence have voluntarily accepted to live with risk in the beach in exchange for a series of related benefits that they find to largely exceed expected personal damages. Risk perception analysis found that the community is aware about the hazards impacting the area, but they are not worried or prepared to face likely levels of risk derived from the impact of storms estimated by experts. Characteristics of risk perception seem shaped by place attachment, underestimation of impact probability and lessons learnt, and inherent cultural aspects. In addition, it seems clear that imposed measures of relocation are contributing to reduce residents risk perception in an attempt to ensure their permanence in the area in a frame of institutional distrust and absence of genuine communication. Alternative measures to relocation can only exist if responsibilities in risk mitigation are reconsidered and shared.



## 1. Introduction

Major parts of the world population concentrate at or near the coast, which is constantly shaped by changing water levels, storms, waves and currents. While nature adapts quite flexibly to such variations and changes, humans attempt to maintain their position. In doing so, tools and methods have been developed over centuries to fight against the sea and fix the coastline or even extend it seaward. However, historic and recent low-frequency, high-impact events (e.g. 1941 Windstorm in Western Europe, 1953 North Sea storm surge, 2005 Hurricane Katrina in the USA, 2010 Xynthia Storm in France, 2012 Superstorm Sandy in the USA or 2014 Winter Storm Hercules in Western Europe) have demonstrated the erosion and flood risks faced by exposed coastal areas. A good example of this was the very recent hybrid Superstorm Sandy impacting New York (Tollefson, 2013), showing how large flooding events pose a significant risk and may devastate and immobilize large cities at developed countries.

Risk can be defined as the product of the probability of a hazard and its consequences (Helm, 1996). Hazard probability is expected to increase in the North Atlantic mid-latitudes as a consequence of changing climate with more frequent and violent surge-driven floods (Francis and Vavrus, 2012), wind damage, erosion,

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overtopping and rain-driven flash floods (Emanuel, 2007; Quevauviller et al., 2012). The storm climate in Europe has undergone substantial spatial changes on a quasi-decadal timescale throughout the past 130 years (Matulla et al., 2008). A recent reanalysis suggests that storminess has increased over the past century in northern and north-western Europe (Donat et al., 2011). The latter has been related to unprecedented high values of storminess towards the end of the 20th century, in particular in the North Sea (Donat et al., 2011). In turn, storminess has not shown a clear trend (positive or negative) in southern Portugal over the last sixty years (Almeida et al., 2011b), supporting spatial variability across Europe as expressed by the results of the FP7 European Projects MICORE and ConHaz (Ciavola et al., 2011). Despite large spatial and temporal variability of storminess, storm-related losses have shown a net increasing trend in recent years mainly driven by socio-economic factors and increasing exposure (NatCatSERVICE, 2010), i.e. increases in population and economic assets in the exposed areas (EEA, 2010). This trend was observed in many coastal areas, forcing in some cases the implementation of measures for coastal protection. In nearly all cases, the desired effects on increased protection and reduction of risk to life were obtained with extensive costs and with creation of new or extended problems to the coastal environment in the near or far field (Zimmermann, 2005). As a result of the exposed above, consequences or impacts of storms over the coast may aggravate in a context of growing occupation of the coast and increased hazard probability.

The projected increase in risk, due to increasing both consequences and hazard probabilities, raises the need for a re-evaluation of coastal disaster risk reduction (DRR) strategies in order to accommodate risk reduction in a sustainable way, building trust and societal acceptance. Even without a change in risk due to climate or socio-economic changes, a re-evaluation is necessary in the light of (i) shrinking public works budgets which drives cost-efficiency, and (ii) a growing appreciation of ecological and natural values which drive ecosystem-based approaches (Assessment, 2005). For that, measures should be assessed under economic, environmental and sociological frameworks, including users risk perception (Martinez et al., 2014). Risk perception includes people beliefs, attitudes, judgements and feelings towards threats to things they value (Pidgeon et al., 1992). The inclusion of risk perception in management strategies is being repeatedly recognized as a basic requisite to ensure successful implementation of management measures (Buchecker et al., 2013; Patt and Schröter, 2008; Pidgeon, 1998). However, the gap between theory and practice remains opened (Höppner et al., 2012).

