Transforming fair decision-making about sea-level rise in cities: the values and beliefs of residents in Botany Bay, Australia

Anne Maree Kreller

Abstract

Sea-level rise (SLR) is a threat to coastal areas and there is growing interest in how social-values, risk perception and fairness can inform adaptation. This study applies these three concepts to an urban community at risk of SLR in Botany Bay, Australia. The study engaged diverse groups of residents via an online survey. Cluster analysis identified four interpretive communities: two groups value work-life balance, are concerned about SLR and would likely engage in collective adaptation. The third group value everything about Botany Bay and are active in organisations that could prove to be an important outreach. The fourth group were older men, disengaged from both SLR and policy but could respond to individual consultation and targeted communication. Thus, multifarious approaches can engage diverse communities in fair decision making and transform community-facilitated adaptation.

Keywords: collective action; climate justice; community-based adaptation; sea-level rise adaptation; transformative adaptation

1   Introduction

Sea-level rise (SLR) is one of the effects of climate change and communities living in cities must prepare for changing coastlines. By 2050 global mean sea levels may increase, relative to 1985-2005 levels, between 0.22 m to 0.38 m and by the end of the 21st Century seas may rise between 0.52 m to 0.98 m (Wong et al. 2014). Others predict that with sustained release of greenhouse gases, SLR will continue beyond the 21st Century (Clark et al. 2016). Since the mid-1990s adaptation has emerged as a field of research and policy response to the effects of climate change, yet scholars argue that current research priorities must focus on the conditions that enable diverse representation in policy discussions (Klein et al. 2017).

The concepts of values, beliefs and fair policy are pillars for analysing who will be impacted by SLR and underscore diverse ways of engaging with communities at risk. Early adaptation research focused on the non-material impacts of SLR to quantify the costs and benefits of adaptation (Awuor, Orindi and Ochieng Adwera 2008, Cooper and Lemckert 2012, Hunt and Watkiss 2011). A concurrent field of enquiry assessed the social capacity of communities to adapt, arguing that adaptation is shaped by value judgements, climate change beliefs and perceptions of policy (Adger et al. 2009). In more recent years, transformative adaptation has emerged in climate change debates; this paradigm places human values and belief systems at the centre of adaptation (O'Brien 2012). A key concept within transformative adaptation discourse is an analysis of the justice and fairness of decision-making systems that empower some voices and marginalise others (Lonsdale, Pringle and Turner 2015). This discussion is often "rooted" in such normative values (Krause 2018: 511) with little linkage between key concepts (Fazey et al. 2018). Yet, Fazey et al. (2018) argue that climate change represents the opportunity to empower local communities to make decisions about adaptation. Individually, each concept has been found to be an important part of past adaptation studies but a concurrent analysis of values, beliefs and fairness have much to offer more comprehensive community engagement and transformative adaptation.

The aim of this study is to illustrate how the key concepts of values, beliefs and fairness can jointly enhance engagement of diverse community groups in areas at risk of SLR. The three guiding research questions are: What do residents' value about living in their coastal area? What are resident's beliefs about SLR? What are resident's perceptions of fairness in local government adaptation planning? The study examines a coastal urban area adjoining Botany Bay, Australia, which is understood to be highly vulnerable to SLR.

Values, fairness and beliefs about sea-level rise

Some researchers argue that climate change is as much a social problem as a biophysical one (Hulme 2009) because how people interpret the consequences depends upon what they value. Values are commonly understood in psychology as the cognitive processes that guide individual judgement and behaviour (O'Brien and Wolf 2010, Schwartz 1994, Wolf, Allice and Bell 2013), a conceptualisation which proved useful to examine how values motivate pro-environmental behaviour (Axelrod 1994, Stern and Dietz 1994). More recent research advanced the study of human-nature relations and pro-environmental behaviour by drawing attention to the dynamic nature of values in response to stimuli such as beliefs, thoughts or worldviews (Braito et al. 2017). Indeed, scholars have observed that climate vulnerability is not merely about material losses but how differentially valued outcomes are integral to the well-being of communities (O'Brien and Wolf 2010). Decisions about adaptation inevitably involve negotiation about whose values are prioritised in policy discussions, so it is important to recognise the diversity of values in communities (Adger et al. 2009). A social values approach is therefore important for adaptation policy and underscores this study.

A values-based approach has also emerged in recent SLR adaptation research and common to these studies is a rigorous analysis of the social values held by coastal residents. Researchers have found that valued objects, landscapes, places and daily activities are at risk of rising seas (Novaczek et al. 2011, Rouse et al. 2011, Zander, Petheram and Garnett 2013) and analysing non-material vulnerabilities allows decision-makers to respond to environmental changes. More recently, Graham et al. (2013) developed a theoretical framework called *lived-values,* which assesses how coastal residents' value the environment, their activities and social networks. Graham et al. (2014), Ramm et al. (2017) and Graham et al. (2018) respectively found eight, six and five different types of residents living in coastal communities in south-eastern Australia based upon their lived-values, to inform adaptation planning. Segmenting people into groups or interpretive communities potentially contributes to effective climate

change strategies by tailoring responses to their personal values (Graham et al. 2014, Hine et al. 2013).

These past studies predominantly illustrate the non-material values at risk in inner and outer regional coastal communities to enhance SLR adaptation engagement. However, urban coastal areas should be of particular interest to adaptation planners. Low-elevation coastal zones (LECZ) (less than 10 m above sea-level) contain 2% of the world's land area and 13% of the world's urban population (McGranahan, Balk and Anderson 2007). LECZ are expected to become more urbanised during the 21st Century, exposing communities to the risks of inundation and flooding (Neumann et al. 2015). Urban planning involves careful trade-offs between the differential values of policymakers and communities (Peckham 2013). Studies comparing the social value orientation of urban and rural dwellers found that the latter were more prosocial and concerned about future generations than city-dwellers (Timilsina et al. 2019). However, place-based studies have found that for urban residents, landscapes are associated with non-material values, such as aesthetics, community and wellbeing (Peckham 2013). The latter study suggests that the non-material value of urban coastlines should be understood and prioritised by adaptation planners.

