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RESEARCH ARTICLE



Resistance to relocation in flood-vulnerable coastal areas: a proposed composite index

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ABSTRACT

The increasing number of coastal floods in recent years in France has resulted in the design of new adaptation principles for the most endangered coastal areas. The aim of the government is to reduce the vulnerability of these areas by relocating property and infrastructure. These measures have, however, come up against considerable opposition from the population concerned. Using a survey of 421 inhabitants of Hyères, a coastal town in the South of France, this article proposes the study of resistance to relocation through the creation of an index for resistance that incorporates attachment to place, residential mobility and risk perception. The results show a correlation for the index and distance from the sea that highlights the existence of conflicting interests with adaptation measures depending upon population categories.

Key policy insights

- In France, although coastal flooding risk is a key issue in numerous populated coastal areas, coastal dwellers show little willingness to relocate.
- Resistance to relocation can be assessed through a composite index integrating place attachment, residential mobility and risk perception.
- Application of such an index shows a correlation between willingness to relocate and distance from the sea.
- Conflicts of interest with adaptation measures also depend on the age of the dwellers, their standard of living and on home ownership.

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Adaptation; attachment; climate change; coastal flooding; mobility; relocation

Introduction

Rising sea levels induced by climate change constitute a considerable challenge for coastal territories (IPCC, 2014). Besides the potential loss of low-lying areas, higher water levels will aggravate the severity of storms, putting populations at risk and increasing damage to property. These prospects have led the French government to recommend new principles to guide adaptation policy in the most endangered areas (MEDDE, 2012). The aim is to reduce coastal vulnerability through policies that relocate populations, property and infrastructure. Relocation is crucial for the resilience of urbanized coastal areas, not only to reduce possible damage but also to consolidate the area's ability to withstand adverse events, sustain attractiveness to tourists, avoid a collapse in property prices and facilitate crisis management when there is flooding.¹

Faced, however, with a risk that is seen as remote, uncertain and even overestimated, preventive relocation measures come up against strong opposition. The effectiveness of adaptation policies requires two, often contradictory, conditions: that measures be taken in advance and that the population feel concerned (Weiss, Girandola, & Colbeau-Justin, 2011).

The purpose of this article is to examine the grounds on which relocation may be resisted by coastal populations, and to propose a measure of this resistance across geographical space. We believe that such resistance can be measured objectively, and this motivated us to design an index enabling resistance to relocation to be assessed both within a given coastal zone as well as between one zone and another. More often than not, analysis of resistance to relocation emphasizes people's optimism bias and their attachment to their place of residence and to the amenities associated with proximity to the sea (Abel et al., 2011; Gibbs, 2013; King et al., 2014). In addition to these factors, we work from the assumption that the demographic specifics of coastal inhabitants must be taken into account. We also consider that acceptance of relocation increases with distance from the sea. Given the anticipatory nature of adaptation, taking into account population ageing and the ensuing reduction in mobility could lead to proposals for a gradual introduction of relocation measures. Thus, our index also includes a measure of the inclination to move according to age and income. As land-use planning is involved, the acceptability of relocation should be assessed not only for the people directly involved (seafront residents) but for all the inhabitants of a coastal community, and even of neighbouring communities. They too are concerned by coastal amenities and the benefits of seaside tourism and may show fiscal solidarity concerning action on the coast (Clément, Rey-Valette, & Rulleau, 2015). Opposition to relocation therefore needs to be assessed with reference to different people's perceptions, which may differ depending on whether they are directly concerned or not. Opposition from people who are directly at risk can be analysed as a dilemma arising from different interests. First, there is their immediate personal interest resulting from a surplus of life satisfaction owing to their proximity to the sea; then, the general interest of their geographical area, through adaptation to the effects of climate change; and even their own long-term personal financial interest, given the risk of the property market collapsing after repeated flooding.

Aiming to propose appropriate measures to raise awareness, this article attempts to understand the diversity of motives behind opposition to relocation by developing an index for resistance. Our contribution consists in proposing a global index, based on a multicriteria approach considering three dimensions: (i) place attachment, (ii) mobility and (iii) risk perception. To characterize the roles of these factors and to confirm the value of a synthetic index, we carried out a survey in Hyères on the French Mediterranean coast. This tourist town is one of the pilot sites of the national relocation experimentation programme (MEDDE, 2013). Seeking to confirm our hypothesis of a link between degree of resistance to relocation and distance from the sea, our survey covered three areas differing in their proximity to the sea, which influences social and demographic profiles and people's perceptions. In the first part, we detail the role of the three dimensions of our resistance index based on data from the existing literature. The second part describes the methodological protocol of the surveys and the principles underlying the index. The main results are presented and discussed in the third and fourth parts.

