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Representations of coastal risk (erosion and marine flooding) among inhabitants of at-risk municipalities

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Abstract

As part of an interdisciplinary research programme on coastal risks, we used a combined environmental psychology-geography approach to study representations of coastal erosion and sea flooding among inhabitants of coastal areas. The relationship between these representations and place, or more specifically sense of place, will initially be examined, followed by individuals' preferred adaptation strategies with risk. Face-to-face interviews were conducted with 894 inhabitants from five coastal municipalities in Brittany. Results show that coastal risks are not a top priority for respondents. Paying particular attention to respondents who spontaneously cited coastal rather than other risks or no risk, we show that their relationship to place differs from the other respondents, as do their preferred adaptation strategies. These results lead to a better understanding of attitudes towards coastal risks among inhabitants of at-risk areas and provide more in-depth knowledge on coastal zone vulnerability.

Keywords

coastal risks / social representations / sense of place / adaptation strategies / environmental psychology / geography

Introduction

Today, global environmental changes have triggered events such as sea-level rise, climate fluctuations and sedimentary imbalances, while the ever-growing appeal of coastal areas has increased construction of new residential housing and infrastructure in zones that are occasionally highly exposed to marine-related hazards. In France, the devastation caused by storm Xynthia along the Vendée and Charente-Maritime coasts in 2010 and the impact of the winter 2014 storms revealed weaknesses in the country's coastal risk management strategies and policies.

To address this situation, an interdisciplinary team of experts (in geology, geography, ethnology, law, environmental psychology...) created the Cocorisco research project in 2010. Its objective is to acquire knowledge and understanding of coastal risks/erosion and flooding vulnerability, and propose suitable management and prevention strategies. The programme uses a systemic approach towards vulnerability (Hellequin *et al.*, 2013) based on four major components: (1) *hazards* (erosion and sea flooding, site susceptibility, current or past events); (2) *stakes* (property and people at risk); (3) management *policies* and protection/safeguarding *measures*; (4) *risk, place* and *environment* representations (among local stakeholders (Poumadère et al., 2015), inhabitants...).

The present study will focus on the fourth component (risk representations) to gain an understanding of how people living in coastal-risk areas, and who are therefore potentially affected by erosion and/or sea flooding, represent this risk and to identify the links between these representations and inhabitant-environment relationships. In line with the transactional perspective to environmental psychology, (Moser & Uzzell, 2003), we hypothesized that risk representations would be linked to sense of place and that they would influence attitude toward coastal risk and preferred adaptation strategies. We will first

concentrate on inhabitants who spontaneously evoke coastal risk and will try to explain their representations through place-related characteristics and constructs. Second, we will show how these representations relate to preferred adaptation strategies. This is another way of understanding vulnerability since people who are defined by others as vulnerable do not always regard themselves as such. Examining people's relationship with risk could provide a more in-depth understanding of the links between practices and representations and therefore information that could be used to improve risk management policies.

Risk representations: A key dimension of the systemic vulnerability

Twentieth-century research into natural risks tended to study hazards through approaches from the earth and engineering sciences. Other dimensions of risk, especially the stakes involved, were primarily addressed in terms of structural or tangible vulnerability (resistance of materials, physical mitigation measures, etc.). The notion of social vulnerability started to emerge in the 1980s when social sciences began to conduct more in-depth research into these natural risks by taking into account the structural and functional factors of vulnerable societies, such as population structure, social and political organization, uses and beliefs (Meur-Ferec *et al.*, 2011). The objective was to enhance knowledge of the fragility of a system in its entirety and its capacity for reconstruction (Birkmann, 2006; Becerra & Peltier, 2009; Metzger & d'Ercole, 2011). A combined psychosociological and environmental approach is particularly relevant in vulnerability research as it can improve the identification of physical, psychological, social and cultural factors, living conditions (proximity to and experience of risks) and relationships to the life space (Moser & Uzzell, 2003; Navarro-Carascal & Michel Guillou, 2014). These factors help provide a clearer picture of vulnerability through a comprehensive understanding of *perceived vulnerability* (Moser, 1998), which depends on individuals' interactions with their environment, or more precisely

their living place. Studying perceived vulnerability is important because people can be seen as vulnerable by others (e.g. by experts) but do not consider themselves to be vulnerable. In the literature, sometimes risk and vulnerability are used interchangeably or (perceived) vulnerability is defined as a component of risk perception (e.g., Acuna-Rivera, Brown & Uzzell, 2014).

In this sense, social representation theory, a major concept in social psychology especially in France (Moscovici, 1976, 2001), offers a valuable perspective for understanding people-risk relationships (Joffe, 2003). Social representations correspond to different forms of knowledge (e.g. informative, cognitive, normative, beliefs) transmitted by society. This theory is a form of social thought that allows individuals to comprehend their environment, and thus provides them with a certain vision of the world. Consequently, these social representations are a social construction of reality – one that is practical, formulated and shared by a social group (Jodelet, 1999) – aimed at making this reality meaningful (Abric, 2001a, 2001b). Such representations are highly contextualized and depend on the group's social anchoring (Doise, 1992). Doise *et al.* (Clémence, Doise & Lorenzi-Cioldi, 1994; Doise, 1993, 1985) define social representations as the underlying principles that generate individual opinions and organize individual differences. Guiding individuals towards a certain viewpoint, social representations provide common reference points for social relationships to be regulated. As organizing principles, they generate inter-individual differences and variations (Clémence *et al.*, 1994) in which individuals' position on the object varies according to what is at stake for them and their level of social inclusion (Doise, 1992, 1993, 1985).

Thus, social representations are shaped in specific contexts and for specific reasons. They explain why there are various social representations of any given risk. Likewise, because adaptation strategy preferences act as a guide for action, they may vary according to risk

representations. As such, risk representations should be recognized and taken into account to understand people-risk relationships. These representations are also affected by the type of people-place relationship.

People-place relationships: The foundations of geography and a key element of risk representations

The people-place relationship is one of the bases of geography, as can be seen in the notion of ecumene, i.e., geographicity (human beings' relationship to the earth) and inhabitation (Dardel, 1952; Berque, 2000; Lussault, 2007). Early geographers highlighted how geography is the science of place in that place is the link between nature and society (Gold, 1980; Pinchemel & Pinchemel, 1997; Reclus, 1866; Tuan, 1979). "It's not the human fact which is geography, any more than it is the environmental fact, but rather the relation which may exist between the two. Geography is a science of relationships" (Barrows, 1923, p.12).

