Research article

Exploring the social dimension of sandy beaches through predictive modelling

Elianny Domínguez-Tejo [a, *], Graciela Metternicht [a], Emma L. Johnston [b, c], Luke Hedge [c]

[a] Pangea Centre, School of Biological, Earth and Environmental Sciences, The University of New South Wales, Biological Sciences Building (D26), Kensington 2052, NSW, Australia
[b] Evolution and Ecology Research Centre, School of Biological, Earth and Environmental Sciences, The University of New South Wales, Biological Sciences South, Kensington 2052, NSW, Australia
[c] Sydney Institute of Marine Science, Chowder Bay Road, Mosman 2088, NSW, Australia

A B S T R A C T

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.

© 2018 Elsevier Ltd. All rights reserved.

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; Sardá 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

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.

underpinning the research approach.

1.1. Theoretical rationale

A review of previous models on recreation and the beach environment (Sardá et al., 2015; James, 2000a; Sardá and Hughes, 2013; Wolch and Zhang, 2004; Westover, 1989; Chapman, 1992; Gutrich et al., 2005; Barker and Dawson, 2012; Cottrell, 2003) provided evidence of linkages between demographics and beach users' perceptions (Lucrezi and van der Walt, 2016; Barbosa de Araújo and Ferreira da Costa, 2008). This knowledge was used to develop a new model of the 'Beach environment' (Fig. 1) inspired by conceptual models of James (2000a), Wolch and Zhang (2004) and McFarlane and Boxall (2000). The model illustrates the link between 'demographics' and 'recreation activity' and 'values' within a Social System (e.g. beach social dimension). The latter are connected to 'Management Systems' which can use this information to improve 'management practice', for example through re-directing management strategies. Both systems are further connected to 'Beach natural systems' which in spite of being dynamic environments, can be altered through interactions with the other systems.

This research focuses on users' opinions, defined as their expressed judgement or preference on two components of the conceptual model: beach activity and personal values (Cervantes et al., 2008). Scarce knowledge is available in Australia regarding these components that can improve beach planning (Maguire et al., 2011). Users' attitudes, knowledge and behaviour are other elements of the cognitive hierarchy (McFarlane and Boxall, 2000) that influence the Social System (Lozoya et al., 2014; Maguire et al., 2011), yet fall outside the scope of this paper (Fig. 1). Prior research argues that recreational activities are likely sources of both environmental and management issues (James, 2000a; Schlacher et al., 2008; Defeo et al., 2009; Cervantes et al., 2008; Barbosa de Araújo and Ferreira da Costa, 2008); and values, defined as the expression of stakeholders' beliefs regarding a desirable end states, qualities or modes of conduct (Lozoya et al., 2014; Schwartz, 1994; Fenton, 2005) should also be integrated to management decisions (Millenium Ecosystem Assessment, 2005; Gregory and Wellman, 2001).

Previous research reports an association between demographic variables and outdoor recreation, particularly beach preferences. Demographics comprise individual characteristics such as age, gender, employment, marital status and cultural background, as well as household/group characteristics like household income, family structure and wealth (Lozoya et al., 2014; Lucrezi and van

der Walt, 2016; Wolch and Zhang, 2004). The methodological framework tested demographic variables as predictors for the two model components of interest: values and recreational activities (Fig. 1). This type of analysis is not often comprehensive when preparing beach management responses, and predictive models have rarely being developed (James, 2000a). Findings from such models could inform management responses to better address these changes and support pulling them away from reactive planning (James, 2000b).

Research scope and objectives, the type of conceptual model (Fenton, 2005; Australian Bureau of Statistics, 2011) and the need to create decision tools unnecessarily complex (McLachlan et al., 2013) appear to influence the selection of representative demographic variables. Hence, based on beach user literature (Lozoya et al., 2014; Lucrezi and van der Walt, 2016; Cervantes et al., 2008; Wolch and Zhang, 2004; Westover, 1989) the following key demographics were chosen: age, education, employment, household income, and residence status; these variables have been previously identified as relevant at local, national or international scale. Household income, for instance, has played a historical role in the fight for middle and poorer classes in Sydney to access recreational spaces outside ordinary parks (Ford, 2010). As well, residence status of beachgoers has been investigated in Australia, in areas where beaches attract both residents and tourists (Raybould and Lazarow, 2009; Sydney Coastal Councils and University of New South Wales, 2013); the studies concluded that residents' perceptions are likely to differ, especially when they do not receive direct economic benefits (Harrill, 2004).

Beach managers often require estimates of how residents and tourists place value on beach access (Oh et al., 2010; Dixon et al., 2012; Freeman et al., 2014), facilities and services (Oh et al., 2010; Dixon et al., 2012; McLachlan et al., 2013) to inform cost and benefits analysis of potential development projects (Oh et al., 2010; Dixon et al., 2012; Frampton, 2010); as well as to influence policy-formulation regarding beach use (Roig i Munar, 2003; Dixon et al., 2012; Sydney Coastal Councils and University of New South Wales, 2013; Freeman et al., 2014; Ariza et al., 2008b). Employment is another variable often associated with sandy beaches that under-pin local economies (Klein et al., 2004; Blakemore and Williams, 2008), as is the case in Manly LGA where they are considered a source of employment, driving small businesses and local services (Manly Council, 2015), and popularity as tourist destination (Manly Council, 2015; Manly Council, 2006). Education on the other hand, is considered crucial to sensitize users to comply and contribute with beach management regulations (Lozoya et al., 2014) and has
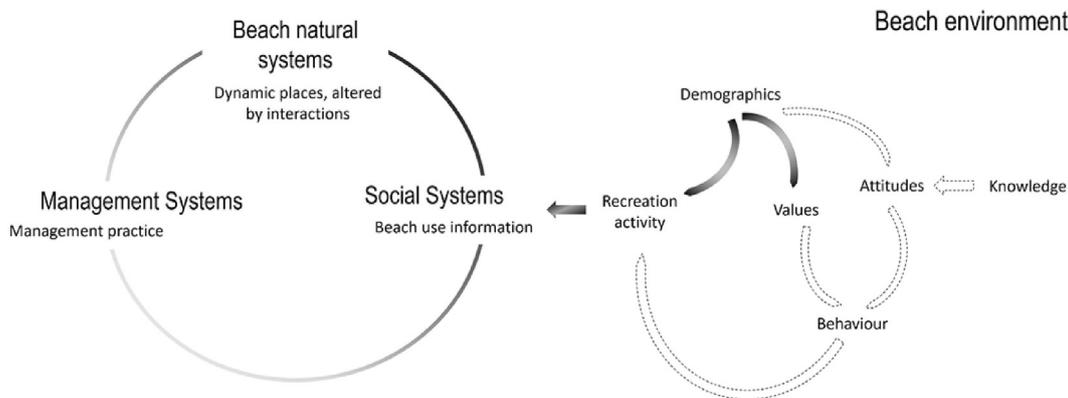
Fig. 1. Conceptual model illustrating links between components of the 'Beach environment'. 'Demographics' influences both 'Recreation activity' and 'Values' within the 'Social Systems' which interact with management and the natural systems (adopted from James (James, 2000a), Wolch and Zhang (Wolch and Zhang, 2004) and McFarlane and Boxall (McFarlane and Boxall, 2000)). Arrows with broken lines indicate interactions not pursued in this research.

been linked to several beach behaviours, including littering (Santos et al., 2005; Araújo and Costa, 2006). Age structure has been highlighted among key demographics potentially explaining beach usage in Melbourne (Mercer, 2007), being also used to characterized 'beach groups' in New South Wales (Chapman, 1992).

2. Methodology

2.1. Research site

Manly LGA is a community highly renowned for the beauty of its built and natural environments, especially its attractive beaches, extending over 16 km^2 (Fig. 2) (Manly Council, 2015). Manly's community and local council are committed to sustainability and transparent decision-making through local planning procedures, including Catchment and Coastal Management Plans (Manly Council, 2004).

Manly is considered culturally diverse in comparison to state levels (Australian Bureau of Statistics, 2012), accommodating a population of 44,786 residents and visitors, and sustaining an influx of interstate and international visitors (approximately six million visitors per year) as well as the largest transportation hub in the area (Manly Council, 2015). In 2011, the resident labour force was estimated at 20,666 people, with a high proportion (30.6%) earning above AUS$1500 per week (high income) (Australian Bureau of Statistics, 2012). An overwhelming 70% of residents work outside of Manly, primarily at Inner Sydney (23%). In the 2011 census the top three industries for Manly's residents population were 'Professional, Scientific and Technical Services' (19%), "Financial and Insurance Services" (11%) and 'Health Care and Social Assistance" (9%) (Australian Bureau of Statistics, 2012).

2.2. Research methods

Through the conceptual model of 'Beach environment' (Fig. 1), this paper explores the relationships between demographic variables and stated preferences of recreational activities and community values. This section describes the research method applied to gather data on the aforementioned variables (Fig. 3). The research is part of a larger research project being undertaken at Manly LGA to advance efforts of EBA-MSP (Fig. A1, Annexe A). As part of Step 1 (Fig. 3), previous reports of local community consultations and resource management plans (Domínguez-Tejo and Metternicht, 2018) were reviewed, generating a list of community values including: valued resource attributes, processes and visual indicators; experiences and especial places; and social and economic values (Manly Council, 2006; Manly Council, 2004; Integrated Catchment and Environmental Management Research Group, 2004; Manly Council, 2010; Manly Council, 2008a; Manly Council, 2011; Manly Council, 2008b; Manly Council, 2007). The list of recreational activities provided to participants is by no means exhaustive, however the method of developing a list of preferred recreational experience/activities drawn from literature and local consultation has been successfully employed before (Chapman, 1992).

Through subsequent meetings with Council (Step 2, Fig. 3) a short, self-administered questionnaire was designed and applied to elucidate the community's opinion and preferences on: beach uses and perceived pressures; perceived threats to their coastal environment; and their social, economic and environmental values. The following principles were adopted to articulate the research with expectations of the Council, as well as time and financial resources available for the research:

a) The survey would be conducted in English and target adult residents and visitors of Manly LGA;
b) The expected completion time would be 15 min;
c) Previous results (e.g. reported community values) would be incorporated into the new instrument whenever possible; albeit, providing the option to include new responses;
d) Basic demographic information would be collected, as opposed to a more detailed demographic profile of each participant;
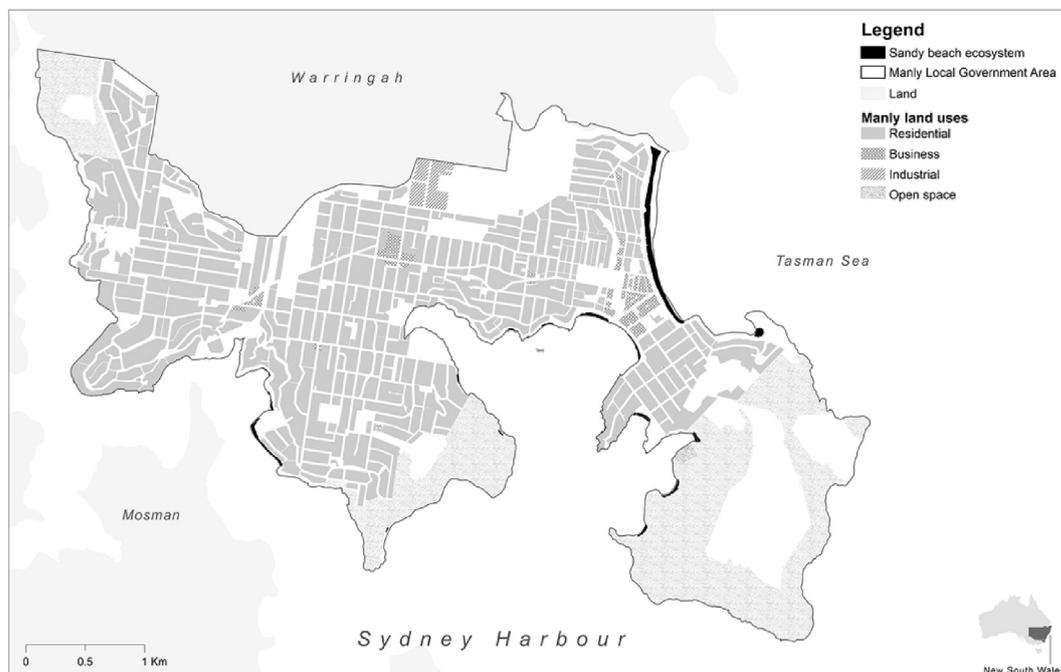

Fig. 2. Map of Manly Local Government Area (LGA), New South Wales, Australia.
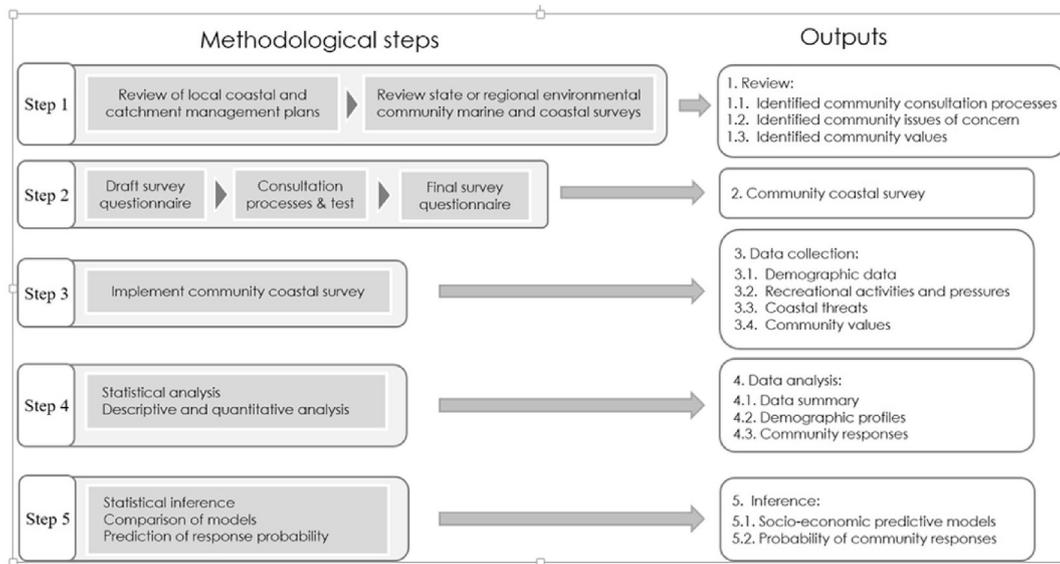
Fig. 3. Research methodological framework.

e) Survey would be conducted during a specific community event, hosted by Council and local organizations, in accordance with a local strategy for community consultation;

f) Council would specifically promote and advertise the survey as a 'Coastal Community Survey', publically inviting all residents and visitors to participate during the event;

g) Advertisement materials would prompt the participation of all stakeholder groups representative of the Manly community.