Community-based adaptation has been an important area of research in international development (Kithiia 2015, Marfai, Sekaranom and Ward 2015). Yet, these studies do not consider how to integrate the voices of the most marginalised citizens into policy decisions. Justice and fairness studies aim to transform policy into something that is owned and facilitated by the community, within a governance framework. Indeed, the concept of justice is integral to adaptation studies. Past justice research in Delhi, India, evaluated whether adaptation policy considered the basic needs of the poorest residents with the aim of developing a more inclusive policy (Hughes 2013). Likewise, recent research engaged with residents of Sydney, Australia, to develop capabilities-based adaptation planning that

considered health, housing, sustainability and environment for the most vulnerable residents (Schlosberg, Collins and Niemeyer 2017). These studies focused on two central concerns of justice studies: understanding the *distribution* of harm from climate change and incorporating the most vulnerable into adaption *procedures*. Fairness advances justice scholarship because it critically analyses the social perception of decision-making (Rawls 1971) and is applicable to SLR adaptation research.

This study draws upon six concepts of fairness developed by past organisational research which has been found to be useful in the context of climate adaptation: procedural, distributional, temporal, interactional, informational and spatial fairness (Graham et al. 2015, Graham and Barnett 2017, Usmani and Jamal 2013). Firstly, *distributional* fairness is integral to SLR studies because the outcomes of climate change are unevenly experienced and adaptation policy should not further marginalise the most vulnerable (Forsyth 2014). Moreover, adaptation policy distributes benefits such as: building resilience; access to flood-proofing, shelter or emergency warning systems; building seawalls to protect culturally important areas; or sharing information about the risks (Douglas et al. 2012, Paolisso et al. 2012, Elliott and Pais 2006, Forsyth 2014). In order access benefits communities must be included in *procedural* decision-making: researchers must analyse who is invited to make adaptation policy decisions and if their needs are being considered (Schlosberg, Collins and Niemeyer 2017).

The impacts of SLR will mostly be experienced over time and questions therefore arise about which generations will bear the costs of decision-making. *Temporal* fairness considers consistent treatment between individuals over time (Lauber 1999), which may include developing policies within acceptable time frames or considering intergenerational equity (Graham et al. 2015, Fincher, Barnett and Graham 2015). In addition, SLR is experienced unequally across the globe and some communities more than others will experience the

effects. *Spatial* fairness considers equitable treatment of locations or communities in decision-making (Graham et al. 2015, Usmani and Jamal 2013, Shi et al. 2016). Finally, the perception of respectful interaction between parties is an important part of legitimate decision-making, which can be assessed by two interrelated concepts: *interpersonal* and *informational* fairness. For instance, individuals must feel they are treated with respect or empathy by policymakers, i.e. interpersonal fairness (Graham et al. 2015, Lauber 1999, Usmani and Jamal 2013). Furthermore, communities must receive adequate information about SLR risks and adaptation planning in their coastal areas to make informed decisions, i.e. informational fairness (Graham et al. 2015). Therefore, this study draws upon six concepts essential to adaptive decision-making: procedural, distributional, temporal, spatial, interpersonal and informational fairness.

Merely analysing lived-values and fair policymaking does not address residents' beliefs about the impacts of climate change, views that may hinder adaptive action. Adger (2016) contends that adaptation involves reducing the moral or psychological distance by bringing climate change home to amplify its immediate risks. Coastal communities are exposed to flooding, extreme seas, inundation, saline intrusion of coastal areas, erosion and loss of wetlands (Nicholls 2011, 2010). Adaptation planning involves understanding how people will respond as these hazards arise. Thus, risk perception has emerged as an important framework to understand the willingness of people to adapt. Indeed, transforming perceptions of climate risk may be a necessary part of adaptation (Pelling 2011).

Two concepts within risk perception can inform SLR adaptation by analysing the *spatial* and *temporal* beliefs of communities living in coastal areas. First, climate change is often thought of as a global issue, with little connection to the cognitive ability to discern changes at proximal scales; certainly, establishing a personal connection to the risks of climate change can enhance collective responsibility (Reser et al. 2012). Communication can therefore be

tailored to suit peoples' responses to questions about the personal or local effects of climate change. Second, studies in regional Australia illustrate that some coastal communities have little knowledge about the timeframe for SLR impacts and these views have hindered their willingness to engage in adaptation (Fincher, Barnett and Graham 2015). In addition, Hine et al. (2013) discovered that people can be grouped into interpretive communities based on their responses to the perceived spatial and temporal proximity to climate change, a method that also informs this paper. Grouping residents by their beliefs illuminates effective ways of communicating the personal relevance of SLR.

This study addresses a gap in SLR research by asking urban residents about their perception of lived-values, fairness and perception of SLR risks. The findings may enable policymakers to effectively communicate with urban residents who have varied levels of knowledge about SLR. While it is useful to understand residents lived-values, perceptions of fairness and SLR risks, it is also important to know how these judgments are intertwined. For example, while Graham et al. (2014, 2018) argue understanding lived-values can inform fairer adaptation decision-making, the authors did not explicitly ask residents about their perceptions of the fairness of existing and planned adaptation policies. This study is unique because it seeks to simultaneously understand the nature of values, beliefs, and perceptions of fairness in a major coastal city in Australia. In the process, it informs an understanding of how these concepts relate to the nascent discussion of transformative adaptation.

2   Case study: adaptation challenges in and around Botany Bay, Australia

 Across the globe, local governments are predominantly responsible for designing and implementing adaptation (Bulkeley et al. 2013). Bulkeley et al. (2013) conducted a review of adaptation plans in urban municipalities, finding limited consideration of just or fair procedures. Moreover, recent research conducted in two council areas abutting Botany Bay, Australia, found council staff are challenged by engagement with diverse communities in

SLR adaptation (Kreller and Graham 2018). Subsequently, this research examines how the three guiding concepts are embedded in the views of residents living in the same urban area.

Botany Bay is a low-lying estuary 15kms south-east of the Sydney central business district, the site of Sydney Airport, Caltex Refinery and Port Botany Terminal. The estuary and adjoining coastal suburbs are some of the most vulnerable areas along the Sydney coastline because of geography, socio-demographics and institutional barriers. Botany Bay consists of two beaches, Foreshore Beach in the east adjacent to Sydney Airport and Lady Robinson's Beach in the south[1]. Botany Bay is intersected by Cooks River, a major waterway discharging into the bay located next to Sydney Airport (Brakell et al. 2012). The estuary is subject to erosion from large waves generated by periodical storm activity, called East Coast Lows (Short 1988). East Coast Lows form in the cooler sub-tropical waters of the south-east Australian coastline and generally only last a few days during winter months (Bureau of Meteorology 2007). Recent studies examining the long-term effects of SLR across Australia found that the southern coast of New South Wales (NSW) will be particularly vulnerable by the end of the 21st Century (Zhang et al. 2017). Moreover, construction and dredging for airport runways and terminal construction in Botany Bay has contributed to erosion around Lady Robinson's Beach (Frost 2011).

