

ASSESSING STAKEHOLDERS' RISK PERCEPTIONS IN A VULNERABLE COASTAL TOURISM DESTINATION (FARO BEACH, SOUTHERN PORTUGAL)

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ABSTRACT

Effective coastal management is essential in regions where tourism is a main economic activity. However, poor communication and disagreement between stakeholders hamper the way decisions are conveyed to residents and home/business owners, potentially affecting economic development. We analysed managers and scientists' views regarding risk perceptions of Faro Beach (Algarve) residents, contributing to the identification of differences and similarities towards a sustainable management. We used a qualitative content analysis of managers and scientists' discourses. Managers and scientists recognize that residents, particularly fishermen, are quite knowledgeable about the risks they face by living at the beach. However, scientists and managers believe that residents easily forget about the problems due to an optimism bias and positive previous experience with hazards, that never caused fatalities or serious consequences, leading to an underestimation of the severity of the risks. Managers think that residents are not concerned about the environmental problems of Faro Beach, and both scientists and managers see education as the best solution to increase risk perception and concern of residents. We suggest that truly collaborative approaches to coastal management should be promoted, including an active involvement of residents in the decision process, thus increasing their self-efficacy and behavioural control.

Keywords: Risk Perception, Public Participation, Coastal Hazards, Coastal Management, Content Analysis.

JEL Classification: Q54, D83

1. INTRODUCTION

Although attractive from natural and socio-economic perspectives, coastal areas are rough places to live in, due to their susceptibility to a myriad of coastal hazards. However, population growth in coastal regions and urbanization of coastlines have been increasing worldwide (Neumann, Vafeidis, Zimmermann, & Nicholls, 2015), and therefore the exposure to the hazard, resulting in increased risk. Thus, it is important to consider coastal areas as linked ecological-socioeconomic systems that co-evolve spatially and temporally, where integrated management approaches should be implemented across scientific disciplines (Crooks & Turner, 1999).

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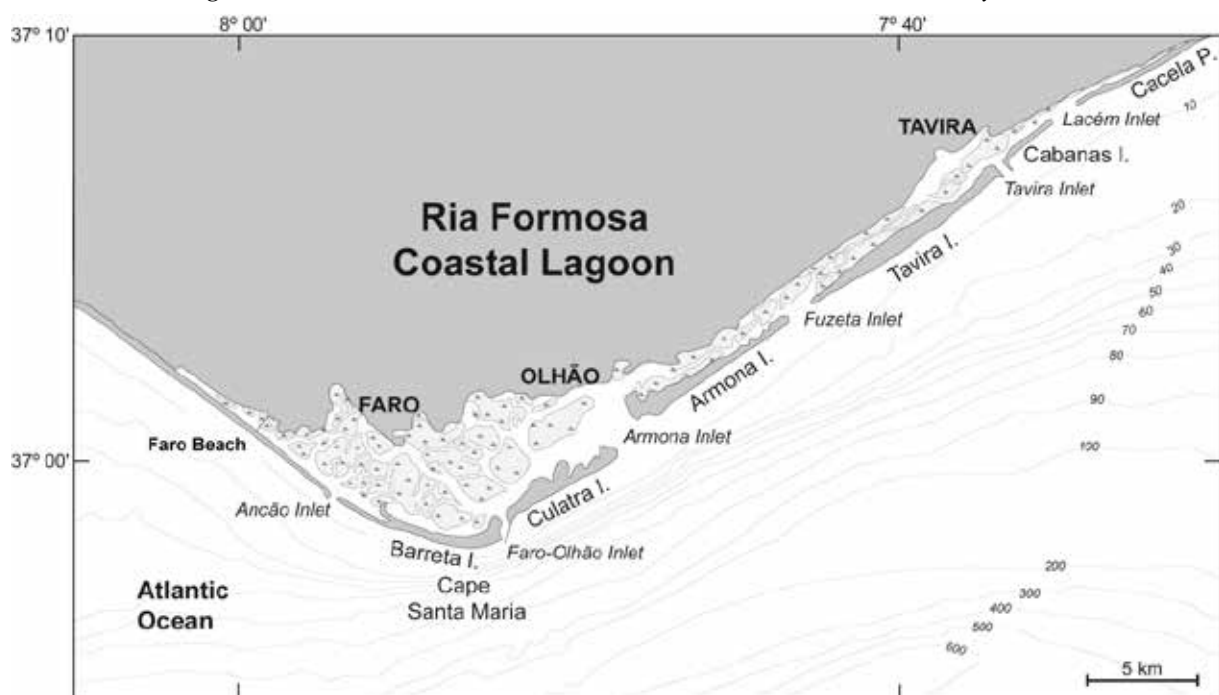
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This is particularly relevant in the Algarve (southern Portugal), where tourism is the main economic driver (Noronha Vaz, Walczynska, & Nijkamp, 2013), driven by “sun and beach” products (Guerreiro, Pinto, & Mendes, 2016), and also by nature and environmental quality (Barreira & Cesário, 2018). However, the Algarve is also extremely vulnerable due to the existence of fragile ecosystems and the location of urban infrastructures in areas subjected to coastal erosion (Noronha Vaz, Cabral, Caetano, Nijkamp, & Painho, 2012). One of the most vulnerable systems is the Ria Formosa coastal lagoon, a multi-inlet system protected by sandy barrier islands that extends over 55 km (Figure 1). Due to its ecological and economic importance, the Ria Formosa and its hinterland, with a total area of 185 km², were established as a Natural Park in 1987. Currently, a multitude of governmental organizations are responsible for its management, including at least five national organizations and five municipalities (Costas, Ferreira, & Martinez, 2015; Guimarães, 2010).