In psychology, many studies have focused on place-related concepts such as sense of place (Hay, 1998; Jorgensen & Stedman, 2001, 2006; Stedman, 2002), place attachment (Bonaiuto *et al.*, 1999; Giulliani, 2003; Hernandez *et al.*, 2007; Hidalgo & Hernandez, 2001; Lewicka, 2011), place identity (Bonaiuto *et al.*, 2002; Proshansky, Fabian & Kaminoff, 1983; Twigger-Ross & Uzzell, 1996) and place dependence (Stokols & Shumaker, 1981). The link between these concepts is not always clear (Giuliani & Feldman, 1993; Hidalgo & Hernandez, 2001; Lewicka, 2011; Stedman, 2003) because of the multiple theoretical viewpoints involved. For example, Hernandez *et al.* (2007) showed that the concepts of place attachment and place identity are sometimes considered to be one and the same; sometimes as an appendage of the other, sometimes as dimensions of sense of place. This confusion may also result from a methodological viewpoint (Lewicka, 2011; Stedman, 2003). As place is an explanatory

variable in our study, these links will not be explored and the concept of sense of place (SOP) as defined by Jorgensen and Stedman has been retained: “SOP is the meaning attached to a spatial setting by a person or group” (p.233). This concept comprises cognitive, affective and conative dimensions (Jorgensen & Stedman, 2001, 2006) and is a relevant concept for our study because it also encompasses place attachment, place identity, sense of community, rootedness and belonging.

The affective dimension deals with a person’s emotional connection to a particular place (Altman & Low, 1992) and is always present in place attachment, which is generally “defined as an affective bond or link between people and specific places” (Hidalgo & Hernandez, 2001, p.274). Rootedness is a type of spatial anchoring which is often expressed and strengthened by length of residence, but also by memories, inter-generational transmission and heritage (Kelly & Hosking, 2008). Temporality is a fundamental concept in this dimension and is frequently evoked in the literature on place. Community is a reflection of social ties and group belongingness (social networks, neighbourhoods, membership of associations, etc.) (Raymond, Brown & Weber, 2010) that may also result in collective commitments and play a role in place identity. Twigger-Ross and Uzzell (1996) defined four principles of place identity: distinctiveness, continuity, self-esteem and self-efficacy. Distinctiveness refers to when “people use place identifications to distinguish themselves from others” (p.207). Continuity refers to past place relationships (actions, experiences, etc.) that are maintained and developed in the present and according to the authors, this link provides a sense of community identity. Self-esteem is not only the positive evaluation of place, but also indicates that the individual “gains a boost to his/her self-esteem from the qualities of the place” (p.208). Self-efficacy “is defined as an individual’s belief in their capabilities to meet situational demands” (p.208) and refers to the functions of place and an

individual's ability to manage it. Place identity and place attachment are strongly linked (Bonaiuto *et al.*, 2002) and both play a role in risk representations.

Risk representations and sense of place

In line with the above-mentioned concepts, we set out to gain an understanding of how sense of place contributes to representations of risk. Several studies have shown a link between place-related concepts and representations or perceptions of risk. Billig (2006), for example, studied how place attachment contributes to risk perceptions in a context of war/conflict. She found that the stronger the place attachment, the lower the perception of risk, which consequently leads to a heightened sense of security: "When attachment is very strong, any environment, even if known to be very dangerous, may still be perceived as being good enough to live in, making one's home one's castle" (p.263-264). Individuals are aware they live in an exposed area but they do not feel insecure and this representation of their environment enables them to cope with the risk situation. Similar results were also found in the studies on river flooding carried out by Weiss, Colbeau-Justin and Marchand (2006) showing that when people displayed high levels of attachment to their living place, they accepted risk as part of the environment. The authors highlighted that people who are very attached to their home and who have lived there for many years, are also informed about and involved in the management of their living place. These results corroborate those of Bonaiuto *et al.* (2011) who showed that for flood risk in Italy, individuals with high levels of attachment to their living place also had a high level of risk perception and were concerned by this particular issue. Such a representation of risk allows people who are strongly attached to their environment to maintain a feeling of control over events (Weiss, Girandola & Colbeau-Justin, 2011) through minimizing change. When people can control risk, they can

avoid relocation or the stigmatization of their place – two elements that can produce a sense of loss and have a negative impact on place identity (Wester-Herber, 2004).

Objectives

Based on these theoretical perspectives, we hypothesized that risk representations would be linked to place, more particularly to sense of place, that they would also be linked to attitudes toward coastal risks, in particular attitudes toward local coastal risks and the level of information, and that they would influence preferred adaptation strategies, especially planning-related ones such as the consolidation of existing coastline, non-action, rolling-back and relocation.

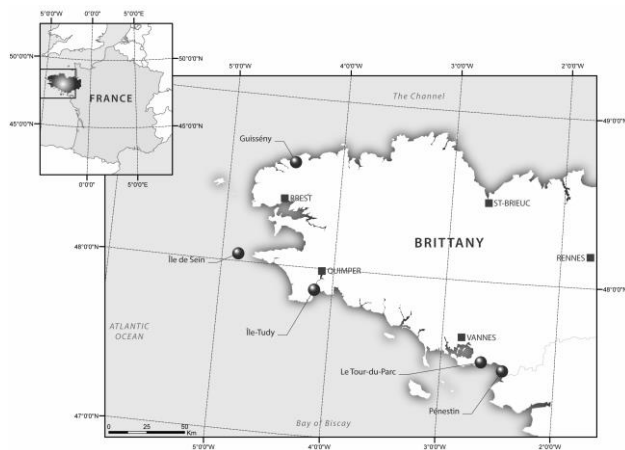
Therefore, this paper will seek to identify how inhabitants of exposed coastal municipalities perceive coastal risks. First, we will study respondents' general representations of risk and then identify and focus on those who spontaneously cited coastal risk. Second, this particular risk representation will be explained in relation to sense of place. In line with the literature, we suggest that people with a high level of place attachment have a low level of perceived risk, even though they are aware that they live in an exposed area. Third, the relationship between inhabitants' representations of risk and their attitude towards coastal risks and adaptation strategies preferences will be examined. We set out to answer the following questions: What risks exist in a given place? More specifically, do respondents identify coastal risks? More generally, how are risks integrated into overall place representations? And finally, what do respondents think about these coastal risks that they spontaneously mention? In their opinion, what are the most suitable adaptation strategies?

