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The impact of economic, social and environmental factors on trip satisfaction and the likelihood of visitors returning

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Highlights

- Tourist trip satisfaction impacts likelihood of returning and related revenues
- Changes in factors affecting satisfaction impact revenue arising from repeat visits
- Economic, social and environmental factors impact trip satisfaction
- Many industries outside tourism impact on factors influencing trip satisfaction
- Developing tourism policy requires a holistic view incorporating all local industries

The impact of economic, social and environmental factors on trip satisfaction and the likelihood of visitors returning

Abstract

Tourism is vital to the economy of many regions; however visitor numbers in some are stagnating. Using a novel approach, this case study of the Great Barrier Reef explores and quantifies risks to visitor numbers, utilising tourist survey data supplemented by objective data from secondary sources. Economic, social and environmental factors affecting trip satisfaction are identified, which itself is found to affect the likelihood of a tourist returning; the impact of changes on trip satisfaction and on repeat visits is then estimated.

Linkages between tourism and other industries are clearly demonstrated; increased construction work, decreased water clarity and decreased perceptions of tourist safety are all estimated to significantly reduce likelihood of repeat visits and hence impact tourist revenues, placing the financial viability of the industry at risk. Future development within the region should be evaluated holistically, rather than industries such as tourism, construction, agriculture etc. each being developed in isolation.

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- Changes in factors affecting satisfaction impact revenue arising from repeat visits
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- Many industries outside tourism impact on factors influencing trip satisfaction
- Developing tourism policy requires a holistic view incorporating all local industries

Key words

Repeat visitors

Tourist trip satisfaction

Life satisfaction

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1 Introduction

Tourism is a vitally important industry to many regions of the world and forms an important and growing part of the world's economy. There were 1,087 million international tourists during 2013, generating 9% of the world's GDP and creating 1 in every 11 of the jobs around the world (The World Tourism Organisation (UNWTO), 2014). This research uses tourism within the Great Barrier Reef (GBR) region of Australia as a case study, and the methods used are transferable to any other region of the world.

Tourism is important to Australia, which has enjoyed significant increases in visitor numbers over the last 20 years, with total annual visitors having almost doubled over the period to almost 6.2 million visitors for 2012/13 as shown in Figure 1 (Australian Bureau of Statistics). Within the GBR catchment area, tourism is the third most important industry behind mining and minerals processing (based on the gross value of production; (PDP Australia Pty Ltd, 2003); in 2011 the tourism industry generated $5.2 billion value added and provided more than 64,000 full-time equivalent jobs (Deloitte Access Economics, 2013). Evidently, maintaining a Reef-based tourism industry is important for the region, and for Australia as a whole.

FIGURE 1 TO BE INSERTED HERE

Figure 1 Number of short term (less than 1 year) visitor arrivals to Australia

But a similar increase in visitors has not been seen within the GBR. Considering the GBR itself, the number of visitors to the reef can be compared over time based on the

Environmental Management Charge data collected by the Great Barrier Reef Marine Park Authority. As demonstrated in Figure 2, the number of visitors to the reef peaked in 2004/05 at almost 2 million reef visitor days but has since declined with less than 1.8 million reef visitor days recorded for 2012/13 (Based on full day, part day and exempt visitors (Great Barrier Reef Marine Park Authority).

FIGURE 2 TO BE INSERTED HERE

Figure 2 Number of reef visitor days

Reduced numbers of visitors to the reef, despite increased numbers of visitors to the country as a whole, implies that visitors are choosing to visit other tourist attractions instead of the GBR; a continuation of this trend over time could threaten the long term future of the tourism industry within the region with consequent impacts on future employment and income.

In addition, a successful tourism industry does not just need to attract new visitors – it also needs to encourage repeat visits. This is because repeat visitors can: reduce marketing costs (benefiting from the spread of positive word of mouth); reduce price sensitivity amongst customers (Assaker & Hallak, 2012; Baker & Crompton, 2000); and increase economic profit (Choo & Petrick, 2014). Importantly, the likelihood of a tourist returning to a particular location has been found to depend on a range of factors (column 2, table 1), but there is broad consensus that overall trip satisfaction is one of the most important factors influencing repeat visitation (including Chen & Tsai, 2007; Kozak, 2001; Yoon & Uysal, 2005). Additionally, while repeat visitors are more likely to return once again than first time visitors, neither are likely to return if their level of satisfaction with their most recent visit is low (Alegre & Cladera, 2006). Specific research on tourists to the GBR region (Moscardo, Saltzer, Norris, & McCoy, 2004) or to the GBR itself (Saltzer, 2002b) has found that those visitors who report positive experiences are more likely to return. Other important factors found to increase the likelihood of returning to the GBR are: if the tourists are younger and from Australia (particularly from Queensland); the particular location visited within GBR also has an impact (Saltzer, 2002b). As such, tourist satisfaction is vital for maintaining/growing visitor numbers: it builds destination loyalty, encourages repeat visits and also increases recommendations to family and friends (Hui, Wan, & Ho, 2007; Kozak & Rimmington, 2000; Yoon & Uysal, 2005).

Tourist satisfaction generally depends on a range of features (column 3, table 1), and in the GBR, has been shown to be particularly sensitive to tourist satisfaction with fish, coral and other marine life (Coghlan, 2012; Saltzer, 2002a), the reasons for choosing the GBR location including the importance of experiencing and learning about nature (Saltzer, 2002a), the number of activities undertaken during the trip (Saltzer, 2002a) and the weather experienced during their visit to the region (Coghlan, 2012; Coghlan & Prideaux, 2009). But factors that impact the probability of repeat visitation do not always have a similar impact on trip satisfaction (compare column 2 and 3, Table 1). Reasons for this may include that tourists are likely to report high levels of trip satisfaction due to the emotional and financial investment they have personally made in that trip, but their reported likelihood of returning is not affected by this personal investment (Alegre & Garau, 2010); alternatively some tourists would not return to a location however high their satisfaction as their main motivation for location choice is novelty seeking (Assaker, Vinzi, & O'Connor, 2011; Jang & Feng, 2007).

Numerous studies have investigated factors impacting tourist trip satisfaction (including Alegre & Garau, 2010; Torres-Sovero, Gonzalez, Martin-Lopez, & Kirkby, 2012); factors impacting the number of tourists returning, and the direction of their impact, have also been identified previously (including Assaker et al., 2011; Kozak, 2001), as shown in Table 1 and Table 9. However, so far as we are aware, previous research has not sought to determine how changes to factors impacting trip satisfaction may subsequently affect the likelihood of tourists returning. Neither are we aware of previous research that has estimated the financial impact (in terms of lost revenues from reduced numbers of returning visitors) that could result from changes to factors impacting satisfaction.

Although not always considered in tourism studies, the life satisfaction literature also has useful insights which can be used to enrich studies of tourist satisfaction. Simplistically, life satisfaction researchers seek to understand more about factors (demographic factors such as age and gender, plus various social, economic and environmental factors) affecting people's overall quality of life, or subjective 'well-being'[1]. They frequently ask survey questions of the type "how satisfied are you with your life as a whole these days?" (with responses recorded using a Likert scale – similar to the approaches used to measure tourist satisfaction) and then undertake statistical analyses to identify factors that contribute to, or detract from,

[1] The terms happiness, life satisfaction and subjective well-being (SWB) are frequently used interchangeably although the term 'happiness' is less closely related to life satisfaction than is the term SWB (Engelbrecht, 2009).

overall life satisfaction (column 4, table 1). Many similarities can be seen between factors found to impact on tourist overall trip satisfaction and on overall life satisfaction (compare columns 3 and 4, table 1) – perhaps the most significant being that both researchers (who are interested in tourist satisfaction and those interested in overall life satisfaction) have found that 'satisfaction' is influenced by factors from social, economic and environmental *domains*, complemented by personal factors relating to the respondent in terms of age, country of origin etc.