Motives for opposition to relocation

Attachment to the seafront

Place attachment is part of engagement, as employed by Thévenot (2006), i.e. 'a physical and emotional experience' but also an accumulation of social, cultural (or 'identity'), functional and economic capital (Thomas, 2014). The study of rehousing after urban demolition (Faure, 2006), for example, provides evidence of attachment to acts of sociability and solidarity among friends and families. For Bonvalet, Drosso, Benguigui, and Huynh (2007), the accumulation of local cultural capital means that mobility has psychological costs, especially for senior citizens. In the same way, long-term occupancy generates an accumulation of memories that makes moving house costly from a psychological standpoint. On coastlines, living by the sea and/or enjoying a sea view is both a factor in socio-environmental identity and important symbolic capital. Because of differences in the price of property and of tourist rentals (Fleischer, 2012; Luttki, 2000), this situation also generates economic capital and wealth-accumulation behaviour that help to explain opposition to relocation. Housing located near the sea constitutes an investment and a source of rental income. For the numerous pensioners living in coastal areas, property assets form part of financial investment strategies and end-of-life wealth-accumulation behaviour as well as intergenerational transfers (Bonvalet et al., 2007).

Denial and optimism bias

Studies on risk highlight the impact of perception on behaviour, and the influence of socio-cultural background (Douglas, 1992; Lupton, 1999), the media (Kasperson, 2003) and memory of past events (Weiss et al., 2011). An optimism bias is observed (Tversky & Kahneman, 1981), i.e. a lower awareness of risk, among people directly involved as well as among those who believe they can technically control risk or those whose exposure to risk is voluntary, given that place attachment generates a form of acceptance (Peretti-Watel, 2005) akin to voluntary exposure. In the case of climate change, these perception biases are even more prevalent due to lack of past experience and memory of the situation (Hellequin, Flanquart, Meur-Férec, & Rulleau, 2013; Rey-Valette et al., 2012; Weiss et al., 2011). Status quo bias also frequently arises (Cameron & Shah, 2015; Dutt & Gonzalez, 2012), since hazard increases only affect the medium term.

Socio-geographical factors affecting residential mobility

Resistance to relocation policies also depends on residential mobility. Mobility differs with type of area, particularly between urban and rural areas, and diminishes with age. In France, the rate of residential mobility is 5% in the over-55 age group (Debrand & Taffin, 2005, 2006) and the number of house moves is three times lower than the national average in the over-60s (Bonvalet et al., 2007). Conversely, mobility is stronger for high-income categories and better-educated people, especially in large towns where mobility is mainly professional (Cusin, 2014; Debrand & Taffin, 2005, 2006). Of course, the distance and attractiveness of receiving areas help to explain the degree of resistance to relocation, as shown in studies in Australia that find stronger acceptance when receiving areas are in the same community or in communities with good employment opportunities (King et al., 2014).

Methodology

Study area

Our survey was carried out in the South of France (Figure 1) in Hyères, a town of approximately 62,500 inhabitants with 421 inhabitants per sq km (data from the French National Institute of Statistics and Economic Studies (Insee) for 2013). Hyères' attraction for tourists is relatively well established (23% second homes and a carrying capacity of 12,084 tourist beds (Insee data for 2013). It extends inland but also has an archipelago of four main islands and a relatively long coastline (114 km).

On the mainland, the seafront is subject to severe erosion owing to its geomorphologic configuration (low-lying sediment coast), urbanization and the existence of several leisure ports. Downstream from these hard structures, erosion reached an average of 0.5m per year over the 1972–2003 period (MEDDE, 2013). The housing districts located in the Ceinturon plain to the east of the airport, whose low altitude (1m to 1.5m) exposes them to flooding, were chosen as the area for our study. The area was divided into three zones² to account for differences in the perception of relocation depending on the different levels of flood risk and on the degree of attachment to living by the sea. Zone 1 consists of seafront housing potentially affected both by flooding and relocation. Zone 2 consists of housing 'at risk' of flooding but not affected by relocation. Zone 3 comprises housing affected neither by flooding nor by possible measures for relocation ('no risk').

Questionnaire construction and mode of administration

A questionnaire (see Supplementary Materials) was constructed to assess the main variables that might explain resistance to relocation and preferences as to the possible ways of carrying out policy measures. The introduction began with questions on living arrangements, place attachment and the influence of proximity to the sea. These were followed by questions on experience and perception of flood risk, anticipation of changes in insurance systems and prices of property assets at risk. Several sections then probed the perception of individual and collective effects of relocation policies as well as preferences concerning the means of implementing and financing them and of providing compensation. The last part addressed the socio-demographic characteristics