Demographics contribute to the vulnerability of the suburbs adjoining Botany Bay: residents' low income, education and percentage of people who speak languages other than English contribute to the social vulnerability of adjoining suburbs (Preston et al. 2008). According to the recent 2016 Census by the Australian Bureau of Statistics, residents of the suburbs adjoining Botany Bay are similar to the average Australian household with respect to median age, education, internet connection and home ownership but median incomes in the largest

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[1] For map of Botany Bay please refer to Bayside Council at https://www.bayside.nsw.gov.au/your-council/meet-your-councillors/find-my-ward

suburbs of Botany and Rockdale are currently higher, and more people speak a second language at home (Australian Bureau of Statistics 2016).

Until 2016, the greater Botany Bay estuary was managed by two separate councils called City of Botany Bay and Rockdale City Council; the former managed the area east of Cooks River and the latter managed the area south of Cooks River. The entire Botany Bay area is vulnerable to erosion and past actions by both councils included building protective actions such as seawalls on the foreshore (Geeves and Jervis 1954, Larcombe 1970). More recent actions by Rockdale Council to arrest erosion included building groynes along Lady Robinson's Beach, with limited success (as per Frost 2011). In late 2016, the two councils were amalgamated to become Bayside Council. In preparation for the 2019 summer season, Bayside Council renourished beaches and swimming baths at the south end of Lady Robinson's which diminished as a result of changing hydrodynamics from the airport and ports expansion (Alexander 2019).

At the time of research neither City of Botany Bay nor Rockdale City Council demonstrated substantial engagement with the community about SLR. Only City of Botany Bay developed a SLR policy which effectively shared information about the issue through implementing benchmarks for future projections (0.4m above the Australian Height Datum (AHD) by 2050 and 0.9m above AHD by 2100, relative to 1980-1999); these benchmarks were integrated into planning and development policies (City of Botany Bay 2015, Rockdale City Council 2011, 2013). Although the amalgamation of councils happened after data collection, and as such had no impact on the results, the term "Bayside" is used in this study to refer to the urban area that encompasses the former City of Botany and Rockdale City Council areas. It is hoped that the concepts and methods demonstrated here will illustrate how comprehensive engagement can be achieved by other municipal councils across the globe.

3   Methods

The survey design followed Salant and Dillman's (1994) guide for surveys (Appendix B). First, questions were based upon past empirical studies that asked coastal residents what they value about their coastal community and their activities (Graham et al. 2014, Novaczek et al. 2011, Rouse et al. 2011, Zander, Petheram and Garnett 2013) (Table 3). Second, to understand their SLR beliefs, questions from past climate change studies were modified to ask residents about their understanding of the causes, whether they felt SLR was a risk to themselves and their area as well as their understanding of the temporal effects (Hine et al. 2013) (Appendix A). Finally, as there was no existing quantitative framework for fairness, questions were based upon past organisational studies that asked about fair workplace procedures: residents were asked whether they were consulted and able to contribute knowledge to policy (procedural fairness), felt treated with respect and heard in adaptation (interpersonal fairness) and were given clear information (informational fairness) (Usmani and Jamal 2013). Where it was not possible to operationalise other fairness variables from quantitative climate change research, questions about spatial and temporal fairness were derived from Graham et al.'s (2015) qualitative study in Lakes Entrance, Victoria as well as examination of SLR policy engagement on City of Botany Bay and Rockdale City Council websites at the time of research (Rockdale City Council 2013, City of Botany Bay 2015). Questions asked about whether residents felt SLR decisions were made in a timely manner and were fair for future generations (temporal fairness); the survey asked residents whether council makes sure that all council wards are treated equally (spatial fairness) (Table 3).

A database was created identifying 46 community organisations situated in the Bayside area, and emails were sent requesting they pass the survey on to residents. Following announcement of the Federal election, emails were sent to four major political parties running in the case study areas. When the response proved limited, a Facebook advertising campaign was run because it has demonstrated some success with hard-to-reach groups (Lea, Bryant and Treloar 2016). A media release was sent to two newspapers in the council areas, and an

article was published in *The St George Leader* which provided details of the survey. The local newspaper for the City of Botany Bay region expressed no interest in the survey.

Forty-nine residents responded to the survey, which was open from the 20th May until 14th July 2016, and whilst this is a low response rate, the Federal election may have reduced interest in the study. Moreover, during mid-June 2016, the east coast of Australia experienced a large East Coast Low affecting 200 kms of coastline and generating winds, powerful waves and erosion (Mortlock et al. 2017). Foreshore homes south of Cooks River were inundated and damaged from the storm (Trembath 2016). Publicity from the storm may have raised awareness of the risks of SLR to the NSW coast and influenced responses in the sample. The small number of people from the City of Botany region (n = 9) may reflect the lack of interest from community organisations and the local newspaper. Limited time and funding during the study prevented the use of mail-outs to advertise the survey but may not have provided many more responses. The small number of residents who responded to the survey was comparable to past surveys in coastal NSW. For example, McManus et al. (2014), received 42 responses from a mail-out survey sent to 400 residences in Lake Macquarie City Council. Both cases reflect the challenges of engaging urban and peri-urban residents in research and policy creation.

Compared to the Bayside population, the survey sample is over-represented by English speakers, residents aged between 45 to 65, people with a Bachelor degree and vocational training and those buying a home (Table 1). The sample is under-represented by renters and residents with year 12 and 10 education. Moreover, the survey sample is underrepresented by 25 to 34-year-old's and those who speak a second language at home. The sample likely represents a middle-aged, established and educated cohort in Bayside.

Cluster analysis has been utilised by past climate change studies to examine common attributes via groups or typologies (Graham et al. 2014, Hine et al. 2013) and reveals how to

communicate with people based on their climate change beliefs or their values at life stages. Clustering derives information about inter-group similarities and intra-group differences based on shared characteristics (Ammon et al. 2008, Bahr et al. 2011, Sarstedt & Mooi 2014).