It should be noted that the factors identified within Table 1 are not intended to be a definitive guide. Instead this table includes a wide range of factors that different studies identified as having a statistically significant relationship with life satisfaction, trip satisfaction or the likelihood that a tourist will return; many of these findings are likely to be context specific to the particular region/country being studied whilst other findings may be more generic.

Table 1 Compendium of findings from previous studies of statistically significant relationships between various socio-economic and demographic factors and the probability that a tourist will return, tourist trip satisfaction and overall satisfaction with life (for references from which factors were drawn, see Appendix 5.2, Table 9)

	Probability that a tourist will return	**Tourist's overall trip satisfaction**	**Overall satisfaction with life**
Age	Older visitors and younger visitors have been found to be more likely to return.	Younger tourists are more satisfied.	Age is significant, although relationship may be U shaped rather than linear, with lowest SWB observed amongst those aged in their 30s. Studies frequently include age and/or age squared to reflect non-linear relationship.
Gender	Males more likely to return.	Females are more satisfied.	Females generally found to have higher SWB than males.
Education level	Those with higher education levels are more likely to return.	Tourists with lower education levels found to be more satisfied.	Higher education level frequently related to higher SWB. However this effect may be indirect – since those with more education are likely to also have higher incomes.
Marital status	Married people are more likely to return		Married people generally happier.
Country of origin	Significant relationship – different nationalities have different likelihood of repeating their visit.	Significant relationship – different nationalities report different levels of trip satisfaction	There may be country specific time invariant personal characteristics which impact on SWB. Living in your country of origin rather than being a

			foreigner improves SWB.
Income	Low income visitors less likely to return.	Higher income tourists are more satisfied.	Higher incomes generally increase SWB. However relative income (both relative to others, impacting on status in society, and relative to previous periods, which impacts on habits and the view of what is the norm), and future material aspirations and their relationship to anticipated future income levels have been found to be important. Some research found a negligible or statistically insignificant relationship to SWB.
Health status			Higher SWB reported by those who report better levels of health.
Employed or unemployed			Employed people report higher SWB than unemployed people.
Overall satisfaction with trip	Higher level of satisfaction contributes to the increased likelihood of returning	Not applicable	Not applicable
Previously visited region	Positive relationship, having visited before increases chance of visiting again	Weak relationship	Not applicable
Trip cost / perceived value for money	Higher travel costs reduce likelihood of returning; perception that trip offers good value for money increases likelihood of returning	More expensive prices reduce trip satisfaction, prices in line with budget or considered good value for money increase satisfaction	Not applicable
Facilities at tourist destination – accommodation, restaurants etc.	Better facilities increase chance of returning	Better and more varied facilities increase satisfaction	Not applicable
Climate	Good climate and sunshine increases repeat visits	Reporting high satisfaction with climate increases satisfaction with trip	Significant impact on SWB
Economic development	Negative relationship between level of development within the region and the tourist's likelihood of returning to the location; indications of overdevelopment and congestion significantly reduce the likelihood of returning.	High level of development increases tourist dissatisfaction; indications of overdevelopment and congestion significantly reduce tourist satisfaction. Peace, quiet and not overcrowded important to satisfaction.	Significant positive relationship between economic growth or development and SWB (e.g. using growth in GDP rates as a proxy for this factor).
Quality of social capital	Fear of becoming a victim of crime and concerns about safety can be a factor in deciding whether to revisit and many would not	Positive relationship with tourism; tourists don't wish to visit locations with high crime levels or regions considered dangerous due to	Positive relationship with SWB, including measures of local political autonomy, political stability, rule of law and control of corruption,

	recommend a high crime location to friends or family.	risk of terrorism, crime or natural disasters.	perceptions of crime levels and personal safety, degree of freedom and personal choice, and trust in others or society.
Quality of natural environment	Declining environmental quality, at least partly attributable to tourism, can cause stagnation or decline by reducing the attractiveness of the area, as described in the tourist area life cycle model; environmental degradation and visitor numbers above the environmental carrying capacity has been found to be a limit to growth.	Better quality of environment, or being satisfied with environment, increases satisfaction with trip	Environmental factors significant impacts on SWB. Pollution, including air pollution and noise levels, significantly reduce SWB. High quality environmental amenities, such as living near the coast or having good views, enhance SWB whilst proximity to landfill sites reduces SWB. The quality of ecosystem services provided by the environment enhances SWB whilst environmental disasters, such as forest fires and flooding, have a negative impact.

Similarities aside, an important difference between the tourism satisfaction and SWB research is that this latter group of researchers have explicitly evaluated genetic or hereditary factors (Lyubomirsky, Sheldon, & Schkade, 2005). Empirical investigations have measured the impact of genetics on variations in life satisfaction, now widely accepted as explaining around 50% of all observed differences (Lyubomirsky et al., 2005; Zidanšek, 2007). This influence of genetic factors has been estimated by calculating correlations between self-reported happiness levels of identical and non-identical twins and siblings, including those brought up together and those separated at birth. For example, based on subjective measures reported by adults, the influence of genetic factors on happiness has been estimated at between 39% and 58% (Tellegen et al., 1988) and between 40% and 55% (Diener, Suh, Lucas, & Smith, 1999). Additionally the influence of genetic factors on happiness has been estimated at between 35% and 57% based on measures reported by examiners viewing children at 12 and 24 months old (Braungart, Plomin, DeFries, & Fulker, 1992). Consequently most studies evaluating non-genetic factors influencing life satisfaction are able to explain only 10% - 30% of variations in SWB as the impact of genetic factors (probably explaining around 50% of the variation) cannot be controlled for within survey based life satisfaction studies. It seems likely that genetic factors would also influence tourist satisfaction levels; the inability to measure or control for these factors will consequently reduce the variation in trip satisfaction that can be explained by such studies.

To summarise key points made thus far: there is evidence to suggest that the GBR tourism industry may be 'stagnating', the key question being "WHY". Research suggests that this might be occurring if external factors are influencing overall trip satisfaction and/or the probability of repeat visitation. This research thus sets out to answer three specific questions that could shed light on the problem:

1 What is the influence of trip satisfaction on the likelihood of repeat visits to the GBR region? This study evaluates the impact of many different factors on the likelihood of tourists returning to the region to determine how significant trip satisfaction is to this decision.

2 What factors influence the trip satisfaction experienced by tourists visiting the GBR? This study considers the influences on trip satisfaction through a different lens to previous research, incorporating insights gleaned from the field of life satisfaction research. This research extends the use of objective data in explaining tourist responses, and matches the objective secondary data more precisely to each tourist's specific trip (spatially and for precise visit dates), than has been attempted in previous research, as far as we are aware.

3 What is the potential financial impact of changes in the number of returning visitors consequent to changes in economic, social and environmental factors that influence tourist trip satisfaction? This provides important information regarding the potential magnitude of the risk to the tourism industry resulting from changes to influencing factors and provides a useful tool for policy developers in tourist regions.

Our empirical estimates are clearly most relevant to the GBR region; however the methods used to generate those empirical insights are, we believe, of generic interest to all who wish to learn more about factors that influence tourist satisfaction and repeat visitation in general, and are transferable to anywhere in the world.

2 Materials and Methods

2.1 Case study region

The GBR, situated in the Coral Sea off the coast of Queensland, Australia (Figure 3), is the world's largest reef system comprising over 2,500 reefs covering an area of 348,700 km^2. It was proclaimed a World Heritage Area (WHA) in 1981, and at that date was believed to comprise an ecosystem of over 1,500 species of fish, around 400 species of coral, 4,000

species of mollusc, 242 species of birds plus a great variety of sponges, anemones etc., and also provides feeding and/or nesting grounds for the endangered dugong and two endangered species of marine turtle (UNESCO World Heritage Convention).