Methodology

A questionnaire survey conducted across five sites

As part of the COCORISCO programme, in 2012–2013, a direct door-to-door survey was conducted with 894 respondents from the following five coastal municipalities in Brittany, France: Guissény, Île de Sein, Île Tudy, Le Tour-du-Parc and Pénestin (see Figure 1). These study sites were selected according to several criteria (including the geomorphologic dynamic, demography and economy) and a multidisciplinary approach was adopted to carry out inter-site comparisons. The study sites were all exposed to coastal risks but had different geomorphological and social characteristics.

Figure 1. Study sites



Pénestin is a large seaside municipality (22 km²) in the Morbihan with 1,910 permanent inhabitants and 3,020 dwellings (Insee¹, 2009) of which over two-thirds are summer residences. The population increases nearly tenfold during the summer months compared to the rest of the year. The municipality's major coastal risk-related concern is the retreat of the clay cliffs endangering homes built on their uppermost part. *Pénestin* is not the object of a risk prevention plan (PPR) for coastal risks.

Le Tour-du-Parc (9 km²) in the Morbihan has 1,135 permanent inhabitants and 907 residences. It is marked by residential tourism (50% second homes) and a thriving shellfish industry. One part of the municipality is made up of former salt marshes bordered by

¹ Data taken from the results of a survey carried out by INSEE (the French National Institute for Statistics and Economic Studies) in 2009.

residential areas. During storms, Tour-du-Parc regularly becomes vulnerable due to flooding in these low-lying areas. In 2011, work started on the preparation of a PPR on sea flooding.

Île-Tudy in southern Finistère (1.3 km²) has 681 permanent inhabitants and 1,473 residences. It has a high rate of residential tourism (70% of dwellings are second homes). Since the 1950s, urbanization has been concentrated in areas close to the coast and is quite extensive in a former tidal marsh that was poldered in the 19th century. Since 1997, a PPR strictly controls new builds in zones exposed to coastal risks.

Île-de-Sein is a small, low-lying island (0.6 km²) with a maximum altitude of 9m, which makes it vulnerable in heavy storms. Census records show Sein has only 211 permanent residents, but the population usually increases tenfold during the summer. The island consists of 341 residences, nearly two-thirds of which are summer homes. Île de Sein does not have a PPR or a land registry.

Guissény is spread out over 27 km² and its area is divided into a low-lying coastal plain, partly polderized, and a higher plateau. It has a population of 1,988 permanent inhabitants and 1,207 residences. Guissény is characterized by the fact that it has retained its agricultural industry; it still has around fifty working farms despite the growth of residential tourism and rurbanisation. Unlike most Breton coastal municipalities, two-thirds of dwellings are still principal residences and the population has a higher proportion of retirees than people of a working age. Erosion of a coastal dune system has exposed some recently built-upon areas along the edge of the polder to the risk of sea flooding. In 2007, the municipality was assigned a PPR that restricts constructible zones.

Sample population

The sample population comprised 56% females and 44% males, most of whom lived in couples (79%). The mean age was 62 years and the age range was 18 to 93 years. The majority of respondents were retirees (65%) and the proportion of people of a working age

was 33% (29% in active employment and 4% with no job). For level of education, respondents with short secondary education were most represented (40%), followed by those who had taken higher education short courses (23%); the percentage of people having followed higher education long courses was 14% and only 2% said that they did not have any qualifications. Finally, 41% of participants were members of an association (e.g. resident, sporting, ecological, leisure and cultural groups).

For living environment, 96% of interviewees lived in a house, 90% of whom owned the property. Principal residences (57%) were the dominant residence type. Most respondents had lived in their municipality for at least 10 years (66%) and 55% lived there throughout the year. Most respondents had bought their property (72%) compared with 16% who were inheritors.

Our sample, because it is based on a random selection of inhabitants, was not socio-demographically representative of each municipality's population. Nevertheless, we ensured that questionnaires were conducted throughout the week (daytime and early evening, school holidays and term time) and with both permanent- and second-home residents, so as to minimize overrepresentation of the more easily accessible categories of the elderly, those not in active employment and permanent residents.

Data collection tools and operationalization of variables

A face-to-face direct questionnaire comprising 29 questions (not counting the common sociological data of sex, age, profession, level of education, family situation and association membership) was designed following an exploratory survey using 44 semi-structured interviews. The questionnaire consisted of closed questions, opinion scales and word associations: the first part focused on residence and lifestyle, the second on general risks in the area and the third on coastal risks.

The objective was to find evidence of connections between risk representations, place relationships and adaptation strategies. The next part will explain how the variables were operationalized and studied.

Risk representations. Representations of risk enabled us to examine how respondents generally perceived risk and more specifically coastal risk, in their municipality. To study spontaneous responses to this variable, a word-association question was used: “What are the first three words or expressions that come to mind when I say ‘risks to your municipality’?”.

Place relationships. Two elements were taken into account to study respondents’ relationships with their living place: spatial criteria and sense of place;

Spatial criteria referred to (1) the municipality in which people lived and (2) the relevant Risk Prevention Plan (PPR) zones.

Sense of place related to how inhabitants assessed their living place and the associated meanings. First (1), individuals’ relationship to their municipality was assessed by addressing the image of the municipality. Respondents were proposed pairs of semantic opposites (as per the Osgood scale) and asked to give their opinion on a 5-point scale. The antonyms, which have been pretested among 40 individuals, were as follows: dynamic/sleepy, quiet/at-risk, young/old, maritime/land, inactive/active, ugly/beautiful, rural/seaside. Second (2), several questions were asked to study attitudes towards place attachment and place identity. In one question, items enabled three particular dimensions from the literature to be assessed: affective (“I’m attached” to this living environment”, “I feel privileged to live here”), rootedness (“If I had to move I would feel uprooted”) and belonging and sense of community (“I consider myself to be a true member of this municipality”, “This municipality is *my* municipality”, “Any decisions taken about this municipality affect me personally, so I like to be involved”). Respondents were asked to give their opinion using a 5-point Likert scale ranging from 1 (strongly agree) to 5 (strongly disagree). In line with the literature, we also took into account length of residence, number of months spent there during one year, homeowner status, involvement in local associations, and principal or secondary residences.

