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Research article

Exploring the social dimension of sandy beaches through predictive modelling

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ABSTRACT

Sandy beaches are unique ecosystems increasingly exposed to human-induced pressures. Consistent with emerging frameworks promoting this holistic approach towards beach management, is the need to improve the integration of social data into management practices. This paper aims to increase understanding of links between demographics and community values and preferred beach activities, as key components of the social dimension of the beach environment. A mixed method approach was adopted to elucidate users' opinions on beach preferences and community values through a survey carried out in Manly Local Government Area in Sydney Harbour, Australia. A proposed conceptual model was used to frame demographic models (using age, education, employment, household income and residence status) as predictors of these two community responses. All possible regression-model combinations were compared using Akaike's information criterion. Best models were then used to calculate quantitative likelihoods of the responses, presented as heat maps. Findings concur with international research indicating the relevance of social and restful activities as important social links between the community and the beach environment. Participant's age was a significant variable in the four predictive models. The use of predictive models informed by demographics could potentially increase our understanding of interactions between the social and ecological systems of the beach environment, as a prelude to integrated beach management approaches.

The research represents a practical demonstration of how demographic predictive models could support proactive approaches to beach management.

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1. Introduction

Beaches are dynamic and resilient environments (Schlacher et al., 2006; Brown and McLachlan, 2002), drivers of local economies and human recreation (Sardá et al., 2015; James, 2000a) providing a unique range of ecosystem services (Lucrezi et al., 2015; Schlacher et al., 2007). Trends in global population growth (Small and Nicholls, 2003; United Nations Atlas of the Oceans Secretariat, 2010; Ariza et al., 2008a; Harvey et al., 2010) are aggravating the scale and magnitude of human-induced pressures on sandy beaches (Brown and McLachlan, 2002; Schlacher et al., 2008, 2014a; Defeo et al., 2009). Overall, there is interest in redirecting the traditional beach management scope of maximizing recreation and coastal defence (Brown and McLachlan, 2002; Schlacher et al., 2014a) to adopt the concept of beaches as multifunctional ecosystems (Ariza et al., 2008a; Schlacher et al., 2008) that require an adaptive, integrated management approach (Ariza et al., 2008a; Sardà et al., 2014; Harris et al., 2014). Consequently, research on approaches to beach management has increased, addressing the full range of socioeconomic and environmental beach values (Martínez et al., 2007; Sardá and Hughes, 2013; Gopalakrishnan et al., 2011; Raybould et al., 2011; Raybould and Lazarow, 2009; Blackwell, 2007), assessments of users' perceptions (Duvat, 2012; Roca et al., 2009; Koehn et al., 2013) and novel metrics (Ariza et al., 2010; Lozoya et al., 2011; Schlacher et al., 2014b; Semeoshenkova et al., 2017) and methodological approaches (Sardá et al., 2015; Gore, 2007) to improve management

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practices.

Consistent with emerging frameworks promoting this holistic approach towards beach management (Sardá et al., 2015; Gore, 2007) is the need to improve the integration of social data into management practices (Koehn et al., 2013; Tuda et al., 2014; Endter-Wada and Blahna, 2011; Cinner and David, 2011; Lozoya et al., 2014). Over the last two decades, the traditional top-down approach in resource management has given way to greater consideration of community values and preferences (Millenium Ecosystem Assessment, 2005; Dutcher et al., 2007; Gregory and Wellman, 2001; van Asselt Marjolein and Rijkens-Klomp, 2002) through participatory approaches (Reed, 2008; Meliadou et al., 2012; Santos et al., 2005). Although several ecosystem planning frameworks aim to integrate social and biophysical data to various degrees (Millenium Ecosystem Assessment, 2005; Binder et al., 2013; Ostrom, 2009; Gregory et al., 2013; Atkins et al., 2011; Cutter et al., 2008; Schwarz et al., 2011), the challenges of identifying key social trends (Ehler, 2008; Le Cornu et al., 2014) and applying interdisciplinary approaches (Ariza et al., 2012; Nel et al., 2014) remain. And while broad-scale planning frameworks, such as the Ecosystem Based Approach (Secretariat of the Convention on Biological Diversity, 2004), Marine Spatial Planning (Douvere, 2008) and related Integrated Coastal Management (ICM) (Forst, 2009) emphasise stakeholder participation (Harvey et al., 2010; Endter-Wada and Blahna, 2011; Grumbine, 1994; Marin et al., 2009), beach management has been usually 'homogenized' to a predetermined set of priorities (James, 2000a; Lozoya et al., 2014).