FIGURE 3 TO BE INSERTED HERE

Figure 3 The study region

2.2 Questionnaire development and data collection

The surveys used for this study were developed after a literature review and pre-tested amongst colleagues, in workshops and in a pilot study, with questions being refined at each stage before the survey was finalised and formal data collection commenced. Surveys were translated into Japanese and Chinese in addition to the original version in English, to avoid bias in the results towards anglo-saxon origin visitors. These languages were chosen as research on international visitors to the GBR catchment region has found the most frequent countries of orgin were UK, China and Japan (Tourism Research Australia, 2013). Since many European visitors speak English, we estimate that our surveys were thus readily understandable to at least 90% of tourists in this region (Stoeckl, Farr, & Sakata, 2013).

Tourist surveys were gathered from 59 different locations along the Queensland coastline adjacent to the GBR from the Daintree in the North, through to Agness Waters at the southern end of the reef at regular periods over a 12 month period (to control for seasonality) between July 2012 and June 2013. Survey locations included a variety of airport departure terminals, ferry ports, beaches and lagoon areas and caravan parks; additionally, some surveys were distributed through tourism operators rather than tourists being approached directly by researchers. Locations were selected reflecting the distribution of tourists across the region, concentrating data collection efforts on the most visited areas, whilst the independent tourism operations were selected using a random stratified sampling process from the population of tourism operators between Cooktown and Gladstone. The GBR region offers a wide diversity of accommodation types, from back-packer hostels to high end resorts, at each location (particularly in the most highly visited Cairns/Port Douglas and Airlie Beach areas). Thus, our sample of tourists includes those staying in both low and high end accommodations, all of whom would have experienced the same economic and environmental features of the location in which they were staying.

212 The GBR region is currently visited by a mix of new and repeat tourists, this was reflected in
213 our sample with 57% of the 1,428 tourists surveyed being first time visitors. More than half
214 of the respondents were female (55%), the average age was 38, and a fairly similar proportion
215 of respondents were married or in legal partnership (51%) or were single (49%). Almost half
216 of the visitors were from Australia (48%).

217 Visitors who stayed within the GBR region for more than 14 days were excluded from the
218 analysis, because we specifically sought to link the characteristics of the particular area being
219 visited (at a particular time – e.g. the amount of rain during the visit) with overall satisfaction.
220 Those staying for more than 14 days were likely to have visited several locations along the
221 coast, making such analysis impractical.

222 2.3 Variables and methods used to determine whether trip satisfaction
223 influences the likelihood of repeat visits to the GBR region

224 Our first research question sought to identify factors – other than trip satisfaction – that were
225 associated with repeat visitation. Formally, we hypothesised that the:

226 $$\text{Likelihood of returning} = f\,(\text{trip satisfaction, other factors})$$

227 Data relating to the dependent variable (likelihood of returning) were collected from a
228 question that asked respondents to indicate the likelihood that they would return to the region
229 using a 5 point Likert scale from "will definitely not return" to "will definitely return"; the
230 frequencies of responses to this question are shown in Table 2.

231 This research thus adopts the ex-ante approach to assessing the likelihood of returning, based
232 on future behavioural intentions regarding the likelihood of the tourist revisiting the region
233 (Chen & Tsai, 2007; Hui et al., 2007; Kozak & Rimmington, 2000)[2]. Importantly, we did not
234 ask respondents to indicate which part of the region they would return to; instead they were
235 presented with a map (with inland catchment region matching that shown in figure 3), and
236 they were asked their likelihood of returning to anywhere within that area. As such we are
237 able to determine whether people who visited (and were interviewed) at different locations
238 have a higher/lower stated propensity to return, but we cannot determine where within the

[2] An alternate ex-post methodology is also common in the literature, whereby researchers use the number of times a respondent has visited the location previously as the dependent variable, and identifying factors associated with it (Assaf, Pestana Barros, & Machado, 2013; Ledesma, Navarro, & Perez-Rodriguez, 2005; Randriamboarison, Rasoamanajara, & Solonandrasana, 2013). The ex-post approach has not been used for this study but could be considered for future research.

GBR catchment, the planned repeat visits might occur. That stands as an important issue for future research.

The model has a categorical dependent variable. Studies investigating the likelihood of tourists revisiting an attraction or region have used a range of techniques, some suitable for categorical or ordinal dependent variables (Alegre & Cladera, 2006; Alegre & Garau, 2010; Ledesma et al., 2005) and others more appropriate for continuous data models. However, there has been considerable debate in the literature as to whether techniques designed for use with continuous data can also be used with ordinal Likert scale data; for example the psychology profession has accepted the use of techniques such as ordinary least squares (OLS) regression. Many economists have preferred to use ordinal techniques such as ordered Probit regression (Ferrer-i-Carbonell & Frijters, 2004), although OLS techniques have sometimes been used in micro level studies focusing on responses of individuals and generally used in macro level research (using cross-section or panel data) where the responses for many individuals in a region or country are aggregated to give average satisfaction levels (Engelbrecht, 2009; Rehdanz & Maddison, 2005; Vemuri & Costanza, 2006). The differences resulting from using either ordinal or continuous data techniques has been empirically tested by comparing the results obtained from using each method. The overwhelming conclusion from these studies is that the choice of technique is more important in theory than in practice, empirical evidence demonstrating that very similar results are obtained from using either continuous or ordinal regression methods (Ferrer-i-Carbonell & Frijters, 2004; Helliwell, 2003; MacKerron & Mourato, 2009).

In this study, as the dependent variable, the likelihood of returning, is an ordinal variable we have used the ordinal regression technique, using a complementary log-log linking function (appropriate when there are more responses in the higher categories than the lower – see Table 2). Following the lead of other tourism researchers (Hui et al., 2007; Kozak, 2001; Yuksel, 2001), we also used OLS regression, allowing us to compare results and make a methodological contribution to the literature on the appropriate use of these techniques.

As regards the independent variables, we firstly used the literature review to identify variables which previous researchers have found to be associated with repeat visitation (see Table 1 for a summary). The final set of variables (shown in Table 2) was obtained after a series of estimations starting with a specification that included all potential variables and gradually dropping insignificant ones. Careful consideration was given to variables which

are likely to affect both satisfaction with the current trip and the likelihood of returning. For variables whose main impact on repeat visits is likely to be indirect via the effect on trip satisfaction, efforts were made to recognise these variables within the trip satisfaction model rather than within the likelihood of returning model (since that includes trip satisfaction and thus captures these effects).

Table 2 Summary of variables used within likelihood of returning model

	%
Likelihood of returning	
The likelihood of returning reported by the tourist on a 5 point Likert scale	
Will definitely not return	1.3
Unlikely to return	3.7
Neutral	18.3
Likely to return	33.0
Will definitely return	43.7
Overall trip satisfaction	
The tourist's level of satisfaction with their experience as a whole on the trip, reported using a 5 point Likert scale	
Very unsatisfied	.8
Unsatisfied	1.5
Neutral	12.5
Satisfied	40.1
Very satisfied	45.0
Number of previous visits	
Tourist's number of previous visits to GBRWHA indicated by selecting from 5 different grouping	
First visit	57.3
One previous visit	8.8
2 - 4 previous visits	17.1
5 - 10 previous visits	8.5
More than 10 previous visits	8.3
Continent of origin	
Originates from Europe	21.2
Originates from North America	7.1
Originates from Asia	19.1
Sample size: n = 1,428	

2.4 Variables and methods used to determine what factors influence the trip satisfaction experienced by tourists visiting the GBR

Our second research question set out to identify factors influencing trip satisfaction. Formally, we thus set out to parameterise the following model:

Trip satisfaction = f (factors relating to the specific tourist and their specific trip, climate, factors relating to society, the economy and the environment)

Data relating to the dependent variable (trip satisfaction) were collected from a question that asked respondents to indicate their level of satisfaction with their experience as a whole on this trip, reported using a 5 point Likert scale. This is the same variable that is used as an explanatory factor within the likelihood of returning discussed above.

