

# Living with climate change risks: stakeholders' employment and coastal relocation in mediterranean climate regions of Australia and Spain

Sandra Fatoric<sup>1,4</sup>  · Ricard Morén-Alegret<sup>1</sup> · Rhiannon Jane Niven<sup>2</sup> · George Tan<sup>3</sup>

© Springer Science+Business Media New York 2017

**Abstract** Climate change impacts are no longer just a future issue for communities in the Mediterranean climate regions. This comparative study offers insights on climate change risk perceptions and attitudes among environmental, economic and social stakeholders in coastal areas in northeastern Spain and South Australia, as well as compares interviewed stakeholders' risk perceptions with available documentary data and participant observation. Using a community risk assessment approach, the results show that some stakeholders perceive that climate change is already and/or may further continue to affect their employment, mostly in a predominantly negative way. Interestingly, some other interviewed stakeholders consider that climate change creates opportunities through new and

additional areas of work. The findings also suggest that climate change may influence relocation of coastal residential populations in both case studies, which is likely to be an acceptable option among the stakeholders. This acceptance can be linked to the fact that in both areas there is a significant percentage of resident population with migrant background. This study calls for a need to understand better the personal experience of climate change in industrialized countries, as well as to consider coastal relocation in the integrated coastal planning and other territorial and population policies.

**Keywords** Risk perception · Direct experience · Relocation · Climate change policy · Australia · Spain

✉ Sandra Fatoric  
sfatoric@ncsu.edu

Ricard Morén-Alegret  
ricard.moren@uab.es

Rhiannon Jane Niven  
rhiannon.niven@adelaide.edu.au

George Tan  
ghim.tan@adelaide.edu.au

<sup>1</sup> Department of Geography, Autonomous University of Barcelona, Building B, Campus UAB, Bellaterra, 08193 Barcelona, Spain

<sup>2</sup> Geography, Environment and Population, School of Social Sciences, Faculty of Arts, University of Adelaide, Adelaide, SA 5005, Australia

<sup>3</sup> Australian Population and Migration Research Centre, Faculty of Arts, University of Adelaide, Adelaide, SA 5005, Australia

<sup>4</sup> Present Address: College of Natural Resources, North Carolina State University, Box 8004, Biltmore Hall, Raleigh, NC 27695, USA

## 1 Introduction

Mitigation and adaptation to climate change are problems of global scope, with significant consequences especially for coastal communities. This is particularly relevant for communities living in Mediterranean climate regions, such as parts of southern Europe and South Australia who have experienced some climate variability and/or change over the past few decades (IPCC 2013, 2014). Coastal Mediterranean climate regions have been described as very vulnerable to a changing climate and the two areas studied in this article can be seen as showcases for adaptation to considerable climate change impacts on communities, livelihoods and ecosystems. From this perspective, the south European and south Australian Mediterranean regions provide a unique opportunity to investigate stakeholders' perceptions of a changing climate and its risks in an inter-continental context.

To understand the mechanisms of policy design relating to the community's adaptation capacity to the changing climate (Cote 2011), it is important to not only recognize how climate change risks<sup>1</sup> are distributed across communities, but also how they are perceived (Bruine de Bruin et al. 2014). According to Vogel et al. (2007), understanding perceptions is a vital entry point in building effective structures and behaviors to reduce vulnerability and strengthen resilience to environmental risks. The role of risk perception was similarly argued by Mozumder et al. (2011) as of the tools required alongside vulnerability analysis and risk analysis when developing successful and supportive risk management strategies against climate change. A greater understanding of these impacts can provide increased support for strong government policy and planning to address future challenges and improve resilience (Garnaut 2008; Niven and Bardsley 2013). However, it is at the local level where a greater insight is key as it is the local and regional levels that most decisions and investments are undertaken for coastal management (Harvey and Caton 2003).

Douglas (1992) argued that understandings about risks are based upon the socio-cultural environment in which people construct their understanding of the world and themselves. In this context, risk studies consider that the role of cognition and personality (Slovic 2000), exposure (Renn et al. 1992), gender (McCright 2010), education and profession (Mozumder et al. 2011), political affiliation (Bruine de Bruin et al. 2014), multi-media visualizations (Lieske et al. 2014), media content and coverage (Leiserowitz et al. 2013) and place attachment (Akerlof et al. 2013) play a substantial role in defining perception of environmental risk. This suggests that Spanish and Australian stakeholders living/working in these study areas experience the changing climate and acquire knowledge differently to external researchers.

Risk perception is a significant research topic which has long been theorized (e.g., Brody et al. 2008; Renn et al. 1992; Slovic 2000; Tam and McDaniel 2013; Wachinger et al. 2013) and empirically identified as an important predictor of people's decisions to adjust to various kinds of environmental hazards (e.g., Ariza et al. 2014; Biesbroek et al. 2011; Bord et al. 1998; Brody et al. 2008; Gurran et al. 2012; Lieske et al. 2014). The relevance and validity of stakeholders' knowledge and perception in environmental and climate change assessments have been demonstrated by a number of studies, especially in developing countries (e.g., El Raey et al. 1999; Linnekamp et al.

2011; Nguyen et al. 2015). Surprisingly, relatively few empirical quantitative or qualitative studies have compared climate change issues in the Mediterranean climate regions (e.g., Cody and Mooney 1978; di Castri 1991; Lereboullet et al. 2013), especially in the context of industrialized countries. The present study attempts to fill this gap by presenting local case studies in Mediterranean climate regions in Spain and Australia with a specific focus on climate change risk perceptions.

Using mainly a qualitative research methodology, this study explores how climate change can impact on stakeholders' employment (or working life) in Spain and Australia and documents how stakeholders perceive possible coastal relocation from both case studies.

## 2 Materials and methods

### 2.1 Case studies

This article focuses on two coastal areas in industrialized country context: Empordà wetlands (Aiguamolls de l'Empordà), located in northeastern Spain (Fig. 1); and the Southern Fleurieu Peninsula and Lower River Murray region, located in South Australia (Fig. 2). Both case studies are composed of natural areas and water bodies, agricultural lands and urbanized territories such as touristic resorts, small towns and villages (Table 1).