There is no generally accepted minimum sample size for cluster analysis, only that the result produces substantial segments (Sarstedt & Mooi 2014). One rule of thumb that has been proposed is to have a minimum sample size of 2^m, where *m* is the number of clustering variables (Sarstedt & Mooi 2014). Here we chose to include eight clustering variables, that reflect four broader concepts: environmental health; community; security; and lifestyle. The selection of such a small number of clustering variables is consistent with the small sample size (49).

The most important aspect of clustering is the iterative process, where each stage informs the next (Ammon et al. 2008). Based on past climate change studies (Graham et al. 2014) this process involved four-steps: selection and standardisation of variables, collinearity tests and hierarchical and non-hierarchical testing. First, variables should be chosen for their relevance to the research questions (Bahr et al. 2011, Ketchen & Sook, 1996). Ammon et al. (2008) recommends theoretical selection of variables, so it was decided to cluster the sample by lived-values because of their relevance to the guiding questions and applicability to SLR research (Graham et al., 2014). Including responses with high levels of agreement dilutes the strength of segmentation, so clustering was limited to variables with the most diverse responses. Analysis of sample responses (to both open and closed questions) revealed the selection: being close to the city and beach (environmental health); the community and a unique place for children to grow up (community); affordability of housing and business and employment opportunities (security); relaxed lifestyle and access to shops (lifestyle).

The next step involves standardising variables by "dummy" coding responses (Ammon et al. 2008: 2); hence lived-values and fairness were coded by giving each variable value from 0 to

1. Means (M) were compared across the four groups but it was not possible to standardise SLR questions, so cluster responses are provided in Appendix A. Next, collinearity must be analysed because if two variables are perfectly correlated they represent the same concept and are likely to weight responses. High collinearity is defined as above 0.8 (Sambandam 2003). A test for collinearity was conducted and no collinearity above 0.6 was found. The combination of hierarchical and non-hierarchical methods of testing is recommended as best practice as one offsets the weakness of the other: the dual technique reveals "true" structure of data (Ketchen & Sook 1996: 452). Following Graham et al. (2014) data was reordered and hierarchical testing utilising SPSS created a dendrogram, indicating four clusters. Next, as recommended by Ammon et al. (2008) and Graham et al. (2014), the final stage involved running non-hierarchical, or k-means, tests with pairwise deletion of missing values. Multiple k-means tests were run in SPSS with three, four and five cluster solutions and a four-cluster solution was determined to provide the most explanatory value. A four-cluster solution was similar to recent studies examining small samples of hard-to-reach groups (Repond et al. 2018).

4   Results: four interpretive communities living around Botany Bay

Cluster analysis revealed four distinct groups of people living in Bayside based upon how they responded to questions about the three guiding concepts. Each cluster's perception of lived-values, beliefs and fairness forms the basis of their descriptions. The names of each group in this section were coined by the author and based on observation of attitude, beliefs and demographics that emerged from clustering. This section provides a description of the Concerned Solo-Flyers, Alarmed Work-Life Balancers, Uncertain Community-Minded Women and Disengaged Male Baby Boomers. Table 2 provides a comparison of socio-demographics and Table 3 indicates the four groups' responses to questions about lived-values and policy fairness.

4.1 Concerned Solo-Flyers

The Concerned Solo-Flyers (CSF) were a group of residents (n = 8) who valued the lifestyle of Bayside and felt personally concerned about SLR. Even though they were the smallest sample, their responses were different to other clusters and warranted their own group. The majority of *'Solo-Flyers'* were middle-aged child-free women and men who lived adjacent to Cook's River (Table 2). Almost two-thirds of this group were between 35-54 years of age, the majority were buying their own home or owned it outright and they were TAFE or university educated. They predominantly fell into the middle-income category, as half of the group earned between AU$80,001 and AU$150,000 a year.

When asked about lived-values, most important to this group was housing affordability and lifestyle, such as being close to the shops. When asked about their valued activities this cluster also mentioned engaging with their own community networks and swimming in Botany Bay. When asked about fairness, this cluster mentioned that they did not think there has been adequate consultation of communities, which was the only dimension they had strong feelings about (Table 3).

The CSF responses to SLR were appreciably different from the other groups (Appendix A). Two thirds attributed SLR to human activity: they were called *'Concerned'* because three-quarters were very or fairly personally concerned about SLR, the highest response out of all four groups, and almost two-thirds of CSF thought that SLR will be a very serious problem for Botany Bay in the future. Regarding the temporal effects, the majority believed that Botany Bay will start feeling the effects of SLR within 25 years, which was the highest response to this question.

4.2 Alarmed Work-Life Balancers

The Alarmed Work-Life Balancers (AWLB) comprised residents (n = 10) who value work-life balance and are very concerned about rising seas. This cluster was mostly derived from

middle-aged women who spoke English at home. Most identified as earning between nil and $80,000 a year and almost two-thirds were in the process of buying their own home west of Cooks River (Table 2).

When asked about their lived-values, the AWLB did not think of Bayside as an important area for children and were likely childless or child-free. They valued being close to the city and in their spare time, this group spent time gardening at home, going out with work colleagues or to enjoy meals in the local area; hence they earned the name *'Work-Life Balancers'.* The AWLB had strong feelings about not being included in adaptation decision-making because this group did not think there was adequate consultation of communities during formation of the SLR policy (Table 3).

When asked about SLR (Appendix A) the two thirds of AWLB attributed it to human activity. This group were the most alarmed group about the spatial effects because most thought that SLR will be very serious for Botany Bay. Regarding the temporal effects, the majority thought SLR will be experienced within the next 25 years. Overall, their concern for SLR set them apart from the other groups so they were called *'Alarmed'.*

The appreciable differences between the *Concerned* and *Alarmed* groups illustrated that the former was more likely to be connected to community networks and the latter valued leisure time. The *Concerned* groups expressed personal concern about SLR and the *Alarmed* groups feel it is a serious issue for Botany Bay.

4.3   Uncertain Community-Minded Women

The Uncertain Community-Minded Women (UCMW) loved almost everything about Bayside. This group (n = 14) were predominantly women of mixed income: around half earned between nil to $80,000 a year, yet one-third of the group were high earners, earning over $150,000. This group may consist of women who comprise social groups both extremely well off and less materially stable because one-third of the UCMW mentioned renting or

living rent free. Almost half of this group spoke a language other than English at home and more than half had a university education (Table 2).

