

Does Participation in Outdoor Activities Determine Residents' Appreciation of Nature: A Case Study From the Great Barrier Reef, Australia

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Abstract

Different people engage in different activities for different reasons. This paper contributes to literature examining participation in various outdoor activities and its association with perceived importance of environmental values. Using data from a survey of more than 1500 residents living adjacent to the Great Barrier Reef World Heritage Area (GBRWHA) in Australia, we examine (1) residents' participation and frequency of participation in a number of GBRWHA-related outdoor activities; (2) if a range of socio-economic characteristics played a role in determining participation in these activities; and (3) the linkages between participation in outdoor activities and a range of environmental values related to the GBRWHA. Going to the mainland beaches and swimming were reported as the most frequent activities. Males, residents with higher income, and those with the main household income from fishing and tourism industries, are more likely to participate in outdoor activities than others. There is a link between participation in activities and the perception of values. We found that occasional participation in an activity does not necessarily change perceptions of importance of the GBRWHA values. However, as frequency of participation increased, importance of some of the values also increased. Frequent participation in consumptive activities such as fishing was linked to higher appreciation of use values. However, with the non-consumptive uses, such as beach and island visitation, the association extends to a whole range of use and non-use values. Findings have implications for management as they indicate that frequent participants in outdoor recreation place higher importance on environmental values and may therefore stand as stronger environmental stewards than others.

Keywords: ecosystem services, quality of life, recreation, values, wellbeing

1. Introduction

Throughout the world, people visit natural spaces and engage in outdoor activities. This phenomenon has led to multiple studies investigating people's travel motivations and perceived importance of environmental values. Nature-based tourism has likewise received much attention (Coghlan & Prideaux, 2009; Esparon, Gyuris, & Stoeckl, 2014; Onofri & Nunes, 2013; Saltzer, 2002). Contributions that environmental goods make to the physical and emotional wellbeing have also been well explored (Fuller, Irvine, Devine-Wright, Warren, & Gaston, 2007; Kopmann & Rehdanz, 2013; Korpela, Ylén, Tyrväinen, & Silvennoinen, 2008; Lee, Kruger, Whang, Uysal, & Sirgy, 2014; Vemuri, 2004).

A seminal study on the relationship between outdoor recreation participation and personal environmental 'perspective' (Note 1) was conducted by Dunlap and Heffernan (1975). They proposed and found evidence of: (1) positive association between outdoor recreation and environmental concern (EC); (2) stronger association between 'appreciative' recreation (e.g., hiking, camping, and photography) and EC, than consumptive activities (e.g., hunting and fishing) and EC; and (3) stronger association with the 'relevant' environment (specific resource upon which the favoured recreation pursuit depends) as opposed to a general EC. A number of studies consequently explored the above proposed hypotheses. Although the reported relationship is weak in some studies, they do confirm the finding that participation in outdoor activities is associated with higher awareness of environmental

issues (Hungerford & Volk, 1990; Teisl & O'Brien, 2003; Thapa & Graefe, 2003; Theodori, Luloff, & Willits, 1998; Ustun, Gumusgul, Isik, Demirel, & Demirel, 2013; van Liere & Noe, 1981). The type of activities that people participate in is equally important: people who participate in non-consumptive, 'appreciative' activities are consistently found to be relatively more concerned about the environment than those who participate in consumptive and motorised activities (Geisler, Martinson, & Wilkening, 1977; Holsman, 2000; Jackson, 1986; Teisl & O'Brien, 2003; Thapa & Graefe 2003; Theodori et al., 1998; Ustun et al., 2013; Waight & Bath, 2014). Reviewing the literature on the relationship between outdoor recreation participation and personal environmental 'perspective' (Berns & Simpson, 2009; Teisl & O'Brien, 2003) we noted that few studies have explored a third hypothesis: that associations form between participation and the 'relevant' environment only, not with the environment in general (for example, Jackson, 1986). Further, relatively little attention has been given to the link between the frequency of participation and environmental 'perspectives' (Waight & Bath, 2014).

Moreover, most previous studies have focused on land-based activities, although a few were related to the freshwater environment. Very few studies have linked participation in marine outdoor recreation with environmental 'perspectives' (for example, see van Riper et al., 2012). This is an important gap, given previous research have shown that coastal and estuarine ecosystems can substantially contribute to the wellbeing of both coastal and inland inhabitants by supporting recreational activities, delivering spiritual and religious values, and providing aesthetic beauty (Ghermandi, van den Bergh, Brander, de Groot, & Nunes, 2010). In particular, areas of outstanding natural beauty that include water have been found to be strongly associated with the human health and wellbeing (Abraham, Sommerhalder, & Abel, 2010; R. Kaplan & S. Kaplan, 1989).

The Great Barrier Reef (GBR), in Australia, is one such area. One of 'seven wonders of the world' and considered a 'must-see' destination, this Australian icon draws over two million visitors annually (Tourism and Events Queensland, 2014). The catchments and coastline of the GBR lagoon are also home to more than one million people, and the population is rising rapidly (Australian Bureau of Statistics, 2010). The GBR region was declared a Marine Park in 1975 and a World Heritage Area in 1981. The Great Barrier Reef World Heritage Area (GBRWHA) encompasses over 348,000 km² and extends for more than 2,300 km along Australia's northeast coast. This area is not limited to reefs but also includes islands, beaches, estuaries, mangroves, and other parts of the marine system (Figure 1).