The questionnaire was informed by previous surveys used in community consultation at local (Micromex Research, 2014; Micromex Research, 2011; Warringah Council, 2014) and state levels (Sweeney Research, 2014; Marine Estate Expert Knowledge Panel, 2014), literature review (detailed in Section 1.1) and specific needs of the research. Four sections were included in the survey (Table 1) and the final format was field tested and finalised in consultation with Council (Fig. B1, Annexe B).

Prior to survey distribution, ten volunteers were trained for field work under supervision of the lead researcher. Volunteers were familiarised with the survey and instructed on the following topics:

a) Clarifying information on survey questions to provide assistance if needed; b) Using randomised techniques to select participants (e.g. counting a predefined number of steps before choosing a participant(s)); c) Avoiding personal bias in selecting participants (e.g. given preference to their own group age); d) Sampling effort within predetermined areas (e.g. covering near-water and near-promenade locations within the beach); e) Surveyor ethical behaviour.

The survey was carried out during the "Manly Sustainability Festival", on the weekend of May 30th and 31st of 2015 (Step 3, Fig. 3). The team was assigned an official festival stance in The Corso (Manly's main street), clearly identified as the "Manly Community Coastal Survey". Working in pairs, surveyors randomly intercepted the public during a period of 5 h each day, from 11 a.m. until 4 p.m., in the festival stance (as a fixed station) and four predetermine sections covering distinct public areas (e.g. Manly Ocean beach and promenade, Manly Wharf arrival area, playground areas) (Fig. 4). At each section, surveyors covered both transit areas (e.g. pathways, promenade walkways) as well as more elusive areas (e.g. people resting in the sand or a bench, away from the crowd). Surveyors were instructed to introduce themselves and the purpose of the

Table 1
Detailed description of the sections of the survey.

Survey section	Description	References
Section A: Demographic data	14 questions to determine basic demographic characteristics of participants, and to ascertain general visiting frequency.	Wolch and Zhang, 2004; Maguire et al., 2011; Mercer, 2007; Roca and Villares, 2008; Lozoya et al., 2014.
Section B: User beach activities Perceived pressures	Randomised list of 23 in-land and water-based activities; and a randomised list of 12 perceived pressures to activities.	Wolch and Zhang, 2004; Maguire et al., 2011; Mercer, 2007; Marin et al, 2009; James, 2000a; Frampton, 2010.
Section C: Perceived coastal threats	Randomised list of 12 coastal and marine threats identified through previous community consultation in the LGA. Participants had to choose and rank the five most relevant threats based on their personal opinion.	Marin et al, 2009; Frampton, 2010.
Section D: Community values	Randomised lists of 9 environmental values, 6 economic values and 16 social values identified in previous community consultation in the LGA. Participants ranked their level of agreement with stated values using a 5-point Likert scale: 'Not relevant', 'Somewhat relevant', 'Neutral', 'Relevant' and 'Very relevant'.	Maguire et al, 2011; Oh et al., 2010; Roca and Villares, 2008; Marin et al, 2009.

Fig. 4. Research area highlighting pre-determine sampling sections (A—D), and a fixed station (S), covered by the surveying team. (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

survey, and promptly provide clarification if requested. Assistance was provided to participants requesting help filling the survey, due to visual/physical difficulties or personal preference.

Survey results were aggregated into a single sample of the Manly community for data analysis (Steps 4 and 5, Fig. 3). Descriptive statistics were used to develop participants' profile, summarize results and capture response frequencies (Step 4, Fig. 3).

Further statistical inference was performed on two survey responses, preferred beach activities and community values (Step 5, Fig. 3). Preferred activities were collected through Section B of the survey; while community's opinions on social, environmental and economic values were elucidated through Section D (Table 1,

Section 2.2). All responses ranking community values as '*Very relevant*' and '*Relevant*' were used in the development and selection of predictive models (Step 5, Fig. 3). Five demographic variables described in Section 1.1 were selected as predictors (Table 2) and fitted as fixed effects in mixed models using the *mvabund* statistical package from the R software, version 3.2.2 (The R Foundation, 2015).

The Akaike's information criterion (AIC value) was applied to assess different combinations of regression models for their fit to the data. Full models were tested first, and subsequently variables were sequentially dropped, one variable at a time, until the AIC value of the model being tested turned the lowest value. Models

Table 2
Demographic variables selected as predictors in statistical inference.

Variable	Levels	Reference
Age group		
(Qage[a])	Group 18—25 (average 21.5)	Wolch and Zhang, 2004; Roca and Villares, 2008.
	Group 26—34 (average 30)	
	Group 35—44 (average 39.5)	
	Group 45—54 (average 49.5)	
	Group 55—64 (average 59.5)	
	Group 65 — older (fixed[b] average 70)	
Education		
Edu1	High School Certificate — Edu1	Wolch and Zhang, 2004.
Edu2	University	
Edu3	Vocational training	
Employment		
Emp	Employed	Lucrezi and van der Walt, 2016
Uemp	Unemployed	
Household income		
Inc1	AU$65,00 or more	Wolch and Zhang, 2004.
Inc2	Less than AU$65,000	
Residence status		
Res	Resident	Oh et al., 2010; Maguire et al., 2011; Roca and Villares, 2008; Dwight et al., 2007.
Vis	Visitor	

[a] 'Qage' denotes 'quantitative age' meaning the average age of each group was used for analysis. The variable age, originally a categorical variable in the survey, was used as a quantitative variable in modelling by calculating the average age between the lower and upper limits of each age group; for the age group '*65 and older*' the average age was set at 70 years.

[b] 'Fixed' denotes that the average age of this group was purposely set at 70 years old.

Table 3
Best demographic models selected for each community response.

No.	Best demographic model	Community Response	AIC value
1	Employment + Education + Residence + Age	Recreational activities	4139.993
2	Employment + Education + Income + Residence + Age	Environmental values	1456.548
3	Employment + Income + Age	Economic values	1954.341
4	Employment + Income + Residence + Age	Social values	3723.019

with the lowest AIC value were used to calculate probabilities for the two community responses by using the function *predict()* of R (Table 3). Heat maps, with rows ordered by demographic variables and community values listed in columns, illustrated likelihood of responses ranging from one to zero (Tables E1.1- 1.6 in Annexe E). The colour scale assigns red to a probability of one (maximum value), orange to the median value (50th percentile), and yellow to zero probability; all other cells are coloured proportionally.

3. Results

3.1. Quality of research instrument

A total of 272 surveys were completed ($n = 272$); this sample size is representative of the residents and the annual estimated visitors to Manly LGA in 2011, with a confidence level of 95% and a confidence interval of 6 (Australian Bureau of Statistics, 2012). The survey effort was also deemed appropriate in the likeness of other studies conducted during weekends (Cervantes et al., 2008; Mercer, 2007) and special events (Cervantes et al., 2008), which showed that between 10 a.m. and 5 p.m. (Mercer, 2007) about 33%–92% fewer surveys were completed (Lucrezi and van der Walt, 2016; Cervantes et al., 2008; Blakemore and Williams, 2008; Williamson et al., 2012).

3.2. Demographic profiles

Residents represented 44% ($n = 120$) of the sampled population, while visitors made 56% ($n = 152$) (Fig. C1-A, Annexe C). Overall, the population sampled was largely employed (71%), and with higher level education (71%). The general annual income was above AUD$65,000 (60%) which corresponds to three quartiles of the 2011 household income quartiles (Australian Bureau of Statistics, 2012) (Fig. C1-A, Annexe C). Comparison of age structure between the survey sample and the 2011 census data (Australian Bureau of Statistics, 2012) indicates the age group, ranging from 35 to 64 years old community members, closely resembled population structure reported in that census (Australian Bureau of Statistics, 2012). The age groups 18–25 (22% in sample vs 8% in census) and 26–34 years old (28% in sample vs 16% in census) were over-represented; and the 65 years and older (5% in sample vs 13% in census) were under-represented (Australian Bureau of Statistics, 2012). Permanent residents amounted to 92%, with the age groups under 44 years old being the most frequent (69%); the majority were employed (76%) with high levels of vocational (88%) and university level education (73%), and an annual income above AUD$65,000 (70%) (Fig. C1-B, Annexe C). Visitors were mostly aged 44 or younger, employed (66%), with a university degree (69%) and just over half of the sample held an annual income over AUD $65,000 (51%) (Fig. C1-C, Annexe C).

3.3. Preferred recreational activities

Findings show higher counts for restful passive land-based activities (Table 4) with the top two choices, '*I enjoy the view, the sound and relax*' and '*I socialise with friends, family*' resulting in 80%

and 75% of the whole sample, respectively. More active choices included swimming, surfing and boarding (67%) and activities associated with sandy areas and adjacent green public areas, such as "*Walking, running and cycling*" (66%). A relatively small number of beach users selected water-based activities, the top one being '*Snorkelling*' (Act 20) selected by 35% of the sampled population. Results by age groups indicate higher counts for respondents under 44 years of age in just over half of the activities (Fig. C2; Annexe C). In particular, the group 26–34 years old reported the highest frequency in almost a third of the activities, both passive and vigorous pursuits. Conversely, the 65 years of age and older group, showed the least counts in all activities, with nil participation in eight activities.

3.4. Community values

Participants expressed their opinion about the relevance of listed environmental, social and economic community values using 5-point Likert scale: '*Not relevant*', '*Somewhat relevant*', '*Neutral*', '*Relevant*' and '*Very relevant*') (Section D of the questionnaire, Table 1). Hereafter, a descriptive analysis of count frequencies is provided for each category of community values (further information is provided in Tables D1.1 − D1.3, Annexe D). Results show for each community value ($n = 31$) a range between 264 and 271 counts, suggesting at least 97% of participants provided their opinion.

All environmental values were predominantly ranked as either '*Very relevant*' or '*Relevant*'; the average count per environmental value was 267, with a minimum of 264 counts and a maximum of 271 counts. '*Water quality*' and '*A clean environment*' were the most valued, with over 200 counts as '*Very relevant*' each; followed by an appreciation for marine life (174 counts), natural views and beauty (161 counts) and threatened species/communities (138 counts). Only one out of the three listed ecosystems, '*Sandy beaches*', attained the highest relevance category in the scale; '*Bushland/terrestrial habitats*' and '*Rocky intertidal habitats*' were perceived as '*Relevant*' (Fig. 5).

In general, participants ranked the majority of economic values as '*Relevant*', with half of the listed values reaching just over 100 counts in this category. The average count per economic value was 270, with a minimum of 268 counts and a maximum of 270 counts. Results show participants valued the contribution of beach environments towards the seafood industry, the economy of aboriginal communities and the provision of facilities as '*Neutral*' to '*Relevant*' (Fig. 6). In contrast, the provision of transportation links and support to marine-related industries and commercial events were all considered of '*Relevant*' value obtaining counts of 115, 111 and 106 for the whole sample, respectively.

Similar to environmental values, the majority of social values were also ranked as '*Relevant*' and '*Very relevant*' (Fig. 7). The average count per social value was 268, with a minimum of 265 counts and a maximum of 271 counts. Participants valued the most '*a place to escape, engage with the natural environment and relax*' (153), '*a place to feel part of the community*' (135) and '*Safe environment*' (132); the last two obtaining higher counts as '*Very relevant*'. The remaining social values individually obtained at least 80

Table 4
Top preferred recreational activities within the beaches of Manly LGA, ordered by count frequency.

Activity code	Recreational activities in the beaches of Manly LGA	Residents	Visitors	Whole sample	Whole sample
		n = 120	n = 152	n = 272	Percentage
Land-based activities					
Act6	*I enjoy the view, the sound and relax*	103	115	218	80%
Act3	*I socialise with friends, family*	97	106	203	75%
Act 5	*I do swimming, surfing, boarding*	94	87	181	67%
Act 14	*Walking, running, cycling*	94	86	180	66%
Act 1	*Sun bathing, exercising, use play grounds*	95	80	175	64%
Water-based activities					
Act 20	*I do snorkelling*	57	38	95	35%
Act 17	*I do kayaking, canoeing*	31	9	40	15%
Act 22	*I do nature tours*	13	18	31	11%
Act 24	*Sailing*	20	10	30	11%
Act 21	*I do scuba*	11	17	28	10%
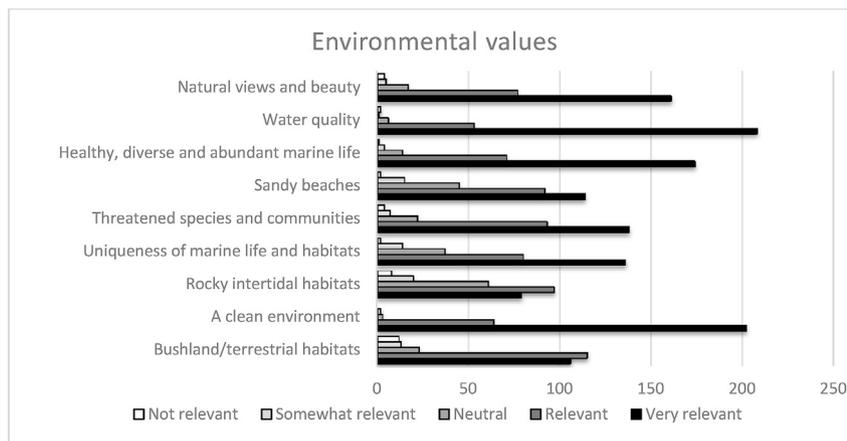
Fig. 5. Frequency analysis of environmental values as ranked by participants.
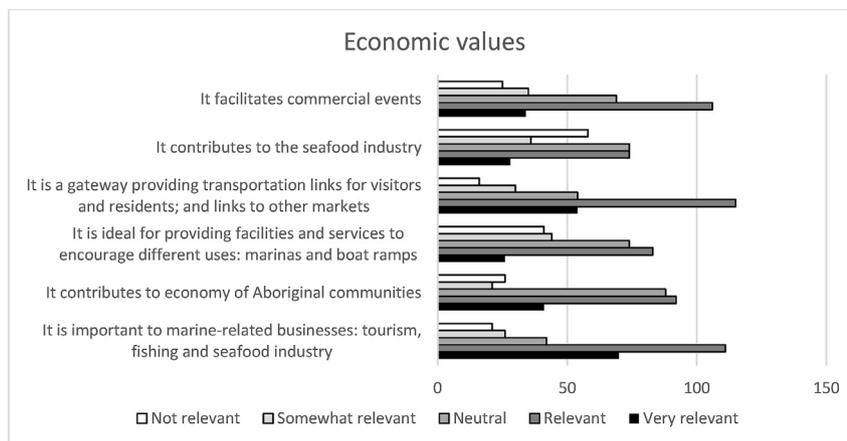
Fig. 6. Frequency analysis of economic values as ranked by participants.

counts, as '*Relevant*' for the whole sample.