It is likely this group were mothers planning for families because they considered Bayside an important place for children to grow up. Overall, everything about Bayside was very important to this cluster: the community, affordability, being close to the shops and lifestyle, being close to the city and beach. In their spare time, they also liked going out around their local area and undertook volunteer work by spending time with community organisations (Table 3); hence this group were called *'Community-Minded'*. Their engagement with council set them apart from other groups. The UCMW felt excluded from policy decision-making but disagreed with the statement that council treats them with contempt during formation of SLR policy. This group were uncertain about the outcome of adaptation policy, because they felt neutral or did not know if the policy is distributively fair. Their responses earned them the name *'Uncertain'*.

Unlike the previous two clusters, the UCMW were somewhat uncertain about the impacts of SLR (Appendix A). For instance, two fifths attributed SLR to human activity but some admitted to being uncertain about the causes. Also, two thirds of this group believed that rising seas will be a serious problem for Botany Bay and while half of the UCMW perceived that Botany Bay will feel the effects within the next 25 to 50 years the rest did not know.

4.4   Disengaged Male Baby Boomers

The Disengaged Male Baby Boomers (DMBB) (n = 17) were the least concerned about SLR. The majority were male and almost half were over 55, one-third of the group earned over $150,000 per year and almost all were in the process of buying their home or owned it outright. The DMBB mostly spoke English at home and lived west of Cooks River (Table 2).

Despite their connection to the area, they did not identify anything of particular value living around Bayside. They were the least likely to volunteer out of all the groups, so earned the

name *'Disengaged'*. However, they were the most active out of all four groups because they frequently go out for meals, swim and bike around Bayside. The DMBB thought that council clearly explains policy decisions (Table 3) but apart from this response, they did not have any strong feelings about fair policy.

The DMBB had the highest number of sceptics about the causes and impacts of SLR (Appendix A). Only one-quarter of the group perceived that SLR is mainly or entirely related to human activity and another quarter perceived there is no such thing or did not know. Also, only one third of the DMBB regarded SLR as a very serious issue for Botany Bay. Finally, two-fifths of this group perceived that Botany Bay will feel the effects beyond the next 50 years and one fifth selected 'Never' or 'Don't know'.

5   Discussion

One of the emerging debates in transformative adaptation rests on changing the "status quo" of current decision-making (Krause 2018: 514) and often there is little guidance as to how such a change can occur. However, there is growing awareness in climate justice research that engaging with civil society can enhance understanding of the decision-making systems that require transformation (Tokar 2018: Gobby and Gareau 2018). By conducting a survey with residents in an urban coastal area at risk of SLR this study illustrated that global adaptation planners can design fair policies that integrate non-material values and diverse SLR beliefs. Concurrently analysing these key concepts can create locally-owned and fair policies commensurate with residents' diverse needs.

The results indicated the presence of four clusters in Bayside, called the Concerned Solo-Flyers (CSF), Alarmed Work-Life Balancers (AWLB), Disengaged Male Baby Boomers (DMBB) and Uncertain Community-Minded Women (UCMW). First, comparing the four groups of Bayside residents with similar studies in regional areas – Kingston Beach, Tasmania (six groups, Ramm et al. 2017), Lakes Entrance, Victoria (eight groups, Graham et

al. 2014), and four small communities on the East Gippsland coast in Victoria (five groups, Graham et al. 2018) – reveals the life-stage and urban-specific values and perceptions that adaptation policy must consider. Non-material values often represent quality of life for urban dwellers. Similarly, past cluster analysis in Porto, Portugal, found that younger residents are attracted to urban areas for recreational value, middle-aged residents value access to amenities, environment and affordable housing and older residents do not identify much of value at all (Santos et al. 2007).

Second, this study provided the opportunity to generate and test a survey that measures six distinct fairness concepts developed in regional coastal areas. Each cluster evaluated fairness differently. Much like residents living in regional coastal areas (Graham et al. 2015; Graham and Barnett 2017), most groups mentioned the importance of procedural fairness in adaptation, suggesting some Bayside residents want to be involved in policy creation. There was limited response to the other fairness concepts, perhaps reflecting the lack of SLR adaptation policy development in both council areas. Third, like other Australian studies, most groups tended to put proximal distance between themselves and SLR (e.g. Reser et al. 2012). Policy-makers can construct messages so SLR is personally relevant and closer in time.

The different responses across groups suggest ways of engaging with SLR adaptation based on values, beliefs and views of policy fairness. For example, the CSF valued swimming in Botany Bay and their local community networks. As such, this group most resembles socially-networked active residents attracted to regional areas (Graham et al. 2014; Ramm et al. 2017). Yet, the *Concerned* group valued the affordability of Bayside, perhaps suggesting the priorities of residents living in populous urban areas at certain stages of their lives. The CSF group was also unique in that they thought SLR was a personal issue. Personal beliefs about climate change can be connected to everyday events or things that people care about, perceived to be at risk (Brügger and Pidgeon 2018). Indeed, this group lives predominantly in

the region that shared information about SLR through property development applications (i.e City of Botany Bay). Past studies into Australian interpretive communities noted that *Concerned* typologies tend to favour collective action approaches to climate change policy (Hine et al. 2013). The CSF would be amenable to collective engagement with climate change discussions where they can articulate their concerns about SLR and adaptation options.

The AWLB appreciated living close to the city and going out with work colleagues as well as gardening at home; they want to be included in policy and feel alarmed about SLR. This group most resembles regional work-life balancers living in Lakes Entrance (Graham et al. 2014), suggesting work-life balance is applicable to urban coastal residents, as well as sea-changers. Their unique perspective can be of use to adaptation policy-makers. Notably the AWLB were the most alarmed group about SLR and perhaps their gender, as much as their values, explains their responses to fairness and risk perception. Past studies have found that gender explains concern about climate change (McCright 2010): the Bayside cohort may reflect settled, predominantly middle-aged women who want to become more active in policy discussion about SLR.

The responses of the *Alarmed* and *Concerned* groups are comparable to a recent study examining moral orientation and environmental engagement: people inclined towards universalism are more likely to engage in environmental activism (Jia et al. 2017). Likewise, *Alarmed* typologies respond to collective adaptation (Hine et al. 2013), so community engagement can be tailored to *Concerned* and *Alarmed* groups. Most importantly, for these groups, fair consultation needs to be based on contributing local knowledge and experiences (i.e voice) as well as representation (Graham et al. 2015). Strategies for fair participation can include developing a shared community vision, scenario workshops and adaptation pathways as thresholds are reached (as per Campos et al. 2016).