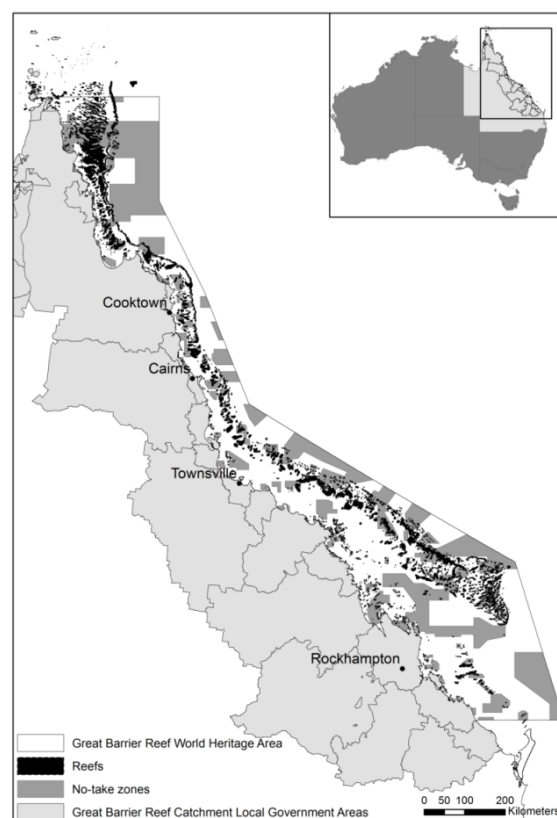


Figure 1. Great Barrier Reef World Heritage Area and adjoining Local Government Areas

While a number of studies have sought to estimate the economic value of various recreational activities related to the GBRWHA, such as recreational fishing (Farr, Stoeckl, & Sutton, 2014a; Prayaga, Rolfe, & Stoeckl, 2010), boating (Farr et al., 2014), beach visitation (Rolfe & Gregg, 2012) and whale-watching (Farr, Stoeckl, & Beg, 2014), a significant knowledge gap remains: is participation in outdoor activities associated with resident perceptions' of the importance of natural values to their wellbeing?

We set out to explore a few of those identified gaps, using data collected from a survey of more than 1500 residents of the GBR catchment area. First, we explored residents' participation and frequency of participation in a number of GBRWHA-related outdoor activities. Second, we examined if a range of socio-economic characteristics (such as gender, marital status, education, income etc.) played a role in determining participation in these outdoor activities. We then explored the linkages between participation in outdoor activities and a range of environmental values related to the GBRWHA, specifically asking:

- 1) is frequency of participation in activities related to perceptions of importance of GBRWHA values?; and
- 2) is that association between participation in outdoor activities and the perception of importance of GBRWHA values limited to the 'relevant' environmental values (i.e. do fishers place more values on fishing and fish health; and beach-goers on undeveloped and uncrowded beaches) or does the association extend to other environmental values, including non-use values associated with the GBRWHA?

2. Methods

2.1 Data Collection

Data were collected using a mail-out survey to a geographically stratified random sample of resident households in postcodes that lay partially or entirely within the Local Government Areas in our study region (Figure 1). The pilot stage included 230 randomly selected households (2 from each of the postcodes identified), while the main mailing included about 40 households in each postcode. Following the Dilman (2007) method, we sent an initial letter and questionnaire, a reminder letter with replacement questionnaire to those who had not responded four weeks later, and a third (final) reminder after that. We estimate that just under 4,000 questionnaires reached their intended recipients, and we received 902 completed questionnaires. Cognisant that some demographic groups are less likely to respond to mail-out surveys than others in these regions (e.g. young males, Indigenous people, see Larson, Stoeckl, Niel, & Welters, 2013), we conducted supplementary face-to-face data-collection activities using the same questionnaire, across various public locations such as ferry terminals, airports and beaches. These extra activities generated an additional 663 responses, bringing the total number of completed resident questionnaires to 1565, 1561 of which could be used in the analyses reported in this paper. Our final sample (Appendix, Table A.1) was representative of the population in the region in terms of geographic distribution, gender, Indigeneity, and those employed in the mining and manufacturing, government agencies and tourism sectors (Government Statistician, 2013). The sample over-represented those within the 45-64 year age group (45% of sample compared to 32% of population), those with a university degree (31% compared to 16% of the population), and those who generate their main household income from agriculture (22% of our sample, compared to 5% of regional employees).

2.2 Survey Questions and Analysis

The survey instrument included both questions reported in this paper, and additional questions reported elsewhere (Note 2). To provide data for exploration of our first research question, respondents were asked how often they participated in a range of the activities in the GBRWHA (Table 1). Development of this question was guided by classification of the water-related recreational activities developed by van der Smissen and Christiansen (1976) that includes: situation-based activities (e.g. beaching, swimming, going to islands); harvest-based activities (e.g. fishing, crabbing); experiential activities (e.g. snorkelling and diving); and kinetic activities (both motor and non-motorised movement such as motorboating and sailing). The following frequencies of the engagement in the activity were proposed: *Almost every day*; *A few times a month*; *About once a month*; *3-4 times a year* (grouped in the analysis as "frequent participation"); *About once a year*; *Rarely*; and *I have never done this* (grouped as "rarely or never").

Respondents were then presented with a list of 14 consumptive use, non-consumptive use and non-use values associated with the GBRWHA. Using a five-point Likert scale ranging from very unimportant (-2) through to very important (2), they were asked to indicate how important each of the values is to their overall quality of life. The GBRWHA-related values included in the survey were identified and defined during several focus group discussions (FGD) with representatives of government agencies, NGOs and citizen groups, industry groups and academics/experts (Note 3). The list of values generated from these FGDs was then tested for suitability and

relevance in a pilot study with a randomly selected sample of 120 residents, to arrive at the final collapsed list of values related to the GBRWHA (Table 1). A number of socio-economic characteristics were also recorded.