Figure 1. Location of Faro Beach at the Ria Formosa barrier island system



Source: Dr. Ana Matias, CIMA-UAIfg

The human occupation of the Ria Formosa with residential and tourist infrastructures has always raised much debate, due to its high vulnerability to coastal hazards; indeed, the safety of human settlements and the restoration of ecological value on the sandy islands and peninsulas have been major concerns of several management plans. These plans aim to preserve landscapes and natural heritage, prevent coastal risks, and promote nature conservation and biodiversity, through the protection and requalification of the coastal zone, using an integrated and sustainable management approach (www.polislitoralriaformosa.pt). Measures to achieve these goals include inlet relocation, beach nourishment, dredging of navigation channels, waterfront requalification, and the demolition of houses. Some measures have been well accepted by residents and home/business owners, but other measures, particularly the demolitions, have generated several public debates and confrontations with the authorities.

Faro Beach, located at the westernmost part of the Ria Formosa, is one of the most threatened locations of the system and is one of the major sources of tension and disagreement between residents, scientists, managers and policy-makers. This location is exposed to several coastal hazards, particularly storm consequences (*e.g.*, overwash and erosion), that

have resulted in house and road destruction, but no casualties were ever observed. Probably because of that, most people living at Faro Beach have voluntarily accepted the risk in exchange for other benefits that the beach provides (Costas et al., 2015). Managers and outside observers believe that Faro Beach residents do not understand the risk to which they are exposed, given that they always return after storms to rebuild their houses (Costas et al., 2015). However, it has been shown that residents, particularly fishermen and their families, possess significant knowledge on coastal hazards and awareness of risks that derive mainly from life experience (Domingues, Santos, de Jesus, & Ferreira, 2018). This incongruence probably reflects the lack of communication between these groups. In order to improve communication and understanding between actors, this study aims to analyse the views/opinions of managers and scientists regarding risk perception and awareness of Faro Beach residents, using a qualitative approach based on a discourse content analysis. Understanding the perceptions of different stakeholder groups towards one another is essential for an effective coastal management, which, in turn, will positively affect this regions' economic activities.

2. METHODS

2.1 Participants and data collection

Participants were scientists and managers involved in the study and management of the Ria Formosa system, particularly Faro Beach. The main method used to collect data were semi-structured interviews (see Costas et al. 2015 for details); in addition, stakeholders' discussions during a meeting to apply a multi-criteria analysis (MCA) method towards coastal management (Barquet & Cumiskey, 2018) were also transcribed and used as a complement to the interviews. Data was collected as part of EU FP7 Collaborative project RISC-KIT (Resilience-Increasing Strategies for Coasts – toolKIT) which, among other goals, aimed to integrate stakeholders' risk perceptions into management tools, to reduce risk and increase resilience to hydro-meteorological events in problematic coastal zones (Costas et al., 2015).

As qualitative research is more interested in searching for depth of meaning through intensive, rather than extensive, research, small groups of respondents (<20) are acceptable (Crouch & McKenzie, 2006). In addition, given the homogeneity of the participants in our study (well-educated individuals working on coastal risks at Faro Beach), we considered that more participants would not add any new or relevant data, according to the saturation principle of qualitative research (Dworkin, 2012). Therefore, our qualitative study is based on semi-structured interviews to eight individuals and a stakeholders meeting with another six individuals.

The semi-structured interviews were conducted in early 2014 to three scientists, three regional-level coastal managers and two local-level coastal managers, selected based on their extensive knowledge of the area. We included one consultant involved in coastal management and a civil protection officer in the managers group as 'managers' is used *sensu lato*. Four main topics were addressed in the interviews, namely socio-cultural and environmental values in the community, risk perception, coastal disaster risk reduction knowledge, and constraints to the application of coastal disaster risk reduction strategies (Costas et al., 2015). The interviewer (S. Costas) used a guide with open-ended questions, and the interviewees could elaborate on their answers. The interviews were recorded, and the content was transcribed. The same method was also applied to residents discourses and published elsewhere (Domingues, Costas, Jesus, & Ferreira, 2017).