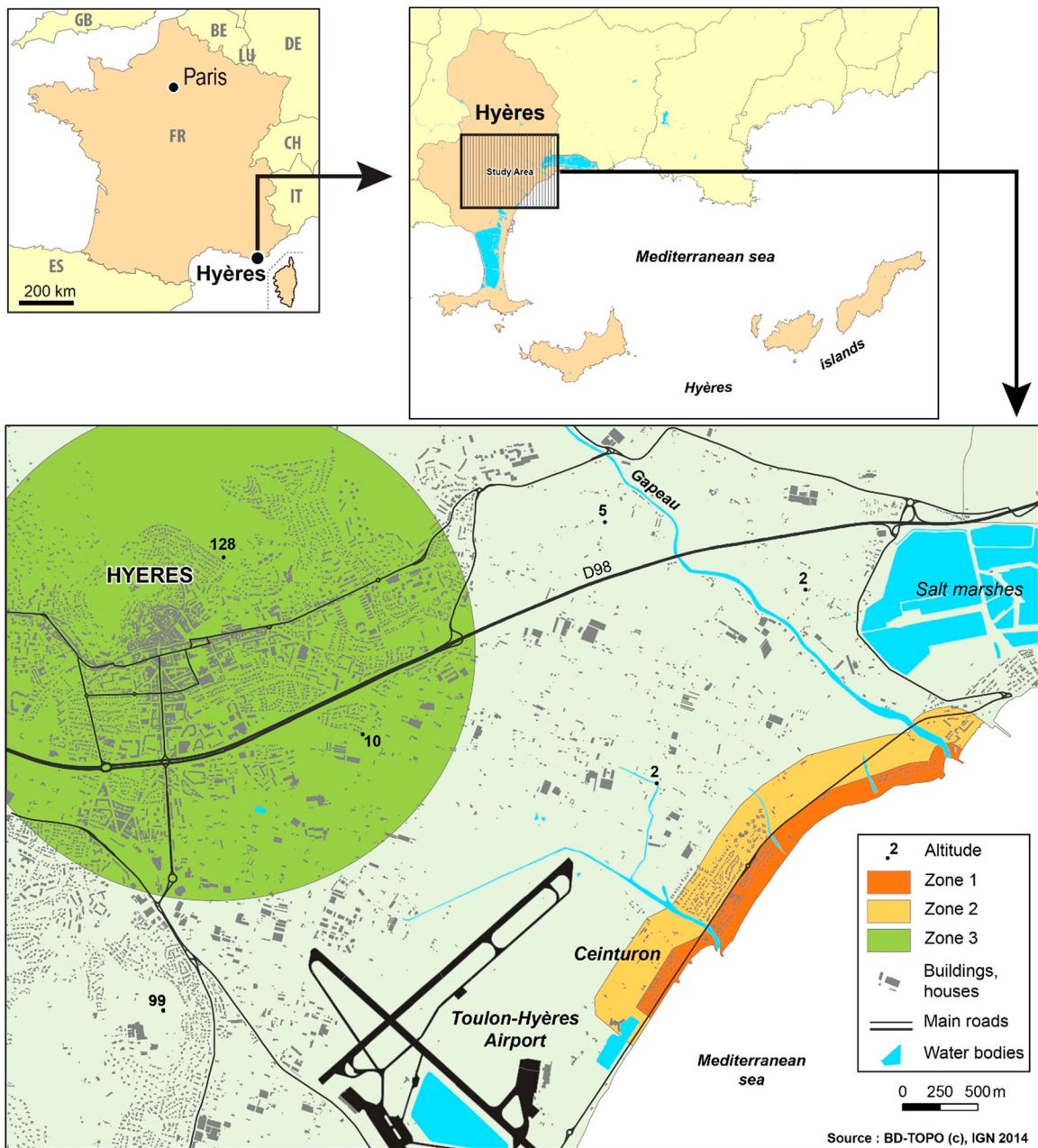


Figure 1. Geographical location of the study area.

of the respondents. Two versions of the questionnaire were proposed depending on whether the respondents were at risk (housing in zones 1 or 2) or not at risk (housing in zone 3) of flooding.

Finally, we included a subjective assessment of life satisfaction in three contexts so as to evaluate inhabitants' place attachment: a general case, a case involving a house move and a case involving a 20% drop in household income. This approach allowed us to assess attachment by exploring loss of life satisfaction resulting from a forced house move, a multi-dimensional approach justified by life satisfaction assessments indicating the importance of quality of life (Dolan, Peasgood, & White, 2008). By analysing the impact of an unwanted change of

residence, it is possible to isolate the impact of attachment from other factors (health, family) which are assumed to be constant. Given the impact of home characteristics and place of living on well-being, we also considered that place attachment was likely to be even stronger when place had a positive influence on residents' life satisfaction. The assessment was performed using the internationally standardized terminology for this type of approach. We asked people to appraise their degree of life satisfaction on a scale of 0 to 10, both generally and in the two cases involving moving house and losing income, in the spirit of subjective approaches aiming to assess life satisfaction or happiness.³

The study involved four interviewers, each questionnaire lasting an average of 30 minutes. It was carried out face-to-face at the respondent's home in various types of neighbourhood (social housing, housing estates, luxury gated communities, etc.). Primary-residence and second-home owners were interviewed over three two-week phases of interviews in May 2014, July 2014 and March 2015. In total, 421 people were interviewed: 14% (59) in zone 1, 38% (162) in zone 2 and 48% (200) in zone 3.