Frequencies of respondent participation in various activities, as a percentage of respondents, are reported first. The tobit regression model was used to explore potential socio-economic determinants of levels of participation, and the binary logistic regressions was then used to explore determinants of those who engage in activities frequently, versus rarely or never.

Next, we explored the linkages between participation in outdoor activities and a range of environmental values related to the GBRWHA. Potential associations between participation and frequent participation in each of the various activities and perceptions of importance of values related to the GBRWHA, was tested using Mann-Whitney non-parametric tests. As a large number of respondents reported frequent participation in more than one activity tested, we constructed a multinomial logistic model and an ordinary least squares model to further explore associations between participation in various activities and the perceived importance of values associated with the GBRWHA. Goodness-of-fit tests suggest that all the models fit reasonably well and are specified correctly.

Table 1. Lists of activities and values related to the GBRWHA tested in this study

Activities in GBRWHA:
How often do you:
<ul style="list-style-type: none"> • Spend time on the mainland beaches (referred to in this paper as ‘beaches’); • Spend time on the islands (‘islands’); • Pay for a boat trip or island visit (‘paid boat’); • Spend time on offshore reefs (‘reef trips’); • Go fishing, spear-fishing, or crabbing (‘fishing’); • Snorkel or scuba dive (‘snorkel’); • Go out on a private motorboat or a jet-ski (‘motorboat’); and/or • Go sailing, kayaking and windsurfing (‘sailing’).
GBRWHA values:
How important each of the following is to your overall quality of life:
Being able to:
<ul style="list-style-type: none"> • eat fresh locally caught seafood (referred to in this paper as ‘seafood’) • go fishing, spear-fishing or crabbing (‘value fishing’) • spend time on the beach, go swimming, diving, etc (‘value beach/swimming’) • go boating, sailing or jet-skiing (‘value boating’)
Having:
<ul style="list-style-type: none"> • undeveloped and uncrowded beaches and islands (‘undeveloped’) • beaches and islands without visible rubbish (bottles, plastic) (‘no rubbish’) • healthy coral reefs (‘coral reefs’) • healthy reef fish (‘reef fish’) • iconic marine species (whales, dugongs, turtles) (‘iconic species’) • clear ocean water (with good underwater visibility) (‘clear ocean’) • healthy mangroves and wetlands that clean polluted water from the land (‘mangroves’)
Protecting traditional/ Indigenous cultural values (‘indigenous’)
Preserving the GBRWHA either for its own sake or for future generations (‘future generations’)
"Bragging rights" - being able to say "I live near the Great Barrier Reef" (‘bragging’)

3. Results

3.1 Resident Participation in Outdoor Activities in the GBRWHA

Most residents have been to the beach (84.5%), to one of the islands (81.5%) or on a paid boat trip (73.6%) at least once (Table 2). However, when looking at the frequency of participation (Figure 2), visiting islands and going on

paid boat trips are not frequent activities for many. For example, only 30% and 12.5% of respondents have been on an island or on a paid boat trip more than once a year, respectively.

On the other hand, 34.5% and 36.8% of respondents have never been fishing or on a private motor boat (Table 2). However, those that do participate in these activities do so frequently: 37.5% go fishing and 31.3% go motorboating more than once a year (Table 2 and Figure 2). Sailing is the least undertaken activity in the GBRWHA region of those tested: more than half (55%) of respondents have never been sailing, with only 13% doing so frequently.

Thirty percent of respondents reported that they did not participate frequently in any of the activities tested; 20% reported participating frequently in at least one, 10% reported participating frequently in two, 9.6% in three, 8.5% in four; and 21% reported participating frequently in five or more of the activities tested.

Table 2. Frequency of participation in GBRWHA-related activities, as a percentages of respondents participating (n=1561)

Frequency (%)	Beaches	Islands	Paid boat	Reef trips	Fishing	Motor boat	Snorkel	Sailing
<i>Rarely or never:</i>								
I have never done this	15.5	18.5	26.4	28.3	34.5	36.8	39.7	55.4
Rarely	10.6	30.4	42.3	34.3	20.1	24.0	32.2	26.8
About once a year	9.4	20.6	18.7	13.6	7.9	7.9	9.8	4.9
<i>Frequently:</i>								
3-4 times a year	19.9	15.4	6.7	12.7	15.2	13.8	9.8	5.1
About once a month	12.4	5.5	2.0	5.3	9.4	7.2	3.6	2.4
A few times a month	19.8	4.8	2.4	4.5	10.6	8.6	3.6	3.7
Almost every day	12.4	4.7	1.5	1.3	2.2	1.6	1.3	1.8

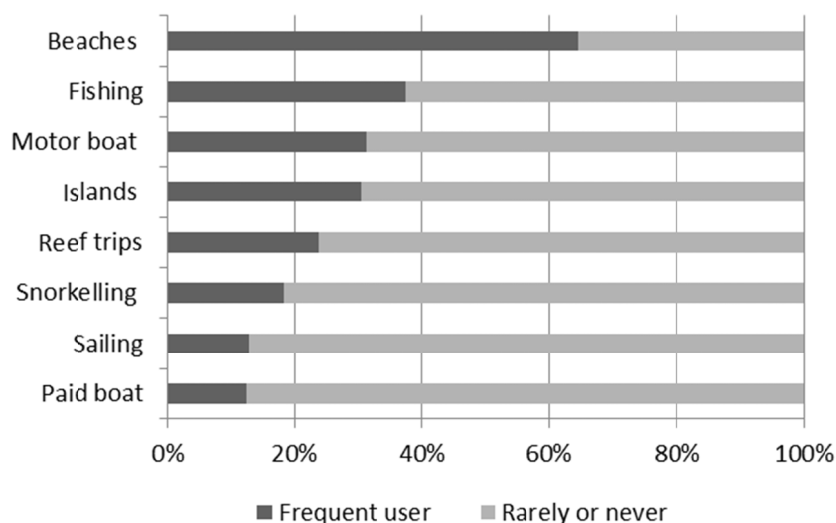


Figure 2. Frequent versus non-frequent participation in GBRWHA-related activities, as a percentage of respondents