Data were also collected during a meeting to apply a multi-criteria analysis (MCA) for assessing disaster risk reduction measures, conducted in September 2016. Stakeholders

present in the meeting included four coastal managers, two scientists, and one resident; two other residents and one business owner were invited but did not attend. The meeting was led by a “content-neutral” facilitator (O. Ferreira); two co-facilitators (one of them S. Costas) in charge of the logistics and one observer with training in psychological sciences (R. Domingues) were also present. The goal of the MCA was to evaluate and rank individual and combined disaster risk reduction measures (*e.g.*, house removal and improvement in communication channels) for Faro Beach. The discussion between stakeholders was registered by the observer, particularly the issues and concerns raised regarding Faro Beach and its residents.

2.2 Data analysis

Data collected in the semi-structured interviews and in the MCA meeting were examined using a qualitative content analysis based on an inductive approach (Gondim & Bendassolli, 2014; Mayring, 2000). The inductive approach was chosen given that the interviews and the meeting were not structured around a specific theory or model; therefore, a more suitable abstraction process that includes open coding and creation of categories derived from the data was used (Elo & Kyngäs, 2008). Three categories of stakeholders were considered in data analysis: scientists (professors and researchers involved in the scientific study of the Ria Formosa), local managers (managers involved in coastal management at a local-level, *e.g.*, municipality, local civil protection), and regional managers (managers involved in coastal management at a regional level, *e.g.*, environmental protection agencies, natural parks).

3. RESULTS

The analysis of managers and scientists’ discourses allowed the identification of three main themes: a) stakeholders’ views on residents’ risk perception and concern (Table 1); b) stakeholders’ explanations for residents’ risk perceptions (Table 2); and c) solutions to increase residents’ risk perception (Table 3).

3.1 Managers and scientists’ views on residents’ risk perception and concern

Overall, managers and scientists believe that residents *‘know about the risk’* they face by living at Faro Beach, given that *‘they are used to live with the risk’* and *‘they have experience’* with the risk, particularly fishermen. Scientists view fishermen as quite knowledgeable about the Ria Formosa, *‘they know a lot about the functioning of the Ria and they know about the risk of building in a barrier island’*. However, managers think that residents *‘do not understand the severity of the risk, or the risk that they are exposed to’*, and they are not concerned about the risk or are only concerned about the risk *‘when it happens’*, *‘when the storm is coming and during the storm’*. Scientists, on the other hand, believe that residents *‘are concerned with storm and storm surges’* and *‘fishermen know that they can lose their houses at any moment’*; one regional manager admits that residents *‘are worried about their homes’*.

When asked about their views on residents’ concern with environmental problems, regional managers believe that residents are not concerned, or are only concerned when the problem *‘affects them directly’*. Some regional managers believe that the environmental concern of residents is seasonal or intermittent, as *‘people only care (about overwash) during the winter’* or *‘they care if something bad happens’*. On the contrary, one local manager thinks that residents *‘are concerned about the environment, because they have an affective relationship with the Ria’*. A scientist suggests that residents may have a utilitarian view of the Ria Formosa, as *‘their vision of the Ria has not changed over time, the Ria is there to be used as their parents did’*.

Table 1. Content analysis of stakeholders discourses. Theme 1 – Scientists and managers’ perceptions of residents’ risk perception and concern. Sc – scientist; LM – local manager; RM – regional manager.

Categories	Codes	Meaning units	Stakeholder
Stakeholders’ perceptions of residents’ risk perception and concern	Risk awareness and perception	The people living here (...) are used to live with the risk.	RM
		The ones that are living (at the Beach) are more at risk but they are used to it and know where they are, and do not demand, and they collaborate because they know that they are at risk.	RM
		They are worried about their homes.	RM
		I would say that people living there are concerned with storm and storm surges, but this is specific of the small area within the Ria where the hazard associated with storms is high and they know it.	Sc
		They do know (about the risk), the fishermen know that they can lose their houses at any moment.	Sc
		Yes, they know, they know a lot about the functioning of the Ria and they know about the risk of building in a barrier island, however, once things are installed in a place, they are very difficult to remove, people react very badly to that.	Sc
		I think fishermen know the kind of risk they face, and they have the experience.	Sc
		I do not think that people are concerned about the risk.	RM
		The people living here do not understand the severity of the risk, or the risk that they are exposed to.	RM
		They are concerned about the risk only when it happens.	RM
		No, I do not think (that people living at the Beach have risk perception), they only have risk perception when the storm is coming and during the storm, but then they forget.	RM
	Concern	People that live here are only concerned when a problem related to the environment affects them directly.	RM
		I think that people only care (about overwash) during the winter.	RM
		They do not care much, although this has improved, but they care if something bad happens.	RM
		Their vision of the Ria has not changed over time, the Ria is there to be used as our parents did.	Sc
		People living here help us to deal with a problematic situation, they are very resilient.	LM
		I do think (that people are concerned about the environment), because they have an affective relationship with the Ria.	LM
	Externalisation of responsibility	I think that the general feeling is that somebody else will solve the problem.	RM
	Trust in authorities	They do not believe in authorities.	Sc
		In many cases people do not like managers’ decisions.	Sc
	Willingness to participate in DRR measures	I think that they would be (willing to participate in the implementation of DRR measures), the fishermen yes, but I am not sure if people with a second house would be interested, because they may think they will lose more than what they’ll get.	Sc