Attitude towards coastal risks and adaptation strategies preferences. We studied respondents' attitudes via direct questions on coastal risks. The aim was to identify their attitude on local coastal risks (Are these risks real or not? Are the consequences important now and in the future?), their information level about these risks, and their preferences about *adaptation strategies* (What is the most suitable type of action? Are risks taken into account?).

Attitudes toward local coastal risks. Interviewees were asked two questions: (1) "What do you think about the current coastal risks (erosion/flooding) in your municipality?". Two items were proposed: "The risk is real" and "The consequences could be significant". Responses were rated on a 5-point Likert scale ranging from 1 (strongly agree) to 5 (strongly disagree); and (2) "What do you think about the future risk of sea-level rise?". Again, responses were also rated on the same 5-point Likert scale: "The risk is real", "Something will have to be done about it within the next ten years", "The consequences will be significant", "There's no proof that this will happen".

Information level. Here, the objective was to find out if inhabitants felt informed about it. The question was: "Do you think that you are sufficiently informed about marine erosion or flooding?", with four proposals: Yes / No / I don't know / Not concerned).

Adaptation strategies preferences. This enabled inhabitants' preferred adaptation strategies to be identified. Respondents were shown a list of actions regularly implemented to mitigate coastal risks (MEEDM, 2010), and evaluated each action with a level of agreement based on a 5-point Likert scale ranging from 1 (not at all suitable) to 5 (very suitable). The list was as follows: "1. Adapting the architecture of homes, 2. Consolidating artificial sea defences, 3. Building more artificial sea defences, 4. Demolishing and rolling back properties, 5. Upkeeping and restoring dunes, 6. Alerting and evacuating populations when risks arise, 7. Banning new builds in exposed zones, 8. Beach sand nourishments, 9. Depoldering programmes, 10. No action necessary". Finally, interviewees were asked the question "Do you think that current/future coastal risks are taken into account?" This opinion was assessed on a 5-point Likert scale ranging from 1 (strongly agree) to 5 (strongly disagree).

Data analysis

The study is based both on qualitative (word associations) and quantitative (closed questions and opinion scales) data analyses. Lewicka (2011) states that this is "Undoubtedly

a clever combination of quantitative and qualitative measures [that] offers the most profound insight into people's relations with meaningful places" (p. 221).

Word associations generated by the expression "risk to my municipality" were treated via a manual thematic content analysis which is essential for carrying out a qualitative data analysis and vital for the in-depth study of a theme (Krippendorff, 2004). Berelson (1952) classed this technique as an "objective" methodological tool for describing the content of communications because it is supported by strict analytical rules and clearly-identified research objectives. The method is mainly based on a content analysis grid that enables categorizations to be established. The first version of the category grid was submitted to a reliability test: 100 respondent answers were randomly extracted and then six independent judges assigned them into the grid's different categories. A comparison was made between each judge's allocation (calculation of inter-rater reliability (IRR)), which gave a concordance score of 84.30%.

Furthermore, as our study population was not normally distributed, non-parametric tests were carried out: the Pearson's chi-square test was used to study links between categorical variables. Standardized adjusted residuals for chi-square test were used to attest the differences observed between the variables (e.g., Canel et al., 2015). Positive values indicate that the observed is greater than expected by chance, whereas negative values indicate that it is less than expected. Finally, the opinion scales were submitted to a Kruskal-Wallis non parametric ANOVA test to analyse variance.

Finally, for attitudes towards coastal risk, an index was created that enabled response profiles to be identified: individuals were regrouped according to the common attitude towards risk. A k-means analysis was used to create the profiles and then group individuals into a number of determined clusters because it is a method which is well-suited for analysing large data tables (Lebart, Morineau & Piron, 2000).

Results

Risk representations

The first objective was to identify how respondents represented coastal risks. To minimize interviewer bias, the word association test was used for “risks to your municipality”. Following an initial thematic content analysis, the words and expressions were then sorted into several categories. People spontaneously cited the following issues when talking about coastal risks: daily (domestic risks, break-ins, road risks, fires, etc.); environmental (pollution, deterioration of the environment, etc.), weather and sea-related risks (coastal storms, sea floods, tsunami, etc.), artificial sea defences (dykes, sometimes the disparagement of actions, etc.), municipality planning (urbanization, rapid deterioration, impact on personal life, etc.), demographic (seasonality, how the countryside is being ruined, ageing, depopulation, etc.), general feelings towards risk (fear, concern, pleasure, etc.) and minimization or absence of risk.

All respondents were distributed across three groups: those who cited other risks but never coastal risks (46%), those who did not believe their municipality was exposed to any risk, those who did not know, or who did not respond (25%), and those who cited a coastal risk (coastal weather and sea-related risks) at least once (29%). As such, less than one-third of participants raised coastal risk as a potential threat to their municipality. This study will focus on this last group, in particular on their sense of place, their attitudes towards coastal risks and their preferred adaptation strategies.

Place relationships

Spatial criteria. The spontaneous citing of risks will be discussed in relation to two points: (1) the municipality where the inhabitants live and (2) their particular living space as defined by the Risk Prevention Plan.

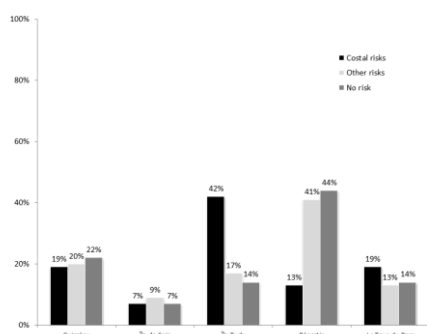
(1) Spontaneous citing of coastal risks varied by municipality of residence (Chi-square=109.94, df=8, p=.00000). Table 1 shows which variables contributed most to this significant result. The most significant contributors to this difference are the municipalities of Île-Tudy and Pénestin: inhabitants of Île-Tudy cited “coastal risks” most often (42%) in contrast to the inhabitants of Pénestin who had the highest percentage of “other risks” (41%) or “no risk” (44%) (see Figure 2).