3.5. Predictive modelling

This section presents key findings of predictive modelling of community responses based on best demographic models (Table 3, Section 2.2). Community preferences on recreational activities show a trend towards passive land-based pursuits and a few more vigorous activities (Table 4, Section 3.3). Predicted values followed the same trend with the highest likelihood obtained for the same group of top preferred activities; only three water-based activities ('*I do scuba*', '*I do nature tours*' and '*Sailing*') scored median to lower values (Tables E1.1 – E1.6; Annexe E). Highest likelihood values on preferred activities (Act1, Act3, Act5, Act6, Act13 and Act14) were associated with residents, with a slight decrease observed by age group. A similar trend was observed in visitors, although likelihood values were lower. Residents under 55 retained the maximum likelihood of choosing top preferred activities; with the same trend
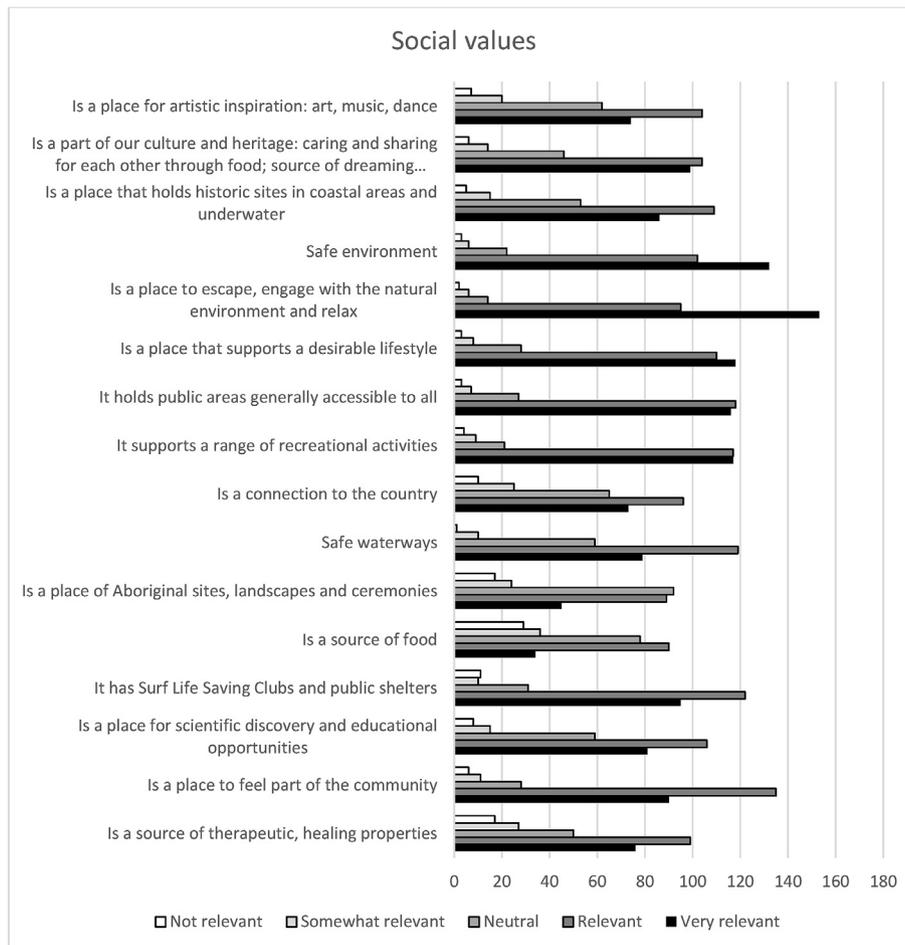
Fig. 7. Frequency analysis of social values as ranked by participants.

observed in visitors at slightly lower likelihood values. Two activities 'I enjoy the view, the sound and relax' (Act6), and 'Walking, running, cycling' (Act14) in age group 65 years and older retained the maximum likelihood for residents and visitors, while likelihood of remaining activities decreased.

Predicted probabilities for environmental values displayed higher likelihood values for 'A clean environment' and 'Sandy beaches' than all remaining values (Table E2; Annexe E); although lower likelihood values were predicted for visitors based on education level. For instance, visitors with a high school certificate (Edu1) had the lowest likelihood to value a clean environment; while visitors with vocational training (Edu3) held the lowest likelihood values for sandy beaches. Similarly, predicted values for 'Threatened species and communities' increased in association with a high school certificate (Edu1); and higher likelihood in 'Water quality' was associated with vocational training (Edu3).

Three distinctive patterns were observed in predicted probabilities of listed economic values (Table E3, Annexe E). Firstly, the likelihood of valuing more the 'Provision of transportation and market links' increased consistently with age. Secondly, the value of 'Facilitating commercial events' was markedly higher when participants were unemployed, in all age groups and irrespective of household income. Thirdly, the likelihood of valuing highly the 'Provision of facilities and services' increased with age, and more markedly with unemployment status.

Among social values, predicted probabilities were found higher in a cluster of six values (Soc 9—14) reaching the highest likelihood values in all participants aged over 45 (Table E4; Annexe E). Outside

this cluster, unemployment was associated with higher likelihood values on two accounts, 'Safe environment' (Soc2) and 'Is a place that supports a desirable lifestyle' (Soc4), in all participants with an annual household income under AUD$65,000 (Inc1) and to a lesser extent with annual household income over AUD$65,000 (Inc2). In contrast, higher likelihood in the social value 'Is a place to feel part of the community' (Soc7) was associated with employed participants, aged over 45 and with annual household income over AUD$65,000 (Inc2).

4. Discussion

As with any social study, results of this research need to be interpreted within context. The demographic profile of the sampled population reflected key population patterns observed in Manly during the last national census; further it suggests a diversity of beach users and community values, a challenging situation for local managers. This research provides insights into the potential of demographic information as predictor of changes in beach preferences and community values, supported by a conceptual model of beaches as multidimensional ecosystems (Fig. 1).

As socio-cultural systems, sandy beaches (James, 2000a) support a wide range of commercial and recreational activities (Vaz et al., 2009; Peden, 2004) benefiting people. Community choices on recreational activities highlighted the particular relevance of social and restful activities linked to the beach environment (Table 4; and Fig. C2, Annexe C). Similar results were found in recreational uses of the Manly coastal lagoon and surrounding

beaches (Micromex Research, 2011) where exercising (78%), picnics (43%) and family time (42%) prevailed. Previous research on southeast Australian coastal residents also identified walking and swimming as the most popular activities, followed by relaxing or meditating (Maguire et al., 2011). Further, a NSW regional survey (Sweeney Research, 2014) indicated 'Walking, exercising, and sunbathing', followed by 'Socialising in a marine area' and 'Swimming, surfing, boarding' as the preferred recreational activities. Hence, this study adds to growing evidence from Italy (Marin et al., 2009), Spain (Breton et al., 1996), England (Tunstall and Penning-Rowsell, 1998), South Africa (van Herwerden et al., 1989) and Mexico-California (Cervantes et al., 2008) that restful activities are favoured over more brisk pursuits. This highlights the role of coastal areas in providing non-material benefits within the full range of marine cultural services (Atkins et al., 2011; Bohnke-Henrichs et al., 2013).

Greater understating of community values is relevant to environmental managers (Dutcher et al., 2007) as well as policy makers (Gregory and Wellman, 2001). In Manly LGA the appreciation for water quality and a clean environment were highlighted as key environmental values, closely followed by the appreciation of marine life and natural views and beauty, and threaten species. This concurs with findings from a regional survey (Sweeney Research, 2014) which highlighted the need to apply a catchment to coast perspective (Domínguez-Tejo et al., 2016) and protect local biodiversity. Within economic values, transportation links and marine-related industries were seen as relevant to the community. This an expected finding since Manly has been developed as a 'transportation hub' and 'tourism destination' (Manly Council, 2015). Socially, the beach was deemed a valuable and safe place to engage with nature and feel part of the community. These values were also embraced by 62% of the greater community of NSW (Sweeney Research, 2014), that perceived the Marine Estate as critical space to relax from everyday life, spend time with loved ones and strengthen community ties. Hence, findings from preferred recreational activities and social values indicate an intricate social dimension attached to sandy beaches; and the relevance of implementing an EBA-MSP approach to advance environmental, social and economic objectives (Domínguez-Tejo et al., 2016).

Among demographic variables, participant's age was a significant variable in the four predictive models. In the case of recreational activities, predictive probabilities were high for 'Enjoying the view, the sound and relax' and 'Walking, running and cycling' amongst the 65 years of age and older (Section 3.5). This age group is projected to increase sharply, and to become one of two dominant age groups by 2031, nearing 16% of the Manly population (Department of Planning and Environment, 2014). Hence, their identified preferences are likely to gain more relevance in mid- and long-term beach planning.

Age was also associated with a higher likelihood of valuing rocky intertidal habitats and the provision of transportation and markets links as an economic value (Section 3.5) in the population 45 years old and older. However, this population segment is not projected to become a local dominant group by 2031 (Department of Planning and Environment, 2014); the age group 45—54 years old is expected to increase by only 0.5%, and 55—64 years old by approximately 1% in that same period (Department of Planning and Environment, 2014). Hence, it would be expected that current high-likelihood values associated with these decreasing age groups may be negatively affected by either: representing smaller percentages of the population through time; or becoming proportionally disadvantaged by the values of other emerging age groups. In both instances, the aforementioned changes might impact their mid- and long-term significance in beach planning.

Predictive models also revealed patterns of community

responses in relation to employment status. For instance, unemployment was associated with the likelihood of 'Facilitating commercial events' and the 'Provision of facilities and services' as relevant community values (Section 3.5). Also the social values of a 'Safe environment' and supporting "a desirable lifestyle" (Section 3.5) were predicted as of higher likelihoods in unemployed participants. Manly has a relatively low unemployment rate as compared to national figures, with a decreasing trend from 3% in 2011 to 1.9% in 2015 (Australian Bureau of Statistics, 2016), however, the aforementioned preferences, if more widespread in the region, could usefully influence the management plans for regional beaches.

Exploratory research of projected values of demographic variables and their theorised linked to community responses is a potential management strategy emerging from this research. For instance, similarly to participants' age, educational level appears to influence the predicted probability of some community values. The appreciation for 'Threatened species and communities', for example, was positively associated with secondary education (Section 3.5); hence further research could focus on strategic segmentation of the general public to improve effectiveness of educational campaigns, often included in management plans.

Several challenges in the methodological approach were identified that could be addressed in the future. While the community survey represented a random sample of the Manly community, sampling effort could be improved to increase statistical precision. Participants were categorized as residents or visitors for data analysis; future studies could examine user groups within those two categories such as permanent versus seasonal residents, or one-day trippers versus overnight stays. Further segmentation of the population should also be considered. Additional demographic variables to improve predictive modelling could be explored, by including gender, family structure and residence tenure. Lastly, while previous research has examined individual components of the conceptual model (participants' attitudes, knowledge and behaviour) (Cottrell, 2003) (Fig. 1), future studies could consider a 'systems thinking' approach of the whole range of variables allowing new interactions to be discovered (Bosch et al., 2007).

It is also necessary to bear in mind research limitations when interpreting these findings. First, survey limitations explained in Section 2.2 impaired participation of several community groups including people under the age of 18 and non-English speaking people. Secondly, complementary survey methods such as quota sampling could serve to improve sampling representativeness. Moreover, the method of handing out surveys during beach peek attendance (weekdays, weekends and festivals) has been employed elsewhere (Cervantes et al., 2008), however, future studies could enhance sampling design to account for seasonality of beach visits (Maguire et al., 2011). Lastly, in-depth interviews could serve to elucidate personal knowledge and feelings through open-ended questions.

The use of predictive models informed by demographics could increase our understanding of interactions between the social and ecological systems of the beach ecosystem, as a prelude to the development of an MSP-EBA approach. Results of this research are particularly relevant to local government and agencies sharing responsibility for beach management, and they provide a method to increase the utility of user surveys, somewhat restricted to descriptive analysis. In particular, greater understanding of interactions between demographic variables and community responses will become increasingly important for adaptive approaches to management of coastal resources.

5. Conclusions

Managing the dynamic and resilient environment of sandy

beaches requires greater integration of social data into management practices. In sandy beaches, the social dimension often involves heterogeneous user groups and strong ties to leisure and tourism worldwide markets, making perception surveys strategic tools to inform and improve management. In Australia, where beaches are strongly attached to national identity and understanding visitors demand, user surveys could become a more critical tool supporting not only identification user groups and uses, but also predictive modelling of future beach preferences and community values. The use of predictive models could unlock a new proactive approach for integrating community consultations into beach management.

A conceptual model of the 'Beach environment' has been proposed detailing the cognitive hierarchy within the beach's 'Social system'. Based on previous research, the model supported the analysis of links between demographics, recreational activity and values as key elements of this social system. Users' opinions on beach preferences and values were elucidated through a community survey in Manly LGA. The conceptual model was then used to frame the construction of demographic models as predictors of these particular community responses.

Results from this research align with previous findings of national and international user surveys, indicating the relevance of social and restful activities as important social links between the community and the beach environment. The community perceived environmental values as highly relevant, especially 'Water quality' and 'A clean environment', reaffirming the need to manage catchments and coastal areas holistically. The provision of transportation links and marine-related industries were ranked as the most relevant economic values; while social values reflected high appreciation for the marine environment as a safe place to engage with nature, relax and feel part of the community.

The method enabled a practical demonstration of how predictive demographic models drawn from beach surveys can inform key management tasks such as: gaining a comprehensive understanding of the community's social links to their beach environment; identifying potential changes in community values based on current and projected demographics; and supporting proactive resource planning that could be embedded into holistic planning frameworks such as EBA-MSP.