Source: Own Elaboration

Regarding the relationship with authorities and the implementation of disaster risk reduction (DRR) measures, stakeholders think that residents of Faro Beach ‘do not believe in

authorities’, but, in contrast, they externalize the responsibility, *‘I think that the general feeling is that somebody else will solve the problems’*. One scientist believes that most residents *‘would be (willing to participate in the implementation of DRR measures), the fishermen yes, but I am not sure if people with a second house would be interested, because they may think that they will lose more than what they’ll get’*.

3.2 Explanations for residents’ risk perception and concern

All managers agree that residents of Faro Beach easily forget the problems and the risks they have faced at the beach. They say, *‘people have a very short climatic memory’*, *‘in the summer, the beach recovers, and they forget’* and *‘people have time to forget about the problems’*. Other explanation found by one of the regional managers to justify their apparent lack of concern with coastal hazards is that residents are convinced that serious consequences of coastal hazards will never happen to them, it may happen to their neighbours but not to them.

Table 2. Content analysis of stakeholders discourses. Theme 2 – Scientists and managers’ explanations for residents’ risk perceptions. Sc – scientist; LM – local manager; RM – regional manager.

Categories	Codes	Meaning units	Stakeholder
Explanations for residents’ risk perceptions	Optimism bias	We are convinced that those things (bad things) will never happen to us, it may happen to our neighbors, but not us.	RM
	Availability and affect heuristics	Time deletes everything.	RM
		People have a very short climatic memory.	LM
		In the summer, the beach recovers and they forget.	RM
		I think that they forget, they only have risk perception when the storm is coming and during the storm, but then they forget.	RM
		People have time to forget about the problems.	LM
	Place attachment	I do think (that people are concerned about the environment), because they have an affective relationship with the Ria.	LM
		They do not want to move away from the Beach, because they have everything there.	LM
		(regarding relocations) I would say there are three versions: ‘we want to stay here, we have been here forever’ (...) they just want to save their homes, even if there is no beach anymore; this is the typical vision of the fishermen. (...) You also have those who would like to preserve the beach in front of their homes (...) and then, there are a few, younger, that say it wouldn’t be a problem to relocate if they were compensated.	Sc
		Once things function in a certain way, they are very difficult to change, people react vary badly to change.	Sc

Source: Own Elaboration

Some stakeholders refer the affective bond between residents and Faro Beach to justify their attachment to that place. One local manager says that residents *‘do not want to move away from the Beach, because they have everything there’* and *‘they have an affective relationship with the Ria’*. One scientist referred the length of residence as a factor explaining the willingness (or lack thereof) of residents to move away from the Beach; one scientist says that fishermen *‘want to stay there, they have been there forever’*, whereas a few other residents, younger, *‘say it wouldn’t be a problem to relocate if they were compensated’*. Other scientist refers that *‘once things function in a certain way, they are very difficult to change, people react very badly to change’*.

3.3 Solutions to increase residents' risk perception

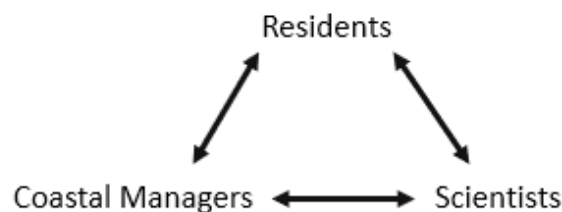
Education is the main (and only) solution referred by stakeholders to increase residents' risk perception and environmental concern at Faro Beach. Managers and scientists agree that *'the only way to change this (risk perception) is to educate the new generations'*, because *'if you educate people, they may help'*. They also believe that people will engage more with environmental issues *'as a result of an investment in education'*. However, not all stakeholders agree that education of residents may lead to good results in the implementation of measures; a regional manager refers that educating residents could not work, as they *'only believe in what they see'* and *'if you go there trying to educate them... they are not open at first, they prefer when people benefit from the experience; if we stand there as doctors, it's over, and you cannot reach them'*. This regional manager also suggests that *'the way to reach them is different, because most of the experience they have is very helpful, so it depends on how we approach them'*.