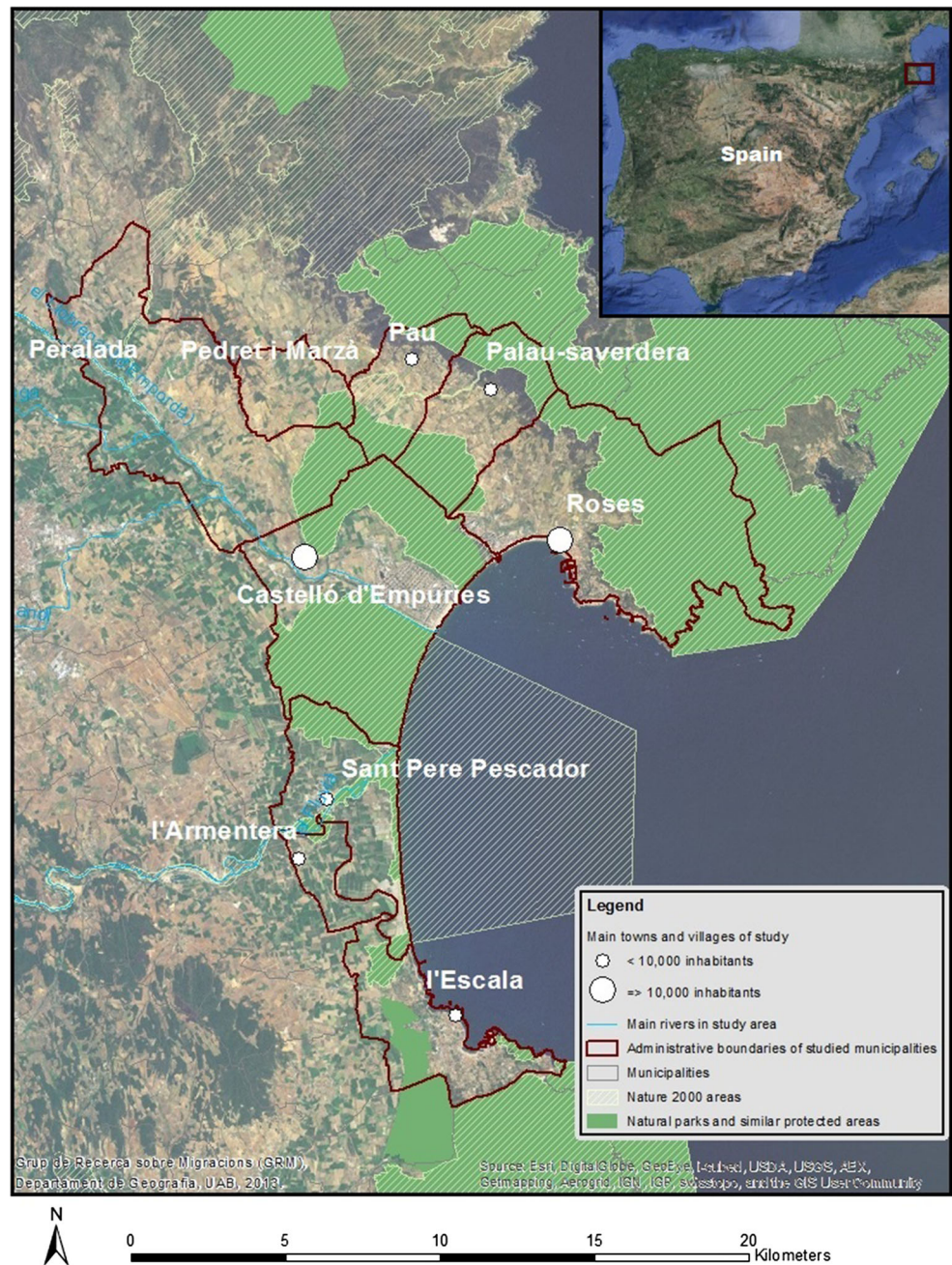
The following common characteristics can be found in two case studies: (1) natural protected coastal wetlands and rivers; (2) Mediterranean climate; (3) variety of small towns and rural/semi-rural localities; (4) a continually growing immigrant population; (5) tourism, agriculture and farming are the prime economic activities; and (6) distant from large cities.

### 2.2 Methods

A non-probabilistic, purposive sampling method was used to collect qualitative data for the present study. Thirty-six in-person, semi-structured interviews were conducted from 2011 to 2013 with stakeholders linked to municipalities or local government areas in both case studies (Table 2). Semi-structured interviews are likely to achieve higher overall response rate than other types of surveys (Bryman 2012) and this method provided a collection of rich and comparable qualitative data. For the purpose of this study, we define a stakeholder as a key local and/or regional actor whose activity could be affected by climate change and/or plays a role in the climate change decision making in the case studies. A list of stakeholders was compiled from extensive web-based search of various stakeholders whose work-related responsibilities were from various environmental,

<sup>1</sup> Risk can be defined by the probability of harmful consequences or expected losses resulting from a given hazard to a given element at danger or peril over a specified time period (Schneiderbauer and Ehrlich 2004).

**Fig. 1** Study area map: Empordà wetlands. The *inset box* indicates the location of the study area with respect to Spain



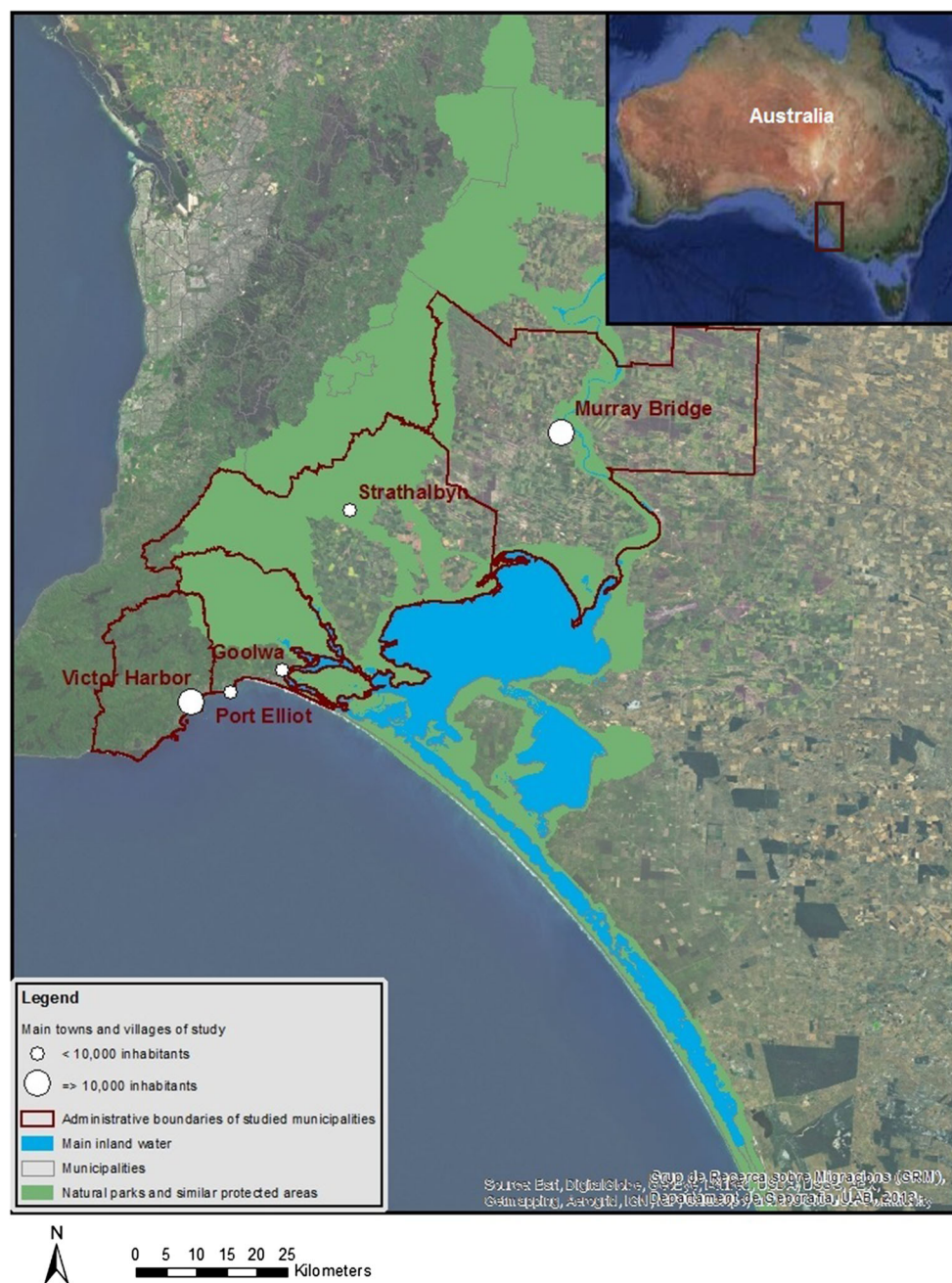
social and economic fields, and through chain-referral sampling with stakeholders previously interviewed. The selected interviewees were grouped into: (1) sixteen environmental stakeholders (referred to as ENV) from government departments, non-governmental organizations and science sector; (2) ten social stakeholders (SC) from cultural institutions, social and ethnic organizations; and (3) ten economic stakeholders (EC) from the tourism sector, engineering companies and real estate agencies.