Table 1

Standardized adjusted residuals for Chi-square test of spontaneous citing of risks and municipality of residence

	Guissény	Sein	Tudy	Penestin	Tour Parc
Coastal risks	-0,6	-0,4	8,5	-8,5	2,1
Other risks	0,0	1,1	-4,3	4,3	-1,5
No risks	0,6	-0,8	-4,0	3,9	-0,5

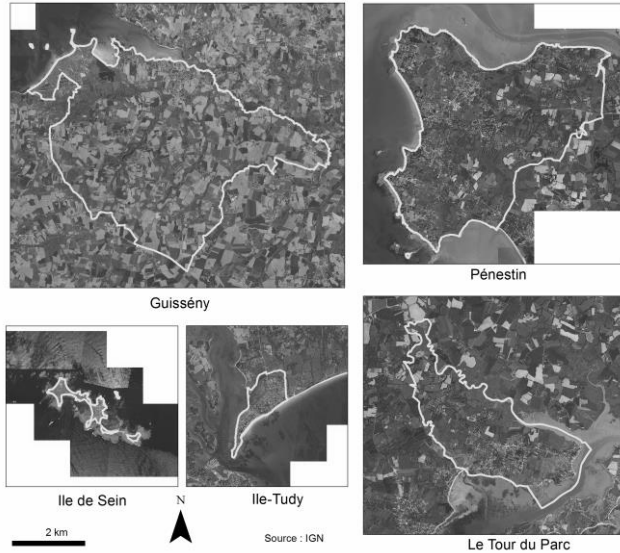
Figure 2. Spontaneous citing of risks according to municipality of residence



This contrast could be explained by the differences in surface area and altitude between both municipalities (in Pénestin, many homes in the hinterland are not very exposed to the sea, which is not the case for Île-Tudy (see Figure 3), and the fact that more local authority awareness-raising campaigns and cultural events (such as the “Si la Mer Monte...” [And if the

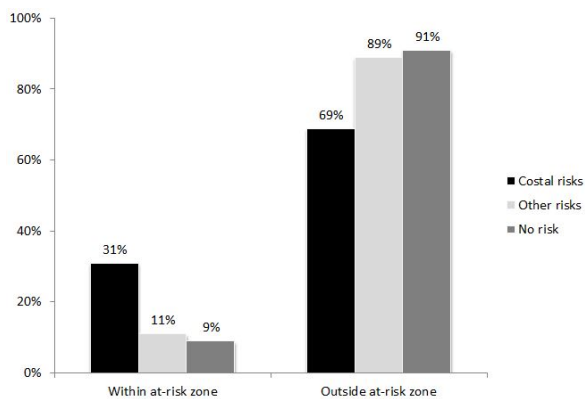
sea rose...] festival) were organized around these risks in Île-Tudy (Krien & Michel-Guillou, 2014).

Figure 3. Configuration of municipalities studied



(2) Is there is a link between the spontaneous citing of risks and whether the individual lives within or outside of a designated Risk Prevention Plan (PPR) zone?

Figure 4. Spontaneous citing of risks according to whether the individual lives within out outside of a designated Risk Prevention Plan (PPR) zone



Spontaneous citing of coastal risks varied according to whether respondents lived within or outside of a zone designated as exposed by the Risk Prevention Plan (PPR) (Chi-square=63.10, df=2, p=.00000). The most significant contributor to this difference is “coastal

risk” (see Table 2). Inhabitants who lived “within at-risk zone” cited more “coastal risks” as a risk on their municipality (31%) than other risks or no risks (see Figure 4).

Table 2

Standardized adjusted residuals for Chi-square test of spontaneous citing of risks and Risk Prevention Plan (PPR) zone

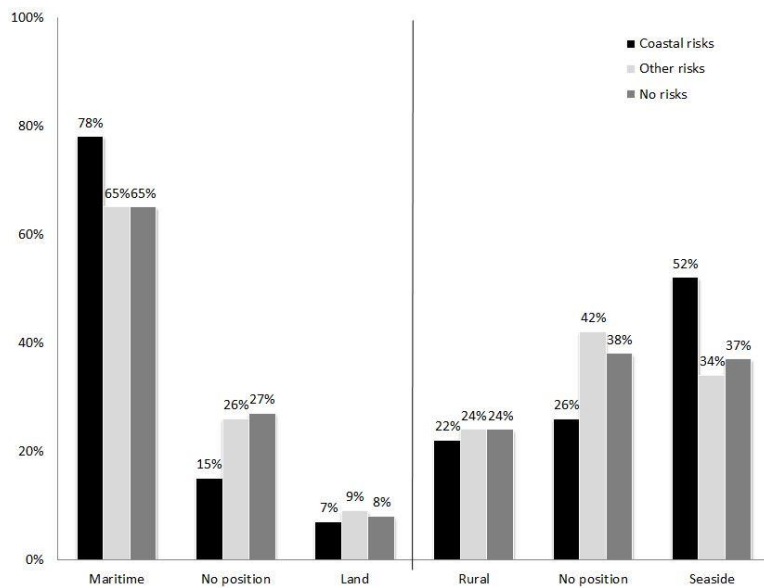
	Within at-risk zone	Outside at-risk zone
Coastal risks	7,9	-7,9
Other risks	-3,8	3,8
No risks	-3,9	3,9

This result shows that inhabitants’ level of risk awareness is related to place of residence. It is important to note that PPRs are a subject of debate and discussion in the municipalities because, on the one hand, they regulate building permits (that are generally prohibited in these zones) and on the other hand, they may potentially impact the cost of house insurance. It is therefore not surprising that people spontaneously evoke these risks more often when they live in these zones.

Sense of place. This tends to be understood as the inhabitants’ relationship with their living place and more particularly, the meaning they give it. We studied the relationships between inhabitants’ risk representations and their living place (image of the municipality, attachment, rootedness and place belonging). Two aspects were studied: (1) image of the municipality, and (2) place attachment and identity.

(1) Out of all the features proposed to define the municipality, only two sea-related characteristics were significantly different from the spontaneous citing of risks: maritime vs land and rural vs seaside (see Figure 5).

Figure 5. Spontaneous citing of risks according to the image of the municipality



More than the other groups, people who spontaneously cited coastal risks perceived their municipality to be a maritime ($\chi^2=15.57$, $df=4$, $p=.00365$) and seaside ($\chi^2=23.26$, $df=4$, $p=.00011$) one. These significant results are attested by the standardized adjusted residuals (see Table 3). Previously, we showed that proximity to the sea is not only physical, it is also social or cognitive, i.e., when thinking about their living place, people automatically make reference to the sea. These results confirm a cognitive proximity to the sea.