3.2 Determinants of Participation in Outdoor Activities

A number of socio-economic characteristics of respondents were tested as potential determinants of participation in outdoor activities related to the GBRWHA (Table 3, with further details of the tests presented in Appendix, Table A.2). Overall, we found that males, residents with higher income, and those employed in the fishing and tourism industries, were more likely to participate in outdoor activities.

Males were more likely to go fishing and motorboating than females; and to go snorkelling and visiting the islands and reefs frequently. Indigenous people go to beaches and fishing more, but visit islands and go on paid boat trips less often than others. Residents with a university degree are likely to visit beaches and go sailing more frequently, but are less likely to engage in fishing or reef trips. Residents born in Queensland are more likely to be fishers than

those born elsewhere. Older people and those born in Queensland were not frequent visitors to the islands and reefs; they were also less likely to be frequent snorkelers or frequently go on paid boat trips than their younger, born 'elsewhere', counterparts (Table 3, in brackets).

Those on higher incomes were more likely to participate and frequently participate in all of the activities tested, except paid boat trips. The industry from which most household income is generated was also important: people whose main household income came from the mining industry were less likely to participate in all activities except fishing and motorboating; while those with income from agriculture were less likely to be frequent visitors to the islands. On the other hand, those receiving income from the fishing and tourism industries were more likely to participate in most of the activities and they did so more frequently than their counterparts (Table 3).

Table 3. Determinants of increasing levels of participation (tobit regression model) and frequent versus non-frequent or no participation (binary logistic regression model, in brackets) in GBRWHA related outdoor activities (n=976)

Variables	Beaches	Fishing	Motor boat	Islands	Reef trips	Snorkel	Sailing	Paid boat
Male	-	+	(+)	+	(+)	(+)	(+)	
Single		+			(+)	+		
Age				-	(-)	(-)		(-)
Indigenous	+	(+)		-				-
Education	(+)	-	(-)		(-)		(+)	
HH size	-			(+)				
QLD born		+	(+)	(-)		(-)		(-)
Income	+	(+)	+	(+)	+	(+)	+	(+)
Main source of household income:								
Mining industry	-	(-)		-	(-)	-	(-)	(-)
Agriculture				(-)				
Tourism industry	+	(+)	+	(+)	+	(+)	+	(+)
Fishing industry		+	(+)	+	(+)	+	(+)	+

Note. A plus-sign indicates that the activity variable was found to have a positive, and statistically significant relationship with the socio-economic characteristic; a negative sign indicates the relationship was negative and statistically significant; a blank indicates no statistically significant relationship.

3.3 Participation in Activities as a Determinant of Perceived Importance of a Range of Use and Non-Use Values Associated With the GBRWHA

Finally, we explored if participation in activities was associated with the perceived importance of a range of use and non-use values associated with the GBRWHA to respondent's wellbeing. Using non-parametric tests, we looked for statistically significant relationships between participation in various activities and respondents' perceptions of values (full details of tests are presented in Appendix, Table A.3). First we distinguished between the respondents who had never participated in an activity versus those who had participated at least once (P). We then distinguished between those who had participated only rarely and those who had participated frequently (FP).

The results in Table 4 indicate that those participating, and in particular, those participating frequently in outdoor activities, indeed place a higher importance on a range of values tested than others. Respondents who engaged in fishing and motorboating, placed more importance on consumptive and non-consumptive use values such as eating fresh locally caught seafood or uncrowded beaches than others. However, they did not value non-use values such as Indigenous values or preservation of the GBR for future generations more than others (Table 4). Perceptions of the importance of some non-use values, such as health of coral reef, were positively associated with the frequency of participation. Interestingly, those who frequently spent time on off-shore reefs were less likely to value non-use values than others – perhaps indicating that the main reason for visiting off-shore reefs was to fish (a consumptive value).

On the other hand, there was little difference in perceptions of importance of values between those who had been to an island, beach or on a paid boat trip, and those who had not. But the frequency of participation in these activities was positively associated with value perceptions. Those frequently going to islands, beaches and on paid boat trips placed significantly higher importance on a whole range of values tested, in particular non-use values such as healthy reef fish; healthy coral reefs; iconic species; and healthy mangroves and wetlands (Table 4).