This research is a step forward in addressing current knowledge gaps in our understanding of linkages between natural and human systems of the beach environment. It explored the influence of demographic factors in stated beach preferences and community values. Results are encouraging in the potential of predictive models as a strategic component of integrated beach management approaches.

Acknowledgements
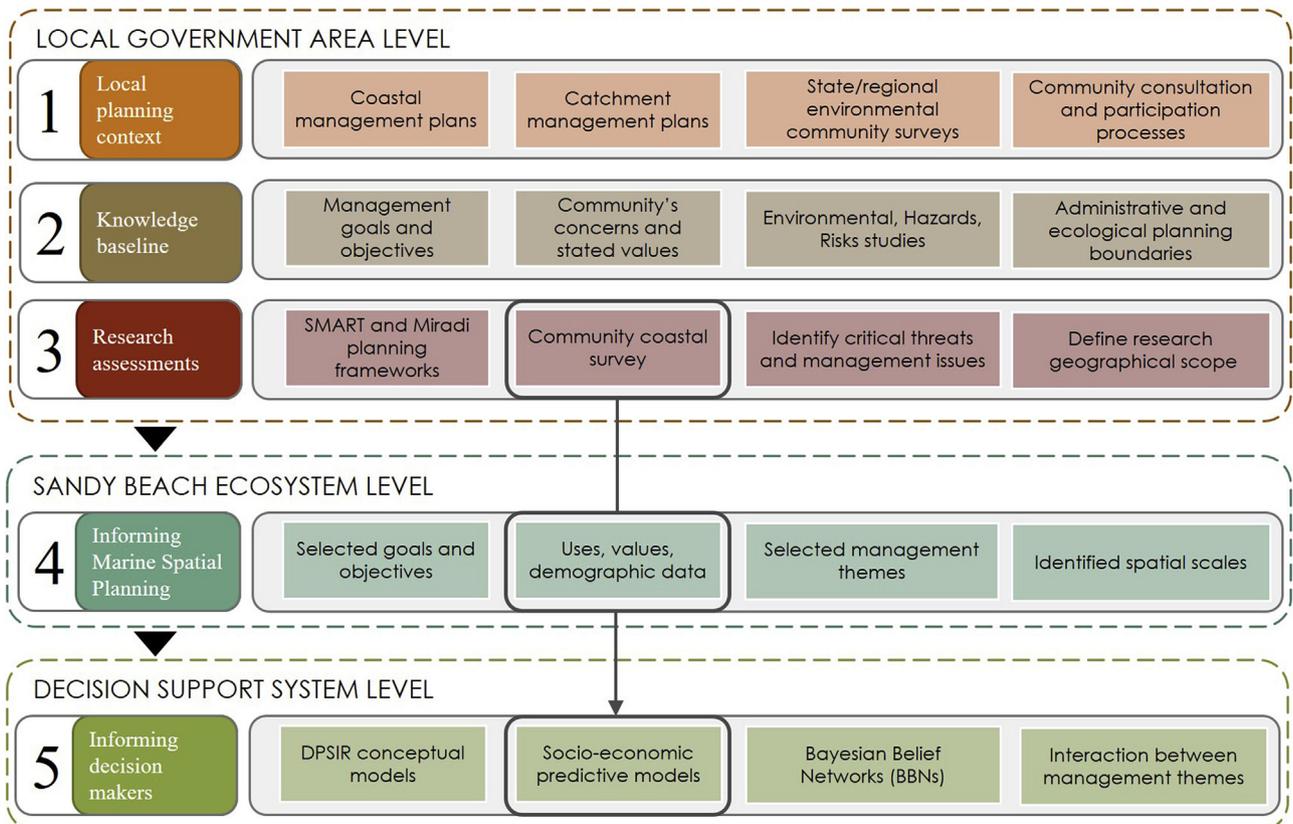
Annexe A

Fig. A1. Research methodological framework: prepared by the authors.

Annexe B

   Fig. B1. Survey questionnaire.

School of Biological, Earth and Environmental Sciences
Approval No. 155008

PART A

1. What is your gender? (please tick)

☐ Male
☐ Female

2. Please specify your age group (please tick)

☐ 18 – 25   ☐ 35 – 44   ☐ 55 – 64
☐ 26 – 34   ☐ 45 – 54   ☐ 65 or older

3a. Are you employed? (please tick)

☐ Yes   ☐ No

3b. If yes, what is your occupation?

_____

4. What are your educational qualifications? (please tick)

☐ High School Certificate   ☐ Vocational Training [TAFE]
☐ University (Bachelor, Postgraduate)   ☐ Other: (please specify) _____

5. Could you tell us whether the household income would be over $65,000 or under $65,000 per annum?

☐ $65,000 or more   ☐ Under $65,000

The amount of AUS$ 65,000 is equal to:
USD $ 52,300   GBP £33,200   NZD $70,100

6. Are you a local resident (living in Manly Local Area Government)? (please tick)

☐ Yes   ☐ No..........Go to question 13

7. If yes, which groups describes you best? (please tick)

☐ Do you identify yourself as either Aboriginal or Torres Strait Islander?
☐ Permanent resident: you live in Manly all year round
☐ Seasonal resident: you live in Manly for only some part of the year

8. If you have a residence in Manly, what is the precinct and post code of your residence? (please specify)

Your precinct: _____   Postcode: _____

9. If you have a residence in Manly, how many people live in your household including you? (please tick)

☐ Two or less   ☐ Three or more

10. Please tick the box that best describes your family status (please tick)

☐ Single – live alone   ☐ Couple with children under 15   ☐ Other specify_____
☐ Single – with parents/or other adults   ☐ Couple with children over 15   _____

11. Please tick the box that best describes the type of dwelling you live in. (please tick)

☐ Separate house   ☐ Semi-detached/terrace   ☐ Flat/unit/apartment

UNSW THE UNIVERSITY OF NEW SOUTH WALES

MANLY COUNCIL

School of Biological, Earth and
Environmental Sciences
Approval No. 155008

12. Please tick the box that best describes your tenure type. (please tick)

☐ Fully owned   ☐ Rented   ☐ Being purchased (mortgaged)   ☐ Other: _____

13. If you are just visiting Manly which of these groups describe you best? (please tick)

☐ Visiting for the day   ☐ Visiting overnight

☐ Domestic visitor from NSW   ☐ Domestic visitor interstate

☐ International visitor from another country

14. How often do you visit Manly in a year? ☐ Once   ☐ Two to five times   ☐ More than five times

PART B

15. What do you like to do in the BEACHES of Manly? (please tick all your choices)

IN LAND	IN THE WATER
☐ Sun bathing, exercising, use play grounds	☐ I do power boating, water/jet skiing
☐ I do spiritual activities, traditions	☐ I do kayaking, canoeing
☐ I socialise with friends, family	☐ I do cruises
☐ I educate or train children, adults	☐ I do recreational boat fishing
☐ I do swimming, surfing, boarding	☐ I do snorkelling
☐ I enjoy the view, the sound and relax	☐ I do scuba
☐ I do beach or rock fishing	☐ I do nature tours: whale/bird watching
☐ My work place/business is on the beach	☐ I do commercial fishing
☐ I do scientific research	☐ Sailing
☐ I do volunteer work	☐ Other, specify _____
☐ I visit historic sites	
☐ I visit Aboriginal sites	
☐ I do nature tours/walks: bush, foreshores, parks	
☐ Walking, running, cycling	
☐ Other, specify _____	

16. What is affecting your activities in the BEACHES of Manly? (please tick all your choices)

☐ You can't find secluded, peaceful areas   ☐ You feel excluded, unwelcomed

☐ Beach waters are polluted: health risk   ☐ Beach erosion, shoreline recession

☐ Crowding, too many people   ☐ Presence of marine invasive species

☐ Litter on the beaches   ☐ Too much noise

☐ The costs of parking   ☐ You don't feel is safe: risk of accidents, crimes

☐ You lost physical access to some beaches   ☐ Other, specify _____

☐ Wildlife/flora decreased or gone

Page2

UNSW THE UNIVERSITY OF NEW SOUTH WALES　　MANLY COUNCIL

School of Biological, Earth and
Environmental Sciences
Approval No. 155008

PART C

17. The following is a list of Coastal and Marine Threats that were identified through community consultation. Please <u>indicate the 5 threats more relevant to you by ranking them</u> in their boxes. (1 = Most relevant)

☐ Water pollution　　　　　　　　　☐ Marine invasive species

☐ Litter　　　　　　　　　　　　　☐ Coastal/marine habitats destruction

☐ Boat pollution and litter　　　　　☐ Resource extraction

☐ Irresponsible practices　　　　　　☐ Little or no knowledge of regulations/restrictions

☐ Pollution from catchments　　　　☐ Political and economic gains at the expense of the ecology

☐ Coastal development　　　　　　　☐ Concentration of fishing activities in some areas

Other: (please specify) _____

18. The following is a list of Coastal and Marine <u>Environmental Values</u> that was identified by the communities of Manly. Please indicate how relevant these values are to you by ticking the most appropriate box.

	Not relevant	Somewhat relevant	Neutral	Relevant	Very Relevant
Bushland/terrestrial habitats					
A clean environment					
Rocky intertidal habitats					
Uniqueness of marine life and habitats					
Threatened species and communities					
Sandy beaches					
Healthy, diverse and abundant marine life					
Water quality					
Natural views and beauty					
Other (please specify):					

19. The following is a list of Coastal and Marine <u>Economic Values</u> identified by the communities of Manly. Please indicate how relevant these values are to you by ticking the most appropriate box.

The marine environment is...	Not relevant	Somewhat relevant	Neutral	Relevant	Very Relevant
It is important to marine-related businesses: tourism, fishing, seafood industry, etc.					
It contributes to economy of Aboriginal communities.					
It is ideal for providing facilities and services to encourage different uses: such as marinas and boat ramps for boating.					
It is a gateway providing transportation links for visitors and residents; and links to other markets.					

Page 3

UNSW
THE UNIVERSITY OF NEW SOUTH WALES

	Not relevant	Somewhat relevant	Neutral	Relevant	Very Relevant
It contributes to the seafood industry.					
It facilitates commercial events.					
Other (please specify):					

20. The following is a list of Coastal and Marine Social Values identified by the communities of Manly.
Please indicate how relevant these values are to you by ticking the most appropriate box.

The marine environment is...	Not relevant	Somewhat relevant	Neutral	Relevant	Very Relevant
Is a source of therapeutic, healing properties					
Is a place to feel part of the community					
Is a place for scientific discovery and educational opportunities					
It has Surf Life Saving Clubs and public shelters					
Is a source of food					
Is a place of Aboriginal sites, landscapes and ceremonies					
Safe waterways					
Is a connection to the country					
It supports a range of recreational activities					
It holds public areas generally accessible to all					
Is a place that supports a desirable lifestyle					
Is a place to escape, engage with the natural environment and de-stress / relax					
Safe environment					
Is a place that holds historic sites in coastal areas and underwater					
Is a part of our culture and heritage: it supports caring and sharing for each other through food; source of dreaming stories; connection to country; and a social gathering place					
Is a place for artistic inspiration: art, music, dance					
Other (please specify):					

- -

Tear off

Thank you for your time and contribution to this project.   GOT MORE TO SAY??

If you are a resident with more to say, we would love to invite you to follow-up sessions of this consultation!

Please leave your details below so that we can arrange an interview at a time that suits you. (This section will be detached from your survey and your comments will remain anonymous).