UCMW are place-attached residents who feel strongly about adaptive actions and the risks of SLR to their valued community. They most resemble a cluster of community-minded residents in Kingston Beach, Tasmania, (Ramm et al. 2017) and place-attached family-focused residents in Lakes Entrance (Graham et al. 2014). The similarities across three studies illustrate that these groups want to live in coastal areas with diverse attractions. As such, coastal adaptation planners must take these values into account when designing policies in urban coastal areas.

Out of all the groups, the UCMW identified as having strong benevolence values such as volunteering in the community. However, a recent study examining moral identification and environmental involvement found that altruistic typologies, as reflected in the *Unconcerned* group, are not necessarily engaged with environmental action or activism (Jia et al. 2017). However, the responses suggest the UCMW are place-attached, which underscores willingness to be included in policy because these citizens feel strongly about adaptive actions in their community (Clarke, Murphy and Lorenzoni 2018). Also, the responses from the UCMW to procedural and interpersonal fairness suggest they share this sentiment along with the perception they have a good relationship with council, something Bayside Council staff can build upon. Moreover, *Uncertain* groups respond to emotive messages about climate change, but they must be linked to action (Hine et al. 2013). This group would appreciate learning about the intergenerational effects of SLR on their families communicated through community networks. Past research in regional areas found that place attached women with children are likely to be financially burdened by relocation (Karlsson, van Oort and Romstad 2015), which is a salient problem for growing global cities. For these groups, building on their perception of procedural and interpersonal fairness can be through council engaging faith and identity-based networks, which can assist with communication, relocation and capacity building at the grassroots level (Airriess et al. 2008). Networks such as these may likely become more vital to engage vulnerable groups as the effects of SLR are experienced.

The DMBB showed little engagement with lived-values, SLR and adaptation policies. This group most resembled self-sufficient middle-aged residents living in regional Victoria (Graham et al. 2018). The lack of concern about SLR could reflect that *Disengaged* groups have low levels of belief in climate change and these groups are generally populated by males (Hine et al. 2013). Moreover, typologies that identify as individualistic tend to be less inclined to environmental engagement (Jia et al. 2017). Yet, the Bayside cohort expressed their value of the outdoor environment through their love of physical activity, which should be considered in urban adaptation planning. Loss of shared coastal spaces represents diminished social connection for older residents living in risky coastal areas (Karlsson, van Oort and Romstad 2015). Some councils have explored the creation of buffer zones, that sustain recreational and community values, but also act as a space to educate the public about coastal hazards (Rebuild By Design 2016). Even a network of walking and bike tracks across the Bayside region may be possible.

For typologies inclined towards individualism rather than environmental activism, engagement can be comprised of issues that resonate with self-interest (Jia et al. 2017). The *Disengaged* cohort was the only group to respond to informational fairness, suggesting that they find council shares general policy information with clarity. To build on this perception, with respect to SLR, *Disengaged* groups will respond to messages linked to things they value (Hine et al. 2013) so communicating about SLR adaptation policy can be linked to changes in Botany Bay such as how erosion can be of risk to their valued foreshore area. The DMBB may prefer individual consultation about living in a flood-prone zone and modifications to their property development applications.

Past studies in regional areas have utilised social-values to understand the non-material aspects of coastal living with the aim of incorporating the findings into adaptation planning (Rouse et al. 2011, Zander et al. 2013, Ramm et al. 2017, Graham et al. 2014, Novaczek et al.

2011). The increasing urbanisation of coastal areas across the globe (Neumann et al. 2015) has prompted the call for municipal planners to engage with community groups in urban adaptation to increase participation and equity (Shi et al. 2016). Shi et al. (2016) observe that urban municipal councils often focus on building large infrastructure solutions without consideration of social and political consequences. Like past SLR studies in regional areas, the findings in this research indicate younger residents are attracted to cities for entertainment and stimulation; middle-aged residents want work-life balance and older people are involved in their own networks. Yet, some differences between this research and regional studies are worth highlighting; people are attracted to regional coastal areas because of the natural environment and change of lifestyle (Graham et al. 2014) but for urban residents, place is associated with activity and community connection (Spartz & Shaw 2011). Spartz & Shaw (2011) argue that place-based meanings should be incorporated into urban planning. Specifically, for Bayside residents, place is strongly associated with a sense of community: this shared vision can therefore prompt collective discussion about what is at risk of SLR and how to accomplish fair adaptation planning.

6   Conclusion

Understanding lived-values, perceptions of fairness and beliefs about SLR can reveal distinct groups of residents who are more and less vulnerable to non-material impacts, and who may respond differently to policy development, communication and implementation. Most groups had some level of knowledge or concern about SLR and the possible effects on Botany Bay as well as willingness to become involved in adaptation policy. The four groups' responses to procedural fairness likely reflects the priorities of early stages of collaborative community adaptation policy development, something which the newly amalgamated council could build upon. The CSF and AWLBs would likely be proactive in collaborative discussions about SLR adaptation and to learn more about how and why the changing coastline is not a global issue but one that concerns Botany Bay. The UCMW highly valued their area, a perception that

perhaps underscored their concern for Botany Bay, despite their lack of knowledge about the time frame for SLR. To enhance their views of interpersonal fairness, these groups can be engaged through volunteer and community networks. Whilst the DMBB may not wish to participate in collective council adaptation policy this cohort can still benefit from targeted communication about coastal management. By extrapolating the similarities and differences across groups, the development of such a typology of residents illuminates the possibility for global councils to further explore these three concepts in adaptation planning.

The study had a few limitations. First, the small sample size was not generalisable to the population of Bayside and reflected the views of older, established and educated residents. Second, placement of the survey on community organisational websites may predispose the interest and knowledge of most clusters about environmental and community issues. Third, the results illustrate the importance and difficulties of engaging transient, younger and culturally diverse residents in climate adaptation. Nonetheless, clustering by lived-values, beliefs about SLR and perceptions of fairness has not been undertaken in previous studies. The results allowed for an understanding of how the key concepts can inform fairer, more community-focused climate responses.

Future research may benefit from undertaking quantitative analyses to compare the lived-values, SLR beliefs and perceptions of fairness in other urban and regional communities. There is also a need for longitudinal research that studies how values, beliefs and perceptions of fairness evolve over time and the impacts that participatory policy processes have.