Sample characteristics

As the study area mainly covered neighbourhoods close to the seaside, the population sample had many specific characteristics (Table 1). Compared to the rest of the town's population, there were more primary residents, homeowners, university graduates, elderly (and thus retired) people as well as people in higher income brackets. Concerning the issue of place attachment, the respondents in zone 1 and 2 also had longer lengths of residency than the town average, which may be explained by their greater age.

The inhabitants interviewed in zone 1, potentially affected by relocation, stood out in several respects: they were older, with a higher than average proportion of retired people and a lower proportion of manual and intermediate workers. The same features were found in second-home occupants, who were more numerous in zones 1 and 2. This population was also more highly educated (49% with a qualification obtained after 5 or more years of study beyond the high school certificate, as compared to 13.5% of primary-residence occupants).

Measuring potential resistance to relocation

To build a relocation resistance index, we first created two indicators providing information on two dimensions of resistance: attachment and mobility. These indicators were obtained by combining for each the most robust variables in the literature and in our data. To identify any spatial variation of resistance to relocation depending on proximity to the seafront, we used the data collected from the questionnaires in the three zones. The attachment indicator combined loss of life satisfaction from a house move and the weight of proximity to the sea in choice of place of residence, both measured on a scale of 1 to 10. The mobility indicator included age and level of income (Figure 2). In both cases, cross-tabulation of the variables enabled us to determine three levels (values varying on an ordinal scale) with relatively well-balanced respondent numbers. Since the two indicators were not correlated, they could then be combined to create an intermediate indicator, which was in turn cross-tabulated with the perception of risk (Figure 2). The final index was the result of the cross-tabulation of five variables

Table 1. Main characteristics of the sample.

Town population ^a	Survey population 2014/2015				Town population ^a
	Average	Zone 1	Zone 2	Zone 3	
Primary residence	88%	75%	79%	98%	69%
Primary residence owners	65%	93%	87%	48%	50%
Females	54%	45%	54%	56%	52%
Household couples	58%	68%	64%	49%	58%
Aged 60 or over	50%	55%	51%	25%	30%
Retired	45%	57%	60%	29%	35%
Higher education graduates	47%	47%	37%	29%	27%
Intermediate level jobs, employees, manual workers	25%	10%	7%	27%	39%
Average monthly taxable income	€3200	€3700	€3100	€2800	€2271

^aData from Insee for 2013.