Name: _____

Contact phone or email: _____

Page4

Annexe C

Fig. C1. Demographic profiles of the sampled population of Manly LGA. A) Whole sampled population; B) Residents sampled population; C) Visitors sampled population.
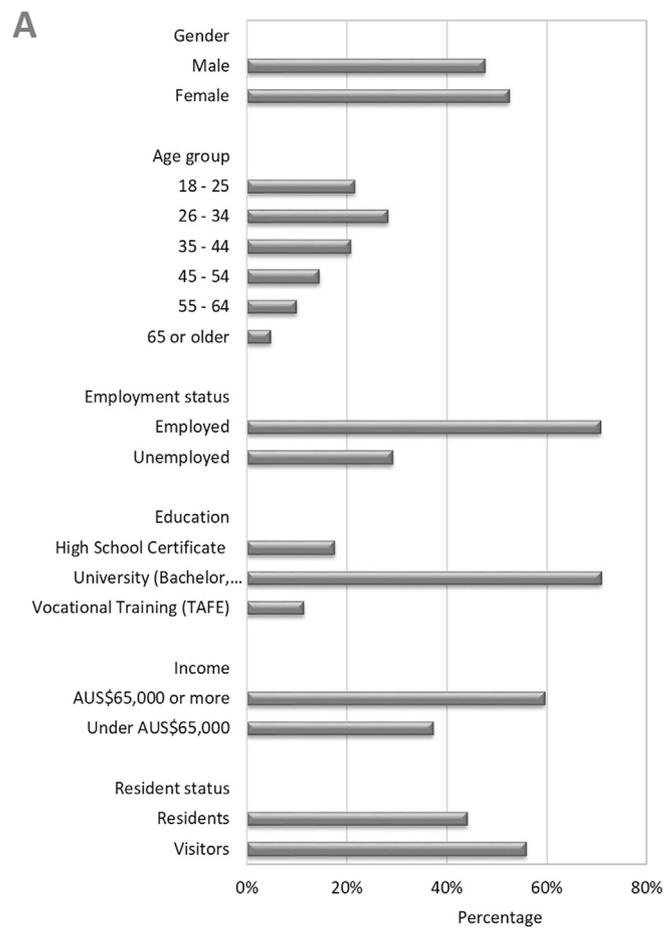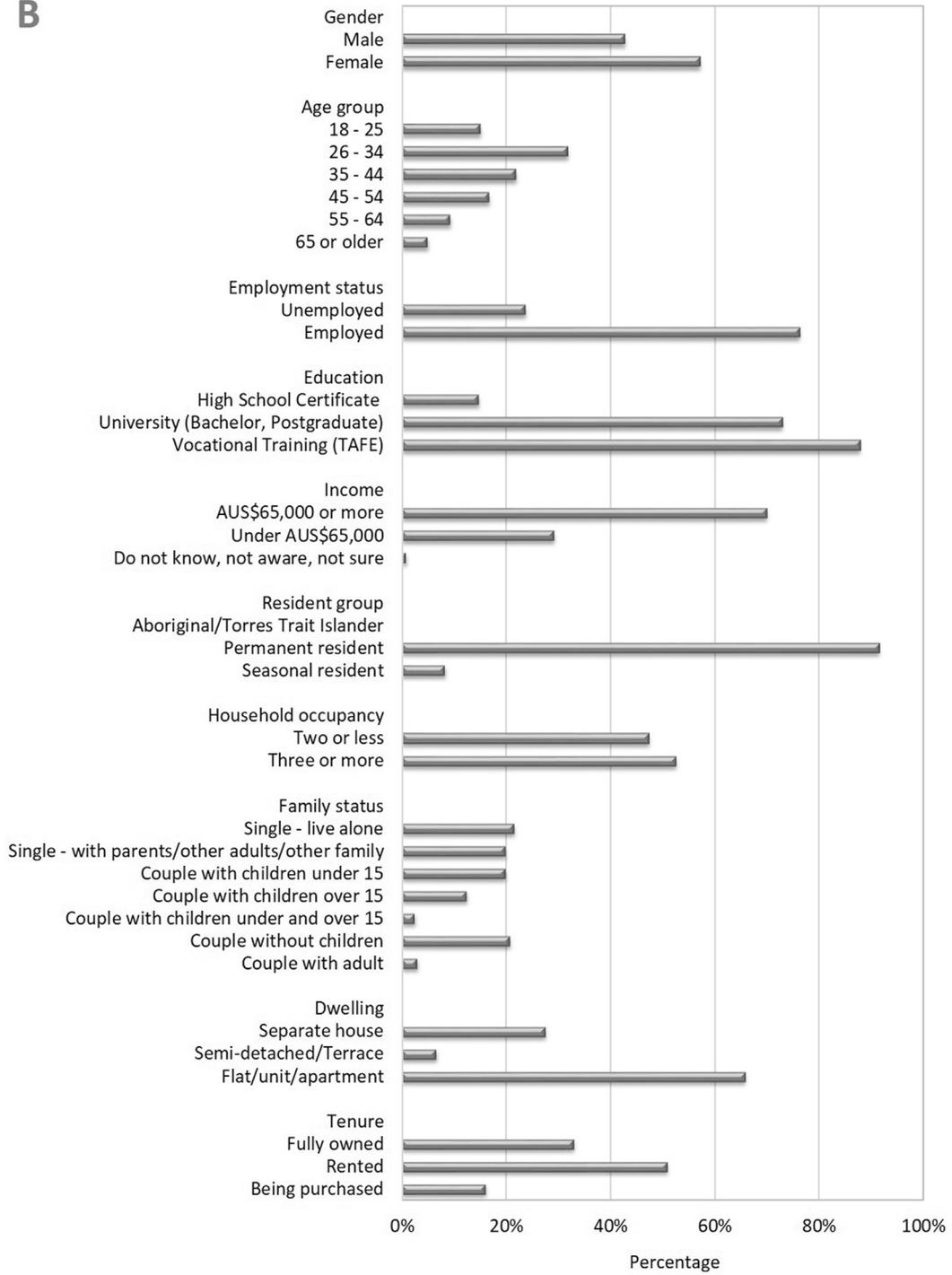
C
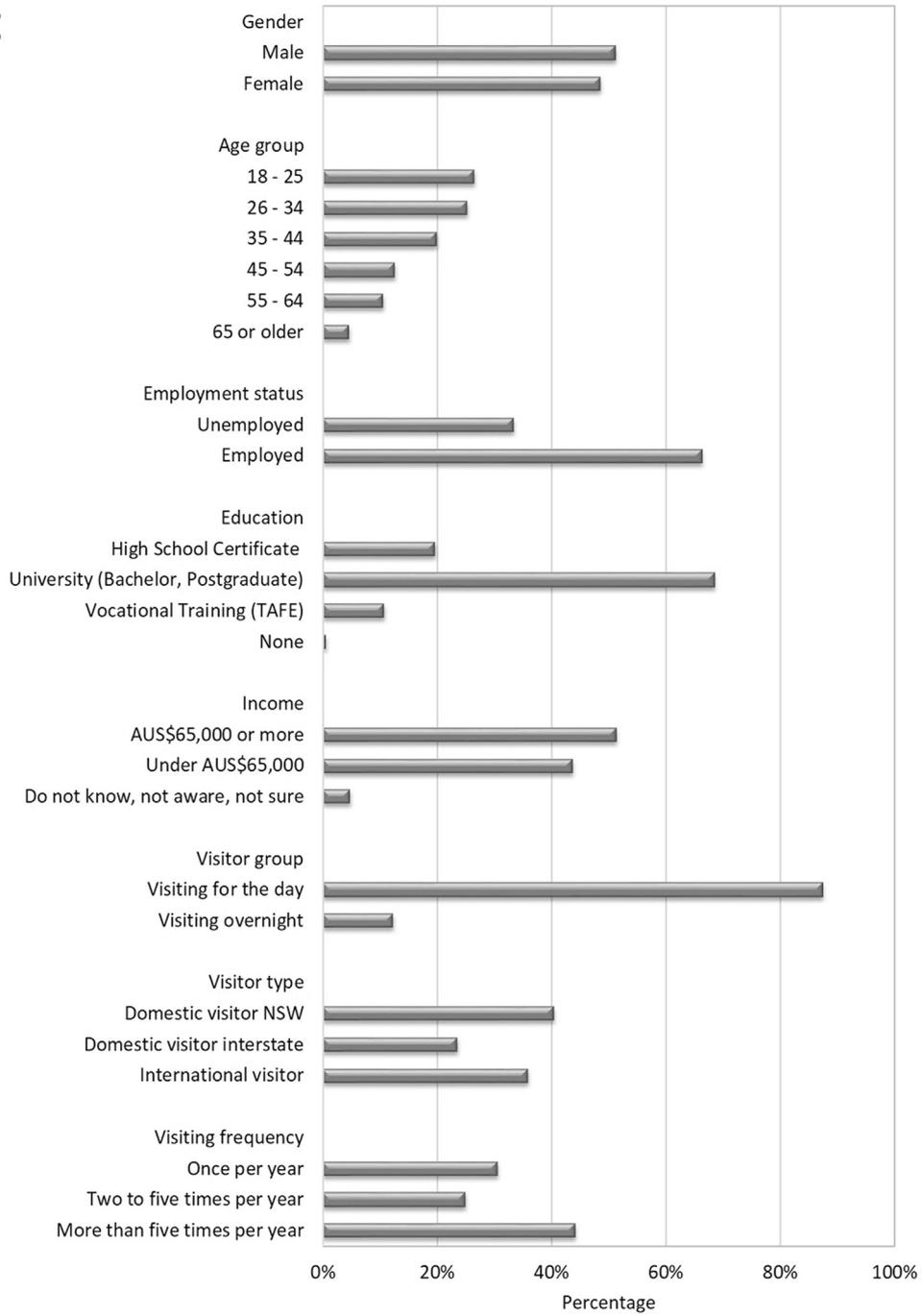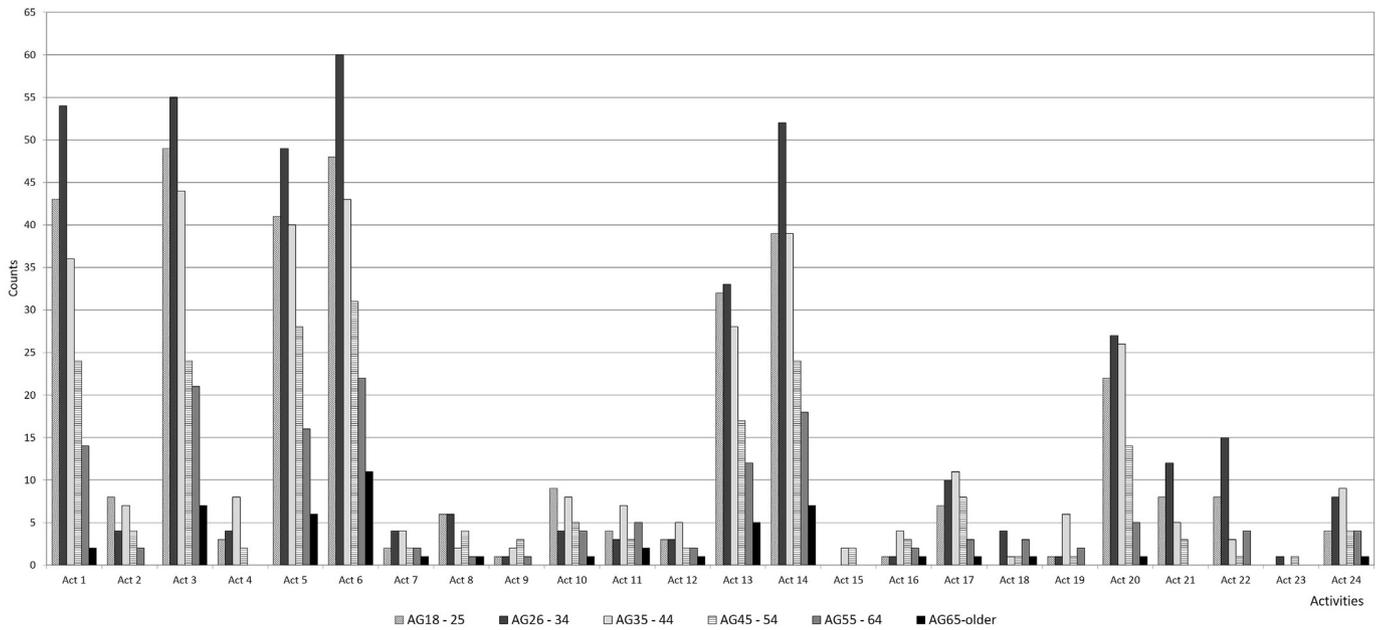
Fig. C2. Results of count frequencies for each recreational activity, presented by age groups. **Act 1:** Sun bathing, exercising, use play grounds; **Act 2:** I do spiritual activities, traditions; **Act 3:** I socialise with friends, family; **Act 4:** I educate or train children, adults; **Act 5:** I do swimming, surfing, boarding; **Act 6:** I enjoy the view, the sound and relax; **Act 7:** I do beach or rock fishing; **Act 8:** My work place/ business is on the beach; **Act 9:** I do scientific research; **Act 10:** I do volunteer work; **Act 11:** I visit historic sites; **Act 12:** I visit Aboriginal sites; **Act 13:** I do nature tours/walks: bush, foreshores, parks; **Act 14:** Walking, running, cycling; **Act 15:** Visit pubs or restaurants; **Act 16:** I do power boating, water/jet skiing; **Act 17:** I do kayaking, canoeing; **Act 18:** I do cruises; **Act 19:** I do recreational boat fishing; **Act 20:** I do snorkelling; **Act 21:** I do scuba; **Act 22:** I do nature tours; **Act 23:** I do commercial fishing; **Act 24:** Sailing.

Annexe D

Table D1.1
Results of count frequency of environmental values based on the survey's 5-point Likert scale.

Community values	Very relevant	Relevant	Neutral	Somewhat relevant	Not relevant
Bushland, terrestrial habitats	106	115	23	13	12
A clean environment	202	64	3	2	0
Rocky intertidal habitats	79	97	61	20	8
Uniqueness of marine life and habitats	136	80	37	14	2
Threatened species and communities	138	93	22	7	4
Sandy beaches	114	92	45	15	2
Healthy, diverse and abundant marine life	174	71	14	4	1
Water quality	208	53	6	1	2
Natural views and beauty	161	77	17	5	4

Table D1.2
Results of count frequency of economic values based on the survey's 5-point Likert scale.

Community values	Very relevant	Relevant	Neutral	Somewhat relevant	Not relevant
It is important to marine-related businesses: tourism, fishing, seafood industry	70	111	42	26	21
It contributes to economy of Aboriginal communities	41	92	88	21	26
It is ideal for providing facilities and services to encourage different uses: such as marinas and boat ramps for boating	26	83	74	44	41
It is a gateway providing transportation links for visitors and residents; and links to other markets	54	115	54	30	16
It contributes to the seafood industry	28	74	74	36	58
It facilitates commercial events	34	106	69	35	25

Table D1.3
Results of count frequency of social values based on the survey's 5-point Likert scale.

Community values	Very relevant	Relevant	Neutral	Somewhat relevant	Not relevant
Is a source of therapeutic, healing properties	76	99	50	27	17
Is a place to feel part of the community	90	135	28	11	6
Is a place for scientific discovery and educational opportunities	81	106	59	15	8
It has Surf Life Saving Clubs and public shelters	95	122	31	10	11
Is a source of food	34	90	78	36	29
Is a place of Aboriginal sites, landscapes and ceremonies	45	89	92	24	17
Safe waterways	79	119	59	10	1
Is a connection to the country	73	96	65	25	10
It supports a range of recreational activities	117	117	21	9	4
It holds public areas generally accessible to all	116	118	27	7	3
Is a place that supports a desirable lifestyle	118	110	28	8	3
Is a place to escape, engage with the natural environment and de-stress/relax	153	95	14	6	2
Safe environment	132	102	22	6	3
Is a place that holds historic sites in coastal areas and underwater	86	109	53	15	5
Is a part of our culture and heritage: it supports caring and sharing for each other through food; source of dreaming stories; connection to country; and a social gathering place	99	104	46	14	6
Is a place for artistic inspiration: art, music, dance	74	104	62	20	7

Annexe E

Table E1.1
Table of probabilities predicted for recreational activities for the age group 18–25 years old (Qage = 21.5), based on the sampled population.

Employment	Education	Act1	Act3	Act5	Act6	Act13	Act14	Act20	Act21	Act22	Act24
Residents											
Emp	Edu2										
Uemp	Edu2										
Emp	Edu1										
Uemp	Edu1										
Emp	Edu3										
Uemp	Edu3										
Visitors											
Emp	Edu2										
Uemp	Edu2										
Emp	Edu1										
Uemp	Edu1										
Emp	Edu3										
Uemp	Edu3										

Abbreviations: Emp: employed; **Uemp:** unemployed; **Edu1:** High School Certificate; **Edu2:** University; **Edu3:** Vocational training; **Act1:** Sun bathing, exercising, use play grounds; **Act 3:** I socialise with friends, family; **Act 5:** I do swimming, surfing, boarding; **Act 6:** I enjoy the view, the sound and relax; **Act 13:** I do nature tours/walks: bush, foreshores, parks; **Act 14:** Walking, running, cycling; **Act 20:** I do snorkelling; **Act 21:** I do scuba; **Act 22:** I do nature tours: whale/bird watching; **Act 24:** Sailing.

Table E1.2
Table of probabilities predicted for recreational activities for the age group 26–34 years old (Qage = 30), based on the sampled population.