Despite the importance of education, suggested by all stakeholders, some managers and scientists believe that education may not lead to higher risk perception. One of the regional managers points out, referring to cliff erosion signs warning people to stay away from cliffs at other beaches in southern Portugal, that *'warning signs at the beaches have no effect on people's behaviour'*, and one scientist agrees, *'this says a lot about people's affinity to what we teach them – it's absolutely incredible how people lay there, close to the warning signs (close to sea-cliffs in risk of falling); the information is there, the education is there, but something is missing'*.

Finally, local and regional managers also referred the lack of communication between scientists and managers. A regional manager says that there is *'a lack of communication between the academia and the administration. I am tired of listening to recommendations for managers that do not get out of their research papers'*. Also, a local manager refers that *'all this information (from research) is not transferred to those who actually need it (...) I feel that the information does not reach us...'*. Figure 2 represents expected and actual communication channels between managers, scientists, and residents of Faro Beach, based on stakeholders' discourses (this study and Domingues et al., 2017).

Figure 2. A) Expected communication channels between residents, scientists and managers, and B) actual communication channels between stakeholders at Faro Beach.

A) EXPECTED CHANNELS OF COMMUNICATION



B) FROM INTERVIEWS



Source: Own Elaboration

Table 3. Content analysis of stakeholders discourses. Theme 3 – Scientists and managers’ solutions for problems. Sc – scientist; LM – local manager; RM – regional manager.

Categories	Codes	Meaning units	Stakeholder
Stakeholders’ solutions for problems	Education and information	The only way to change this (risk perception) is to educate the new generations.	RM
		It’s logic that more information will increase the acceptability of this measure (demolition of houses).	
		(People engage more with environmental issues) as a result of an investment in education.	RM
		I do not think (that educating people could be good), I think they only believe in what they see.	RM
		If you go there trying to educate them ... they are not open at first, they prefer when people benefit from the experience; if we stand there as doctors, it’s over, you cannot reach them.	RM
		The way to reach them is different, because most of the experience they have is very helpful, so it depends on how we approach them.	RM
		If you educate people, they may help.	LM
		When people know certain things, they have a totally different reaction (to the implementation of measures).	LM
		Informed people collaborate better in the resolution of problems – I think we can all agree on that.	RM
		People will be more receptive (to change) when they have more information.	
		If there was more information, more explanations regarding the demolitions (maybe residents would agree)...	LM
		If there was a continuous education of residents, like every year or so, then improvements in communication channels could be effective.	LM
		Warning signs at the beaches have no effect on people’s behaviour.	RM
		If there was a continuous education of residents, like every year or so, then improvements in communication channels could be effective.	LM
		People will be more receptive (to change) when they have more information.	Sc
		It’s logic that more information will increase the acceptability of this measure (demolition of houses).	Sc
		This says a lot about people’s affinity to what we teach them – it’s absolutely incredible how people lay there, close to the warning signs (close to sea-cliffs in risk of falling); the information is there, the education is there, but something is missing.	Sc
	Communication between scientists and managers	It looks like all this information (from research) is not transferred to those who actually need it. I do not need very deep information, I need the results to understand the risk, and I feel that the information does not reach us...	LM
		(There is) a lack of communication between the academia and the administration. I am tired of listening to recommendations for the managers that do not get out of their research papers.	RM

Source: Own Elaboration

4. DISCUSSION

This study aimed to understand the opinions of managers and scientists involved with the Ria Formosa system on the risk perception and awareness of Faro Beach residents. Overall, managers and scientists believe that residents' risk perception and awareness of coastal risks is relatively high, given that they have experience with risks, but residents easily forget the problems and the risks that they face at the beach, demonstrating a low concern; education is seen by these stakeholders as the best solution to increase risk perception and environmental concern of Faro Beach residents.