Data presented in this study are part of a larger study and only represent a subset of questions. In this sense, an interview script (Rubin and Rubin 2012) was used to

(a) explore the current and potential impacts of climate change on the interviewee's employment; and (b) their willingness to relocate from both case studies. The community risk assessment (CRA) approach (van Aalst et al. 2008), which emphasizes the importance of community engagement in the scientific research, was used to structure the questions asked in semi-structured interviews and analysis of the empirical data. It gathers experiences, knowledge and perceptions about livelihoods, community's vulnerability and resilience, local risks and hazards. Demographic information on stakeholders' gender, age and nationality were also collected in the interviews.



**Fig. 2** Study area map: Southern Fleurieu Peninsula and Lower River Murray region. The *inset box* indicates the location of the study area with respect to Australia



The interviews were conducted in English, Spanish and Catalan, and the average length was 35 min. While some interviews took place indoors, others were conducted outdoors with stakeholders showing and explaining their perceptions about climate impacts on their work activities, and terrain that might be affected by climate hazards. After obtaining agreement from the stakeholders, all interviews were digitally audio-recorded, transcribed for analysis and two authors bilingual and/or proficient in Spanish and Catalan translated those interviews into English. The interviewed stakeholders are not representative of the broader population in both case studies, as the aim was to

capture a diversity of stakeholders' experiences, perceptions and attitudes. After reaching saturation with thirty-six interviews, an additional six interviews were carried out to ensure that no relevant additional perceptions emerged. Guest et al.'s (2006) methodological research strengthens the sample size choice for this article.

The application of different data collection methods ensured triangulation. Data from scientific literature, reports, official documents, local newspapers and statistical data (obtained from the Australian Bureau of Statistics, ABS; and Statistical Institute of Catalonia, IDESCAT) were gathered to gain background information about the

**Table 1** Comparison of environmental, climatic and socio-economic characteristics of Empordà wetlands and Southern Fleurieu Peninsula and Lower River Murray region. *Source:* ABS (2015), CREAM (2015), SA GOV (2016), IDESCAT (2015), Ramsar (2016)

	Empordà wetlands	Southern Fleurieu Peninsula and Lower River Murray
Location	Catalonia, Spain, South Europe	South Australia, Australia
Administrative division	Municipalities of Armentera, Castelló d'Empúries, Escala, Palau-Saverdera, Pau, Pedret i Marzà, Peralada, Roses, Sant Pere Pescador	Rural City of Murray Bridge, Alexandrina Council, City of Victor Harbor
Physical territory	Coastal lagoons, inland freshwater ponds, marshlands, beaches, dunes	Coastal lagoons, lakes, marshlands, dunes, beaches
River	Muga and Fluvià	Murray
Protection	Ramsar Convention on Wetlands (1992), Natura 2000, Special Protection Area for Birds (1986)	Ramsar Convention on Wetlands (1985)
Vegetation	<i>Arthrocnemum fruticosum</i> , <i>Callitriche</i> , <i>Eringium maritimum</i> , <i>Alisma plantagoaquatica</i> , <i>Orchis laxiflora</i> ,	<i>Eucalyptus camaldulensis</i> , <i>Gahnia filum</i> , <i>Muehlenbeckia florulenta</i> , <i>Pterostylis arenicola</i> , <i>Ruppia tuberosa</i>
Fauna	<i>Aphanius iberus</i> , <i>Botaurus stellaris</i> , <i>Ciconia ciconia</i> , <i>Crossidula russula</i> , <i>Putorius putorius</i>	<i>Botaurus poiciloptilus</i> , <i>Dama dama</i> , <i>Emydura macquarii</i> , <i>Geotria australis</i> , <i>Oryctolagus cuniculus</i>
Climatic region	European Mediterranean climate region	South Australian Mediterranean climate region
Absolute maximum and minimum air temperatures (1971–2015) <sup>a</sup>	Increase by 0.7 °C/decade (Max); Increase by 0.1 °C/decade (Min)	Increase by 0.6 °C/decade (Max); decrease by 0.8 °C/decade (Min)
Sea level (1990–2015) <sup>b</sup>	Increase by 3.6 cm/decade	Increase by 3.0 cm/decade
Tourism	Campsites, second homes, hotels, marina, ecotourism, birdwatching	Ecotourism, birdwatching, marina, second homes, bed and breakfasts
Agriculture	Cereals, fruits trees, vines, olives	Vines, citrus, stone fruits, cereals; beef and dairy products
Fishery	14% of Catalonia's fish production	Important source of income
N° population	48,309 (2014); 107% increase in 1991–2014	51,325 (2011); 39% increase in 1991–2011

<sup>a</sup> Annual absolute maximum and minimum temperature values for Southern Fleurieu Peninsula and Lower River Murray (station Victor Harbor) were sourced from the Australian Bureau of Meteorology and for Empordà wetlands (station Estartit) from the Meteorological Service of Catalonia

<sup>b</sup> Annual mean values for Victor Harbor and Estartit stations were obtained from the Permanent Service for Mean Sea Level

case studies and to contextualize perceptions and knowledge brought up in interviews. Participant observations and photographic records were also made during several visits in both case studies.

Content analysis (Weber 1990) was used to analyze qualitative data collected through semi-structured interviews with stakeholders. Transcribed data were entered in Excel spreadsheet and coded according to the question set in the interview script (i.e., descriptive codes), and additional themes that emerged during the interviews (Cope 2005). The main categories of codes such as “awareness of climate impacts on employment,” “willingness to relocate” and “unwillingness to relocate” were formulated with regard to research questions and additional sub-themes emerged from the interview data. These research themes illustrate the range of the perceptions about two research questions, which were then carefully interpreted and discussed. Similarities and differences were analyzed

comparing both the two case studies and different stakeholder groups within each case study. Reliability and validity were increased through data triangulation (Ritchie 2003). Direct interview quotes<sup>2</sup> are used to further illustrate the identified trends and contexts. These interview quotes are a way of giving voice to various stakeholders, which is one of the key objectives of qualitative research (Ragin 1994).