The study also demonstrated relevance beyond the Botany Bay setting. One of the aims of the study was to demonstrate the methods that can underscore adaptation planning in municipal areas at risk of SLR. The current discussion about transformative adaptation bears little relationship with case studies in areas at risk of SLR. Adaptation should be informed by engagement with residents, asking them *why* and *how* climate change decision-making needs

to change. The key concepts demonstrate how adaptation policy can become an inclusive process informed by the diverse values, beliefs and needs of residents at risk of SLR now and in the future.

Compliance with Ethical Standards

Disclosure of potential conflicts of interest: The author declares that they have no conflict of interest.

Research involving Human Participants and/or Animals: This research involved a survey with human participants. Ethics approval was sought and received (HC16276) from the UNSW Human Research Ethics Advisory Panel for the Arts, Humanities and Law prior to sampling.

Informed consent: The survey included the following information: all study participants involved in data collection were informed about the research and what the results were going to be used for; during the survey they were given a declaration of consent and were also informed of the option to withdraw from the study at any point.

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Table 1 Survey sample Bayside demographics (Australian Bureau of Statistics 2016). Bold and italics indicate the over-representation and under-representation of demographics, respectively.

	Survey sample	Bayside
Gender		
Female	53%	50%
Male	47%	50%
Age range		
18-24	10%	8%
25-34	*10%*	19%
35-44	14%	15%
45-54	**31%**	12%
55-64	**24%**	10%
65+	10%	14%
Education		
Bachelor degree and above	**40%**	27%
Vocational training	**44%**	20%
Year 12	*8%*	20%
Year 11	2%	3%
Year 10 or below	*4%*	16%
Language		
English only at home	**78%**	43%
More than one language at	*22%*	54%

home		
Housing status		
Owned outright	33%	27%
Buying with mortgage	**44%**	29%
Renting and rent free	*23%*	40%
Annual income		
Nil to $40,000	16%	Median household incomes were $81,900 (Rockdale City Council) and $84,522 (City of Botany Bay)
$40,0001 to $80,000	31%	
$80,001 to $150,000	22%	
Over $150,000	29%	

Table 2 Cluster demographics. Figures show percentages and brackets represent number of respondents. Underline indicates the highest percentage across clusters.

		Concerned Solo-Flyers	Alarmed Work-Life Balancers	Uncertain Community-Minded Women	Disengaged Male Baby Boomers	Total
Postcode	East Cooks River	37.5% (3)	0.0% (0)	18.2% (2)	5.9% (1)	13.0% (6)
	West Cooks River	25.0% (2)	60.0% (6)	27.3% (3)	58.8% (10)	45.7% (21)
	Inner suburbs	25.0% (2)	30.0% (3)	27.3% (3)	11.8% (2)	21.7% (10)
	Beach	12.5% (1)	10.0% (1)	27.3% (3)	23.5% (4)	19.6% (9)
Total		8	10	11*	17	46
Gender	Female	50.0% (4)	60.0% (6)	64.3% (9)	41.2% (7)	53.1% (26)
	Male	50.0% (4)	40.0% (4)	35.7% (5)	58.8% (10)	46.9% (23)
Total		8	10	14	17	49
Living arrange-ments	Buying or own outright	87.5% (7)	60.0% (6)	64.3% (9)	93.8% (15)	77.1% (37)
	Renting or living rent free	12.5% (1)	40.0% (4)	35.7% (5)	6.3% (1)	22.9% (11)
Total		8	10	14	16*	48
Annual gross income	Nil to $40,000	0.0% (0)	20.0% (2)	15.4% (2)	23.5% (4)	16.7% (8)
	$40,001 to $80,000	37.5% (3)	40.0% (4)	38.5% (5)	17.6% (3)	31.3% (15)
	$80,001 to $150,000	50.0% (4)	10.0% (1)	15.4% (2)	23.5% (4)	22.9% (11)
	Over $150,000	12.5% (1)	30.0% (3)	30.8% (4)	35.3% (6)	29.2% (14)
Total		8	10	13*	17	48
Highest level of education achieved	Year 12 or below	0.0% (0)	20.0% (2)	21.4% (3)	11.8% (2)	14.3% (7)
	TAFE or vocational certificate	62.5% (5)	60.0% (6)	21.4% (3)	47.1% (8)	44.9% (22)
	University	37.5% (3)	20.0% (2)	57.1% (8)	41.2% (7)	40.8% (20)
Total		8	10	14	17	49
Age	18-34	0.0% (0)	20.0% (2)	35.7% (5)	17.6% (3)	20.4% (10)
	35-54	62.5% (5)	50.0% (5)	42.9% (6)	35.3% (6)	44.9% (22)
	55+	37.5% (3)	30.0% (3)	21.4% (3)	47.1% (8)	34.7% (17)
Total		8	10	14	17	49
Language	English only	100.0% (8)	80.0% (8)	57.1% (8)	82.4% (14)	77.6% (38)
	Other	0.0% (0)	20.0% (2)	42.9% (6)	17.6% (3)	22.4% (11)
Total		8	10	14	17	49

*Denotes non-response to question

Table 3 The four groups' responses to questions about lived-values, activities and fair policy. Underlined indicates the highest response to a question as Mean (M).