This study thus adopts the performance approach whereby factors explaining tourist trip satisfaction relate entirely to the actual experiences and perceptions of the tourist on the trip, rather than the disconfirmation approach whereby tourist expectations, and the degree to which these were met, are evaluated to explain overall trip satisfaction. Whilst many tourism satisfaction studies (for example Shahrivar, 2012) have focused on expectations, a body of literature has suggested that the performance approach (i.e. ignoring prior expectations and focusing instead on actual perceptions of satisfaction with the tourism experience) is a valid and probably better alternative to the expectations based approach. Empirical research has demonstrated the performance approach to better explain tourist trip satisfaction (Baker & Crompton, 2000; Hui et al., 2007); suggested reasons for this include that even a poor visit experience may be reported as meeting expectations if the level of expectation were low (Assaker et al., 2011; Fuchs & Weiermair, 2003) and expectations may be updated as the holiday progresses resulting in difficulties distinguishing between initial expectations and actual satisfaction with their experiences (Kozak & Rimmington, 2000). The performance approach also accords with general SWB research, based on the respondent's current life satisfaction and circumstances rather than the respondent's expectations.

Like the likelihood of returning model, this model also has a categorical dependent variable. Here too, we choose to estimate the model using ordinal regression (with a complementary log-log linking function because of the higher number of satisfied / very satisfied responses) and also OLS regression enabling comparisons between the two approaches.

As regards the independent variables, we firstly consulted literature relating to both tourist satisfaction and overall life satisfaction to identify variables likely to be significant (see Table 1). These can be broadly categorised into those describing the tourist and their trip plus those associated with society, the economy, and the environment.

We thus included variables capturing several socio-demographic factors (e.g. age, marital status) and factors relating specifically to the trip (e.g. cost of trip, length of trip, whether or not the visitor had been to the reef whilst in the area). Some variables which previous researchers have found to influence SWB could not, however, be included within this study;

315 for example, tourists were not asked any questions regarding their
316 employment/unemployment status, or the state of their health. The omission of these factors
317 is acknowledged as a limitation to this research.

318 Objective data relating to social factors were considered but not used. This is because all
319 tourists were visiting an admittedly large region (GBRWHA) – but a relatively homogenous
320 one since it is part of a single state in a single country. As such, we expected little variation
321 in the actual social capital levels across the different tourist locations. However, tourists
322 often perceive locations differently based on their own personal characteristics (including
323 their views on social capital in Australia compared to their home location). Consequently,
324 tourist perceptions of social factors are likely to be relevant to trip satisfaction. Data for this
325 variable were collected in a question that asked respondents how safe they felt whilst visiting
326 the region, by indicating how much they agreed or disagreed with the statement: "if I lost my
327 wallet/purse somewhere in the town I am now visiting, I would get it back with all the money
328 and cards still in it." The perceived likelihood of a lost wallet being returned has been used
329 in a number of life satisfaction studies as a measure of social capital, representing a proxy for
330 the level of trust in society (Helliwell & Wang, 2011). It has been found to have a significant
331 impact on life satisfaction; hence our decision to test its impact on tourist satisfaction[3].

332 Data representing economic activity were obtained from the Australian Bureau of Statistics
333 (ABS); it was determined that a suitable proxy to represent the varying levels of development
334 across the GBRWHA would be the intensity of construction work being undertaken within
335 the different statistical regions visited by the tourists, measured by the percentage of the
336 workforce employed in the construction industry. The use of this variable was selected after
337 considering and testing a range of other measures, including the percentage of the workforce
338 employed within agriculture, percentage of workforce employed within mining, and
339 percentage of land area used for mining. The search for suitable variables focused on those
340 relating to the mining, minerals processing and agricultural industries, as mining and minerals
341 processing are the largest industries within the region by value of production (PDP Australia

[3] Researchers have also compared perceptions about the chances of a wallet being returned to actual rates of return using a real experiment (Helliwell & Wang, 2011). They found that perceptions underestimated trustworthiness. Studies comparing expectations about becoming a victim of crime with actual crime rates have found a similar underestimation of social capital (van Dijk, Kesteren & Smit, 2007). These observations accord with findings from our data. We compared responses to our 'trust' question with actual crime statistics for 2012-2013 for each of the local government areas where the tourists visited; no statistical relationship was found between the actual levels of recorded crime and either the tourist's perceptions that their wallet would be returned, or the tourist's level of satisfaction with their trip.

342 Pty Ltd, 2003), whilst mining and agriculture dominate the exports of the region (Great
343 Barrier Reef Marine Park Authority, 2014). The region has seen, and continues to see, huge
344 construction projects including the development of new mines, expansion of existing mines,
345 development of extensive minerals processing plants (such as the LNG processing plant at
346 Curtis Island, off Gladstone), along with extensive development of associated infrastructure
347 (such as the expansion of the coal terminals at Gladstone Harbour, Hay Point and Abbott
348 Point, already amongst the world's largest coal ports). Given the large scale of these projects
349 and their dominance of industrial activity within the region, the number of people employed
350 in construction was considered to be a suitable proxy for economic activity within the region.
351 Objective data of this type has not been used to represent the level of development in specific
352 regions in previous research as far as we are aware, and thus is an innovative contribution to
353 this field of study.

354 Objective data on various climate variables suggested by previous research (see Table 1),
355 including maximum or minimum temperatures, hours of sunshine, rainfall and wind speed,
356 were obtained from the Australian Bureau of Meteorology (BOM), using daily data from the
357 measuring stations located closest to where each of the tourist's survey responses were
358 obtained. Thus a precise measure of the weather experienced by each tourist was obtained,
359 for the specific days of their visit at the actual location where they stayed. This precise
360 matching of objective climate condition measures to tourist visit has not been included within
361 previous research as far as we are aware.

362 Other environmental factors are expected to be important to tourists visiting the GBRWHA
363 as intuitively it seems likely that the quality of the environment itself (in the form of the reef,
364 the lagoon, beaches and islands), and the opportunity to enjoy and experience environmental
365 features (through activities such as swimming, diving, spending time on the beach etc.), is an
366 important reason why this location was chosen. This intuition is supported by the survey
367 responses gathered for this study; visitors were asked how important a number of different
368 factors were to them when they chose their holiday, the most important factors were the
369 importance of clear oceans, healthy coral reefs, healthy reef fish and lack of rubbish (Stoeckl
370 et al., 2013). Interestingly, many factors traditionally considered to be important within the
371 tourism literature were not considered to be so by a large proportion of tourists to the region;
372 the environmental factors were considered much more important than factors such as the
373 availability of good quality accommodation, shops and restaurants and that the price of the
374 holiday matched their budget (Stoeckl et al., 2013). The findings for the visitors to the GBR

are supported by other studies of nature or environment based tourism; for example the importance of good underwater visibility (Ziegler, Dearden, & Rollins, 2012).

Based on this, measures of the clarity of the ocean and the health of the coral reef and the reef fish would appear to be important when researching factors influencing the satisfaction of visitors to the region, and are also likely to be an important (indirect) factor influencing the likelihood of the tourist returning. Water turbidity, referred to as "the cloudy appearance of water caused by fine suspended particles (Fabricius, De'ath, Humphrey, Zagorskis, & Schaffelke, 2013, p. 57) is important of its own right as indicated by the preference of tourists for clear ocean waters, and is also an important factor within coastal marine systems impacting on both coral reef and seagrass ecosystems. Poor water quality, including the effects of land-based pollutants such as suspended solids, nutrients and pesticides contained within river runoff, is a major contributor to factors such as Crown of Thorns Starfish (COTS) outbreaks, storms, coral bleaching and disease (Kroon et al., 2012), particularly contributing to COTS outbreaks and to disease (Waterhouse, Brodie, Lewis, & Mitchell, 2012), all of which are believed to adversely affect the health of coral reefs (Brodie & Waterhouse, 2012; Osborne, Dolman, Burgess, & Johns, 2011; Sweatman, Delean, & Syms, 2011). Thus a variable representing water turbidity can also act as a proxy for the health of the reef due to the complex direct and indirect impacts that turbidity has on the coral. By including such a variable within our factors explaining trip satisfaction we are also reflecting the indirect impact that these variables have on the likelihood of returning, as trip satisfaction is an important variable explaining variations in the likelihood of a tourist returning to the region.