Table 4. Difference in perceived importance of GBRWHA-based values between respondents who never participated in an activity versus those who have participated (P); and those who have participated rarely and those who participate frequently (FP) (Stars indicate that null hypothesis can be rejected at specified significance level, Mann-Whitney non-parametric U test). Right-hand side (Determinant): Results of a multinomial logistic model, testing participation in which outdoor activities is a determinant of importance of each of the values associated with the GBRWHA

Values:	Activities:	Fishing	Motor boat	Reef trips	Sailing	Snorkel	Islands	Beach	Paid boat	Determinant ^a
Seafood	P	***	***	***	-	-	-	-	-	Beach +
	FP	***	***	***	-	*	***	**	-	Fishing +
Value fishing	P	***	***	***	*	-	*	-	-	Beach +
	FP	***	***	***	***	***	***	***	-	Fishing + Motorboat + Sailing - Paid trip -
Value boating	P	***	***	***	***	***	*	-	-	Beach +
	FP	***	***	***	***	***	***	***	-	Fishing + Island +
Value beaches	P	***	***	***	***	***	***	***	***	Beach +
	FP	***	***	***	***	***	***	***	***	Fishing +
Undeveloped	P	***	***	*	***	***	**	*	-	Beach +
	FP	***	***	*	***	***	***	***	*	Snorkel +
No rubbish	P	-	*	-	-	-	-	-	-	Beach +
	FP	**	***	-	**	**	*	***	*	
Reef fish	P	*	*	**	**	***	-	-	*	Beach +
	FP	***	***	-	***	***	***	***	***	
Coral reefs	P	-	*	*	**	*	-	-	-	Beach +
	FP	**	*	-	**	***	***	***	***	
Iconic species	P	*	**	*	**	*	-	-	-	Beach +
	FP	*	**	-	***	***	***	***	***	
Mangroves	P	*	*	*	**	*	-	-	*	Beach +
	FP	**	*	-	**	**	***	***	**	
Clear ocean	P	-	*	**	**	**	-	-	-	Beach +
	FP	-	*	-	**	***	***	**	***	
Bragging	P	-	*	*	**	*	-	-	-	Beach +
	FP	**	***	***	***	**	***	***	***	Fishing + Island +
Indigenous values	P	-	-	-	**	*	-	-	-	Beach +
	FP	-	-	-	***	*	***	**	***	Island +
Future generations	P	-	*	**	**	**	**	**	*	Beach +
	FP	-	-	-	**	*	**	***	***	Island +

Note. * $p < 0.05$; ** $p < 0.01$; *** $p \leq 0.001$; - = no statistical difference between groups in importance of the value

^aResults of a multinomial logistic model testing participation in which of the outdoor activities is determinant of importance of values associated with the GBRWHA. A plus-sign indicates that the activity variable was found to have a positive, and statistically significant relationship with the score assigned to the importance of the corresponding value; a negative sign indicates the relationship was negative and statistically significant; All the activities were tested for each value, but the activities with no significant relationship are not reported.

As noted before, a number of people who engage in outdoor activities frequently do so with more than one activity. So in order to learn more about which, if any, particular activity is most strongly associated with perceptions of values, we constructed a multinomial logistic model and an OLS model to test the relationship between each value, and all activities simultaneously (results of the regression models are presented in Table 4, right-hand side; with more details in Appendix, Table A.4). Spending time on the beaches emerged as the most important determinant. Spending large amounts of time on the islands was a determinant of boating and bragging, but also protection of Indigenous values and preservation of the GBRWHA for its own sake and for future generations. Frequent fishing

emerged as a key determinant of the importance of use values: eating fresh locally caught seafood; fishing, spear-fishing, crabbing; boating, sailing and jet-skiing; and spending time on beaches and swimming.

4. Discussion and Conclusions

Going to the mainland beaches and swimming was reported as the most frequent activity associated with the GBRWHA. Only 15.5% of residents have never been to the beach, and more than two-thirds do so frequently. About one-third of residents of the GBR catchment area have never been fishing or boating; but on the other hand, one-third reported going fishing and boating frequently. These findings are in line with reports from the USA, where swimming and fishing were also found to be the most frequent water recreation activities (Smardon, 1988). Similarly, in Australia, Rolfe and Gregg (2012) estimated that each adult residing in the GBR area makes approximately 20 visits per year to the beach. Farr (2013) and Farr et al. (2014) found that only twenty-one percent of the respondents in North Queensland coastal regions had never been fishing as an adult and 56.3% had not been fishing during the previous two years. This is also consistent with findings of Rolfe et al. (2011) who collected data from Queensland coastal cities and found that 42% of respondents went fishing/boating over the last two years.

Previous research has demonstrated that preferences for natural attributes and activities differ between population groups differing in gender, age, social status, educational level, income etc. (Bell et al., 2005; Edwards et al., 2012; Geisler et al., 1977; Larson, De Freitas, & Hicks, 2013; Nielsen, Olsen, & Lundhede, 2007; Nielsen, Heyman, & Richnau, 2012; Teisl & O'Brien, 2003). Similarly, we found that males, residents with higher income, and those with the main household income from fishing and tourism industries, are more likely to participate in outdoor activities related to the GBRWHA; while older people are less likely to participate, in particular to frequently go to islands, reefs, snorkelling, or visiting on a paid boat. Similar to findings of Rolfe and Gregg (2012), beach visitors in our study were more likely to be Indigenous people, those who had achieved a higher education level and earning more, and those employed in the tourism industry. The highest participation in fishing is by single males, Indigenous people, those born in Queensland and of higher income, but less educated, most likely to be employed in the fishing or tourism industries. Farr et al. (2014) also found single males to be more likely to participate in recreational fishing in the GBR region. Furthermore, in USA, McDonough and Field (1979) found that fishers tend to be older adult males, originally from rural areas, who often visit the same fishing area for several decades.

Older, Indigenous people, those born in Queensland and employed in the mining industry, were least likely to go on paid boat trips. Indeed, Lawrence et al. (2010) found that 94% of all reported visits to the Marine Parks within the GBRWHA were unpaid visits and were therefore classified as independent recreational activities (visits on privately owned motor or sailing boats). Income was a significant determinant for participation in all activities except paid boat trips, following on a previous observation, arguably as those on high incomes have their own boats and thus engage in a range of activities frequently.