		Concerned Solo-Flyers	Alarmed Work-Life Balancers	Uncertain Community-Minded Women	Disengaged Male Baby Boomers
Lived-values [a]	The community	1.3	1.2	<u>1.9</u>	1.1
	A unique place for children to grow up	0.0	0.5	<u>1.9</u>	0.6
	Close to the beach	1.5	0.8	<u>1.7</u>	1.1
	Close to the city	1.5	<u>1.6</u>	<u>1.8</u>	0.9
	Business or employment opportunities	0.9	0.2	1.1	1.0
	Affordability of housing	<u>1.8</u>	1.2	<u>1.6</u>	0.5
	Relaxed lifestyle	<u>1.9</u>	0.7	<u>1.9</u>	1.0
	Access to shops	<u>1.6</u>	1.1	<u>1.9</u>	1.1
Valued activities [b]	Spend time with work colleagues outside of work	1.0	<u>1.6</u>	1.4	1.4
	Spend time with groups for organisations you belong to	<u>1.6</u>	1.3	1.5	1.4
	Do volunteer work	1.1	1.1	<u>1.3</u>	0.9
	Go out for a meal	1.5	<u>1.8</u>	1.9	<u>1.8</u>
	Ride a bike along the foreshore	0.6	1.3	1.0	<u>1.5</u>
	Do gardening	1.4	<u>1.8</u>	1.4	1.5
	Go swimming	<u>1.8</u>	1.4	1.4	<u>1.7</u>
Perceptions of fair policy [c]	Procedural - There was adequate consultation of communities during development of the SLR policy	<u>-0.6</u> (0.4)	<u>-1.0</u> (0.4)	<u>-0.7</u> (0.3)	-0.5 (0.2)
	Procedural - Residents had the opportunity to contribute knowledge to decisions about SLR	-0.2 (0.4)	-0.3 (0.6)	-0.5 (0.4)	-0.3 (0.3)
	Distributional - The outcomes of the SLR policy are fair	-0.3 (0.5)	-0.3 (0.7)	<u>0.0</u> (<u>0.6</u>)	-0.4 (0.5)
	Temporal - Decisions about SLR have been made in a timely manner	-0.5 (0.5)	0.0 (0.8)	-0.3 (0.5)	-0.4 (0.5)
	Temporal - The SLR policy is fair for future generations	-0.5 (0.5)	0.5 (0.8)	-0.3 (0.5)	-0.2 (0.5)
	Interpersonal I feel that council treats me with contempt when making decisions about SLR	0.3 (0.5)	-0.7 (0.7)	<u>-0.8</u> (0.5)	0.0 (0.5)
	Interpersonal - Whenever I have raised a concern with council I feel they have listened	-0.1 (0.1)	-0.3 (0.2)	-0.5 (0.1)	-0.1 (0.1)
	Informational - The council offers explanations about SLR that make sense to me	-0.4 (0.4)	-0.6 (0.5)	-0.3 (0.5)	-0.5 (0.4)
	Informational - The council clearly explains policy decisions	0.0 (.0)	0.0 (0.3)	0.0 (0.0)	<u>0.4</u> (0.2)
	Spatial - The council works hard to make sure all Wards are treated equally	-0.3 (0.3)	-0.5 (0.4)	-0.4 (0.2)	-0.1 (0.2)

[a] Variables representing lived-values were standardised to a scale of 0 = Not important to 2= Very important

[b] Variables representing valued activities were standardised to a scale of 0 = Never to 2 = Frequently

[c] Fairness variables were standardised to a scale of -1 = Disagree to 1 = Agree; numbers represent the Means (M) for each group and figures in brackets represent 'Don't know' responses. These responses were standardised to a scale of 0 = Other responses to 1 = Don't know.

Appendix A Responses to SLR questions. Figures show percentages and brackets represent number of respondents. Underline and italics denote highest and lowest percentage across four clusters, respectively.

		Concerned Solo-Flyers	Alarmed Work-Life Balancers	Uncertain Community-Minded Women	Disengaged Male Baby Boomers	Total
Thinking about the causes of SLR, which of the following best describes your opinion?[a]	SLR is entirely or mainly caused by natural processes	12.5% (1)	10.0% (1)	0.0% (0)	17.6% (3)	10.2% (5)
	SLR is partly caused by natural processes and partly by human activity	25.0% (2)	30.0% (3)	42.9% (6)	35.3% (6)	34.7% (17)
	SLR is mainly or entirely caused by human activity	<u>62.5% (5)</u>	<u>60.0% (6)</u>	42.9% (6)	*23.5% (4)*	42.9% (21)
	There is no such thing as SLR	0.0% (0)	0.0% (0)	0.0% (0)	11.8% (2)	4.1% (2)
	Don't know	0.0% (0)	0.0% (0)	14.3% (2)	11.8% (2)	8.2% (4)
	Total	100.0% (8)	100.0% (10)	100.0% (14)	100.0% (17)	100.0% (49)
Considering any potential effects of SLR that might affect you personally, to what extent are you concerned about SLR?	Very concerned	<u>50.0% (4)</u>	20.0% (2)	21.4% (3)	*11.8% (2)*	22.4% (11)
	Fairly concerned	25.0% (2)	40.0% (4)	35.7% (5)	29.4% (5)	32.7% (16)
	Not very concerned	12.5% (1)	40.0% (4)	21.4% (3)	35.3% (6)	28.6% (14)
	Not at all concerned	12.5% (1)	0.0% (0)	7.1% (1)	17.6% (3)	10.2% (5)
	Don't know	0.0% (0)	0.0% (0)	14.3% (2)	5.9% (1)	6.1% (3)
	Total	100.0% (8)	100.0% (10)	100.0% (14)	100.0% (17)	100.0% (49)
If nothing is done to reduce SLR in the future, how serious a problem do you think it will be for Botany Bay?	Very serious	62.5% (5)	<u>80.0% (8)</u>	64.3% (9)	*35.3% (6)*	57.1% (28)
	Somewhat serious	25.0% (2)	10.0% (1)	28.6% (4)	41.2% (7)	28.6% (14)
	Not so serious	0.0% (0)	10.0% (1)	7.1% (1)	11.8% (2)	8.2% (4)
	Not serious at all	12.5% (1)	0.0% (0)	0.0% (0)	11.8% (2)	6.1% (3)
	Total	100.0% (8)	100.0% (10)	100.0% (14)	100.0% (17)	100.0% (49)
When, if at all, do you think Botany Bay will start feeling the effects of SLR[b]	Within the next 25 years	<u>87.5% (7)</u>	<u>80.0% (8)</u>	50.0% (7)	*35.3% (6)*	57.1% (28)
	50 years+	0.0% (0)	20.0% (2)	7.1% (1)	41.2% (7)	20.4% (10)
	Never	12.5% (1)	0.0% (0)	0.0% (0)	5.9% (1)	4.1% (2)
	Don't know	0.0% (0)	0.0% (0)	42.9% (6)	17.6% (3)	18.4% (9)
	Total	100.0% (8)	100.0% (10)	100.0% (14)	100.0% (17)	100.0% (49)

[a] To manage the data and present results, response categories "SLR is entirely caused by natural processes" and "SLR is mainly caused by natural processes" were collapsed to "SLR is entirely or mainly caused by natural processes". The categories "SLR is mainly caused by human activity" and "SLR is entirely caused by human activity" were collapsed to "SLR is mainly or entirely caused by human activity".

[b] Responses to the question about the temporal effects of SLR were collapsed to "Within 25 years", "50+ years", "Never" and "Don't know".