4.1 Risk perception and awareness

In the interviews and MCA meeting, managers and scientists consistently referred to risk 'perception' when what they meant was risk 'awareness'. These two terms are commonly used interchangeably by stakeholders, the public and the media, but they represent distinct, although related, psychological constructs. Risk awareness refers to having information about hazards and risks (Gifford, 2014; Luís, Pinho, Lima, & Roseta-palma, 2016), or to recognize the risk, accept its possibility and understand its mechanisms and impacts. Raising awareness of a risk has been used as a synonym of increasing risk perception (*e.g.*, Cologna et al. 2017), but psychological research shows that being aware of a risk does not necessarily lead to increased risk perception (Schuetz et al., 2011). In fact, risk perception is not a rational, analytical or objective process, but rather a subjective judgment that an individual makes regarding the characteristics and severity of a risk (Slovic, 1987). It is driven by unconscious emotional processes, such as feelings of fear or anxiety (Gifford, 2014), and cognitive heuristics, that are mental shortcuts expressed as simple information-processing rules that individuals use when making decisions and judgments, and that may lead to biases in decision making (Tversky & Kahneman, 1974). The cultural and social context may also influence risk perception and lead to social representations of risk (Michel-Guillou & Meur-Ferec, 2017), given that individuals tend to shape their views to match those of people with whom they identify (Brown, 2014).

Most stakeholders agree that Faro Beach residents, particularly fishermen, have high risk awareness, as they know that they are at risk, they are worried about their homes, they know the kind of risks they face, and they know that they can lose their houses at any moment. Scientists see residents as very knowledgeable about the functioning of the Ria Formosa, but managers believe that residents do not understand the severity of the risk, and they are concerned only when something bad happens. Drawing from the stakeholders' discourses, residents of Faro Beach apparently have a considerable risk awareness, *i.e.*, they have information about hazards and they are aware of the potential risks; the lack of concern that managers refer may be interpreted as a low risk perception, *i.e.*, residents, unconsciously and subjectively, underestimate the severity of the risks.

Risk perception has been evaluated at Faro Beach in previous studies using both qualitative and quantitative approaches, and results are inconsistent. Qualitative analysis of residents' discourses suggested that residents are well aware of the risks, but nonetheless their risk perception is low, as they feel safe at the beach and feel that their lives are not at risk (Costas et al., 2015; Domingues et al., 2017). However, a quantitative approach based on the psychometric paradigm demonstrated that residents have medium/high levels of risk perception, informed by past experience with hazards, but they believe hazards are not very dangerous and are distant in time (Domingues et al., 2018).

4.2 Cognitive biases, heuristics and place attachment

Managers and scientists explained residents' apparent lack of concern making references to cognitive biases, which are systematic deviations from norm or rationality when making judgements, leading individuals to draw inferences or adopt beliefs in a non-logical manner, without or with insufficient evidence to do so (Haselton, Nettle, & Andrews, 2005). One of the managers referred that residents believe that bad things only happen to other people, expressing their optimism bias, and several managers pointed out the '*short climatic memory*' of residents, related to the availability heuristics.

Individuals with an optimism bias usually believe that they are personally less likely to experience negative events, and more likely to experience positive events, than other people (Breakwell, 2014). Optimism bias has been observed not only in regard to natural hazards, such as hurricanes (Trumbo, Lueck, Marlatt, & Peek, 2011) and earthquakes (Helweg-Larsen, 1999), but also in relation to other hazards, such as health-related or terrorism events (see Breakwell, 2014 and references therein). Optimism bias is informed by personal experience with hazards; experience may either increase or decrease risk perceptions (see review by Wachinger et al. 2013), depending on how individuals interpret their experiences (Lindell & Perry, 2004). At Faro Beach, optimism bias is rooted in the 'positive' personal experience that most residents have with coastal risks, particularly storms and beach erosion that have led to the destruction of buildings, but never to the loss of lives (Domingues et al., 2018). This represents a behavioural barrier that may hamper residents' preparedness in case of disaster (Domingues et al., 2018), as optimism bias might be at the root of the unwillingness of individuals to take precautions to protect themselves from hazards (Breakwell, 2014). Optimism bias is, indeed, an important psychological barrier that hinders self-protective and proenvironmental behaviours (Gifford, 2011).

Optimism bias is closely associated with the availability heuristic, a mental shortcut that individuals use when estimating the probability of an event, based on how easily previous similar events can be recalled. This is what stakeholders called a '*very short climatic memory*', referring that Faro Beach residents only have high risk perception/awareness when the storms are happening, in the winter; when the summer starts and the beach recovers, residents easily forget the hazards and the risks they faced in the winter. Events that people recall and probability judgements that people make are influenced by many variables, including beliefs, expectations, and frequency of exposure (Tversky & Kahneman, 1973). Faro Beach residents are frequently exposed to storms and other hazards, which could, according to the availability heuristic, lead to an easier recall of problems and risks. However, the positive emotions, feelings, and expectations associated with hazards at Faro Beach, informed by the 'positive' personal experience that residents have with hazards, lead to the opposite effect: high-frequency storm events that never had serious consequences (*e.g.*, fatalities) are easily forgotten or underestimated. The same has been observed in a location in Jakarta exposed to tsunamis, typhoon storm surges and dyke-break induced floods, where residents are aware of the risks they face, but seem to underestimate their severity, most likely due to a high frequency of exposure to hazards in the recent past (Esteban et al., 2017). If the severity of personal disaster consequences were high, the intensity of negative emotions would be higher; according to the affect heuristic, or the risk-as-feelings hypothesis, negative emotions increase risk perceptions (Loewenstein, Weber, Hsee, & Welch, 2001), which would lead to an easier recall of events; consequently, the probability of occurrence of disaster events would be judged as higher. As the personal consequences of disasters cannot be exacerbated from an ethical viewpoint, one way to increase risk perception would be to decrease optimism bias, by increasing the availability heuristics (Jolls & Sunstein, 2005), *i.e.*, making frequent events, such as storms, more prominent and easy to recall. Exposing individuals to more information about the risk does not necessarily eliminate optimism and it may even