The social dimension of sandy beaches often involves heterogeneous groups of people, with diverse socioeconomic characteristics that influence their perceptions of the beach environment (Ariza et al., 2008a; Micallef and Williams, 2002; Lucrezi and van der Walt, 2016). This social complexity is enhanced by the important role that beaches play in the worldwide markets of travel, leisure and tourism (Australian Government, 2009); especially in the case of marine protected areas (Petrosillo et al., 2007; Windevoxhel et al., 2003), small islands (Pelling and Uitto, 2001; Roig i Munar, 2003) and tropical nations (Araújo and Costa, 2006; Lincoln, 2014; Yepes and Cardona, 2000). Nonetheless, these groups can still share the same concerns and values regarding sandy beaches (Lucrezi and van der Walt, 2016). In this context, perception surveys are considered an important tool to inform management (Williams et al., 1992; Morgan et al., 1993), enable identification of user groups and their perceptions, beach uses (Gore, 2007; Cervantes et al., 2008; Priskin, 2003; Villares et al., 2006) and ultimately improve management (Marin et al., 2009; Petrosillo et al., 2007; Cervantes et al., 2008; Webb et al., 2004).

Initial contributions from user surveys included demographic profiles, preferences and assessment of management practices (Williams et al., 1992; Morgan et al., 1993; Cutter et al., 1979; Breton et al., 1996; Tunstall and Penning-Rowsell, 1998). More recent work considered incorporating user perceptions into beach planning (Cervantes et al., 2008); international comparisons of user preferences (Vaz et al., 2009); exploring recreational needs (Oh et al., 2010) and beach quality awards (Nelson and Botterill, 2002; Nelson et al., 2000); and determining economic value of beach access (Dixon et al., 2012; Oh et al., 2008). Other topics of attention have been socio-economic concerns including accessibility (Dixon et al., 2012; Oh et al., 2008), quality rating systems (Nelson et al., 2000; Cagilaba and Rennie, 2005), littering (Santos et al., 2005), beach nourishment (AECOM, 2010; Peterson and Bishop, 2005), beach erosion (Dahm, 2003; Keqi et al., 2001; Mendoza and Jiménez, 2006) and management frameworks (Sardá et al., 2015; Gore, 2007; Micallef and Williams, 2002; James, 2000b). In Latin America and the Caribbean research has analysed carrying capacity (Amador Soriano et al., 2013), perception of ecosystem services and local threats (Guerra-Vargas and Mancera-Pineda, 2015) and user preferences (Williams and Barugh, 2014; Botero et al., 2013).

Australian sandy beaches make up around half of the coastline (Australian Government, 2009). They play a central role in defining national identity (Australian Government, 2009; Bonner et al., 2001; Pettigrew and Cowan, 2002; McKay et al., 2014) as well as driving visitor's demand (Tourism Australia, 2013). For instance, in 2014–2015 the attendance to patrolled beaches of New South Wales was estimated at 4.1 million people, while an aggregated annual expenditure of $480 million was calculated for all Sydney beaches (Marine Estate Management Authority, 2015). These figures highlight the importance of supporting local governments in understanding the distribution of social, economic and environmental costs and benefits associated to the diversity of beachgoers.

In Australia, early work on beach user attitudes has been at metropolitan beaches in Melbourne and Adelaide (Houghton, 1989); while O'Rourke (O'Rourke, 1978) addressed the relationship between demographic data and distance travelled to beaches of NSW. More recent research has focused on policy perspective to beach management (James, 2000b); the value of recreational visits to the beach (Blackwell, 2007); guidelines on nature, characteristics, surf and safety of beaches of NSW (Short, 2007); beach usage in Melbourne (Mercer, 2007) and beach use and preferences among coastal residents of south-eastern Australia (Maguire et al., 2011). The aforementioned research has advanced knowledge, yet enhanced understanding of beach management in Australia (James, 2000b) and elsewhere is still needed. Research on beach management represented merely 12% of publications over the period 1950–2013 (Nel et al., 2014), and gaps in knowledge include a deeper understanding of linkages and impacts between the natural and human systems at play (James, 2000b; Maguire et al., 2011). Specifically the latter relates to accounting for the influence of demographic and psychological factors in stated preferences of beach goers (Williams and Barugh, 2014; O'Rourke, 1978), specific guidelines to support management at the local level (Schlacher et al., 2014b; James, 2000b) and the construction of predictive models of beach uses (James, 2000b).

Prior research (Oh et al., 2010; Mercer, 2007; Maguire et al., 2011; Wolch and Zhang, 2004) identifies information related to community values and preferred beach activities as critical to encourage new trends in beach management. Hence, this research paper aims to increase understanding of relationships between demographics and community values and preferred beach activities. Providing such insight could increase local capabilities to proactively address dynamic relationships between the human dimension and the beach ecosystem, thus increasing management effectiveness (McLachlan et al., 2013). A mixed method approach was adopted in this case study of Manly Local Government Area (LGA),[1] part of the Sydney Harbour catchment area. The choice of Manly is suitable, as it exemplifies a costal council where the role of the beach environment is rooted socially, as an iconic open-space, highly regarded by the residents and visitors alike; and economically, as a component of local tourism and local businesses (Manly Council, 2015). The case study explores community responses on preferred beach activities and key community values through a survey; results are then used to develop predictive models. The following section discusses the theoretical framework

[1] The Manly Council was recently amalgamated into the Northern Beaches Council in addition to the former Pittwater and Warringah Councils, under the 2016 Local Government (Council Amalgamations) Proclamation 106. Australian Government, Local Government (Council Amalgamations) Proclamation, 2016, NSW Parliamentary Counsel's Office: New South Wales.

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