<sup>2</sup> In each quote, details on the stakeholders' country of residence (AUS stands for Australia; SP for Spain), main sector of activity (Environment, ENV; Economic, EC; Social, SC), gender (female/male) and age (years old) are provided.

**Table 2** List of thirty-six interviewed stakeholders in Empordà wetlands and Southern Fleurieu Peninsula and Lower River Murray region

Empordà wetlands	Southern Fleurieu Peninsula and Lower River Murray
<i>Environmental stakeholders (n = 8)</i>	<i>Environmental stakeholders (n = 8)</i>
Association of Friends of Natural Park of the Aiguamolls de l'Empordà (APNAE)	Friends of Newland Head Conservation Park
Center for Ecological Research and Forestry Applications (CREAF), UAB	South Australian Research and Development Institute (SARDI)
Catalan Office for Climate Change, Government of Catalonia	Department of Environment, Water and Natural Resources, Government of South Australia
General Directorate of Civil Protection, Government of Catalonia	City of Victor Harbor, Renewable Energy Programs
Centre for Coastal Resources Research, Polytechnic University of Catalonia	South Australian Whale Centre
Geonival Applied Geology (Geotechnical engineering company)	Climate Institute
Institute of Environment, University of Girona	Alexandrina Wildlife Support Group
Greenpeace Catalonia	KESAB Tidy Towns Group
<i>Social stakeholders (n = 5)</i>	<i>Social stakeholders (n = 5)</i>
Arena, German Daily Newspaper for Northern Costa Brava	Victor Harbor Public Library
Youth of Socialist Party of Catalonia	Green Party of South Australia
Dutch in Roses	Rotary Club of Strathalbyn
British Society of Catalonia	Croatian Club Adelaide
Ecomuseu-Farineria Castelló d'Empúries	National Trust of South Australia
<i>Economic stakeholders (n = 5)</i>	<i>Economic stakeholders (n = 5)</i>
Engel and Völkers Roses, Costa Brava (Real estate agency)	Anchorage Seafront Hotel
Tres 60 Innovació (Environmental consulting company)	Victor Harbor Yacht Club
Estudis i Projectes Empordà (Environmental consulting company)	Comfort Inn Hotel
Oceans Enginyeria Civil (Maritime, harbor and coastal engineering company)	Victor Harbor Farmers Market
Tourist Information Office Empuriabrava, Castelló d'Empúries	Victor Harbor Visitor Information Centre

### 3 Results and discussion

The main results from the data analysis are reported and discussed below. Direct quotes from the interviews with stakeholders from both case studies are displayed.

#### 3.1 Climate change policy context

Climate change has been identified by the governments in the Australian and Spanish case study regions as a key issue, and they have developed policies and strategies to address climate change (Table 3).

At a national scale, the Australian government focuses on emissions mitigation policy, with the local and state governments integrating climate change adaptation into their strategic business operations and planning (DEE 2015a). Similarly, in Spain, policies focus to develop and implement methods and tools to evaluate adaptation options for vulnerable industries, as well as to promote the participation of public and private stakeholders to mainstream adaptation and mitigation into sectorial policies

(MAGRAMA 2006). This Spanish strategy also recognizes the importance of evaluating coastal retreat or relocation under different sea level rise (SLR) scenarios. At the wider European Union level, the adaptation strategy (EC 2013) acknowledges the new market opportunities and jobs in sectors as agricultural technologies, ecosystem and water management, that adaptation may bring. This strategy also recognizes importance of coastal relocation, environmentally induced migration and displacement, highlighting the EC's role in promoting them as adaptation strategies.

South Australia has also a strong recognition of the physical vulnerability of coastal environments to climate change impacts. Planning for SLR has been in place since the early 1980s (DEWNR 2004, 2012b) with a 1 m allowance by 2100 for planning purposes. South Australian government provides the most direction for strategic adaptation for employment in the region, addresses vulnerabilities and future opportunities (DEWNR 2012a, 2014). In Catalonia, most of the mitigation measures (OCCC 2008) are precautionary adaptation measures. The Catalan adaptation strategy (OCCC 2012) highlights

**Table 3** Comparison of climate change policies in Empordà wetlands and Southern Fleurieu Peninsula and Lower River Murray region. *Source:* DEE (2015a, b), DEWNR (2004, 2012a, b, 2014, 2015), EC (2013, 2014), MAGRAMA (2002, 2006, 2007), OCCO (2008, 2012)

Empordà wetlands			Southern Fleurieu Peninsula and Lower River Murray region	
Catalonia	Spain	European Union	South Australia	Australia
Strategy for Adapting to Climate Change (ESCACC, Horizon 2013–2020)	Spanish National Climate Change Adaptation Plan (PNACC)	European Union Strategy on Adaptation to Climate Change	Prospering in Changing Climate: A Climate Change Adaptation Framework for South Australia	National Climate Resilience and Adaptation Strategy
Framework Plan for Climate Change Mitigation in Catalonia 2008–2012	Spanish Climate Change and Clean Energy Strategy 2007–2012–2020	A Policy Framework for Climate and Energy in the Period from 2020 to 2030	Building Resilience to a Changing Climate in the South Australian Murray–Darling Basin: A Climate Change Adaptation Plan for the South Australian Murray–Darling Basin	National Energy Productivity Plan 2015–2030
	Integrated Coastal Management in Spain		South Australia's Climate Change Strategy 2015–2050, Toward a Low Carbon Economy	
			Living Coast Strategy for South Australia	
			Coast Protection Board Policy Document	

that tourism diversification and increase in less climate-dependent tourism options is important adaptation measure. However, this strategy does not address coastal relocation.

### 3.2 Risk perceptions of climate change impacts on employment

Our study shows that there is generally a high awareness of the influence of climate change on stakeholders' employment in both case studies as the majority of stakeholders acknowledged how climate change has already and/or may further continue to affect their employment. Australian stakeholders were slightly more aware of this issue than Spanish ones. Further, economic and environmental stakeholders from both case studies were more aware of climate change impacts on their current and future work activities than social stakeholders. As a respondent from a governmental department stated:

We are adjusting our well-managed risk communication to the needs of the Catalan residents. Over the last decade our work tasks have increased due to people's concern and awareness about the increased frequency and severity of extreme weather events (SP-ENV-male-45).

Age is likely to play a factor in risk perceptions as stakeholders who were over 41 years old, were more likely to express stronger perceptions of the impacts of a changing climate on their employment than their younger counterparts. Relevant differences between stakeholders' gender and nationality were not found.

Results also suggest that climate change seems to be no longer considered just as a global issue; rather it is also a local issue, visible and current problem affecting stakeholders' employment in both case studies. Interestingly, this implies that the global economic crisis (especially in Spain) did not overshadow climate change impacts on stakeholders' work activities. Moreover, Tàbara's (2010) study on climate change perception and communication in Catalonia suggested that the economic crisis might increase the perception that dealing with climate change could be an important factor in overcoming the economic crisis.