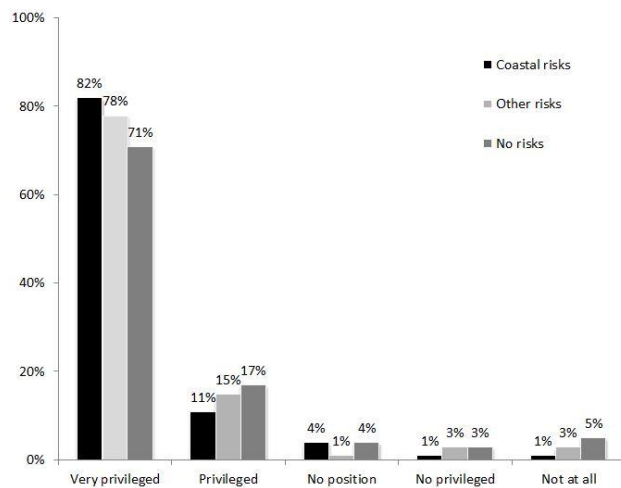
Table 3

Standardized adjusted residuals for Chi-square test of spontaneous citing of risks and image of the municipality

	Marime/Land			Rural/Seaside		
	Martime	No position	Land	Rural	No postion	Seaside
Coastal risks	3,7	-3,7	-0,7	-0,7	-3,9	4,5
Others risks	-2,2	1,9	0,9	0,5	3,0	-3,3
No risks	-1,3	1,7	-0,3	0,2	0,7	-0,9

(2) The second point highlighted the link to living place. Overall, it can be seen that nearly all people (98%) say that they are attached to their place. As set out in the methodology, several indicators measure place attachment and place identity and among these various place indicators studied (attached, privileged, uprooted, membership, concerned), only two of them significantly vary according to the spontaneous citing of risks (see Figures 6 and 7).

Figure 6. Spontaneous citing of risks according to the “privileged” dimension



People who spontaneously cited coastal risks more often considered themselves to be very privileged to live in the place ($\chi^2=20.36$, $df=8$, $p=.00907$). This idea, attested by the standardized adjusted residuals (see Table 4), was also found in the previous semi-directive interviews:

“We feel really privileged to live here, with the beach and everything, it’s really all very good”, “Compared to other places, for me, Île-Tudy is a privileged place to live in and after having seen plots of land in many different locations, Île-Tudy really was the ideal place for me. So we came here to live, even though we had to make some financial sacrifices to buy the land”.

Table 4

Standardized adjusted residuals for Chi-square test of spontaneous citing of risks and the “privileged” dimension

	Very privileged	Privileged	No position	No privileged	Not at all
Coastal risks	2,3	-1,7	1,5	-1,8	-2,1
Others risks	0,3	0,4	-2,4	1,1	0,1
No risks	-2,7	1,4	1,1	0,6	2,2

Figure 7. Spontaneous citing of risks according to involvement in decision-making processes in the municipality

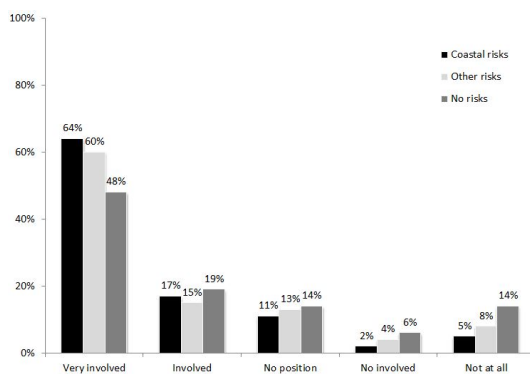


Table 5

Standardized adjusted residuals for Chi-square test of spontaneous citing of risks and involvement in decision-making processes in the municipality

	Very involved	Involved	No position	No involved	Not at all
Coastal risks	2,1	0,2	-0,7	-1,6	-2,1
Others risks	1,2	-1,0	0,0	0,0	-0,9
No risks	-3,6	0,9	0,7	1,6	3,2

Furthermore, people who spontaneously cited coastal risks displayed a community dimension, as they considered themselves to be more involved in the decisions taken about their municipality ($\text{Chi}^2=21.20$, $\text{df}=8$, $p=,00664$) (see Figure 7 and Table 5). Furthermore, we

have seen that these people, more than other respondents, live in the Risk Prevention Plan zone (see Figure 4). Consequently, as previously explained, these inhabitants are particularly concerned by town-planning decisions that regulate constructions.

This study also considered other variables which may play a role in sense of place: home ownership status, principal or secondary residences, number of months spent per year, length of residence, and if the property had been in the family for more than one generation. No significant differences were identified between the spontaneous citing of risks (risk representations) and the different variables above. In our sample, risk representations do not depend on place variables. Among the place-related socio-demographic variables in these small coastal municipalities, the only significant differences were found with age. The older the people were (75 years-old and over), the more they cited “no risk”. One reason for this is that during their lifetime they never have experienced a catastrophe that proved the existence of risk. Among all interviewees, only 41 reported that they had suffered damages.

Attitude towards coastal risks and adaptation strategies preferences

This section will discuss the possible link between risk representations and attitude towards local coastal risks (when the question is explicitly asked), knowledge and information level and preferred adaptation strategies.

Attitude towards local coastal risks. We carried out a direct survey on inhabitants’ attitudes towards coastal risks in their municipality. To do this, an index of “attitude towards coastal risks” was created from the propositions set out in the methodology. The internal coherence coefficient (Cronbach’s Alpha) was 0.79. The k-means test was used to create the index, which enabled four clusters (see Table 1) to be built which are all significantly different (Analysis of variance, $p < .00$).