Employment	Education	Act1	Act3	Act5	Act6	Act13	Act14	Act20	Act21	Act22	Act24
Residents											
Emp	Edu2										
Uemp	Edu2										
Emp	Edu1										
Uemp	Edu1										
Emp	Edu3										
Uemp	Edu3										
Visitors											
Emp	Edu2										
Uemp	Edu2										
Emp	Edu1										
Uemp	Edu1										
Emp	Edu3										
Uemp	Edu3										

Abbreviations: Emp: employed; **Uemp:** unemployed; **Edu1:** High School Certificate; **Edu2:** University; **Edu3:** Vocational training; **Act1:** Sun bathing, exercising, use play grounds; **Act 3:** I socialise with friends, family; **Act 5:** I do swimming, surfing, boarding; **Act 6:** I enjoy the view, the sound and relax; **Act 13:** I do nature tours/walks: bush, foreshores, parks; **Act 14:** Walking, running, cycling; **Act 20:** I do snorkelling; **Act 21:** I do scuba; **Act 22:** I do nature tours: whale/bird watching; **Act 24:** Sailing.

Table E1.3
Table of probabilities predicted for recreational activities for the age group 35–44 years old (Qage = 39.5), based on the sampled population.

Employment	Education	Act1	Act3	Act5	Act6	Act13	Act14	Act20	Act21	Act22	Act24
Residents											
Emp	Edu2										
Uemp	Edu2										
Emp	Edu1										
Uemp	Edu1										
Emp	Edu3										
Uemp	Edu3										
Visitors											
Emp	Edu2										
Uemp	Edu2										
Emp	Edu1										
Uemp	Edu1										
Emp	Edu3										
Uemp	Edu3										

Abbreviations: Emp: employed; **Uemp:** unemployed; **Edu1:** High School Certificate; **Edu2:** University; **Edu3:** Vocational training; **Act1:** Sun bathing, exercising, use play grounds; **Act 3:** I socialise with friends, family; **Act 5:** I do swimming, surfing, boarding; **Act 6:** I enjoy the view, the sound and relax; **Act 13:** I do nature tours/walks: bush, foreshores, parks; **Act 14:** Walking, running, cycling; **Act 20:** I do snorkelling; **Act 21:** I do scuba; **Act 22:** I do nature tours: whale/bird watching; **Act 24:** Sailing.

Table E1.4
Table of probabilities predicted for recreational activities for the age group 45—54 years old (Qage = 49.5), based on the sampled population.

Employment	Education	Act1	Act3	Act5	Act6	Act13	Act14	Act20	Act21	Act22	Act24
Residents											
Emp	Edu2										
Uemp	Edu2										
Emp	Edu1										
Uemp	Edu1										
Emp	Edu3										
Uemp	Edu3										
Visitors											
Emp	Edu2										
Uemp	Edu2										
Emp	Edu1										
Uemp	Edu1										
Emp	Edu3										
Uemp	Edu3										

Abbreviations: Emp: employed; **Uemp:** unemployed; **Edu1:** High School Certificate; **Edu2:** University; **Edu3:** Vocational training; **Act1:** Sun bathing, exercising, use play grounds; **Act 3:** I socialise with friends, family; **Act 5:** I do swimming, surfing, boarding; **Act 6:** I enjoy the view, the sound and relax; **Act 13:** I do nature tours/walks: bush, foreshores, parks; **Act 14:** Walking, running, cycling; **Act 20:** I do snorkelling; **Act 21:** I do scuba; **Act 22:** I do nature tours: whale/bird watching; **Act 24:** Sailing.

Table E1.5
Table of probabilities predicted for recreational activities for the age group 55—64 years old (Qage = 59.5), based on the sampled population.

Employment	Education	Act1	Act3	Act5	Act6	Act13	Act14	Act20	Act21	Act22	Act24
Residents											
Emp	Edu2										
Uemp	Edu2										
Emp	Edu1										
Uemp	Edu1										
Emp	Edu3										
Uemp	Edu3										
Visitors											
Emp	Edu2										
Uemp	Edu2										
Emp	Edu1										
Uemp	Edu1										
Emp	Edu3										
Uemp	Edu3										

Abbreviations: Emp: employed; **Uemp:** unemployed; **Edu1:** High School Certificate; **Edu2:** University; **Edu3:** Vocational training; **Act1:** Sun bathing, exercising, use play grounds; **Act 3:** I socialise with friends, family; **Act 5:** I do swimming, surfing, boarding; **Act 6:** I enjoy the view, the sound and relax; **Act 13:** I do nature tours/walks: bush, foreshores, parks; **Act 14:** Walking, running, cycling; **Act 20:** I do snorkelling; **Act 21:** I do scuba; **Act 22:** I do nature tours: whale/bird watching; **Act 24:** Sailing.

Table E1.6
Table of probabilities predicted for recreational activities for the age group 65- and older years old (Qage = 70), based on the sampled population.
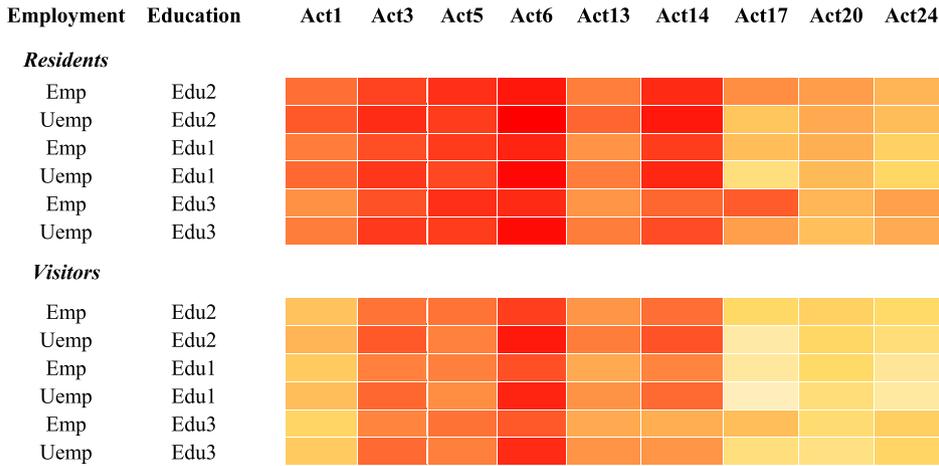
Employment	Education	Act1	Act3	Act5	Act6	Act13	Act14	Act17	Act20	Act24
Residents										
Emp	Edu2									
Uemp	Edu2									
Emp	Edu1									
Uemp	Edu1									
Emp	Edu3									
Uemp	Edu3									
Visitors										
Emp	Edu2									
Uemp	Edu2									
Emp	Edu1									
Uemp	Edu1									
Emp	Edu3									
Uemp	Edu3									

Abbreviations: Emp: employed; **Uemp:** unemployed; **Edu1:** High School Certificate; **Edu2:** University; **Edu3:** Vocational training; **Act1:** Sun bathing, exercising, use play grounds; **Act 3:** I socialise with friends, family; **Act 5:** I do swimming, surfing, boarding; **Act 6:** I enjoy the view, the sound and relax; **Act 13:** I do nature tours/walks: bush, foreshores, parks; **Act 14:** Walking, running, cycling; **Act 17:** I do kayaking, canoeing; **Act 20:** I do snorkelling; **Act 24:** Sailing.

Table E2
Table of probabilities predicted for environmental values based on sampled population.

QAge	Employment	Education	Income	Residence	Water quality	A clean environment	Healthy, diverse and abundant marine life	Natural views and beauty	Threatened species and communities	Uniqueness of marine life and habitats	Bushland/ terrestrial habitats	Sandy beaches	Rocky intertidal habitats
	Emp	Edu2	Inc1	Vis									
	Unemp	Edu2	Inc1	Vis									
	Emp	Edu1	Inc1	Vis									
	Unemp	Edu1	Inc1	Vis									
	Emp	Edu3	Inc1	Vis									
	Unemp	Edu3	Inc1	Vis									
	Emp	Edu2	Inc2	Vis									
	Unemp	Edu2	Inc2	Vis									
	Emp	Edu1	Inc2	Vis									
	Unemp	Edu1	Inc2	Vis									
21.5	Emp	Edu3	Inc2	Vis									
	Unemp	Edu3	Inc2	Vis									
	Emp	Edu2	Inc1	Res									
	Unemp	Edu2	Inc1	Res									
	Emp	Edu1	Inc1	Res									
	Unemp	Edu1	Inc1	Res									
	Emp	Edu3	Inc1	Res									
	Unemp	Edu3	Inc1	Res									
	Emp	Edu2	Inc2	Res									
	Unemp	Edu2	Inc2	Res									
	Emp	Edu1	Inc2	Res									
	Unemp	Edu1	Inc2	Res									
	Emp	Edu3	Inc2	Res									
	Unemp	Edu3	Inc2	Res									
	Emp	Edu2	Inc1	Vis									
	Unemp	Edu2	Inc1	Vis									
	Emp	Edu1	Inc1	Vis									
	Unemp	Edu1	Inc1	Vis									
30	Emp	Edu3	Inc1	Vis									
	Unemp	Edu3	Inc1	Vis									
	Emp	Edu2	Inc2	Vis									
	Unemp	Edu2	Inc2	Vis									
	Emp	Edu1	Inc2	Vis									

Abbreviations: **Emp:** employed; **Uemp:** unemployed; **Edu1:** High School Certificate; **Edu2:** University; **Edu3:** Vocational training; **Inc1:** >$65,000; **Inc2:** Under$65,000; **Res:** Resident; **Vis:** Visitor.

QAge	Employment	Education	Income	Residence	Water quality	A clean environment	Healthy, diverse and abundant marine life	Natural views and beauty	Threatened species and communities	Uniqueness of marine life and habitats	Bushland/ terrestrial habitats	Sandy beaches	Rocky intertidal habitats
	Unemp	Edu1	Inc2	Vis									
	Emp	Edu3	Inc2	Vis									
	Unemp	Edu3	Inc2	Vis									
	Emp	Edu2	Inc1	Res									
	Unemp	Edu2	Inc1	Res									
	Emp	Edu1	Inc1	Res									
	Unemp	Edu1	Inc1	Res									
30	Emp	Edu3	Inc1	Res									
	Unemp	Edu3	Inc1	Res									
	Emp	Edu2	Inc2	Res									
	Unemp	Edu2	Inc2	Res									
	Emp	Edu1	Inc2	Res									
	Unemp	Edu1	Inc2	Res									
	Emp	Edu3	Inc2	Res									
	Unemp	Edu3	Inc2	Res									
	Emp	Edu2	Inc1	Vis									
	Unemp	Edu2	Inc1	Vis									
	Emp	Edu1	Inc1	Vis									
	Unemp	Edu1	Inc1	Vis									
	Emp	Edu3	Inc1	Vis									
	Unemp	Edu3	Inc1	Vis									
	Emp	Edu2	Inc2	Vis									
	Unemp	Edu2	Inc2	Vis									
49.5	Emp	Edu1	Inc2	Vis									
	Unemp	Edu1	Inc2	Vis									
	Emp	Edu3	Inc2	Vis									
	Unemp	Edu3	Inc2	Vis									
	Emp	Edu2	Inc1	Res									
	Unemp	Edu2	Inc1	Res									
	Emp	Edu1	Inc1	Res									
	Unemp	Edu1	Inc1	Res									
	Emp	Edu3	Inc1	Res									
	Unemp	Edu3	Inc1	Res									

Abbreviations: **Emp:** employed; **Uemp:** unemployed; **Edu1:** High School Certificate; **Edu2:** University; **Edu3:** Vocational training; **Inc1:** >$65,000; **Inc2:** Under$65,000; **Res:** Resident; **Vis:** Visitor.

QAge	Employment	Education	Income	Residence	Water quality	A clean environment	Healthy, diverse and abundant marine life	Natural views and beauty	Threatened species and communities	Uniqueness of marine life and habitats	Bushland/ terrestrial habitats	Sandy beaches	Rocky intertidal habitats
	Emp	Edu2	Inc2	Res									
	Unemp	Edu2	Inc2	Res									
49.5	Emp	Edu1	Inc2	Res									
	Unemp	Edu1	Inc2	Res									
	Emp	Edu3	Inc2	Res									
	Unemp	Edu3	Inc2	Res									
	Emp	Edu2	Inc1	Vis									
	Unemp	Edu2	Inc1	Vis									
	Emp	Edu1	Inc1	Vis									
	Unemp	Edu1	Inc1	Vis									
	Emp	Edu3	Inc1	Vis									
	Unemp	Edu3	Inc1	Vis									
	Emp	Edu2	Inc2	Vis									
	Unemp	Edu2	Inc2	Vis									
	Emp	Edu1	Inc2	Vis									
70	Unemp	Edu1	Inc2	Vis									
	Emp	Edu3	Inc2	Vis									
	Unemp	Edu3	Inc2	Vis									
	Emp	Edu2	Inc1	Res									
	Unemp	Edu2	Inc1	Res									
	Emp	Edu1	Inc1	Res									
	Unemp	Edu1	Inc1	Res									
	Emp	Edu3	Inc1	Res									
	Unemp	Edu3	Inc1	Res									
	Emp	Edu2	Inc2	Res									
	Unemp	Edu2	Inc2	Res									
	Emp	Edu1	Inc2	Res									
	Unemp	Edu1	Inc2	Res									
	Emp	Edu3	Inc2	Res									
	Unemp	Edu3	Inc2	Res									

Abbreviations: **Emp:** employed; **Uemp:** unemployed; **Edu1:** High School Certificate; **Edu2:** University; **Edu3:** Vocational training; **Inc1:** >$65,000; **Inc2:** Under$65,000; **Res:** Resident; **Vis:** Visitor.

Table E3
Table of probabilities predicted for economic values based on the sampled population.

Employment	Income	Age Group	It is a gateway providing transportation links for visitors and residents; and links to other markets	It is important to marine-related businesses: tourism, fishing, seafood industry, others	It contributes to economy of Aboriginal communities	It facilitates commercial events	It contributes to the seafood industry	It is ideal for providing facilities and services to encourage different uses: such as marinas and boat ramps for boating
Emp	Inc1	18 - 25						
Unemp	Inc1							
Emp	Inc2							
Unemp	Inc2							
Emp	Inc1	26 - 34						
Unemp	Inc1							
Emp	Inc2							
Unemp	Inc2							
Emp	Inc1	35 - 44						
Unemp	Inc1							
Emp	Inc2							
Unemp	Inc2							
Emp	Inc1	45 - 54						
Unemp	Inc1							
Emp	Inc2							
Unemp	Inc2							
Emp	Inc1	55 - 64						
Unemp	Inc1							
Emp	Inc2							
Unemp	Inc2							
Emp	Inc1	65 - older						
Unemp	Inc1							
Emp	Inc2							
Unemp	Inc2							

Abbreviations: **Emp:** employed; **Uemp:** unemployed; **Inc1:** >$65,000; **Inc2:** Under$65,000.