Various stakeholders from both case studies who expressed awareness of climate change impacts on their work activities, perceived that climate change is already and/or may further adversely affect their employment. This is common perception as noted by various Australian stakeholders:

Everybody wants a piece of the Murray River. Two years ago, we had ten years of drought and the river dried up even more with irrigation and growing crops such as cotton, rice and oranges. Clearly crops can be affected by climate change and this can lead to the shortage of food and water...The fish stocks are already in decline due to sea temperature rise (AUS-EC-male-55).

Marine life is already affected. People are hunting whales for their oil and if our waters become warmer, our whales won't necessarily come here...These all can affect our work. We are coastal town, the water and marine life are very important, both for conservation and tourism since many tourists come here for



fishing, whale-watching, surfing (AUS-ENV-female-24).

Farming is always going to be a big part of the economy, its biggest threat is climate change because this part of Australia is fairly dry and warm and with climate change the rainfall is likely to decrease. The places where they grow, for example, grape, they might grow very well now, but maybe in thirty or forty years the climate won't be suitable in those areas, so agriculture will shift inevitably if we don't get climate change under control (AUS-SC-male-51).

Climate change can affect my work only negatively. Our telecommunication service relies on fiber optic, which is vulnerable to the observed and projected increase in temperature, heat waves, lightning, floods and other extreme weather events (AUS-ENV-male-62).

Meanwhile, Spanish stakeholders expressed similar views on the impact of climate change on their employment:

The tourism is likely to be severely affected by intense heatwaves and higher temperatures, losing the ecosystem services for tourism industry (SP-EC-female-38).

Property sales in Castelló d'Empúries and Roses could be restricted under the recurring climate hazards such as flooding (SP-EC-male-42).

We have more frequent and persistent droughts here. The precipitation is more intense, but occur for just a short period. This is enormously affecting water supply especially for agricultural and tourism industry (SP-ENV-male-46).

In this context, other stakeholders were more ironical about the future climate change impacts on their employment:

We don't plan to grow cactus instead of fruits (SP-SC-female-45).

Local media in both study areas also reported news focusing on local climate change awareness and potential adverse impacts on employment. For example, in the case of Spain it was observed that some fish species have already migrated northward to colder waters (Empordà 2012) what might negatively affect the fishery. Similarly, in Australian case study, increasing coastal erosion and sea level rise (Victor Harbor Times 2012) might adversely affect tourism industry through reduction in the esthetic appeal, surface areas of beaches, damage to infrastructure and causing it as less attractive tourism destination and

second home residence. It is worth noting that Spanish tourism industry is also particularly vulnerable as the coastline and its ecosystems have been a focal point for an important part of tourism industry in Empordà wetlands.

Interestingly, some stakeholders perceived benefits from climate change, stating how it can facilitate job and other economic opportunities. These positive impacts of climate change are perceived particularly among Spanish stakeholders. For instance, they believed that a changing climate could influence a creation of new economic activities or expand existing jobs due to the growing demand and interest in climate change issues. This finding is in accordance with Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment (2014) where is suggested that climate change adaptation—besides moderating harm—encompasses “exploiting beneficial opportunities.” Some stakeholders linked to specific sectors like engineering and environmental management highlighted this as follows:

I think that climate change could in fact benefit my work activity because our company is specialized in coastal and port engineering, so with SLR our work would increase too due to new coastal management (SP-EC-male-38).

Coupled with the changing climate and SLR our coastal community may lose one economic activity, but may gain another one (SP-ENV-male-49).

Both interview data and participant observation suggest that economic diversification can be an effective tool to reduce the adverse climate change impacts on socio-economic systems in both case studies by increasing economic resilience and reducing dependence on vulnerable economic sectors. As a Spanish scientist and an Australian non-governmental member emphasized:

Climate change is inviting us to rethink our way of land use, our way of adapting to climate change... To reformulate our tourism market, look for sustainable development of tourism along the coastline...Perhaps relocating inland and leaving the coastline to its natural form (SP-ENV-male-48).

Agriculture should start to focus primarily on drought-tolerant crops, for example, introducing more vineyards and olive trees. Vineyards are important part of South Australian's agricultural production, where shifts in grape types may occur soon...But we must have a market for such changes. So we must ask ourselves—where can we sell it? And then—can we grow it? (AUS-ENV-M-41).

This finding has important implications for climate policy. For instance, the best practices and experiences of stakeholders and their facilitation of technical and financial



assistance could be communicated to people outside the realm of research and policy making. Such communication strategy could ensure transparent support for formulation and implementation of climate change adaptation and mitigation policies among the public.

Furthermore, economic diversification as an essential component of any adaptation strategy can also reduce the risks from current climate variability, which has been observed in present study as an important hazard and concern in both Mediterranean climate regions. The interview data show support for the economic diversification in the Spanish case study. For example, ongoing tourism reconstruction is aiming to provide tourist accommodations with sustainable practices and create networks of natural roads, which can improve tourism options and reduce the impacts of seasonality patterns in order to cope with climatic variability and current economic crisis. Very relevant to this implication is a study of relocation strategies for businesses in Australia (Linnenluecke et al. 2011) where authors argued that there is a crucial need to understand how relocation is utilized by business and industry as an adaptive strategy to deal with climate variability and change. They also suggested that decision makers need to reflect on the costs of relocation versus the costs of staying in highly vulnerable areas and maintaining their infrastructure and economic activities.

### 3.3 Identifying risk perceptions on coastal relocation

When asked about considering coastal relocation (also known as planned retreat, Niven and Bardsley 2013) in case of more frequent and severe climate change effects, various stakeholders from both case studies expressed that this option would be an acceptable one. Some examples illustrating this perception are the following:

Living near the coastline is the result of people's ignorance. This should be stopped! Protecting entire coastline would be too difficult, it would be better to start relocating inland and creating buffer zone between development and shoreline (SP-ENV-female-45).

You cannot do anything here, nature will always win. It is much easier to move elsewhere than protecting this area. People started to sell their properties because of more frequent flooding, which is causing damage on buildings in Empuriabrava [Castelló d'Empúries] and Santa Margarida [Roses]. These buildings and canals are of terrible construction quality (SP-SC-male-43).

Every big change is a challenge and opportunity. It will be difficult to adapt many of the infrastructure and housing here, so government will need to think about coastal relocation (SP-ENV-male-48).

Mother Earth will make difficult and expensive life to the communities here. I don't think that this area can be preserved. Communities will need to leave and this is the wisest thing to do. People spend millions of dollars for building huge walls and other structures to protect themselves against the sea (AUS-ENV-male-70).

Manage the avoidable and avoid the unmanageable... We are already relocating people due to forest and bush fires that are intensified with recent climate change. Increase in drought will drive to abandoning the areas and people living and working in coastal areas will have to be relocated too... Climate change is affecting insurance companies, even construction materials and fabrics for buildings (AUS-ENV-M-41).