Table 6

Attitude towards local coastal risk index

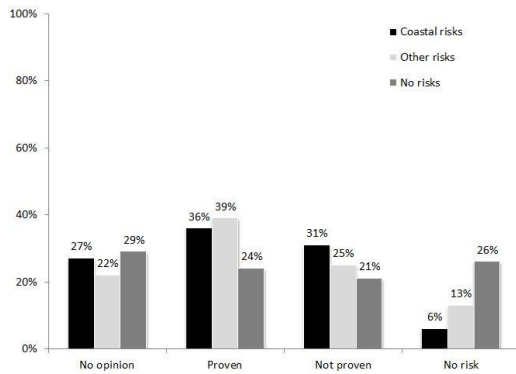
Group means (M) and standard deviations (SD) arrayed by clusters

	Cluster 1		Cluster 2		Cluster 3		Cluster 4	
	Risk proven		Risk not proven		No opinion		No risk	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Current risk real	1.67	1.02	1.40	0.69	2.78	1.30	3.83	1.40
Consequences significant	1.51	0.81	1.23	0.51	3.42	1.18	3.59	1.46
Future risk real	1.41	0.64	1.55	0.73	2.80	1.19	4.08	1.20
Something must be done within next 10 years	1.58	1.08	1.43	0.92	2.45	1.20	4.13	1.24
Future consequences significant	1.37	0.63	1.32	0.57	2.42	0.96	4.05	1.22
No proof	4.69	0.46	1.74	0.86	2.08	1.10	1.59	1.12

Four groups of attitudes toward local coastal risks were identified: Cluster 1, n=310/The risk exists and has been proven. This collates people with the highest level of coastal risk awareness; they believe that current and future coastal risks and their consequences are significant and do not agree with the notion that “there’s no proof that this will happen”; Cluster 2, n=230/The risk exists but has not been proven. This group is composed of individuals who are aware of coastal risk but unlike the first group, are not completely convinced that the phenomenon has been proven; Cluster 3, n=226/No opinion. This covers people who have no opinion on risk; Cluster 4, n=128/No risk. These people do not agree with the notion that current or future coastal risks exist and they do not believe that the phenomenon has been proven.

As for respondents who spontaneously cited coastal risks, what are their attitudes towards these risks when the question is clearly asked?

Figure 8. Spontaneous citing of risks according to attitude towards local coastal risks



In the figure 10, results show that the group who spontaneously cited coastal risks more often thought that these risks were real both now and in the future, and that their consequences are or will be important, but they did not think the phenomenon has been scientifically proven ($\chi^2=50.29$, $df=6$, $p=.00000$). In contrary, the group who spontaneously cited “other risks” thought that these risks were real, that their consequences are or will be important, and that the phenomenon has been scientifically proven. These significant differences are attested by the standardized adjusted residuals (see Table 8). According to previous results, this group are aware of coastal risks but these risks are relativized.

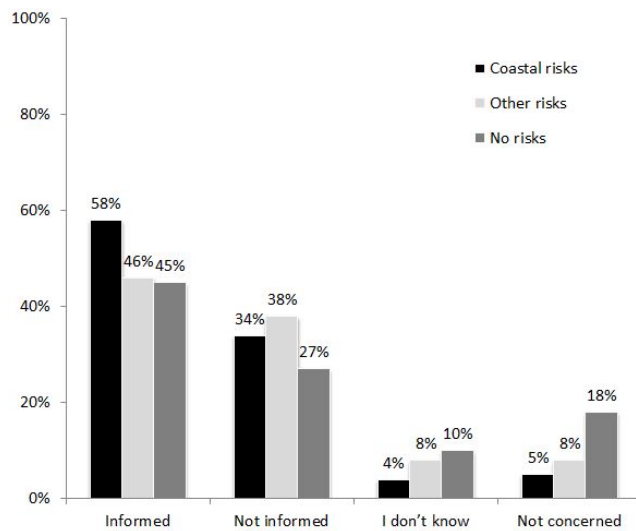
Table 7

Standardized adjusted residuals for Chi-square test of spontaneous citing of risks and attitudes toward local coastal risks

	No opinion	Risk proven	Risk not proven	No risk
Coastal risks	0,8	0,6	2,1	-4,4
Others risks	-2,1	2,7	-0,2	-0,9
No risks	1,6	-3,8	-2,0	5,6

Information level. In this section, available information on coastal risks was assessed for the group who spontaneously cited such risks (see Figure 9). Significant differences were observed.

Figure 9. Spontaneous citing of risks according to level of available information on coastal risks



The spontaneous citing of risks group felt more informed ($\text{Chi}^2=42.16$, $\text{df}=6$, $p=.00000$). This difference with the other groups is attested by the standardized adjusted residuals (see Table 8). Previous results show that as they lived within a zone designated as “at-risk” by the Risk Prevention Plan, they are involved in the decision-making process within their municipality and consequently they feel well-informed about coastal risks.

Table 8

Standardized adjusted residuals for Chi-square test of spontaneous citing of risks and available information on coastal risks

	Informed	Not informed	I don't Know	Not concerned
Coastal risks	3,4	-0,3	-2,4	-3,2
Others risks	-1,8	2,4	0,7	-1,4
No risks	-1,5	-2,5	1,7	5,0

Adaptation strategies preferences. In this last part, respondents’ attitudes towards current adaptation strategies for coastal risks were studied. In general, an overwhelming majority of respondents believed that *action is necessary* (74%). Preferred actions included “*banning any*

new builds in vulnerable zones” (85%), “*consolidating artificial sea defences*” (80%), and unsuitable actions included “*demolishing and rolling back properties*” (65%) and “*building more artificial sea defences*” (62%). There were mixed opinions on the (un)suitability of other strategies: “*depoldering programmes*” (28% vs. 52%), “*adapting the architecture of dwellings*” (47% vs. 36%) and “*beach sand nourishments*” (33%

Adaptation strategies preferences were then studied in relation to the spontaneous citing of risks in the municipality. Significant differences were observed with four items highlighting that people who spontaneously cited coastal risks were even more likely to declare that preventive action must be taken towards such risks (see Table 9).

Table 9

Adaptation strategies preferences according to the spontaneous citing of risks

	Costal risks	Other risks	No risk	ANOVA Kruskall-Wallis
Adapting the architecture of dwellings	3.43	3.00	2.96	H(2,N=849)=20.56 p<.000
Demolishing and rolling back properties	1.86	2.30	2.19	H(2,N=837)=12.03 p<.005
Banning new builds in vulnerable zones	4.28	4.67	4.57	H(2,N=871)=16.76 p<.000
No action necessary	1.40	1.65	1.82	H(2,N=800)=7.79 p<.05

Note: 1=Unsuitable strategies; 5=Suitable strategies (Significant Means)

Results show significant differences between the group who cited coastal risks and the other groups. The coastal risks group more often thought that “adapting the architecture of dwellings” is a suitable strategy while the other groups have no opinion. They also more often think that “demolishing and rolling back properties” is unsuitable. Because most of these people live in a PPR zone, they may be affected by a relocation plan, so they refuse the relocation. Like the other groups, they believe that “banning new builds in vulnerable zones” is a suitable strategy but significantly less than the others. This strategy is now socially desirable, in other words, it may be inappropriate (after storm Xynthia) to say that new builds

could be constructed in vulnerable zones. Therefore, this group are unfavourable to this strategy but less so than the other groups. Finally, more so than the other groups, they consider that “no action” is an unsuitable strategy. Consequently, in terms of adaptation strategies preferences, they are in favour of changes that can improve their living place (e.g. the adaptation of architecture), not completely against a total ban on new builds and against the relocation of homes.