Measures of water turbidity within the lagoon itself and measures of sediment and pollutant loads within the rivers discharging into the lagoon were considered for inclusion within this study as water turbidity has been demonstrated to be strongly effected by terrestrial runoff and rainfall (which are themselves related) (Fabricius et al., 2013). However, water turbidity is influenced by rainfall and other climatic variables, so to include both water turbidity and climate as independent variables would be to introduce endogeneity into the model. To control for this, a two-step regression model (instrumental variable approach) was adopted.

To be more specific, we firstly used OLS to model the relationship between water turbidity and other climatic variables (described in Table 3). The predicted values from this model were retained, and used as regressors within the trip satisfaction model, which was estimated

using ordinal regression, recognising the ordinal nature of the dependent variable. Thus, trip satisfaction was modelled using a two stage regression process.

Table 3 Variables used in the overall trip satisfaction model - step 1

Variable	Description	Mean	Std. Dev.	Skew	Kurtosis
Dependent Variables					
Natural log of water turbidity data from AIMS	Data obtained from the Australian Institute of Marine Science (AIMS) who conducted water quality monitoring in the inshore lagoon at 14 fixed coral reef locations. Monitoring included measurements of water turbidity, measured by nephelometers detecting the scattered light from a red (700 nm) LED at 140 degrees to a detector every 10 minutes (Schaffelke et al., 2010). Daily water turbidity data, measured in nephelometric turbidity units (NTU), was compiled by AIMS from these readings for each of the 14 locations. The data was then matched to the specific dates of each tourist's visit at the location closest to where the tourist was staying to determine the water quality experienced by each tourist. The natural log of water turbidity was then calculated.	0.38	0.86	0.88	0.20
Instrumental Variables					
Average daily rainfall during trip	Obtained from BOM website, defined as all forms of water particles that fall from clouds and reach the ground. The rain gauge is the standard instrument for recording rainfall in millimetres, generally observed daily at 9 am local time, thus measuring the total rainfall that has been received over the previous 24 hours.	2. 55	5.07	2.51	5.85
TSS kilotonnes/annum in river	Best estimates of current mean tonnes per annum of TSS in each of 35 river basins discharging into the GBR lagoon had been compiled by researchers combining information from a number of sources and studies over the period 1983 to 2009 (Kroon et al., 2012) for each of the river basins. From this information, levels were identified for each of tourist survey locations by selecting the data for the river mouth closest to the location where the tourist was staying.	312.20	670.18	4. 27	16.90

Sample size: n =641

The final set of variables explaining variations in overall trip satisfaction, shown in Table 4 was obtained after a series of estimations; starting from a specification including all potential variables within one equation. Insignificant variables were gradually dropped.

414 **Table 4 Variables used in the overall trip satisfaction model – step 2**

Variable	Description	Mean	Std. Dev.	Skew	Kurtosis
Dependent Variables					
Overall trip satisfaction	The tourist's level of satisfaction with their experience as a whole on this trip, reported using a 5 point Likert scale from "very unsatisfied" (-2) to "very satisfied" (+2)	1.30	0.75	a	a
Explanatory Variables					
Midpoint income divided by equivalence factor	Tourists were asked the question "On average, how much pre-tax income does your household (you and everyone you live with) earn each year?" Respondents selected the appropriate category from a list; the midpoint of each category was used for the study. The household income was converted to individual income using the modified OECD scale adopted by the ABS (Australian Bureau of Statistics, 2010).	58,873.76	36,787.52	0.66	0.22
Construction intensity by place of work in SA2 region	Obtained from the ABS website detailing the industry sector within which each member of the workforce was employed, coded by the statistical region where the employee actually worked (as opposed to their normal place of residence) using 2011 census data by Statistical Area 2 regions	7.23	2.86	0.29	0.69
Unstandardized predicted value LnTurbidity on TSS, Rainfall	Predicted values of natural log of water turbidity derived from first step of modelling process	0.38	0.52	1.96	3.12
Spent 0 or 1 night in GBR - Just arrived	Dummy variable = 0 if tourist had just arrived in the GBRWHA, having spent 1 night or less in the region, 1 if tourist spent more than 1 night in region	0.85	0.36	a	a
Believe would get lost wallet and contents back	The tourist response to the question "To help us gauge how 'safe' you have felt whilst here, please tell us how much you agree or disagree with the following statement: if I lost my wallet/purse somewhere in the town I am now visiting, I would get it back with all the money and cards still in it." were reported using a 5 point Likert scale ranging from strongly agree to strongly disagree, responses were coded as a dummy variable with a value of 1 for those agreeing and a value of 0 for those who were neutral or disagreed.	0.35	0.48	a	a
Did visit offshore reefs	Dummy variable = 1 if tourist did visit the offshore reefs at least once	0.61	0.49	a	a

415 Sample size: n = 641; a: skew and kurtosis are not relevant for categorical data; frequency table is included
416 within Table 8 Appendices 5.1.

2.5 Variables and methods used to value the impact on tourist revenues from reduced likelihood of returning resulting from changes to factors influencing trip satisfaction

Our final research question sought to use coefficients from the models above to assess the likely financial impact (in terms of changed tourism revenues) of changes in social, economic, or environmental variables in the GBR region.

In simple terms, the coefficients of the trip satisfaction model were first used to evaluate the impact on trip satisfaction that result from a change in construction intensity, water turbidity or the tourists perception that a lost wallet would be returned. This calculated change to trip satisfaction was then used within the likelihood of returning model to determine the impact on the likelihood that the tourist will return resulting from that initial change to construction intensity, water turbidity or perception that the lost wallet would be returned. Using secondary data to obtain a value for each repeat visitor, we were then able to estimate the income to the region that would be lost due to that reduced number of repeat visitors.

A complication resulting from using ordinal regression methods is that the coefficients cannot be easily interpreted, unlike when working with OLS models. With OLS, the coefficient can easily be interpreted as showing the amount the dependent variable would change as a result of a one unit change in the explanatory variable. However, with ordinal regression techniques this is not the case; rather the coefficients can be used to derive the probability that the response to the dependent variable will fall into each of the possible categories available. The calculation of probabilities depends on the cumulative link model used, as the cumulative link model is the function linking the conditional cumulative probabilities; for the complementary log-log linking function used here this is specified as $\log(-\log(1 - \gamma_{i,k}))$. This formula can be transformed to derive the probability of the dependent variable adopting each potential value, resulting in an equation as follows:

> Probability of particular trip satisfaction level = 1 – exp (- exp (coefficient of predictor variable under consideration)

Specifically, the approach adopted here was to use the transformed linking equation to determine the number of visitors changing from being satisfied to neutral or dissatisfied that would result from a number of specified scenarios, such as a 10% increase in water turbidity (scenarios are discussed in detail in 3.3 with the presentation of results). This reduced

number of satisfied visitors is then applied to the likelihood of returning model, again using the transformed complementary log-log linking function equation, to estimate the reduced probability of the tourist repeating the visit.

3 Results and discussion

3.1 Likelihood of returning

As discussed above, ordinal regression using a complementary log-log linking function was used to estimate the relationship between the likelihood of a tourist returning and the factors impacting on this. The ordinal regression parameter estimates from our first model are provided in Table 5. As expected from the literature, our OLS regressions (results available on request) produced very similar results with regard to significant variables and the direction of impact on the dependent variable.