The finding of willingness to relocate is in consonance with similar studies in industrialized countries such as the United States (e.g., Bukvic 2015; Granja and Carvalho 2000; Marino 2012; Mozumder et al. 2011) and Australia (e.g., Hurlimann and Dolnicar 2011) where that majority of experts, decision makers and community members opined that relocation due to SLR and subsequent coastal erosion, flooding, more severe hurricane events and water scarcity would be an acceptable option (see Fig. 3 as an illustration of vulnerable settlement and its infrastructure). Our findings also show that Spanish stakeholders were more likely to opt for relocation than the Australian ones. A possible explanation is linked to the fact that in Empordà wetlands there is a higher percentage of foreign residents than in the Southern Fleurieu Peninsula and Lower River Murray region. Recent foreign residents and newcomers in Empordà wetlands may not have a strong place attachment to the area that would prevent them from relocating. Additionally, their previous migration experience can facilitate relocation, in contrast to other coastal areas with more sedentary population like Ebro Delta (Fatorić and Chelleri 2012). Similar results were found in the recent study on voluntary relocation in Australia, where is documented a stronger tendency of relocation between newcomers than longer-term residents (King et al. 2014). In terms of demographic characteristics, stakeholders who were over 41 years old tended to be more in favor of relocation than younger ones. Conversely, Koerber (2006) found that in the context of Hurricane Katrina (USA) younger people were more likely to relocate. There are not relevant differences between willing and not willing to



**Fig. 3** Residential marina and its system of artificial canals in Empuriabrava (Castelló d'Empúries), which are vulnerable to climate change hazards

relocate among ENV, EC and SC stakeholder groups and in terms of stakeholders' gender.

On the other hand, some stakeholders would not be supportive of relocation from their areas due to strong place attachment:

I don't agree with taking an action and move away because I'm part of this coastal area for 27 years and I want to continue to live and work here (AUS-EC-female-27).

Additionally, high economic and ecological importance of Australian and Spanish case studies and past financial investments in both territories are also highlighted as reasons to remain, while specific protection measures are claimed:

Government will have to protect us against climate change impacts because it cannot be acceptable to lose significant economic industries (SP-SC-female-21).

We should look at the Netherlands and its protection capacity. They are a great lesson to all, so we need to keep protecting our piece of land (AUS-SC-male-55).

Regarding the investments in second home tourism, it is economically more acceptable to build seawalls and other protection than to relocate activities and population (AUS-EC-female-40).

Some studies conducted in other coastal areas in Spain (Fatorić and Chelleri 2012), Egypt (El Raey et al. 1999) and Australia (Niven and Bardsley 2013) found similar

results, where was demonstrated that strong majority of stakeholders were not willing to relocate from their areas. Another study in Australia (Marshall et al. 2012) found that place attachment and occupational attachment can be a barrier to adaptation that involve relocation. It was showed that farmers were highly attached to their place and occupation and unlikely to adopt a new occupation outside of farming or relocate elsewhere, regardless of the tenability of their situation. Moreover, Collins (2013) emphasized that a reason for remaining in an environmental hazardous area can be for the new potential of rebuilding a livelihood within the impact zone and to protect remaining ongoing assets held there despite ongoing risks. In this sense, one of the Spanish stakeholders expressed:

Even if today there is a lot of debate about SLR and flooding in this part of Catalonia—do you think that people will stop buying properties and abandon the area? Of course not (SP-SC-male-53).

This study suggests that climate-induced relocation—which may occur due to loss of income or other means of livelihoods, access to natural capital and increased morbidity and mortality—is perceived as a significant local concern among some Australian and Spanish stakeholders. Thus, at policy level, the involvement of local and regional communities and stakeholders in the design of best practices for coastal land-uses is essential in order to maximize socio-economic and environmental benefits and to minimize costs of environmental or climate change. Moreover, it is important to engage with vulnerable and marginalized

population (e.g., elderly, linguistically isolated, minorities and indigenous people, low-income people, people with disabilities) in the decision-making process and provide them with positive and constructive climate change communication. Hansen et al. (2013) showed that communities with ethnic and linguistically diverse backgrounds could face greater challenges during extreme weather due to socio-economic disadvantage, linguistic barriers, poor housing conditions and cultural practices. During the fieldwork in Spanish case study, where places with more than 50% of registered foreign residents are, was observed that a large percentage of foreign residents have or might have language difficulties to follow weather reports and understand extreme weather warning and emergency communication from governmental organizations. The responsible body for hazard and risk communication, the Catalan General Directorate of Civil Protection, provides information and instructions in Spanish, Catalan, English and French. However, special attention should be given to consider a larger language variety (i.e., Arabic, and Amazigh) due to the high percentage of Moroccan population living there (see IDESCAT 2015). This could remove linguistic barriers and increase adaptive capacity of some vulnerable ethnic minorities.

However, one of the possible concerns in both case studies could be finding a place where local communities may relocate. It could be argued that drought, water scarcity, coastal erosion and flooding pose major risks for the socio-economic systems in both coastal Mediterranean climate regions. As a consequence of these climatic impacts, migration patterns may be directed toward higher grounds and/or greater urban (metropolitan) areas, especially if the well-being and livelihoods depend on ecosystem services and if there is no alternative source of income or adaptation measure. Supporting this view, some studies (e.g., Cernea and Schmidt-Soltau 2006; Wilmsen and Webber 2015) showed that policies aimed at relocating communities can be successful when communities are well-informed about social, economic and environmental conditions. We acknowledge that successful relocation policies should include stakeholders' ability to inform and affect the relocation process and insuring adequate compensation (e.g., assets, incomes, economic opportunities) that can be provided for affected communities. Wilmsen and Webber (2015) pointed out that capitalist economy, modernization and nationalism largely shape relocation policies, but preparation is crucial (de Sherbinin et al. 2011). Data from interviews and participant observation show that for the formulation of successful relocation policy is important to provide adequate time for those affected to adjust to the idea of relocation, engage them in relocation planning and ensure financial resources for their relocation. One of the important issues prior to the

relocation is the determination of compensations for the land acquisition and loss of properties or other assets. Compensation should avoid impoverishment of affected communities and should be equal to the standard of housing and quality of life those affected had before being relocated.

Finally, the results suggest that local values and knowledge of place is a valuable component that is necessary for successful relocation. Involving local population and stakeholders and their environmental, socio-cultural and economic values can enrich the process of relocation planning, facilitate empowerment and alleviate potential conflict throughout its implementation. As Bukvic (2015) suggested, even if relocation is often considered as a last resort or outside the range of acceptable options, it may represent the most effective long-term solution for at high-risk coastal communities.

## 4 Conclusions

Climate change and its impacts are no longer just a future issue to be considered in some coastal areas of Mediterranean climate regions. Stakeholders in these locations are currently considering, acting and adapting to climate change impacts. This article uses mainly qualitative data to collectively examine meaning, interpretations and experiences of changing climate conditions in industrialized countries such as Australia and Spain. The two case studies highlight the importance of various social, economic and environmental stakeholders' engagement, encompassing sustainable development ideologies. This study stresses the critical importance of gathering and integrating local risk perceptions with scientific knowledge in order to provide a strong entry point for building and evaluating local and regional capacity to support and improve climate-related policy making.