Table E4
Table of probabilities predicted for social values based on the sampled population.

Employment	Income	Residence	QAge	Soc1	Soc2	Soc3	Soc4	Soc5	Soc6	Soc7	Soc8	Soc9	Soc10	Soc11	Soc12	Soc13	Soc14	Soc15	Soc16
Emp	Inc1	Vis																	
Unemp	Inc1	Vis																	
Emp	Inc2	Vis																	
Unemp	Inc2	Vis	21.5																
Emp	Inc1	Res																	
Unemp	Inc1	Res																	
Emp	Inc2	Res																	
Unemp	Inc2	Res																	
Emp	Inc1	Vis																	
Unemp	Inc1	Vis																	
Emp	Inc2	Vis																	
Unemp	Inc2	Vis	30																
Emp	Inc1	Res																	
Unemp	Inc1	Res																	
Emp	Inc2	Res																	
Unemp	Inc2	Res																	
Emp	Inc1	Vis																	
Unemp	Inc1	Vis																	
Emp	Inc2	Vis																	
Unemp	Inc2	Vis	49.5																
Emp	Inc1	Res																	
Unemp	Inc1	Res																	
Emp	Inc2	Res																	
Unemp	Inc2	Res																	

Abbreviations: Emp: employed; **Uemp:** unemployed; **Inc1:** >$65,000; **Inc2:** Under$65,000; **Res:** Resident; **Vis:** Visitor.
Soc1: Is a place to escape, engage with the natural environment and de‑stress / relax; **Soc2:** Safe environment; **Soc3:** It supports a range of recreational activities; **Soc4:** Is a place that supports a desirable lifestyle; **Soc5:** It holds public areas generally accessible to all; **Soc6:** It has Surf Life Saving Clubs and public shelters; **Soc7:** Is a place to feel part of the community; **Soc8:** Is a part of our culture and heritage; **Soc9:** Is a place that holds historic sites in coastal areas and underwater; **Soc10:** Safe waterways; **Soc11:** Is a place for scientific discovery and educational opportunities; **Soc12:** Is a source of therapeutic, healing properties; **Soc13:** Is a place for artistic inspiration: art, music, dance; **Soc14:** Is a connection to the country; **Soc15:** Is a place of Aboriginal sites, landscapes and ceremonies; **Soc16:** Is a source of food.

Employment	Income	Residence	Age	Soc1	Soc2	Soc3	Soci4	Soc5	Soc6	Soc7	Soc8	Soc9	Soc10	Soc11	Soc12	Soc13	Soc14	Soc15	Soc16
Emp	Inc1	Vis																	
Unemp	Inc1	Vis																	
Emp	Inc2	Vis																	
Unemp	Inc2	Vis	59.5																
Emp	Inc1	Res																	
Unemp	Inc1	Res																	
Emp	Inc2	Res																	
Unemp	Inc2	Res																	
Emp	Inc1	Vis																	
Unemp	Inc1	Vis																	
Emp	Inc2	Vis																	
Unemp	Inc2	Vis	70																
Emp	Inc1	Res																	
Unemp	Inc1	Res																	
Emp	Inc2	Res																	
Unemp	Inc2	Res																	

Abbreviations: Emp: employed; **Uemp:** unemployed; **Inc1:** >$65,000; **Inc2:** Under$65,000; **Res:** Resident; **Vis:** Visitor. **Soc1:** Is a place to escape, engage with the natural environment and de‑stress / relax; **Soc2:** Safe environment; **Soc3:** It supports a range of recreational activities; **Soc4:** Is a place that supports a desirable lifestyle; **Soc5:** It holds public areas generally accessible to all; **Soc6:** It has Surf Life Saving Clubs and public shelters; **Soc7:** Is a place to feel part of the community; **Soc8:** Is a part of our culture and heritage;

Soc9: Is a place that holds historic sites in coastal areas and underwater; **Soc10:** Safe waterways; **Soc11:** Is a place for scientific discovery and educational opportunities; **Soc12:** Is a source of therapeutic, healing properties; **Soc13:** Is a place for artistic inspiration: art, music, dance; **Soc14:** Is a connection to the country; **Soc15:** Is a place of Aboriginal sites, landscapes and ceremonies; **Soc16:** Is a source of food.

References

Amador Soriano, K., et al., 2013. A dimensão social na capacidade de carga turística: estudo de caso da praia Chen Río, ilha de Cozumel, México. Terra Plur. 7 (1), 157—170.

Araújo, M.C.B.d., Costa, M.F., 2006. Municipal services on tourist beaches: costs and benefits of solid waste collection. J. Coast. Res. 1070—1075.

Ariza, E., et al., 2008a. Beyond performance assessment measurements for beach management: application to Spanish Mediterranean beaches. Coast. Manag. 36, 47—66.

Ariza, E., Jiménez, J.A., Sardá, R., 2008b. A critical assessment of beach management on the Catalan coast. Ocean Coast. Manag. 51 (2), 141—160.

Ariza, E., et al., 2010. Proposal for an integral quality index for urban and urbanized beaches. Environ. Manage 45 (5), 998—1013.

Ariza, E., Jiménez, J.A., Sardá, R., 2012. An interdisciplinary analysis of beach management in the Catalan coast (North-Western Mediterranean). Coast. Manag. 40 (4), 442—459.

AECOM, 2010. Beach Sand Nourishment Scoping Study. Maintaining Sydney's Beach Amenity against Climate Change Sea Level Rise. AECOM Australia Pty Ltd, Australia, p. 332.

van Asselt Marjolein, B.A., Rijkens-Klomp, N., 2002. A look in the mirror: reflection on participation in Integrated Assessment from a methodological perspective. Glob. Environ. Change 12 (3), 167—184.

Atkins, J.P., et al., 2011. Management of the marine environment: integrating ecosystem services and societal benefits with the DPSIR framework in a systems approach. Mar. Pollut. Bull. 62 (2), 215—226.

Australian Bureau of Statistics, 2011. Information Paper: Measures of Socioeconomic Status. Australian Bureau of Statistics.

Australian Bureau of Statistics, 2012. Manly basic Community Profile. 2011 Census of Population and Housing.

Australian Bureau of Statistics, 2016. Labour Force Survey, D.O. Employment. Editor. Compiled and presented in economy.id by.id the population experts.

Australian Government, 2009. Climate Change Risks to Australia's Coast. A First Pass National Assessment. Department of Climate Change.

Australian Government, 2016. Local Government (Council Amalgamations) Proclamation. NSW Parliamentary Counsel's Office, New South Wales.

Barbosa de Araújo, M.C., Ferreira da Costa, M., 2008. Environmental quality indicators for recreational beaches classification. J. Coast. Res 24 (6), 1439—1449.

Barker, L., Dawson, C., 2012. Exploring the relationship between outdoor recreation activities, community participation, and environmental attitudes. In: 2010 Northeastern Recreation Research Symposium.

Binder, C.R., et al., 2013. Comparison of frameworks for analyzing social-ecological systems. Ecol. Soc. 18 (4).

Blackwell, B., 2007. The value of a recreational beach visit: an application to mooloolaba beach and comparisons with other outdoor recreation sites. Econ. Anal. Policy 37 (1), 77—97.

Blakemore, F., Williams, A., 2008. British tourists' valuation of a Turkish beach using contingent valuation and travel cost methods. J. Coast. Res. 1469—1480.

Bohnke-Henrichs, A., et al., 2013. Typology and indicators of ecosystem services for marine spatial planning and management. J. Environ. Manage 130, 135—145.

Bonner, F., McKay, S., McKee, A., 2001. On the beach. Continuum. J. Media & Cult. Stud. 15 (3), 269—274.

Bosch, O.J.H., et al., 2007. Getting the big picture in natural resource management—systems thinking as 'method' for scientists, policy makers and other stakeholders. Syst. Res. Behav. Sci. 24 (2), 217—232.

Botero, C., et al., 2013. Reasons for beach choice: European and Caribbean perspectives. In: Conley, D.C., Masselink, G., Russell, P.E., O'Hare, T.J. (Eds.), Proceedings 12th International Coastal Symposium (Plymouth, England), Journal of Coastal Research, Special Issue. Journal of Coastal Research, vol. 65, pp. 880—885.

Breton, F., et al., 1996. The recreational use of beaches and consequences for the development of new trends in management: the case of the beaches of the Metropolitan Region of Barcelona (Catalonia, Spain). Ocean Coast. Manag. 32 (3), 153—180.

Brown, A.C., McLachlan, A., 2002. Sandy shore ecosystems and the threats facing them: some predictions for the year 2025. Environ. Conserv. 29 (01), 62—77.

Cagilaba, V., Rennie, H.G., 2005. Literature review of beach awards and rating systems. In: Environment Waikato Technical Report, p. 74.

Cervantes, O., et al., 2008. Users' perception as a tool to improve urban beach planning and management. Environ. Manage 42 (2), 249—264.

Chapman, D.M., 1992. Information management in beach planning. Coast. Manag. 20 (3), 203—217.

Cinner, J.E., David, G., 2011. The human dimensions of coastal and marine ecosystems in the Western Indian Ocean. Coast. Manag. 39 (4), 351—357.

Le Cornu, E., et al., 2014. Current practice and future prospects for social data in coastal and ocean planning. Conserv. Biol. 28 (4), 902—911.

Cottrell, S.P., 2003. Influence of sociodemographics and environmental attitudes on general responsible environmental behavior among recreational boaters. Environ. Behav. 35 (3), 347—375.

Cutter, S.L., Nordstrom, K.F., Kucma, G., 1979. Social and Environmental Factors Influencing beach Site Selection. Resource Allocation Issues in the Coastal Environment, pp. 183—194.

Cutter, S.L., et al., 2008. A place-based model for understanding community resilience to natural disasters. Glob. Environ. Change 18 (4), 598—606.

Dahm, C., 2003. Beach user values and perceptions of coastal erosion. Final. In: Environment Waikato Technical Report. Environment Waikato, Hamilton East, NSW, p. 68.

Defeo, O., et al., 2009. Threats to sandy beach ecosystems: a review. Estuar. Coast. Shelf Sci. 81 (1), 1—12.

Department of Planning & Environment, 2014. New South Wales State and Local Government Area Population, Household and Dwelling Projections: 2014 Final. Excell Workbook. Demography Unit, Centre for Demography, Research and Policy.

Dixon, A.W., Oh, C.-O., Draper, J., 2012. Access to the beach: comparing the economic values of coastal residents and tourists. J. Travel Res. 1—12. XX(X).

Domínguez-Tejo, E., Metternicht, G., 2018. Poorly-designed goals and objectives in resource management plans: assessing their impact for an Ecosystem-Based Approach to Marine Spatial Planning. Mar. Policy 88, 122—131.

Domínguez-Tejo, E., et al., 2016. Marine Spatial Planning advancing the Ecosystem-Based Approach to coastal zone management: a review. Mar. Policy 72, 115—130.

Douvere, F., 2008. The importance of marine spatial planning in advancing ecosystem-based sea use management. Mar. Policy 32 (5), 762—771.

Dutcher, D.D., et al., 2007. Connectivity with nature as a measure of environmental values. Environ. Behav. 39 (4), 474—493.

Duvat, V., 2012. Public Perception of beach Quality: Lessons Learnt from a French Case Study. Public Perception of beach Quality: Lessons Learnt from a French Case Study. Colombia.

Dwight, R., et al., 2007. Beach attendance and bathing rates for Southern California beaches. Ocean Coast. Manag. 50 (10), 847—858.

Ehler, C., 2008. Conclusions: benefits, lessons learned, and future challenges of marine spatial planning. Mar. Policy 32 (5), 840—843.

Endter-Wada, J., Blahna, D.J., 2011. Linkages to Public Land Framework: toward embedding humans in ecosystem analyses by using "inside-out social assessment". Ecol. Appl. 21 (8), 3254—3271.

Fenton, M., 2005. Guidebook on Social Impact Assessment. Environment and Behaviour Consultants, Townsville, QLD, p. 52.

Ford, C., 2010. The battle for publics rights to private spaces on Sydney's ocean beaches, 1854—1920s. Aust. Hist. Stud. 41 (3), 253—268.

Forst, M.F., 2009. The convergence of integrated coastal zone management and the ecosystems approach. Ocean Coast. Manag. 52 (6), 294—306.

Frampton, A.P.R., 2010. A Review of amenity beach management. J. Coast. Res. 26 (6), 1112—1122.

Freeman III, A.M., Herriges, J.A., Kling, C.L., 2014. The Measurement of Environmental and Resource Values: Theory and Methods, third ed. Routledge, , Washington, D.C.

Gopalakrishnan, S., et al., 2011. The value of disappearing beaches: a hedonic pricing model with endogenous beach width. J. Environ. Econ. Manag. 61 (3), 297—310.

Gore, S., 2007. Framework development for beach management in the British Virgin Islands. Ocean Coast. Manag. 50 (9), 732—753.

Gregory, R., Wellman, K., 2001. Bringing stakeholder values into environmental policy choices: a community-based estuary case study. Ecol. Econ. 39 (1), 37—52.

Gregory, A.J., et al., 2013. A problem structuring method for ecosystem-based management: the DPSIR modelling process. Eur. J. Oper. Res. 227 (3), 558—569.

Grumbine, R.E., 1994. What is ecosystem management? Conserv. Biol. 8 (1), 27—38.

Guerra-Vargas, L.A., Mancera-Pineda, J.E., 2015. Evaluación de amenazas antropogénicas en ecosistemas de playa en San Andrés, una isla pequeña del Caribe suroccidental. Bol. Investig. Mar. Costeras 44 (1), 33—54.

Gutrich, J., et al., 2005. Science in the public process of ecosystem management: lessons from Hawaii, Southeast Asia, Africa and the US Mainland. J. Environ. Manag. 76 (3), 197—209.

Harrill, R., 2004. Residents' attitudes toward tourism development: a literature review with implications for tourism planning. J. Plan. Literat. 18 (3), 251—266.

Harris, L., et al., 2014. Setting conservation targets for sandy beach ecosystems. Estuar. Coast. Shelf Sci. 150, 45—57.