Table 5 Results of likelihood of returning model using ordinal regression

	Coefficients	Standard error	Significance
Dependent variable			
Likelihood of returning			
Will definitely not return	-3.886	.391	***
Unlikely to return	-2.478	.334	***
Neutral	-.755	.317	**
Likely to return	.527	.316	*
Will definitely return	Reference group		
Independent variables:			
Overall trip satisfaction			
Very unsatisfied	-1.083	.371	***
Unsatisfied	-1.474	.252	***
Neutral	-1.253	.113	***
Satisfied	-.651	.082	***
Very satisfied	Reference group		
Number of previous visits			
First visit	-.999	.188	***
One previous visit	-.714	.217	***
2 - 4 previous visits	-.602	.198	***
5 - 10 previous visits	-.090	.243	
More than 10 previous visits	Reference group		
Continent of origin			
Doesn't originate from Europe	.558	.100	***
Originates from Europe	Reference group		
Doesn't originate from North America	.830	.140	***
Originates from North America	Reference group		
Doesn't originate from Asia	.904	.105	***
Originates from Asia	Reference group		

*** Significant at 0.01 level ** Significant at 0.05 level * Significant at 0.1 level Observations 1,428 PseudoR^2 .229 (Cox and Snell), .251 (Nagelkerke) Model $\chi 2$ (11) 371.540, $p<.001$

Evidently, tourists are more likely to return to the region if they have reported a high degree of satisfaction on this trip or if they have previously visited the region, whilst they are less likely to return if they are from Europe, Asia or North America. These findings are in accordance with previous studies which found trip satisfaction to be an important factor in explaining the likelihood of a tourist returning (including Alegre & Cladera, 2006; Chen & Tsai, 2007; Kozak, 2001; Yoon & Uysal, 2005) including studies focusing specifically on the GBR (Moscardo et al., 2004; Saltzer, 2002b). Additionally, these findings also accord with

previous research which found that those who have previously visited a region are more likely to return (for example Alegre & Cladera, 2006; Assaker & Hallak, 2012; Kozak, 2001; Yuksel, 2001) and that the country of origin can significantly impact on whether a tourist is likely to return or not (Assaker & Hallak, 2012; Hui et al., 2007; Saltzer, 2002b).

3.2 Trip satisfaction

Our water turbidity regression results are presented in bottom half of Table 6; the trip satisfaction results (which use the predicted values of water turbidity) are in the top half. As previously, we found that our OLS model results (available on request) were very similar.

Table 6 Results of two-stage trip satisfaction model

	Coefficients	Standard error	Significance
Second stage – ordinal regression			
Dependent variable			
Overall trip satisfaction			
Very unsatisfied	-7.300	1.018	***
Unsatisfied	-4.805	.347	***
Neutral	-2.787	.220	***
Satisfied	-.959	.192	***
Very satisfied	Reference group		
Independent variables:			
Midpoint income divided by equivalence factor	4.712E-006	1.577E-006	***
Construction intensity by place of work in SA2 region	-.055	.020	***
Unstandardized predicted value LnTurbidity on TSS, Rainfall	-.457	.098	***
Just arrived in region			
Spent 0 or 1 night in GBR - Just arrived	-.651	.139	***
Spent more than 1 night in GBR - Been in region a while	Reference group	.	
Perception that lost wallet would be returned			
Neutral or don't believe would get lost wallet and contents back	-.347	.120	***
Believe would get lost wallet and contents back	Reference group	.	
Visited reef			
Didn't visit offshore reefs	-.274	.115	**
Did visit offshore reefs	Reference group	.	
Observations	641		
Pseudo R^2	.100 (Cox and Snell), .114 (Nagelkerke)		
Model $\chi 2$ (7)	67.598, p<.001		
First stage – OLS regression			
Dependent variable	LnWaterTurbidity		
Excluded instruments:			
TSS kilotonnes/annum in river	.000	.000	***
Average daily rainfall during trip	.092	.006	***
Included instruments	Yes		
Observations	641		
Adjusted R^2	.355		

*** Significant at 0.01 level ** Significant at 0.05 level * Significant at 0.1 level

This model shows that trip satisfaction is positively associated with income, perceptions of personal safety, length of stay in the region or a visit to the reef. Trip satisfaction was negatively associated with construction intensity and water turbidity.

The finding that higher income tourists are more satisfied confirms previous tourism research (Shahrivar, 2012); this may reflect that the better off tourists are able to benefit from high end accomodation, entertainment and trips. This finding is also in accordance with SWB research where those with higher incomes are generally happier with life overall (for example Di Tella, MacCulloch, & Oswald, 2003; Ferrer-i-Carbonell & Frijters, 2004; Frey & Stutzer, 1999; Welsch, 2007b).

The positive relationship between perceptions that a lost wallet would be returned and increased trip satisfaction corroborates previous findings that tourists don't wish to visit locations perceived to have high crime levels or be dangerous (Demos, 1992; Handszuh, 2006; Tarlow, 2006) and accords with research that life satisfaction is related to perceptions of crime and personal safety (Michalos & Zumbo, 2000) and to trust in others and trust in society (Engelbrecht, 2009; Helliwell, 2003; Helliwell & Wang, 2011; MacKerron & Mourato, 2009; Stanca, 2009).

The finding that a higher intensity of construction work contributes to a lower level of tourist satisfaction is in accordance with previous research indicating that tourists were dissatisfied by overdevelopment and congestion including too much building development, noise and congestion (Alegre & Garau, 2010).

The finding that lower levels of water turbidity enhance tourist satisfaction, combined with tourists who have visited the reef reporting higher trip satisfaction, confirms our initial hypothesis that tourists prefer clear water and a healthy reef. This finding is in accordance with research demonstrating the importance of environmental quality to tourist satisfaction (Alegre & Garau, 2010, 2011; Brau & Cao, 2008; Hernández & León, 2007), that tourist satisfaction of visitors to the GBR specifically is highly impacted by the quality of the coral and the level of marine bio-diversity (Coghlan, 2012), and that higher levels of SWB result when there are high quality environmental amenities (Ambrey & Fleming, 2011; Brereton, Clinch, & Ferreira, 2008) or low levels of pollution (Levinson, 2012; MacKerron & Mourato, 2009; van Praag & Baarsma, 2005; Welsch, 2006).

Finally, the significance of the variable indicating lower satisfaction from tourists who have just arrived in the region is in accordance with previous tourism research that has found higher satisfaction levels to be reported by tourists making longer stays (Shahrivar, 2012).

3.3 Valuation of the impact on tourist revenues resulting from changes to economic, social and environmental factors via their impact on overall trip satisfaction and ensuing impact on the likelihood of the tourist returning

Coefficients from the ordinal regression models associated with trip satisfaction were used to make predictions about the likely impact on satisfaction from a change in each of the 'core' variables (perceptions of 'crime', construction activity, and water turbidity) representing factors associated with the social, economic and environmental domains. These estimates were then used in conjunction with the coefficients relating to the likelihood of a tourist returning, to make predictions about the way in which social, economic, or environmental changes might affect repeat visitation. A more detailed explanation of the calculation process for each of the triple bottom line factors is given below.

Calculations show that a small adverse change in each of these variables (increase in water turbidity or construction intensity, decreased perception that lost wallet would be returned) has a small adverse impact on the likelihood of a tourist returning to the region, and may appear to be too small to give concern regarding future visitor numbers within the region. However, when considered in the context of the potential scale by which these factors could change, combined with the number of tourists visiting the GBRWHA each year and the revenue generated for the region by repeat tourist visits, the resulting impact on the economy from changes to any of the triple bottom line factors could be significant.

A recent report for the year 2011/2012 identified that there were almost 35 million visitor nights, including international and domestic visitors, spent within the GBRWHA, with an average daily expenditure of $155.65 (Deloitte Access Economics, 2013). Based on the data from our survey responses, 42.7% of visitors have been to the region before (see Table 8). Applying this percentage of repeat visits to the total number of visitor nights in the region and the average spend per visitor implies a total spend by repeat visitors to the region, per year, of approximately $2.3bn. Thus, if the proportion of visitors saying they were likely to return should reduce, by 10% for example, then the revenue earned in the region would reduce by 10% of $2.3bn, that is $230m, per annum. The models developed to explain trip satisfaction and the likelihood of returning can be used to estimate the reduction in repeat visitors in different scenarios, and hence the reduction in annual revenues. Each of the explanatory variables representing the triple bottom line will be considered in turn, explaining the

processes adopted and results obtained; the processes were different in each case due to differences in the type of explanatory variable.