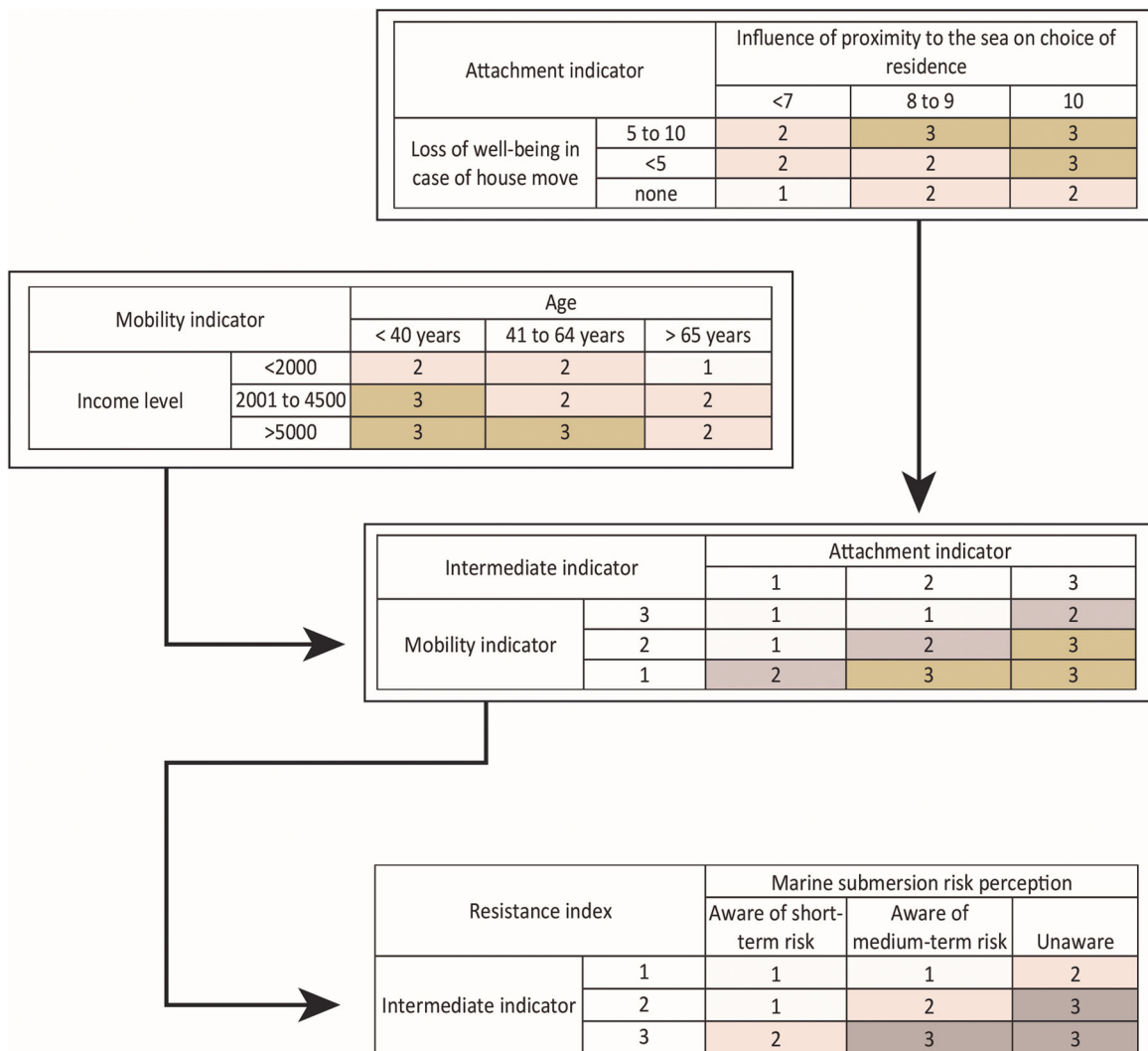


Figure 2. Principal for constructing attachment and mobility indicators and the resistance index.

indicating the three dimensions identified: attachment, mobility and risk perception. In this kind of multicriteria approach, the index needs to be built in such a way as to ensure that classes have more or less equal numbers of individuals, to comply with statistical test procedures seeking correlations. Class thresholds were therefore defined according to the context and the population studied.

Results

We first detail the factors indicating the three dimensions of the resistance index, before presenting the levels of resistance to relocation and the dependence between this index and the other variables.

Fairly realistic perception of risk and optimism bias among seafront residents

Although nearly three-quarters (74%) of the respondents had never experienced coastal flooding, they were often aware of the risks from rising sea levels: 59% considered it urgent to envisage this risk occurring in the

next ten years and 26% in the longer term. Only 15% of the respondents were sceptical, believing the forecasts to be unproven or that the sea level rise would not be high (6%). Similarly, only 21% considered relocation policies to be achievable. They believed these policies would be feasible within 20 years (41%), within 50 years (24%) or at an even later date (14%). Perception of risk in our study area was higher among the least endangered inhabitants of zone 3 (significant chi-square test: p -value = 0.02%), while the inhabitants directly affected (zone 1) were more inclined to consider relocation unachievable (p -value < 0.01%). Perceptions of the consequences of possible repeated flooding on property prices also varied greatly, and revealed an optimism bias among seafront residents (zone1), only 11% of whom believed properties would become almost impossible to sell, compared with 43% in zone 3.

Strong attachment to the sea (proximity and view)

For most of the people interviewed, proximity to the sea was a deciding factor in the choice of place of residence. Nearly 60% of respondents weighted it higher than 8 on a scale of 0 to 10, and almost a third (32%) gave the highest score of 10 (Figure 3). Its weight was greater for second-home occupants (53% of whom gave a score of 10 and 82.5% a score of 8 or higher).

An overall indirect measurement of place attachment was provided by assessing differences in life satisfaction related to a house move. The differences between levels of current life satisfaction and those under a projected forced move were clustered into three impact classes (Figure 4). The results reveal a higher impact and therefore a stronger attachment in zone 1. The impact of moving house appears higher than that of loss of income. On average, current life satisfaction was at a 7.7 level, falling to 4.5 with a house move and to 5.5 with a drop of 20% in income. This might be explained by the fact that inhabitants of zones 1 and 2, potentially those most affected by relocation, were both older and in a higher income bracket, and therefore less sensitive to income loss. The average monthly income was €3750 per household in zone 1 against €2500 in zone 2 and €1650 in zone 3, with a town average of €2271 (Insee for 2013).

Mobility constraints generate differences in ability to cope with relocation

Age and income distribution among respondents was correlated with zone of residence (p -value < 0.01% for age and equal to 2.5% for income), showing lower mobility for seafront residents. As previously mentioned for life satisfaction, the decreasing average household income with distance from the sea might have been expected to lead to greater mobility in zone 1. However, the generally higher age in zone 1 leads instead to lower mobility in this zone, the average age being 65 in zones 1 and 2 against 56 in zone 3.