strengthen their belief that bad things only happen to others (Weinstein, Lyon, Sandman, & Cuite, 1998).

In addition to cognitive biases and heuristics that affect judgements, residents have affective connections with Faro Beach, as referred by one local manager. Place attachment, defined as an affective bond or link between people and specific places (Hidalgo & Hernández, 2001), may have contributed to lowering residents' risk perceptions, as already observed for other environmental risks, such as seismic (Armaş, 2006) and volcanic risks (Donovan, Suryanto, & Utami, 2012). However, increases in risk perception have also been observed in association with place attachment, for volcanic (Bird, Gísladóttir, & Dominey-Howes, 2011), hurricane (Burley, Jenkins, Laska, & Davis, 2007) and drought risks (Stain et al., 2011).

One scientist referred that length of residence is a factor that differentiates residents who have been living at the beach '*forever*' and refuse to leave the beach, from younger residents who may accept a potential relocation. Indeed, length of residence is a significant predictor of place attachment, thus influencing risk perception. Most residents have lived at the beach for most of their lives (Domingues et al., 2018), and a longer length of residence is associated with higher familiarity with the risk. This familiarity with the risk leads to an increase in an individual's sense of control over the risk (Bernardo, 2013), and, consequently, a decrease in risk perception.

4.3 Education and normalization of risk

Providing more education to residents was exhaustively referred by managers and scientists as the best way to increase their risk perception and, more important, their acceptance of measures, particularly house removal. Environmental education was referred several times as one of the measures that should be implemented to get people on board with managers' decisions, by increasing people's awareness of coastal risks and, hence, their risk perceptions. Information is indeed a major variable influencing risk awareness and risk perception, and it may be very effective in increasing awareness of hazards (Charrière et al., 2017; Hajito, Gesesew, Bayu, & Tsehay, 2015). However, information may not always act in the way that is intended by managers and policy-makers; this approach to risk communication is naïve and ignores fundamental aspects of psychological functioning, such as the use of cognitive biases and heuristics, and the conflict with existing beliefs (Lindell & Perry, 2004). The idea, known as the information deficit model, that public misunderstanding, scepticism, objections or hostility towards science and technology is due to a lack of knowledge that can be overcome by providing more information to the public (Rowe & Frewer, 2000), still persists in coastal management strategies, probably due to its logic and simplicity. However, psychological research has shown that the effects of awareness on risk perception are not straightforward.

Higher awareness about hazards and risks may lead to higher risk perceptions, as desired by managers, but it can also lead to a decrease in risk perception (Lima, 2004; Lima, Barnett, & Vala, 2005; Luís et al., 2016; Luís, Vauclair, & Lima, 2018) - the opposite of what is intended with more education. Awareness about coastal risks may not result in higher risk perceptions because people develop strategies to psychologically cope with the threats, hence decreasing the subjective judgment they make about the risk (Luís et al., 2016). This psychological strategy is known as risk normalization, and it commonly occurs when people expose themselves voluntarily to risks (Twigger-Ross & Breakwell, 1999), like Faro Beach residents (Costas et al., 2015).

Residents of Faro Beach are fully aware of the risks they face by living there (Domingues et al., 2017, 2018); in fact, most individuals living in coastal zones demonstrate high levels

of awareness and knowledge about coastal hazards and associated risks (Delicado, Schmidt, Guerreiro, & Gomes, 2012; Schmidt, Gomes, Guerreiro, & O'Riordan, 2014). However, due to their physical proximity, emotional bonds and previous experience with hazards, they developed strategies to cope with the threats, namely by normalizing the risk and thus decreasing their risk perceptions.