Firstly, the tourist's perception that a lost wallet would be returned; this is a dummy variable rather than being of a continuous nature, that is the tourist either believes the wallet will be returned or that it will not be returned with no-other response possible. The probabilities of the tourist trip satisfaction response being within each categories, from very unsatisfied to very satisfied, were calculated with the current proportion of respondents expecting their wallet to be returned (34.8% as in Table 8). The proportions for each category were then recalculated should every tourist perceive their wallet would not be returned, that is a 100% reduction from current levels. The changes in proportions of satisfied responses were then applied to the likelihood of returning model, estimating from this the reduction in the proportion of tourists that would revisit if all had perceived their wallet would not be returned. This analysis showed that the 100% reduction in the number of current tourists expecting their wallet back would reduce the likelihood of a repeat visit by 0.13%. Applying this proportionate reduction to the $2.3bn annual revenue received from repeat visitors, described above, tourism revenue in the region would fall by $3m. Whilst it is overly pessimistic to assume all tourists currently expecting their wallet to be returned may change their views, it is reasonable to consider what could happen should the perceptions of a proportion of these change; hence the scenario results shown in Table 7 demonstrate the outcome should the proportion of those expecting their wallet to be returned fall by 10%.

Considering the construction intensity variable, this is a continuous variable and therefore the method adopted to value a change in this is a little different to that for the perception that a lost wallet would be returned. For this variable, the trip satisfaction model was used to estimate the change in the proportion of tourist providing each satisfaction response should the mean construction intensity across the region change by a specified amount. These changes in proportions were then applied to the likelihood of returning model to calculate the reduction in repeat visitors consequent to that change; the value of this reduction in repeat visitors could then be calculated. The reductions in annual tourist revenue in the region estimated to result from the possible scenario of a 10% increase in construction intensity across the region is shown in Table 7. Construction intensity for this sample on average is 7.23% (as shown in Table 4); this average encompasses a range from a minimum of 2.10% in Cairns City to a maximum of 18.77% at Callemondah, near Gladstone. The GBR region includes some districts where construction comprises an even larger proportion of

577 employment by place of work, such as the region of Shoal Point – Bucasia near Mackay at
578 23.88% or Bohle Plains near Townsville at 33.47%. Given the degree of construction
579 intensity in some locations across the GBRWHA, a scenario showing a 10% increase does
580 not appear to be overdramatizing the potential scale of change to this variable.

581 For the water turbidity variable, a similar approach was followed as for the construction
582 intensity variable as water turbidity is also a continuous variable. However, the model uses
583 the natural log of water turbidity; the use of logs means this is not a particularly meaningful
584 measure to discuss within scenario analysis hence the calculation was extended to calculate
585 the impact of changes on absolute, rather than logged, water turbidity, also shown in Table 7.

586 This impact assessment technique can also be considered from the reverse point of view.
587 Instead of calculating the cost in terms of potentially lost tourist revenue resulting from a
588 worsening of economic, social or environmental factors, the technique can also be used to
589 calculate the benefit in terms of increased tourist revenue that could result from
590 improvements to these factors. These benefits may be sufficient to cover costs incurred in
591 making the improvement, and may in fact be able to demonstrate a net benefit to the region
592 from expenditure invested in making improvements to the region, thus encouraging
593 improvement projects to be undertaken. For example, biophysical scientists have
594 recommended that requiring land holders within the GBR catchment to transition to best
595 practice land management techniques could, over a period of time, reduce total suspended
596 sediment (TSS) in the rivers by 25%. Future advancements in farming practices and
597 technology could reduce TSS more effectively, resulting in reductions of 50%. Alternately,
598 farmers in certain catchments could be required to stop cane farming altogether, reducing
599 TSS in those rivers to pre-industrial levels over time, whilst other catchments could continue
600 at current levels. Table 7 provides the revenue benefits that could result from the adoption of
601 these possible policy initiatives.

602 **Table 7 The impact on tourist revenue resulting from various possible scenarios**

Change to particular factor	Scenario explaining change to factor	Policy decisions that could result in this change	Estimated impact on annual tourist revenue in GBRWHA
Negative scenarios			
Perception that a lost wallet would be returned reduces	10% decrease in the average perception of tourists visiting the region that a lost wallet would be returned	n/a	Reduction of $305,000
Construction intensity increases	10% increase in average proportion of workers in the region employed in the construction industry	n/a	Reduction of $392,000
Water turbidity increases (that is water clarity worsens)	10% increase in true (not logged) average water turbidity in the lagoon	n/a	Reduction of $430,000
Positive scenarios			
Total suspended solids (TSS) reduce in all rivers, consequently reducing water turbidity (that is water clarity improves)	25% reduction in TSS in each of the rivers flowing in to the GBR lagoon	Land holders across the GBR catchment area could be required to adopt strategies that would reduce the level of total suspended sediment	Increase of $89,000
Total suspended solids (TSS) reduce in all rivers, consequently reducing water turbidity (that is water clarity improves)	50% reduction in TSS in each of the rivers flowing in to the GBR lagoon	Land holders across the GBR catchment area could be required to adopt strategies that would reduce the level of total suspended sediment	Increase of $178,000
Total suspended solids (TSS) reduce in certain rivers only, consequently reducing water turbidity (that is water clarity improves)	Daintree and Russell-Mulgrave catchments reduce the TSS within those rivers back to the levels experienced before the arrival of European settlers, TSS loads in the other rivers maintained at current levels, thus reducing water turbidity in the GBR lagoon	Land holders in specific river catchments could be required to adopt aggressive strategies to reduce sediments whilst land holders in the remaining river catchments could be required to maintain loads at current levels.	Increase of $12,000

603

604 Ideally, for this estimation process, we would have used the trip satisfaction model developed
605 earlier in the research to predict the satisfaction levels for each of our survey respondents,
606 then included these predicted satisfaction data within the likelihood of returning model in
607 place of the actual satisfaction levels; thus fully recognising the nested nature of the models.
608 Unfortunately limitations in our data prevented this, as the predicted satisfaction responses
609 failed to show sufficient variation to allow the calculation of meaningful estimates of the
610 impact on the likelihood of tourists returning to the region. For future research we would
611 recommend that the survey questions regarding trip satisfaction and likelihood of returning
612 are posed with a wider range of possible responses than we used; use of a 7 or 9 point Likert

613 scale (as opposed to the 5 point scale adopted here) would give more variation in the
614 respondent's answers which should also result in a wider range of predicted responses to the
615 level of trip satisfaction. Better resolution in the data should enable the predicted satisfaction
616 responses to be used in the likelihood of returning model, better representing the nested
617 nature of these models. However, this limitation to this particular case study does not detract
618 from the potential usefulness of this technique in future studies focusing on many different
619 tourist locations around the world.

620 Prior research has identified the 'environmental paradox' of tourism, based on environmental
621 resources being one of the core ingredients for a tourism industry; tourism requires high
622 quality natural resources but tourism itself places stresses on those very resources that the
623 industry requires if it is to continue (Williams & Ponsford, 2009). Excluding the effect of
624 this paradox from the study introduces a risk that the effects of increased/decreased numbers
625 of visitors on the environment may also affect satisfaction and hence repeat visitation rates.
626 The omission of this interaction between visitor numbers and the environment from the
627 analysis is admitted as a limitation to this study, and could be usefully addressed in future
628 research. However, the authors feel that for this particular region, the impact of tourism itself
629 on the factors influencing trip satisfaction is likely to be small in comparison to the impact of
630 other industries. Indeed an analysis of threats to the health of the GBR has identified that the
631 major threat to water quality arises from the agriculture of the region and the main
632 construction work and coastal development results from mining, minerals processing and
633 related infrastructure development, particularly relating to ports (Great Barrier Reef Marine
634 Park Authority, 2014).