High relocation resistance index for a quarter of respondents

Respondents were distributed over the three levels of the index of potential resistance to relocation as follows: a quarter of the sample showed high resistance (level 3), 29% average resistance (level 2) and 46% low resistance (class 1). We examined the dependence between the three levels of resistance and the main structural variables

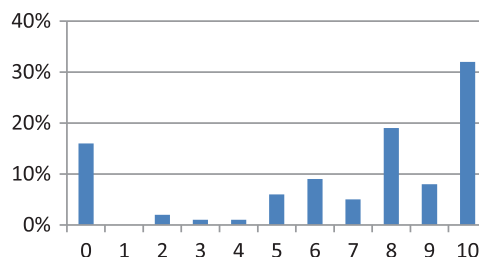


Figure 3. Role of proximity to the sea in choice of place of residence. Source: CEARC LAMETA 2014–2015 study – 0: none; 10: very high. In respondent percentages.

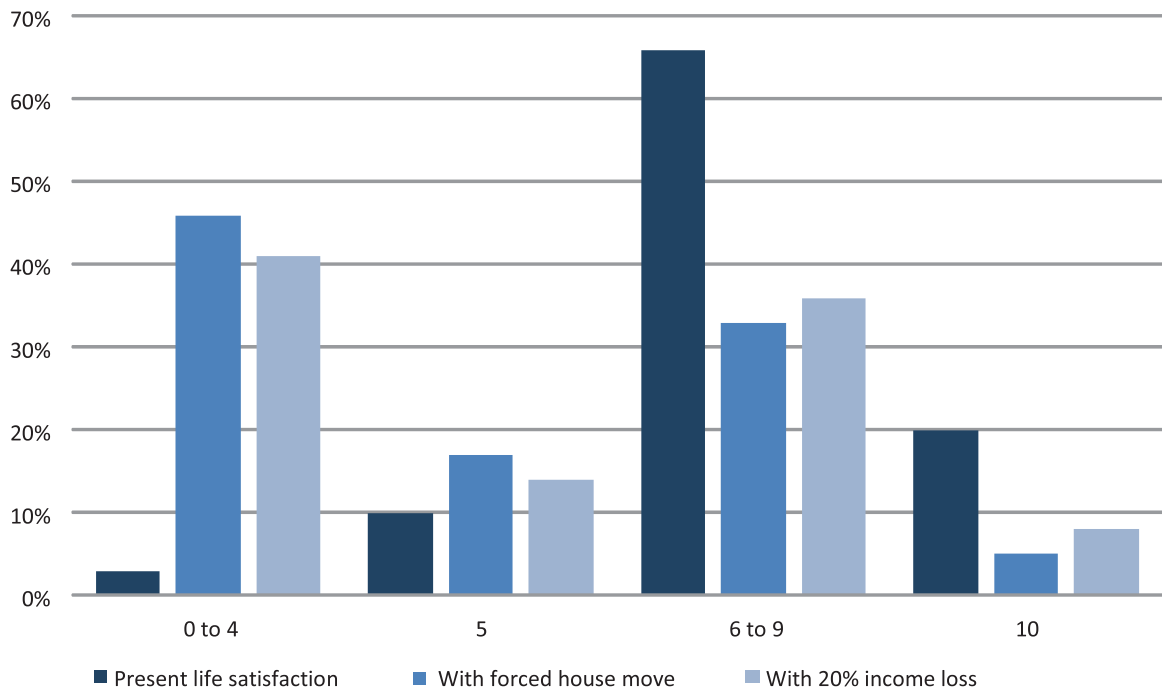


Figure 4. Assessment of respondents' life satisfaction with variations according to hypotheses tested. Source: CEARC LAMETA 2014–2015 study.

of the study, i.e. residence type and zone, risk perceptions and life satisfaction as well as the socio-demographic characteristics of the sample. Table 2 presents the variables showing dependence, with the degree of uncertainty observed for this relationship (error probability of the chi-squared test).

The significance of the statistical relationship between individual characteristics and the relocation resistance index highlights the importance of zone of residence and type of housing. The inhabitants located furthest from the sea (zone 3) and inhabiting their primary residence mainly showed lower resistance to relocation, whereas second-home occupants were more reluctant to move. As with risk perception, greater awareness of weather alerts appears to go hand in hand with low resistance to relocation. Paying attention to weather alerts therefore constitutes a sign of risk awareness, and could be seen as indicating recognition that one day inhabitants will have to move. In accordance with optimism bias, more of those characterized by risk denial believed that relocation policies were unachievable (chi-square test significant at 0.3%) and also showed higher resistance to relocation (level 3). This optimism bias may partly explain resistance among zone 1 inhabitants, leading them either

Table 2. Identification of the variables showing dependence with the potential resistance to relocation index.