While most of the scientific risk perception studies on climate change have focused on a global, or national scale, this article presents stakeholders' risk perceptions on a comparative interlocal scale in two industrialized countries. In this sense, after overcoming several challenges (e.g., financial, cultural and logistic), this article proves that is possible to scientifically compare two distant Mediterranean climate regions located almost in the antipodes. Our results show that Australian and Spanish stakeholders are capable of generating social learning and they have a high level of risk awareness about their employment under changing climate. Generally, stakeholders indicated that climate change is already or may further continue to affect their employment. While some stakeholders perceived that climate change is or may positively affect their work activities with new economic activities, or with expansion



of current tasks and productivity of their existing jobs, others perceived that climate change has only negative impacts on their employment. Additionally, the present study suggests that climate change may influence coastal relocation in both study areas where it was considered as possible option. This is especially significant, as both case study regions have experienced large population growth and an increase in touristic development in the recent decades. Our results suggest that vulnerability to climate change and the impact on employment and general way of life may be a relocation driver, but is not yet a deciding factor in two industrialized Mediterranean regions. We found that industrialized—not just developing—countries need to seriously consider coastal relocation in their short- and long-term coastal planning and management, as well as in other population policies. In this sense, it would be crucial to implement multi-level policy making when thinking about coastal relocation, i.e., involving in the same working team a variety of coordinated stakeholders and policy makers from the local, regional, national and international governance levels. This could contribute to better design of coastal relocation planning, and to overcome barriers to achieving it in a sustainable way.

**Acknowledgements** This study was supported by the Ministry of Economy and Competitiveness, State Secretariat for Research, Development and Innovation (MINECO), Spain (Grant Number CSO2009-13909) and by the Agency for Management of University and Research Grants, Spain (AGAUR), (Grant Number FI-DGR 2011). Among the participants in the MINECO-funded project was the late Dr. Graeme Hugo. Thus, this article also pays an international tribute to Dr. Hugo's contribution to population geography and climate change studies.

## References

- ABS (2015) 2011 Census of population and housing. <http://www.abs.gov.au/census>. Accessed 14 May 2015
- Akerlof K, Maibach EW, Fitzgerald D, Cedeno AY, Neuman A (2013) Do people “personally experience” global warming, and if so how, and does it matter? *Glob Environ Change* 23:81–91
- Ariza E, Lindeman KC, Mozumder P, Suman DO (2014) Beach management in Florida: assessing stakeholder perceptions on governance. *Ocean Coast Manag* 96:82–93
- Biesbroek R, Klostermann J, Termeer C, Kabat P (2011) Barriers to climate change adaptation in the Netherlands. *Clim Law* 2(2):181–199
- Bord RJ, Fisher A, O'Connor RE (1998) Public perceptions of global warming: United States and international perspectives. *Clim Res* 11:75–84
- Brody SD, Zahran S, Vedlitz A, Grover H (2008) Examining the relationship between physical vulnerability and public perceptions of global climate change in the United States. *Environ Behav* 41:72–95
- Bruine de Bruin W, Wong-Parodi G, Morgan G (2014) Public perceptions of local flood risk and the role of climate change. *Environ Syst Decis* 34:591–599
- Bryman A (2012) *Social research methods*, 4th edn. Oxford University Press, New York
- Bukvic A (2015) Integrated framework for the Relocation Potential Assessment of Coastal Communities (RPACC): application to Hurricane Sandy-affected areas. *Environ Syst Decis* 35(2):264–278
- Catalan Office for Climate Change, OCCC (2012) Strategy for adapting to climate change (ESCACC, horizon 2013–2020). Government of Catalonia, Barcelona
- Cernea MM, Schmidt-Soltau K (2006) Poverty risks and national parks: policy in conservation and resettlement. *World Dev* 34(10):1808–1830
- Cody ML, Mooney HA (1978) Convergence versus nonconvergence in Mediterranean-climate ecosystems. *Annu Rev Ecol Syst* 9:265–321
- Collins AE (2013) Applications of the disaster risk reduction approach to migration influenced by environmental change. *Environ Sci Policy* 27S:S112–S125
- Cope M (2005) Coding qualitative data. In: Hay I (ed) *Qualitative research methods in human geography*, 2nd edn. Oxford University Press, Melbourne, pp 223–233
- Cote M (2011) Climate adaptation planning: anticipating the legal issues for urban planners. *Int J Clim Change Impact Responses* 2(3):87–102
- CREAF (2015) Land cover map of Catalonia. <http://www.creaf.uab.es/mcsc/usa/index.htm>. Accessed 14 May 2015
- De Sherbinin A, Castro M, Gemenne F, Cernea MM, Adamo S, Fearnside PM et al (2011) Preparing for resettlement associated with climate change. *Science* 334(6055):456–457
- DEE (2015) National energy productivity plan 2015–2030. Australian Government, Canberra
- Department of Environment and Energy, DEE (2015) National climate resilience and adaptation strategy. Australian Government, Canberra
- Department of Environment, Water and Natural Resources, DEWNR (2015) South Australia's climate change strategy 2015–2050, towards a low carbon economy. SA GOV, Adelaide
- DEWNR (2004) Living coast strategy for South Australia. SA GOV, Adelaide
- DEWNR (2012a) Prospering in changing climate: a climate change adaptation framework for South Australia. SA GOV, Adelaide
- DEWNR (2012b) Coast protection board policy document. SA GOV, Adelaide
- DEWNR (2014) Building resilience to a changing climate in the South Australian Murray Darling Basin: a climate change adaptation plan for the South Australian Murray-Darling Basin. SA GOV, Adelaide
- Di Castri F (1991) An ecological overview of the five regions of the world with a mediterranean climate. In: Groves RH, di Castri F (eds) *Biogeography of mediterranean invasions*. Cambridge University Press, Cambridge, pp 3–14
- Douglas M (1992) Risk and danger. In: Douglas M (ed) *Risk and blame-essays in cultural theory*. Routledge, London, pp 38–54
- EC (2013) An EU strategy on adaptation to climate change. EC, Brussels
- El Raey M, Dewidar K, El Hattab M (1999) Adaptation to the impacts of sea level rise in Egypt. *Clim Res* 12:117–128
- Emporda Info (2012) El canvi climàtic canvia les espècies a Cap de Creus. <http://www.emporda.info/comarca/2012/02/19/canvi-climatic-canvia-especies-cap-creus/159278.html>. Accessed 29 Nov 2016
- European Commission, EC (2014) A policy framework for climate and energy in the period from 2020 to 2030. EC, Brussels
- Fatorić S, Chelleri L (2012) Vulnerability to the effects of climate change and adaptation: the case of Spanish Ebro Delta. *Ocean Coast Manag* 60:1–10