Harvey, N., Caton, B., 2010. In: Harvey, N., Caton, B. (Eds.), Coastal Management in Australia. The University of Adelaide Press, Adelaide, Australia.

van Herwerden, L., et al., 1989. Patterns of shore utilization in a metropolitan area: the Cape Peninsula, South Africa. Ocean Shorel. Manag. 12, 331—346.

Houghton, D.S., 1989. Some aspects of beach use in the Perth Metropolitan area. Aust. Geogr. 20 (2), 173—184.

Integrated Catchment and Environmental Management Research Group, 2004. Manly Lagoon and Catchment Integrated Catchment Management Strategy and Evaluation. Final Report. University of Sydney.

James, R.J., 2000a. From beaches to beach environments: linking the ecology, human-use and management of beaches in Australia. Ocean Coast. Manag. 43 (6), 495—514.

James, R., 2000b. The first step for the environmental management of australian beaches: Establishing an effective policy framework. Coast. Manag. 28 (2), 149—160.

Keqi, Z., Douglas, B.C., Leatherman, S.P., 2001. Beach erosion potential for severe Nor'easters. J. Coast. Res. 17 (2), 309—321.

Klein, Y.L., Osleeb, J.P., Viola, M.R., 2004. Tourism-generated earnings in the coastal zone: a regional analysis. J. Coast. Res. 1080—1088.

Koehn, J.Z., Reineman, D.R., Kittinger, J.N., 2013. Progress and promise in spatial human dimensions research for ecosystem-based ocean planning. Mar. Policy 42, 31—38.

Lincoln, Z., 2014. Socio-economic and cultural impacts of tourism in Bangladesh.

Eur. Sci. J. 9 (10).

Lozoya, J.P., Sardá, R., Jiménez, J.A., 2011. A methodological framework for multi-hazard risk assessment in beaches. Environ. Sci. Policy 14 (6), 685—696.

Lozoya, J.P., Sardá, R., Jiménez, J.A., 2014. Users expectations and the need for differential beach management frameworks along the Costa Brava: urban vs. natural protected beaches. Land Use Policy 38, 397—414.

Lucrezi, S., van der Walt, M.F., 2016. Beachgoers' perceptions of sandy beach conditions: demographic and attitudinal influences, and the implications for beach ecosystem management. J. Coast. Conserv. 20 (1), 81—96.

Lucrezi, S., Saayman, M., Van der Merwe, P., 2015. Managing beaches and beachgoers: lessons from and for the blue flag award. Tour. Manag. 48, 211—230.

Maguire, G.S., et al., 2011. Being beside the seaside: beach use and preferences among coastal residents of south-eastern Australia. Ocean Coast. Manag. 54 (10), 781—788.

Manly Council, 2004. Little Manly Coastline Management Plan, p. 71.

Manly Council, 2006. Manly Sustainability Strategy: for Today and Future Generations. Manly Council, Manly, p. 127.

Manly Council, 2007. Clontarf/Bantry Bay Data Compilation & Estuary Processes Study. Final Report. Executive Summary, p. 7.

Manly Council, 2008. Clontarf/Bantry Bay Estuary Management Plan. Final Report, p. 132.

Manly Council, 2008. Manly Ocean Beach Coastline Management Plan, p. 10.

Manly Council, 2010. North Harbour Coastline Management Plan. Final Report, p. 108.

Manly Council, 2011. Manly Cove Coastal Zone Management Plan. Final Report, p. 154.

Manly Council, 2015. Community Strategic Plan beyond 2025, p. 33.

Marin, V., et al., 2009. Users' perception analysis for sustainable beach management in Italy. Ocean Coast. Manag. 52 (5), 268—277.

Marine Estate Expert Knowledge Panel, 2014. Technical Paper 2: Surveying the Community's Views on the NSW Marine Estate. NSW Marine Estate Expert Knowledge Panel. Editor.

Marine Estate Management Authority, 2015. Social and Economic Background Information Report on the NSW Marine Estate, p. 209.

Martínez, M.L., et al., 2007. The coasts of our world: ecological, economic and social importance. Ecol. Econ. 63 (2—3), 254—272.

McFarlane, B.L., Boxall, P.C., 2000. Factors influencing forest values and attitudes of two stakeholder groups: the case of the Foothills model Forest, Alberta, Canada. Soc. Nat. Resour. 13 (7), 649—661.

McKay, C., Brander, R.W., Goff, J., 2014. Putting tourists in harms way — coastal tourist parks and hazardous unpatrolled surf beaches in New South Wales, Australia. Tour. Manag. 45, 71—84.

McLachlan, A., et al., 2013. Sandy beach conservation and recreation: guidelines for optimising management strategies for multi-purpose use. Ocean Coast. Manag. 71, 256—268.

Meliadou, A., et al., 2012. Prioritising coastal zone management issues through fuzzy cognitive mapping approach. J. Environ. Manage 97, 56—68.

Mendoza, E.T., Jiménez, J.A., 2006. Storm-induced beach erosion potential on the Catalonian coast. J. Coast. Res. 81—88.

Mercer, D., 2007. Beach usage in the Melbourne region. Aust. Geogr. 12 (2), 123—139.

Micallef, A., Williams, A.T., 2002. Theoretical strategy considerations for beach management. Ocean Coast. Manag. 45 (4—5), 261—275.

Micromex Research, 2011. Recreational Use Survey of Manly Lagoon, p. 51. Chittaway Bay, NSW.

Micromex Research, 2014. Warringah Council Community Research, p. 8.

Millenium Ecosystem Assessment, 2005. Ecosystems and Human Well-being: Synthesis. The Millenium Ecosystem Assessment Series. Island Press, Washington DC, p. 137.

Morgan, R., Jones, T.C., Williams, A.T., 1993. Opinions and perceptions of England and Wales heritage coast beach users : some management implications from the Glamorgan Heritage Coast, Wales. J. Coast. Res. 9 (4), 1083—1093.

Nel, R., et al., 2014. The status of sandy beach science: past trends, progress, and possible futures. Estuarine. Coast. Shelf Sci. 150, 1—10.

Nelson, C., Botterill, D., 2002. Evaluating the contribution of beach quality awards to the local tourism industry in Wales—the Green Coast Award. Ocean Coast. Manag. 45 (2), 157—170.

Nelson, C., et al., 2000. Beach awards and management. Ocean Coast. Manag. 43 (1), 87—98.

O'Rourke, B., 1978. Recreational travel to New South Wales beaches. Geogr. Res. 16, 53—64.

Oh, C.-O., et al., 2008. Valuing visitors' economic benefits of public beach access points. Ocean Coast. Manag. 51 (12), 847—853.

Oh, C.-O., Draper, J., Dixon, A.W., 2010. Comparing resident and tourist preferences for public beach access and related amenities. Ocean Coast. Manag. 53 (5—6), 245—251.

Ostrom, E., 2009. A general framework for analyzing sustainability of social-ecological systems. Science 325, 419—422.

Peden, J.G., 2004. Proceedings of the 2003 Northeastern recreation research symposium: april 6-8, 2003 Bolton Landing, New York. In: Proceedings of the 2003 Northeastern Recreation Research Symposium: April 6-8, 2003 Bolton Landing, New York. USDA Forest Service, Northeastern Research Station, New York.

Pelling, M., Uitto, J.I., 2001. Small island developing states: natural disaster vulnerability and global change. Glob. Environ. Change Part B Environ. Hazards 3 (2), 49—62.

Peterson, C.H., Bishop, M.J., 2005. Assessing the environmental impacts of beach nourishment. BioScience 55 (10), 887—896.

Petrosillo, I., et al., 2007. Tourist perception of recreational environment and management in a marine protected area. Landsc. Urban Plan. 79 (1), 29—37.

Pettigrew, S., Cowan, E., 2002. Australians and Their Leisure Time. Asia Pacific Advances in Consumer Research, vol. 5, pp. 108—112.

Priskin, J., 2003. Tourist perceptions of degradation caused by coastal nature-based recreation. Environ. Manage 32 (2), 189—204.

Raybould, M., Lazarow, N., 2009. Economic and social values of beach recreation on the gold coast. In: Technical Report. Cooperative Research Centre for Sustainable Tourism, Australia, p. 36.

Raybould, M., et al., 2011. A travel cost model of local resident's beach recreation values on the gold coast. In: 20th NSW Coastal Conference: 20/20 Vision: Lessons Learnt and Looking toward Future Improvement, pp. 1—13. Tweed Heads, Australia.

Reed, M.S., 2008. Stakeholder participation for environmental management: a literature review. Biol. Conserv. 141 (10), 2417—2431.

Roca, E., Villares, M., 2008. Public perceptions for evaluating beach quality in urban and semi-natural environments. Ocean Coast. Manag. 51 (4), 314—329.

Roca, E., Villares, M., Ortego, M.I., 2009. Assessing public perceptions on beach quality according to beach users' profile: a case study in the Costa Brava (Spain). Tour. Manag. 30 (4), 598—607.

Roig i Munar, F.X., 2003. Analisis de la relacion entre capacidad de carga playas Menorca. Investigaciones Geográficas, pp. 107—118.

Santos, I.R., et al., 2005. Influence of socio-economic characteristics of beach users on litter generation. Ocean Coast. Manag. 48 (9—10), 742—752.

Sardá, R., 2013. Ecosystem services in the mediterranean sea: the need for an economic and business oriented approach. In: Hughes, T.B. (Ed.), Mediterranean Sea Ecosystems, Economic Importance and Environmental Threats. Nova Science Publishers, Inc., New York, pp. 1—33.

Sardà, R., et al., 2014. A proposed ecosystem-based management system for marine waters: linking the theory of environmental policy to the practice of environmental management. Ecol. Soc. 19 (4).

Sardá, R., et al., 2015. Towards a new integrated beach management system: the ecosystem-based management system for beaches. Ocean Coast. Manag. 118, 167—177.

Schlacher, T.A., et al., 2006. Neglected ecosystems bear the brunt of change. Ethol. Ecol. Evol. 18 (4), 349—351.

Schlacher, T.A., et al., 2007. Sandy beaches at the brink. Divers. Distrib. 13 (5), 556—560.

Schlacher, T.A., et al., 2008. Sandy beach ecosystems: key features, sampling issues, management challenges and climate change impacts. Mar. Ecol. 29, 70—90.

Schlacher, T.A., et al., 2014a. Open-coast sandy beaches and coastal dunes. Chapter 5. In: Lockwood, J.L., Maslo, B. (Eds.), Coastal Conservation. Cambridge University Press, Cambridge, pp. 37—94.

Schlacher, T.A., et al., 2014b. Metrics to assess ecological condition, change, and impacts in sandy beach ecosystems. J. Environ. Manage 144, 322—335.

Schwartz, S.H., 1994. Are there universal aspects in the structure and contents of human values? J. Soc. issues 50 (4), 19—45.

Schwarz, A.-M., et al., 2011. Vulnerability and resilience of remote rural communities to shocks and global changes: Empirical analysis from Solomon Islands. Glob. Environ. Change 21 (3), 1128—1140.

Secretariat of the Convention on Biological Diversity, 2004. The Ecosystem Approach (CBD Guidelines), Secretariat of the Convention on Biological Diversity. Editor, p. 50. Montreal.

Semeoshenkova, V., et al., 2017. Development and application of an integrated beach quality index (BQI). Ocean Coast. Manag. 143, 74—86.

Short, A.D., 2007. Beaches of New South Wales Coast. A Guide to Their Nature, Characteristics, Surf and Safety. Sydney University Press, Sydney.

Small, C., Nicholls, R.J., 2003. A global analysis of human settlement in coastal zones. J. Coast. Res. 19 (3), 584—599.

Sweeney Research, 2014. Marine Estate Community Survey. Final Report, p. 112.

Sydney Coastal Councils and University of New South Wales, 2013. Sydney Beaches Valuation Project Overview & Summary. Sydney Coastal Councils, University of New South Wales.

The R Foundation, 2015. The R Project for Statistical Computing [cited 2015; Available from: https://www.r-project.org/.

Tourism Australia, 2013. Annual Report 2012—2013. Tourism Australia — Partnering for Tourism Growth, p. 117.

Tuda, A.O., Stevens, T.F., Rodwell, L.D., 2014. Resolving coastal conflicts using marine spatial planning. J. Environ. Manag. 133, 59—68.

Tunstall, S.M., Penning-Rowsell, E.C., 1998. The English beach experiences and values. Geogr. J. 164 (3), 319—332.

United Nations Atlas of the Oceans Secretariat, 2010. UN Atlas of the Oceans 2002-2016. The UN Atlas of the Oceans [cited 2016 October 1]; Available from: http://www.oceansatlas.org/.

Vaz, B., et al., 2009. The importance of users perception for beach management. J. Coast. Res. II (56), 1164—1168.

Villares, M., et al., 2006. Social perception as a tool for beach planning: a case study on the Catalan coast. In: Proceedings of the III Spanish Conference on Coastal Geomorphology. Coastal Education & Research Foundation, Inc, Spain.

Warringah Council, 2014. Warringah Council Community Environment Perceptions Study 2014, p. 67.

Webb, E.L., Maliao, R.J., Siar, S.V., 2004. Using local user perceptions to evaluate outcomes of protected area management in the Sagay Marine Reserve, Philippines. Environ. Conserv. 31 (2), 138—148.

Westover, T., 1989. Perceived Crowding in Recreational Settings an Environment Behavior Model.

Williams, A.T., Barugh, A., 2014. Beach user perceptions at the eastern Yucatan peninsula, Mexico. J. Coast. Res. 70, 426–430.

Williams, A., et al., 1992. Psychological profile of the beach/dune user in South Wales, UK. Shore Beach 60 (2).

Williamson, A., et al., 2012. A comparison of attitudes and knowledge of beach safety in Australia for beachgoers, rural residents and international tourists. Aust. N. Z. J. Public Health 36 (4), 385–391.

Windevoxhel, N., Rodríguez, J., Lahmann, E., 2003. Situación del manejo integrado de zonas costeras en Centroamérica: Experiencias del Programa de Conservación Humedales y Zonas Costeras de UICN para la región. SF Recuperado el, vol. 28, pp. 3–40.

Wolch, Zhang, J., 2004. Beach recreation, Cultural Diversity and Attitudes toward Nature.

Yepes, V., Cardona, A., 2000. Mantenimiento y explotación de las playas como soporte de la actividad turística. El Plan de Turismo Litoral 1991-99 de la Comunidad Valenciana. Jornadas Españolas Ing. Costas Puertos 2, 857–876.