Traditionally, risk perception came to be seen as an obstacle to rational decision making due to the emerging conflict between expert and public risk perception at the basis of the social dilemmas of risk management (Sjöberg, 1999). People respond to a risk or hazard in ways consistent to their risk perception, which results from the relationships between risk characteristics; i.e. voluntariness, dread or worry, awareness and preparedness (Raaijmakers et al., 2008). Combining risk characteristics (i.e. awareness, preparedness and worry) Raaijmakers et al. (2008) developed a typology that reveals the state of mind of individuals regarding risk perception: ignorance, safety, risk reduction and control. This supports the need for understanding public perception in order to successfully impact hazard preparedness as residents of risk areas often have inaccurate beliefs about the hazard agent and its impacts (Lindell and Perry, 1993).

The present work aims at understanding how citizens owning a first residence at a coastal area prone to coastal erosion and wave-driven flooding (overwash) perceive the risk and how perception determines their decision and adaptation or not to live with risk at the coast. The present work develops in the frame of the EU FP7 project RISC-KIT (Resilience-Increasing Strategies for Coasts – toolKIT) with the aim of integrating stakeholder risk perception into tools and management approaches to develop in the project to reduce risk and increase resilience to low-frequency, high-impact hydro-meteorological events in the coastal zone. The case study area exemplifies land occupation of local coastal communities that traditionally developed without following regulations in a non-organized way, including a traditional fisherman community and a touristic based occupation in the Praia de Faro, southernmost coast of Portugal. The region has been already impacted by severe storms in the past (between 1941 and 2010) with consequences over infrastructures and private buildings (building collapse). In this regard, we will explore the reasons behind the risky occupation of the beach testing the following possible explanations: (i) Residents decide to live with risk because they do not understand it; i.e. residents do not share the vision of experts regarding probabilities and consequences of storm impact over their community. (ii) Residents understand the risk and voluntarily decide to live with it, accepting a known level of risk. In this regard, they may be or not prepared to respond accordingly in case of a risky situation or demand solutions. For this, we identify the cultural, socio-economic and ecological framework of the case study and run a series of in-depth interviews with representative individuals of different groups of stakeholders involved in the area. In addition, this work will examine to which extent risk perception could help to integrate solutions for damage mitigation accounting for the needs of a group of stakeholders.

## 2. A population living with risk: Praia de Faro

### 2.1. A heterogeneous coastal community

The present work focuses on the coastal community of Praia de Faro, assented in the Ria Formosa Natural Park, a natural reserve created in 1987. The Ria Formosa is a coastal lagoon protected from the direct action of the open ocean by five barrier islands and two peninsulas spatially distributed to produce a cuspate shoreline that extends over 55 km and represents the southernmost end of the Portuguese coast (Fig. 1). The Ria Formosa is managed by the ICNF (Institute of the Conservation of the Nature and Forests), the APA (Portuguese Agency of the Environment), the CCDR (Commission for Coordination and Regional Development of the Algarve), the IPTM (Institute for Ports and Maritime Transport, I.P.), the IPMA (Portuguese Institute of Ocean and Atmosphere) and the Municipalities integrating the Natural Park. APA and ICNF share the main responsibilities on coastal management in this area. Exceptionally, a part of the Ancão Peninsula (i.e. central area of the population of Praia de Faro) was officially excluded from the public domain and Faro municipality became responsible for the coastal management and the implementation of DRR measures along this 2 km of sandy barrier. The existence of several institutions with responsibilities on decision-making management strategies and policies makes their implementation a complex and bureaucratic process (Guimarães, 2010). Indeed, a working group was created in 2008 to define a future strategy for the Ria Formosa Coastal Zone to solve the problems identified in the Natural Park accounting with the integrated participation of all the institutions. This was originally planned to be done within the framework of the Polis Littoral Ria Formosa (2008–2012) action plan, which had the direct access to the financial support founded by Europe, Municipalities and the National Government.

The population of Praia de Faro is located within the Ancão Peninsula, at the western side of Ria Formosa. Praia de Faro is a