	Error probability of the χ^2 test ^a
Status, housing location and origin	
Housing location zone (1,2 or3)	<0.01%
Owner or tenant status	<0.01%
Primary or secondary residence	4.2%
Perception of warnings and relocation	
Awareness of weather alerts (flooding and submergence)	<0.01%
Relocation perceived as realistic	<0.01%
Quality of life	
Quality of life indicator	0.08%
Socio-demographic variables	
Socio-professional categories	<0.01%

^aCorrelations is significant for an error margin less than or equal to 5% and very significant if the margin is less than or equal to 1%.

to deny the risk or to believe that coastal flooding can be prevented by technical solutions such as dykes. However, it should be borne in mind that they may have been unaware of the negative impact of dykes on maintaining beaches. The fact that people who considered relocation to be unachievable were more likely to show high resistance to relocation, however, seems very logical. The very significant relationship between the resistance index and the declared level of life satisfaction also confirms the role played by amenities. More people who rated their life satisfaction as excellent (value > 8) were in the highest resistance category and, conversely, individuals assessing their life satisfaction as 6 or below were in the category showing lowest resistance (level 1). Lastly, resistance to relocation also seems to be influenced by professional status. Retired people featured in the highest resistance category (level 3), whereas skilled self-employed people, employees and non-active people (with the exception of pensioners) all showed low resistance (level 1).

To test the strength and the relevance of the index, we compared our results with those obtained with an index based only on the two dimensions usually studied: risk perception and attachment. When we used this two-dimension index, we found that resistance to relocation was no longer linked to socio-professional categories but showed the influence of place of birth: there were more people born in Hyères and single people⁴ among those showing the highest resistance level. Similarly, membership of environmental associations, which is linked to individual knowledge and value levels, seemed to be an explanatory variable (there were more non-members in the highest resistance category). Adding the mobility dimension, related to age and income levels, to the resistance index hides these explanatory elements, which incidentally are also age-related. As numerous studies have shown (Hellequin et al., 2013; King et al., 2014; Myatt, Scrimshaw, & Lester, 2003; Rey-Valette et al., 2012, 2015), age seems to be a type of meta-variable that determines adaptation behaviour. Its influence is all the more striking in medium- and long-term effects, for which status quo bias is stronger with age, an observation that confirms the benefit of gradual implementation of relocation policies.

Discussion

Diverse determinants of resistance to relocation

The factors behind resistance to relocation are more diverse than might be expected. They include geographical location and type of housing as well as personal factors. Firstly, our hypothesis that distance from the sea (zone 3) leads to greater acceptance of relocation is confirmed. Secondly, it appears that second-home occupants and home-owners are more opposed to relocation (being more attached to their place of residence), as was clearly shown in the literature review carried out in Australia (King et al., 2014). In any event, strong resistance from home-owners constitutes a form of short-sightedness concerning the long-term conservation of their properties. Though the real estate market has yet to fully take account of flooding risks, the collapse of the real estate market in Houston, Texas in 1980 due to the sharp rise of insurance premiums after flooding in 1979 provides clear evidence of the possible medium-term effects of such hazards (Grislain-Letrémy & Villeneuve, 2015). In our study, the differing levels of resistance from different professional categories tend to illustrate the weight of economic factors: the skilled self-employed and employees show higher mobility and therefore greater willingness to relocate. It may also be true that the active population feels more concerned with maintaining the town's tourist attractiveness (Black et al., 2011; Cooper & Lemckert, 2012), an aspect which no doubt concerns retired people less. The weaker resistance can also be explained by the fact that these households, whose income levels are lower, are located in zone 3 (Table 1), further from the seafront, with amenities that are less well defined (and, as such, more easily replaced) than those provided by close proximity to the sea. Concerning the relationship to life satisfaction, since proximity to the sea offers specific natural, social and economic capital, there are obviously more people who see their life satisfaction as excellent (value > 8) in the highest resistance category. These results encourage greater precision in determining social factors and life satisfaction (Adger et al., 2009; Wise et al., 2014), as is the case with Graham et al. (2013), who propose an analytical framework covering health, safety, belongingness, esteem and self-fulfilment. Our results show a conflict between immediate personal interest (higher life satisfaction owing to proximity to the sea) and long-term interest (risk of the property market collapsing after repeated flooding). In France, where there is specific insurance coverage for natural catastrophes (with systematic indemnities for marine flooding) such resistance to change is

reinforced. Paradoxically, moreover, while other studies show that place attachment also concerns attachment to a lifestyle that then engenders a feeling of security (Cadoret, 2017), our index indicates inhabitants' sense of short-term quality and security of life while simultaneously pointing to their minimization of uncertainty and potential medium-term damage.