Despite the general belief that more education will result in higher risk perception, some managers and scientists have already realized that more information may not always work, referring to cliff erosion signs that have no effect on people's behaviour. A higher public involvement may be achieved, not by educating people, but rather by directly involving the public in the decision process, leading to higher compliance to measures and reducing the need for enforcement (Smith, 2012). In fact, the most important source of knowledge on coastal hazards at Faro Beach is not formal education or environmental education campaigns, but rather life experience (Domingues et al., 2018). In addition, stakeholders are well aware that residents do not trust the authorities, given that they feel that their opinion is not considered by coastal managers (Costas et al., 2015; Domingues et al., 2017).

4.4 Communication among stakeholders

Overall, managers and scientists are quite accurate regarding the views, beliefs, and risk awareness and perception of Faro Beach residents (Costas et al., 2015; Domingues et al., 2017, 2018). The most prominent discrepancy relates to the role of education/information on risk perception. Most managers and scientists believe that education is the most effective way to increase environmental concern and risk perception, but some recognize that more information may not work, as already observed with beachgoers in beaches with sea-cliffs in risk of falling.

Conversely, residents regard education (includes environmental education, formal education and public discussions) as the least important source of information on coastal hazards and risks, in comparison with life experience, which they consider their major source of information (Domingues et al., 2018). Only one of the stakeholders, a regional manager, expressed that education may not work with these individuals, due to the important role that their personal experience with coastal hazards plays.

Communication between actors is, thus, a major issue in Faro Beach, and improvements in communication channels are deemed necessary for a sustainable management of this coastal system (Cumiskey et al., 2018). As scientists and managers have an appropriate understanding of residents' opinions and beliefs regarding coastal hazards and risks, this knowledge could be applied to improve communication with residents. To begin with, residents should feel that their opinion matters. Public discussions should be discussions between actors, not one-way information exchanges that leave no room for higher levels of engagement (Rowe & Frewer, 2000). An active involvement of people whose lives are affected by the program under discussion must be pursued in all phases of the process, including the selection and evaluation of measures. If residents' opinions were heard and taken into consideration, their perceived behavioural control and self-efficacy would increase – people would feel that they can make a difference. In addition, higher public engagement based on participation (and not just communication) could also help individuals cope with threats in more adaptive ways (Luís et al., 2016), eliminating risk normalization and hence developing more realistic risk perceptions. However, residents' cognitive biases and heuristics, which can affect judgements and decision-making, must be firstly identified. Thus, psychology experts should be included in coastal management programs to work not only with residents, but also with the other stakeholders, and help them overcome their cognitive shortcuts. Indeed, decision-makers, like every human being, make decisions based on their values, beliefs, and

past experiences; scientists can also play an important role in helping decision-makers, by shaping their beliefs (von Winterfeldt, 2013) with adequate scientific evidences.

However, communication between scientists and managers is often poor, as scientific results are not readily accessible to managers, and scientists may not understand which information is the most relevant for decision-makers (von Winterfeldt, 2013). In order to bridge the gap between these stakeholders, scientists should be trained to write for policy-makers, scientific results should be actively communicated and marketed, and precise recommendations to policy-makers should be included (Choi, McQueen, & Rootman, 2003). Although it can be challenging for decision-makers, the legitimacy and acceptance of coastal management decisions can only be achieved with truly collaborative approaches that include the opinions of residents and the recommendations of scientists.

5. CONCLUSION

The qualitative content analysis of managers and scientists' discourses regarding risk awareness and perception of Faro Beach residents showed that managers and scientists recognize that residents, particularly fishermen, are aware and quite knowledgeable about the risks they face by living there. However, managers and scientists believe that residents easily forget the risks due to an optimism bias and positive personal experience with hazards that lead to an underestimation of the severity of the risks. An effective communication between all stakeholders is essential for a sustainable coastal management, but managers are aware that residents mistrust the authorities and externalize the responsibility for coastal problems. Additionally, managers complain about the lack of communication between them and scientists, as scientific results that could be useful for coastal managers seldom reach them. A possible approach to improve coastal management and decrease risks would be to promote an active participation of all stakeholders in the discussions and decision-making processes, based on trust and on the sharing of experiences among stakeholders. Long-term collaborative projects that include all stakeholders and multidisciplinary teams are thus necessary for a sustainable coastal management at Faro Beach.

ACKNOWLEDGEMENTS

This work was financially supported by the Portuguese Foundation for Science and Technology (FCT) through projects UID/MAR/00350/2013 e UID/SOC/04020/2013. FCT provided funding for R.B.D. through a postdoctoral fellowship (SFRH/BPD/108444/2015) and a research contract (DL57/2016), and for S.C. through 'FCT Investigator' Program (IF/01047/2014). Ó.F. and S.C. participation was under the scope of the EU FP7 research project RISC-KIT (RISC-KIT-GA-2013-603458) and FCT project EVREST (PTDC/MAR-EST/1031/2014).

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