Our study also confirms association between participation in activities and the perception of values. We found that occasional participation in an activity does not necessarily change perceptions of importance of the GBRWHA values. However, as frequency of participation increased, importance of some of the GBRWHA values also increased.

In particular, we were interested to see if the association between outdoor activities and the perception of importance of values is limited to the 'relevant' environmental values (i.e. do fishers place more values on fishing and fish health; and beach-goers on undeveloped and uncrowded beaches), as Dunlap and Heffernan (1975) originally hypothesised, or if the association extends to other environmental values, including non-use values associated with the GBRWHA. We found that people who engaged in consumptive activities, such as fishing, spear-fishing or crabbing, indeed placed more importance on consumptive values of the GBRWHA, such as eating fresh locally caught seafood and fishing. That said, they also placed more value on non-consumptive uses such as spending time on beaches and swimming; and boating, sailing and jet-skiing. Being a fisher or a motorboat owner, however, did not impact on the perceptions of the non-use values of the GBRWHA, such as its preservation for future generations. There was nonetheless an increase in perceived importance of health of its coral, reported by frequent participants in these activities. Dunlop and Heffernan's hypothesis that associations exist between an activity and 'relevant' environmental attributes is thus largely supported by our findings, as far as consumptive activities are concerned. However with the non-consumptive uses, such as beach and island visitation, the association extends to a whole range of values, not just the 'relevant' ones. Thus, we suggest that their hypothesis does not hold for the non-consumptive activities. Interestingly, frequent visitation of the outer reefs is associated with lower perceptions of the importance of some non-use values, such as health of the reef and importance of iconic species. Given that most of the frequent reef visitors are fishers and spear-fishers with private boats; this finding appears to be in line with that of Waight and Bath (2014), who found that the frequency of participation in

four-wheel driving (all-terrain vehicles) was negatively associated with environmental concerns. Given the relatively large percentages of residents who participated in consumptive activities, these findings are worth further exploration.

Our findings have implications for management of the GBRWHA and for development of relevant policies and programs, but also for ways in which managers and decision makers can engage with the specific user groups. In line with the argument of Dunlap and Heffernan (1975), we believe that frequent participants in outdoor recreation place higher importance on environmental values and may therefore stand as strong environmental stewards. Our findings indicate that frequent beach and island-goers thus might serve as the best group to target and mobilise for various environmental activities and actions. Other groups of participants, such as frequent participants in consumptive and motorised activities, already have higher appreciation of some of the values of the GBRWHA, but could be specifically targeted by educational and information campaigns in order to increase their awareness of the importance of other environmental values and the environmental quality overall. Further, our findings indicate that surveying frequent beach-goers might serve as a reasonable proxy for monitoring perceptions of 'values', in particular the longitudinal perceptions of satisfaction with the state of a range of values beach goers find important to their wellbeing.

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Notes

Note 1. A number of related terms, grouped here under ‘environmental perspectives’ label, have been used in relevant studies over time, starting from environmental ‘concerns’ (Dunlap & Heffernan, 1975), moving on to ‘attitudes’ (measured using New Environmental Paradigm, van Liere & Noe, 1981), pro-environmental ‘behaviour’ (Theodori et al, 1998) and ‘sensitivity’ (Bustam, Young, & Todd, 2005).

Note 2. The main aim of the project was to improve our understanding of the relationship between the socioeconomic system and the GBRWHA, specifically, to improve understanding of resident views about the relative ‘value’ of key ecosystem services that are provided by the GBRWHA. Thus the core sections of resident questionnaire included questions about: (1) The socio-demographic background of respondents; (2) Residents’ activities and frequency of activities within the GBRWHA; (3) The importance of various values related to the GBRWHA to overall wellbeing and quality of life and satisfaction with the current state of these values; (4) Perceptions about the way in which overall quality of life would be affected by changes in various environmental and market factors; and (5) Willingness to pay (WTP) for improvements in various environmental attributes of the GBRWHA. Please refer to Stoeckl et al. (2013) for more details on the survey instrument and its development.

Note 3. In the first round, attended by a total of 31 participants across three FGDs, the objectives of the study and relevant concepts were introduced, and an initial list of values was generated. Lists from these FGDs were then collated and presented back to participants in the next round (three FGDs with the total of 42 participants). To avoid response bias, 24 different versions of the survey with importance questions presented in a different order were mailed out, ensuring equal geographic coverage of each version.

Appendix

Details of the survey sample and analyses results

Table A1. Characteristics of respondents (n=1561)

Characteristic	Percentage respondents
Female	50.3
Single	22.6
Born in Australia	80.6
Born in QLD	51.3
Aborigine/Torres Strait Islander	6.6
Age:	
Under 40	27.8
40-60 years old	44.3
More than 60	28.1
Household size:	
One person	13.5
Two people	44.2
Three people	16.4
More than 3	25.9
Education levels:	
Primary	3.8
High school to year 10	20.2
High school to year 12	19.8
Trade	18.4
University	31.0
Sector of employment:	
Retail, Accommodation, Cafes, Tourism	12.7

Government, Health and Education	26.5
Agriculture	22.4
Mining, Manufacturing and Ports	31.0
Fishing	7.4
Annual household income:	
Under 60,000 A\$	21.7
60-100,000 A\$	30.4
Over 100,000 A\$	39.0
Recreational fisher(wo)men	46.6

Table A2. Determinants of increasing levels (frequency) of participation (LP; tobit regression model) and frequent vs non-frequent or no participation (FP; binary logistic regressions model) in GBRWHA related outdoor activities (n=976), Coefficient, significance levels and robust standard error presented