- Garnaut R (2008) The garnaut climate change review: final report. Cambridge University Press, Cambridge
- Government of South Australia, SA GOV (2016) Location SA map viewer. <https://www.sa.gov.au/topics/property-and-land/planning-and-land-management/planning-data-for-research-and-mapping/atlas-of-south-australia>. Accessed 7 Sept 2016
- Granja HM, Carvalho GS (2000) Inland beach migration (beach erosion) and the coastal zone Management (the experience of the northwest coastal zone of Portugal). *Period Biol* 102(1):413–424
- Guest G, Bunce A, Johnson L (2006) How many interviews are enough? An experiment with data saturation and variability. *Field Method* 18(1):59–82
- Gurran N, Norman B, Hamin E (2012) Climate change adaptation in coastal Australia: an audit of planning practice. *Ocean Coast Manag* 86:100–109
- Hansen A, Bi L, Saniotis A, Nitschke M (2013) Vulnerability to extreme heat and climate change: Is ethnicity a factor? *Glob Health Action* 6:1–7
- Harvey N, Caton B (2003) Coastal management in Australia. Oxford University Press, Melbourne
- Hurlimann A, Dolnicar S (2011) Voluntary relocation—an exploration of Australian attitudes in the context of drought, recycled and desalinated water. *Glob Environ Change* 21:1084–1094
- IDESCAT (2015) Statistical yearbook of Catalonia. <http://www.idescat.cat/pub/?id=aec&lang=en>. Accessed 10 May 2015
- IPCC (2013) IPCC fifth assessment report: climate change 2013, working group I: the physical science basis. Cambridge University Press, Cambridge
- IPCC (2014) IPCC fifth assessment report: climate change 2014, working group II: impacts. Cambridge University Press, Cambridge, New York, Adaptation and Vulnerability
- King D, Bird D, Haynes K, Boon H, Cottrell A, Millar J et al (2014) Voluntary relocation as an adaptation strategy to extreme weather events. *Int J Disaster Risk Reduct* 8:83–90
- Koerber K (2006) Migration patterns and mover characteristics from the 2005 ACS gulf coast area special products. <http://www.census.gov/content/dam/Census/library/working-papers/2006/de/mo/koerber-01.pdf>. Accessed 14 June 2015
- Leiserowitz AA, Maibach EW, Roser-Renouf C, Smith N, Dawson E (2013) Climategate, public opinion, and the loss of trust. *Am Behav Sci* 57(6):818–837
- Lereboullet AL, Beltrando G, Bardsley DK (2013) Socio-ecological adaptation to climate change: a comparative case study from the Mediterranean wine industry in France and Australia. *Agric Ecosys Environ* 64:273–285
- Lieske DJ, Wade T, Roness LA (2014) Climate change awareness and strategies for communicating the risk of coastal flooding: a Canadian Maritime case example. *Estuar Coast Shelf Sci* 140:83–94
- Linnekamp F, Koedam A, Baud ISA (2011) Household vulnerability to climate change: examining perceptions of households of flood risks in Georgetown and Paramaribo. *Habitat Int* 35:447–456
- Linnenluecke MK, Stathakis A, Griffiths A (2011) Firm relocation as adaptive response to climate change and weather extremes. *Glob Environ Change* 21:123–133
- MAGRAMA (2002) Integrated coastal zone management in Spain. Government of Spain, Madrid
- MAGRAMA (2006) Spanish national climate change adaptation plan (PNACC). Government of Spain, Madrid
- Marino E (2012) The long history of environmental migration: assessing vulnerability construction and obstacles to successful relocation in Shishmaref, Alaska. *Glob Environ Change* 22:374–381
- Marshall NA, Park SE, Adger WN, Brown K, Howden SM (2012) Transformational capacity and the influence of place and identity. *Environ Res Lett* 7(3):1–9
- McCright AM (2010) The effects of gender on climate change knowledge and concern in the American public. *Popul Environ* 32:66–87
- Ministry of Agriculture, Food and Environment, MAGRAMA (2007) Spanish climate change and clean energy strategy (2007–2012–2020). Government of Spain, Madrid
- Mozumder P, Flugman E, Randhir T (2011) Adaptation behaviour in the face of global climate change: survey responses from experts and decision makers serving the Florida Keys. *Ocean Coast Manag* 54(1):37–44
- Nguyen NH, Beeton RJS, Halog A (2015) A systems thinking approach for enhancing adaptive capacity in small- and medium-sized enterprises: causal mapping of factors influencing environmental adaptation in Vietnam's textile and garment industry. *Environ Syst Decis* 35:490–503
- Niven RJ, Bardsley DK (2013) Planned retreat as a management response to coastal risk: a case study from the Fleurieu Peninsula, South Australia. *Reg Environ Change* 13(1):193–209
- OCCC (2008) Framework plan for climate change mitigation in Catalonia 2008–2012. Government of Catalonia, Barcelona
- Ragin CC (1994) Constructing social research—the unity and diversity of method. Pine Forge Press, Thousand Oaks
- Ramsar (2016) Ramsar sites information service. <https://rsis.ramsar.org>. Accessed 7 Sept 2016
- Renn O, Burns WJ, Kasperson JX, Kasperson RE, Slovic P (1992) The social amplification of risk: theoretical foundations and empirical applications. *J Soc Issues* 48(4):137–160
- Ritchie J (2003) The applications of qualitative methods to social research. In: Ritchie J, Lewis J (eds) *Qualitative research practice: a guide for social science students and researchers*. Sage Publications, London, pp 24–46
- Rubin HJ, Rubin IS (2012) *Qualitative interviewing: the art of hearing data*, 3rd edn. Sage Publications, Thousand Oaks
- Schneiderbauer S, Ehrlich D (2004) Risk, hazard and people's vulnerability to natural hazards: a review of definitions, concepts and data. EC Joint Research Centre, Brussels
- Slovic P (2000) The perception of risk. Risk, society, and policy series. Earthscan Publications, London
- Tàbara JD (2010) Percepció i comunicació del canvi climàtic a Catalunya. In: Llebot JE (ed) *Segon informe sobre el canvi climàtic a Catalunya*. Generalitat de Catalunya, Barcelona, pp 973–1010
- Tam J, McDaniels TL (2013) Understanding individual risk perceptions and preferences for climate change adaptations in biological conservation. *Environ Sci Policy* 27:114–123
- Van Aalst MK, Cannon T, Burton I (2008) Community level adaptation to climate change: the potential role of participatory community risk assessment. *Glob Environ Change* 18:165–179
- Victor Harbor Times (2012) Victor Harbor's sand dunes keep disappearing. <http://www.victorharbortimes.com.au/story/264197/victor-harbors-sand-dunes-keep-disappearing/>. Accessed 29 Nov 2016
- Vogel C, Moser SC, Kasperson RE, Dabelko GD (2007) Linking vulnerability, adaptation, and resilience science to practice: pathways, players and partnerships. *Glob Environ Change* 17:349–364
- Wachinger G, Renn R, Begg C, Kuhlicke C (2013) The risk perception paradox—implications for governance and communication of natural hazards. *Risk Anal* 33(6):1049–1065
- Weber RP (1990) *Basic content analysis*. Sage Publications, Newbury Park
- Wilmsen B, Webber M (2015) What can we learn from the practice of development-forced displacement and resettlement for organised resettlements in response to climate change? *Geoforum* 58:76–85