An operational contribution to implementing appropriate land-use planning policies

The approach promoted by our index could contribute to the design of relocation policies through better identification of areas at stake, analysis of local residents' propensity to mobility and more suitable design of communication strategies, thus making relocation more acceptable. In addition to place attachment and risk perception, which are often studied, the integration of mobility into the reflection provides new perspectives to accompany adaptation strategies. Given the nature of the relationship with age and the psychological barriers to mobility of elderly people (Bonvalet et al., 2007; Debrand & Taffin, 2005, 2006), legal measures for gradual relinquishment of property (André, Sauboua, Rey-Valette, & Schauner, 2015; Lambert, 2013) or pre-emption upon the deaths of present owners could foster greater acceptance. In the most endangered areas, increasing violence and frequency of storms over time may facilitate awareness and acceptance (King et al., 2014). Moreover, studies in Florida by Treuer, Broad, and Meyer (2018) show that the acceptability of relocation increases over time. In our results, this may be related to the fact that people consider relocation achievable as the time horizon increases (after 20 to 50 years). In France, a national survey on the perception of environmental risk exposure already shows greater awareness among people who have experienced adverse events, and only one person in five was unaware of the presence of a risk when settling in an area (CGDD, 2014). Our resistance index could also help administrators to anticipate not only opportunities to mobilize residents but also possible land conflicts (Cadoret, 2017), as well as identifying the motives behind opposition to relocation projects. It appears, for example, that levels of resistance are partially related to an optimism bias stemming from unconscious psychological behaviour in terms of risk-adaptation (Lupton, 1999; Peretti-Watel, 2005) and a more or less realistic perception of the need for relocation. These factors point to the importance of conducting communication campaigns on risks, and also on the need for and feasibility of relocation (Gibbs, 2015). In the presence of sea-level rise, it is indispensable to convince residents of the necessity of combining multiple adaptation strategies. Relocation is one of them: relying solely on technical solutions such as dykes may not be wise.

The importance of information campaigns is also highlighted by recent work on resilience or economic and behavioural psychology (Thaler & Sunstein, 2008), which underlines the role of knowledge, new perceptions and values in stimulating pro-active behaviour. In the case of natural hazards and adaptation to climate change, perceptions of nature and environmental attitudes (Dunlap, Van Liere, Mertig, & Jones, 2000) play a crucial role. This multi-dimensional assessment of resistance to relocation could help administrators identify the kind of measures to be implemented and the population categories to be targeted. As we have seen, the aim is not only to design information campaigns that are appropriate to residents' profiles, but also to progressively implement programmes so as to overcome the factors of attachment.

Building the resistance index requires *ad hoc* surveys, but the perception variables to be collected are quite simple. Thus, the structure of our index can be transposed to other territories. As underlined in the methodology above, thresholds need to be adjusted to the specific demographics of the territories studied and, depending on the survey and the available data, other variables could be selected for place attachment or risk perception. Other similar indexes could therefore be constructed for different contexts. However, the main value of our approach lies in combining the three dimensions of resistance (risk perception, place attachment and mobility) that we identified.

Conclusion

Better understanding of resistance to relocation could be useful in the creation and implementation of withdrawal strategies on coastlines exposed to flooding risks. Using survey data and a resistance index provides insights into these policies' likelihood of success. In the case of Hyères, analysing inhabitants' profiles according to levels of resistance to relocation demonstrates the value of such a composite index with dimensions pertaining to

place attachment, risk perception and mobility. As expected, accounting for the spatial dimension pinpoints diverging interests between population categories within the same coastal community or between neighbouring communities. Assessment of resistance to relocation shows that people with the lowest level of resistance are both the least attached and the most mobile. Moreover, they are mainly situated in zone 3, i.e. not directly exposed to risk and not directly affected by relocation. These different levels of resistance to, and therefore acceptance of, relocation are closely interlinked with issues of local public asset management, of behavioural contradictions according to scale (Warren, Lumsden, O'Dowd, & Birnie, 2005) and of the need for solidarity so as to adapt to climate change (Clément et al., 2015).

Notes

1. Elderly people, for example, who are relatively more numerous in seafront populations and whose numbers in European countries will have risen by 2050, have been observed to have a slower capacity for reaction.
2. The division follows hazard levels based on Flood Risk Area (TRI in French) maps drawn up using the 100-year flood risk and including climate change. Flood Risk Areas correspond to the zones most at risk from flooding within a catchment area. These zones must set up local management plans under State supervision. <http://www.rhone-mediterranee.eaufrance.fr/gestion/inondations/tri.php>
3. Assessments of well-being, initially macroeconomic (World Values Survey), have recently been developed at the local scale. These involve either an overall assessment of life satisfaction or an examination of the factors determining well-being that depend on the living environment and territorial characteristics (OECD, 2011).
4. People born in Hyères are relatively young, which may explain the fact that they are more often than not single.

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Disclosure statement

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