Variables	Beaches	Fishing	Motor boat	Islands	Reef trips	Snorkel	Sailing	Paid boat
<i>Male</i>								
LP tobit	-10.24** (4.84)	6.735*** (2.503)	6.612*** (2.31)					
FP logit		.689*** (.141)	.713*** (.150)	.337** (.151)	.846*** (.168)	.707*** (.187)		
<i>Single</i>								
LP tobit		8.168** (3.396)				5.100* (2.847)		
FP logit				.619*** (.188)				
<i>Age</i>								
LP tobit				-.305** (.155)				
LP logit				-.015*** (.005)	-.019*** (.006)	-.026*** (.007)		-.029*** (.008)
<i>Indigenous</i>								
FP tobit	23.35* (13.31)			-9.662* (5.795)				-5.821** (2.498)
LP logit		.539* (.301)						
<i>Education</i>								
LP		-1.994** (.966)						
FP	.1158* (.060)	-.143** (.060)			-.156** (.073)		.194** (.092)	
<i>HH size</i>								
LP tobit	-3.784** (1.77)							
FP logit				.100* (.058)				
<i>QLD born</i>								
LP tobit		4.375* (2.401)						
FP logit		.345** (.144)		-.444*** (.152)		-.457** (.182)		-.4012* (.210)
<i>Income</i>								
LP tobit	.0001*** (.000)	.0001*** (.000)	.0001*** (.000)		.00008*** (.000)	.0001*** (.000)	.00009** (.000)	
FP logit	.000008*** (.000)	.00001*** (.000)	.000007*** (.000)	.00006*** (.000)	.000006*** (.000)	.000008*** (.000)	.000004* (.000)	
<i>Main source of household income:</i>								
<i>Mining</i>								
LP tobit	-19.26*** (6.017)			-8.417** (3.46)	-4.343** (2.18)			-4.189** (1.881)
FP logit	-.679*** (.199)			-.492** (.194)		-.590** (.244)	-.702** (.283)	
<i>Agriculture</i>								
LP tobit								
FP logit				-.495** (.217)				
<i>Tourism</i>								
LP tobit	28.80*** (8.79)	7.555** (3.832)	7.286** (3.38)			8.237** (3.53)	16.54*** (5.58)	

FP logit	.469** (.238)	.484** (.212)	.698*** (.218)		.450* (.238)		.507* (.261)	
<i>Fishing</i>								
LP tobit		15.475** (7.089)	23.699*** (7.09)	40.240*** (10.104)		21.99*** (6.553)	32.84*** (8.69)	18.37 ** (7.20)
FP logit		.575** (.274)	.991*** (.284)	1.199*** (.277)	1.152*** (.287)	1.256*** (.295)	1.378*** (.291)	1.249*** (.313)
N uncensored	835	651	621	811	720	612	458	748
LP: F test;	4.97***	2.86***	2.93***	3.82***	1.95**	2.44***	3.19***	1.79**
AIC ;	10.03	7.05	6.59	9.09	7.23	6.41	5.37	7.62
BIC	3141.02	239.74	-217.82	2229.79	409.05	-386.92	-1408.27	795.76
N	976	976	976	976		976	976	976
FP: Wald chi2;	62.65***	69.72***	71.92***	99.76***	75.37***	97.66***	73.60***	63.67***
AIC								
BIC	1.22	1.27	1.18	1.15	1.01	0.87	0.75	0.69
	-5455.76	-5411.06	-5500.48	-5523.84	-5663.09	-5801.18	-5914.43	-5974.52

Note. *** significant at 1% level ** significant at 5% level * significant at 10% level.

Table A3. Difference in perceived importance of GBRWHA-based values between respondents who never participated in an activity versus those who have participated (P); and those who have participated rarely and those who participate frequently (FP), Man-Whitney non-parametric U test values and significance (sig), n=number of respondents