The final question asked inhabitants if they thought that coastal risks were taken into account (see Table 10).

Table 10

Opinion about the consideration of current/future coastal risks

	Costal risks	Other risks	No risk	ANOVA Kruskall-Wallis
Current risks are taken into account	2.11	2.46	2.42	H(2,N=804)=9.91 p<.01
Future risks are taken into account	2.41	2.88	2.89	H(2,N=755)=15.66 p<.000

Note: 1=strongly agree; 5=strongly disagree (Significant Means)

More than the other groups, respondents who cited coastal risks believed that current or future coastal risks are taken into account. Interviewees were confident that there is appropriate management of this risk in their community: *“Now that the work has been undertaken. (...) We trust that it’s good, it had to be done, so that’s reassuring, very reassuring.”*

Discussion

The first objective of this paper was to identify coastal risk representations among inhabitants of at-risk coastal municipalities. In association with the expression “*risks to your municipality*”, less than one-third (29%) of interviewees spontaneously cited an element of coastal risk (submersion, flooding, erosion, storms, etc.). This figure reveals a low level of

perceived vulnerability as these risks are not present in their everyday life. Nevertheless, when the question is specifically asked about coastal risks, it could be seen that in general, people expressed willingness to intervene to mitigate these risks. Finally, through exploring inhabitant-living place relationships, this study shows that an overwhelming majority of respondents have a very strong sense of place.

Following this overall analysis, special attention was given to the group who spontaneously cited coastal risks (29%). It can be seen that respondents from this group have a social representation of coastal risk (Moscovici, 1976). The study aimed to define this group through the use of environmental and psycho-sociological factors to explain why they refer to coastal risks. Results show that they have particular attitudes toward risks, in particular coastal risks, and particular adaptation strategy preferences and ultimately, particular relationships to place.

First, inhabitants who spontaneously cited coastal risks were more concerned by these risks. More than the others, they live in an exposed area (according to PPR zoning) and they say they are informed about the phenomenon. Finally these respondents seemed to have a higher level of awareness about coastal risks. Indeed, more than the other inhabitants, they think that coastal risks are real and the consequences of these risks are currently important, or will be in the future. Furthermore, they believe that it is taken into account in decision-making processes in their municipality. However, they also believe that the risk is not proven. Here, as in other flood risk studies (Weiss *et al.*, 2011; Bonaiuto *et al.*, 2011), it can be seen that respondents recognize the existence of coastal risks, are concerned by and aware of such risks and ultimately show a sense of control over these risks. This feeling is expressed through the relativization of risk or by the belief that the local authorities are managing the risks. This acknowledgment of risk and the feeling of control allow people to maintain a positive place identity. The place contributes to self-esteem and self-efficacy (Twigger-Ross & Uzzell,

1996; Wester-Herber, 2004). In relation to place, their image of the municipality is one of a maritime and seaside area. These characteristics show a strong proximity to or familiarity with the sea and furthermore, these inhabitants feel very privileged to live in this area. Therefore, there appears to be a paradox: this group of respondents say that that they are exposed to risk, but at the same time, feel very privileged to live in the area. This seems to be inconsistent with the notion that place attachment produces a sense of security. Indeed, previous studies have shown that people with high levels of place attachment to their living environment are more likely to minimize the risk to which they are exposed (Billig, 2006; Moser, 2009; Navarro-Carascal, 2009; Flanquart, Hellequin & Vallet, 2013). How can this apparent paradox be explained?

It may be supposed that feeling privileged contributes to the distinctiveness principle of place identity (Twigger-Ross & Uzzell, 1996). Living in a coastal municipality is considered to be a privilege because of the beautiful landscapes, access to sea-related activities, tranquillity, etc. Identifying the place as “privileged” allows individuals to distinguish themselves from others. This study’s focus on sea- and coastal-related risks is original, differing from previous studies that concentrate on exposure to industrial hazards, other natural hazards and situations of war/conflict. The particularity found in the nature of coastal risks is related to the ambivalence of the sea: sea is Janus-faced, dangerous but with a very positive image in contemporary Western societies (Corbin, 1988). It is primarily a source of amenities rather than risk. This ambivalence of the sea explains how people may be simultaneously sensitive to the associated risks and feel very privileged by its proximity. Here, it can be assumed that for people who spontaneously cited coastal risks, the sea, as an object of place attachment, seems to play a role in place identity more than place attachment itself (the overwhelming majority of respondents are attached to their living place). This could explain why in the present study, no link can be identified between the risk representation and

other place-related variables such as length of residence – a result that differs from other studies (Billig, 2006; Weiss *et al.*, 2006). This finding is an avenue of future research that deserves more in-depth study. In modern societies, seaside communities have become an object of attractiveness which plays a role in the motivation to live in particular place (Kelly & Hosking, 2008). Therefore, studying the social representation of the sea could provide important insight into the inhabitant-place relationship. In relation to practices (Moscovici, 1976), this particular representation also explains the strong willingness to remain in a privileged position by rejecting strategies that imply change (demolishing and rolling back properties) and by accepting those which can strengthen their position (adaptation of architecture). Once again, this willingness can be linked to the identity dimension of sense of place. Considering that living environment plays a role in identity construction, (Bonaiuto *et al.*, 2002), it is understandable that any changes to the spatial configuration of a place can be perceived as a threat to identity (Wester-Herber, 2004).

Conclusion

The results of our study, focused on inhabitants, show the links between representations of coastal risks, adaptation strategies and sense of place. These elements help us to understand the human and social dimension inherent in coastal risks that are a fundamental part of systemic vulnerability. Consequently, this research highlights the importance for policy-makers to take into account the opinions of individuals affected by and/or exposed to risks to diminish the gap that is frequently observed between policies and practices. For example, these results help to explain the disparity between the national integrated coastline management strategy in France which favours “relocalisation of stakes and activities” (MEDDE, 2012) and its application difficulties in the field as regards the reluctance of inhabitants (Meur-Ferec & Rabuteau, 2014).

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