Activities:	Fishing	Reef trips	Motor boat	Sailing	Snorkel	Islands	Beach	Paid boat
Values:	U (sig)	U (sig)	U (sig)	U (sig)	U (sig)	U (sig)	U (sig)	U (sig)
<i>Seafood n=1543</i>								
P	310,390 (.000)	264,624 (.000)	313,276 (.000)	306,831 (.132)	292,247 (.228)	189,377 (.051)	164,774 (0.560)	234,978 (.372)
FP	331,026 (.000)	236,180 (.000)	300,969 (.000)	137,237 (.104)	184,211 (.018)	265,039 (.001)	282,503 (.010)	131,830 (.085)
<i>Value fishing n=1492</i>								
P	349,935 (.000)	251,903 (.000)	326,074 (.000)	294,460 (.026)	277,122 (.069)	177,275 (.015)	146,843 (.297)	210,049 (.660)
FP	398,121 (.000)	272,685 (.000)	348,444 (.000)	138,697 (.001)	193,656 (.000)	276,825 (.000)	281,041 (.000)	116,774 (.859)
<i>Value boating n=1508</i>								
P	337,191 (.000)	264,717 (.000)	339,894 (.000)	335,447 (.000)	302,454 (.000)	181,808 (.022)	150,818 (.349)	214,337 (.678)
FP	376,268 (.000)	272,038 (.000)	362,684 (.000)	166,497 (.000)	209,350 (.000)	303,921 (.000)	290,989 (.000)	126,227 (.056)
<i>Undeveloped n=1512</i>								
P	280,659 (.001)	245,730 (.033)	288,705 (.001)	318,412 (.000)	296,306 (.001)	185,867 (.012)	161,076 (.016)	229,960 (.104)
FP	288,152 (.000)	209,580 (.062)	269,335 (.000)	146,929 (.000)	192,326 (.000)	263,408 (.000)	295,647 (.000)	128,136 (.025)
<i>No rubbish n=1539</i>								
P	269,371 (.547)	248,009 (.088)	287,085 (.023)	303,858 (.089)	288,689 (.271)	182,651 (.206)	161,033 (.094)	237,341 (.083)
FP	284,975 (.005)	211,233 (.213)	267,716 (.000)	140,243 (.002)	182,062 (.007)	255,384 (.017)	281,726 (.001)	131,163 (.039)
<i>Reef fish n=1542</i>								
P	279,484 (.028)	252,810 (.013)	288,762 (.015)	311,992 (.005)	303,584 (.001)	182,727 (.242)	161,263(.082) 291,296	239,951 (.045)
FP	289,327 (.001)	215,381 (.065)	265,383 (.001)	142,669 (.001)	188,078 (.000)	263,803 (.000)	(.000)	136,444 (.000)
<i>Coral P n=1546</i>								
P	276,108 (.177)	253,631 (.016)	288,541 (.031)	313,391 (.007)	297,838 (.029)	183,416 (.245)	162,235 (0.720)	239,686 (.080)
FP	288,132 (.004)	213,021 (.228)	264,889 (.006)	142,360 (.002)	187,035 (.001)	267,142 (.000)	290,176 (.000)	138,607 (.000)
<i>Iconic species n=1542</i>								
P	279,798 (.038)	250,971 (.037)	292,041 (.004)	312,386 (.007)	296,275 (.034)	184,854 (.105)	161,302 (.078)	241,903 (.122)
FP	284,854 (.013)	212,644 (.248)	264,713 (.005)	143,233 (.001)	191,098 (.000)	264,922 (.000)	287,422 (.000)	138,199 (.000)
<i>Mangroves n=1540</i>								
P	278,890 (.035)	252,026 (.018)	288,877 (.013)	311,761 (.007)	296,511 (.023)	179,533 (.366)	158,796 (.108)	238,764 (.047)
FP	287,760	210,349	262,508	141,553	185,335	266,283	284,085	134,755

	(.003)	(.392)	(.014)	(.002)	(.002)	(.000)	(.001)	(.006)
<i>Clear ocean n=1541</i>								
P	272,128 (.394)	251,565 (.030)	286,735 (.049)	315,289 (.002)	302,137 (.002)	180,834 (.408)	154,794 (.617)	235,949 (.189)
FP	281,295 (.070)	211,549 (.357)	261,769 (.024)	142,517 (.002)	188,220 (.001)	263,967 (.000)	282,396 (.002)	138,151 (.001)
<i>Bragging n=1521</i>								
P	273,386 (.054)	246,176 (.030)	283,135 (.031)	309,124 (.008)	290,772 (.035)	168,166 (.971)	144,471 (.685)	210,262 (.141)
FP	285,135 (.004)	222,771 (.001)	270,577 (.000)	145,183 (.000)	183,778 (.006)	277,702 (.000)	282,568 (.001)	139,097 (.000)
<i>Indigenous n=1523</i>								
P	255,774 (.651)	233,924 (.864)	263,575 (.615)	313,207 (.002)	291,504 (.046)	163,083 (.207)	143,287 (.463)	232,307 (.190)
FP	252,458 (.137)	196,731 (.478)	237,772 (.553)	145,548 (.000)	181,838 (.013)	265,137 (.000)	278,479 (.008)	140,992 (.000)
<i>Future generation n=1540</i>								
P	274,891 (.187)	255,399 (.006)	289,632 (.019)	314,712 (.004)	300,205 (.009)	191,801 (.004)	166,830 (.003)	244,182 (.010)
FP	272,955 (.592)	202,097 (.571)	253,324 (.367)	141,996 (.005)	181,564 (.036)	260,573 (.005)	285,940 (.001)	141,718 (.000)

Table A4. Frequency of participation in outdoor activities as a determinant of importance of each of the values associated with the GBRWHA, results of the ordinary least square regression models (only significant coefficients reported)

	Fishing β (sig)	Reef trips β (sig)	Motor boat β (sig)	Sailing β (sig)	Snorkel β (sig)	Islands β (sig)	Beach β (sig)	Paid boat β (sig)	F (df)
Seafood	.082 (.002)						.053 (.041)		8.52 (2,1516)
Value fishing	.186 (.000)		.104 (.001)	-.087 (.003)			.073 (.005)	-.072 (.007)	18.70 (5,1464)
Value boating	.134 (.000)					.054 (.045)	.062 (.017)		17.02 (3,1482)
Value beaches	.065 (.012)						.201 (.000)		38.92 (2,1496)
Un developed					.060 (.022)		.096 (.000)		11.22 (2,1490)
No rubbish							.095 (.000)		13.81 (1,1515)
Reef fish							.113 (.000)		19.43 (1,1516)
Coral reefs							.105 (.000)		16.99 (1,1520)
Iconic species						.051 (.049)	.111 (.000)		12.61 (2,1515)
Mangroves							.111 (.000)		18.90 (1,1514)
Clear ocean							.121 (.000)		22.51 (1,1516)
Bragging	.075 (.005)					.060 (.025)	.106 (.000)		14.11 (3,1494)
Indigenous values						.096 (.000)	.081 (.002)		13.59 (2,1499)
Future generations						.068 (.008)	.108 (.000)		14.05 (2,1514)

Note. B = Beta; sig = significance; F = score of F-test; df = degrees of freedom (reg., residual).

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