635 Evidently, increases (decreases) in perceptions of crime rate, in construction activity or in
636 water turbidity could generate a significant decrease (increase) in tourism revenues within the
637 GBRWHA. These findings have important policy implications for those concerned with
638 society, the economy or the environment of the region, as they demonstrates how different
639 industries directly and indirectly affect each other. The examples demonstrated here show
640 that a booming construction industry (perhaps supporting a booming mining and/or minerals
641 processing industry) can adversely impact the apparently unrelated tourism industry, whilst a
642 requirement to change agricultural practices to improve the environment could positively
643 enhance tourism despite tourism being an industry seemingly unrelated to agriculture. The
644 linkages between industries must be considered by those assessing development proposals to
645 ensure the future viability of all industries and the region as a whole.

4 Conclusion

This research investigated three important issues relating to: the factors influencing tourist satisfaction; the likelihood of tourists returning; and the potential regional economic impact from variations in tourist satisfaction that occur in response to social, environmental and economic changes. For example, the GBR case study reveals that tourist satisfaction in this region is influenced by increased perceptions of crime, increased construction activity or increased water turbidity. However, the methodology used in this case study can be transferrable to any other tourist location around the world.

A significant positive relationship was also found to exist between trip satisfaction and the likelihood of repeat visits in the GBR case. Based on this finding, it is apparent that tourism regions can increase the numbers of repeat visitors if tourist trip satisfaction can be increased. This clearly calls attention to the importance of research that improves understanding of these influencing factors.

Moreover, trip satisfaction was found to be affected by environmental, social and economic factors, in addition to income, whether they visited the Reef and whether they had just arrived in the region, as indicated in the GBR case. The importance of the economic, social and environmental factors indicates that tourist satisfaction is impacted by the actions of those outside of the tourism industry (such as the agriculture and construction industries in this case). It points out that important links exist between superficially unconnected industries; and these links must be taken into account when considering developments to other industries to ensure the future success of the tourism industry in attracting new and repeat visitors.

Furthermore, changes to perceptions of crime, construction and water turbidity could have a significant regional economic impact – because these factors affect tourist satisfaction which, in turn, affects the likelihood that tourists will return in future. Another important contribution from this research is that it enables the impact on annual tourist revenue resulting from changes to these factors to be quantified, enabling sophisticated cost-benefit analysis of different scenarios to be conducted as part of any policy development process. This approach has great potential to be used in the research areas where non-market evaluation technique is needed.

In conclusion for tourism to remain viable into the future, one requirement is for visitors to experience high levels of trip satisfaction, therefore having a greater likelihood of returning to

the region. Environmental, social and economic factors all have quantifiable impacts on the tourist's trip satisfaction and therefore their likelihood of revisiting, evidencing the complex interactions between industries. The successful development of the tourism industry cannot be achieved in isolation but requires a holistic view to be taken of the development of all industries across the region as a whole.

5 Appendices

5.1 Frequency tables for categorical variables used in models

Table 8 Frequencies for variables used within trip satisfaction model

	%
Overall trip satisfaction	
Very unsatisfied	.2
Unsatisfied	1.7
Neutral	11.1
Satisfied	42.0
Very satisfied	45.1
Just arrived in region	
Spent more than 1 night in GBR - Been in region a while	84.7
Spent 0 or 1 night in GBR - Just arrived	15.3
Perception that lost wallet would be returned	
Neutral or don't believe would get lost wallet and contents back	65.2
Believe would get lost wallet and contents back	34.8
Visited reef	
Didn't visit offshore reefs	38.8
Did visit offshore reefs	61.2

5.2 References used to compile the compendium of factors found in previous studies to influence the likelihood of returning, tourist trip satisfaction and overall trip satisfaction

Table 9 References used to compile Table 1

	Probability that a tourist will return	Tourist's overall trip satisfaction	Overall satisfaction with life
Age	(Assaf et al., 2013; Saltzer, 2002b)	(Alegre & Cladera, 2006; Shahrivar, 2012)	(Alesina, Di Tella, & MacCulloch, 2004; Brereton et al., 2008; Cuñado & de Gracia, 2013; Di Tella et al., 2003; Ferrer-i-Carbonell & Gowdy, 2007; Ferrer-i-Carbonell & Frijters, 2004; Frey & Stutzer, 1999, 2000, 2002; Helliwell, 2003; Michalos & Zumbo, 2000; Oswald, 1997; Stanca, 2009; van

	Probability that a tourist will return	Tourist's overall trip satisfaction	Overall satisfaction with life
			Praag & Baarsma, 2005; Welsch, 2007b; Winkelmann & Winkelmann, 1998)
Gender	(Assaf et al., 2013)	(Saltzer, 2002a)	(Alesina et al., 2004; Brereton et al., 2008; Di Tella et al., 2003; Ferrer-i-Carbonell & Gowdy, 2007; Frey & Stutzer, 1999; Michalos & Zumbo, 2000; Stanca, 2009; Welsch, 2007b)
Education level	(Assaf et al., 2013)	(Shahrivar, 2012)	Relationship found by (Abdallah, Thompson, & Marks, 2008; Alesina et al., 2004; Arifwidodo & Perera, 2011; Brereton et al., 2008; Cuñado & de Gracia, 2013; Di Tella et al., 2003; Ferrer-i-Carbonell & Gowdy, 2007; Frey & Stutzer, 2000, 2002; Helliwell, 2003; Stanca, 2009; Welsch, 2007b). Finding that may be indirect via effect on income rather than direct found by (Diener et al., 1999)
Marital status	(Assaf et al., 2013; Randriamboarison et al., 2013)		(Alesina et al., 2004; Arifwidodo & Perera, 2011; Cuñado & de Gracia, 2013; Di Tella et al., 2003; Diener et al., 1999; Ferrer-i-Carbonell & Gowdy, 2007; Ferrer-i-Carbonell & Frijters, 2004; Frey & Stutzer, 1999, 2000, 2002; Helliwell, 2003; Michalos & Zumbo, 2000; Stanca, 2009; Welsch, 2007b; Winkelmann & Winkelmann, 1998)
Country of origin	(Assaf et al., 2013; Assaker & Hallak, 2012; Hui et al., 2007; Saltzer, 2002b)	(Alegre & Cladera, 2006; Hui et al., 2007; McElroy & Parry, 2010; Saltzer, 2002a; Shahrivar, 2012)	Country specific characteristics found by (Welsch, 2006, 2007b). Difference between being national or foreigner found by (Frey & Stutzer, 1999, 2000, 2002)
Income	(Assaker & Hallak, 2012)	(Shahrivar, 2012)	Higher income effect found by (Abdallah et al., 2008; Brereton et al., 2008; Cuñado & de Gracia, 2013; Di Tella et al., 2003; Diener et al., 1999; Easterlin, 2001; Engelbrecht, 2009; Ferrer-i-Carbonell & Gowdy, 2007; Ferrer-i-Carbonell & Frijters, 2004; Frey & Stutzer, 1999, 2000, 2002; Helliwell, 2003; MacKerron & Mourato, 2009; Michalos & Zumbo, 2000; Rehdanz & Maddison, 2005; Stanca, 2009; van Praag & Baarsma, 2005; Welsch, 2002, 2006, 2007b; Winkelmann & Winkelmann, 1998). Relative income studied by (Daly, 1987;

	Probability that a tourist will return	Tourist's overall trip satisfaction	Overall satisfaction with life
			Diener et al., 1999; Dixon, 1997; Easterlin, 1995, 2003; Layard, 2003; Stutzer & Frey, 2010). Future material aspirations and their relationship to anticipated future income levels considered by (Easterlin, 1995, 2001). Income effect found to be negligible or not significant by (Easterlin, 1995; Oswald, 1997)
Health status			(Ambrey & Fleming, 2011; Brereton et al., 2008; Cuñado & de Gracia, 2013; Di Tella et al., 2003; Ferrer-i-Carbonell & Gowdy, 2007; Ferrer-i-Carbonell & Frijters, 2004; Frey & Stutzer, 1999, 2002; Helliwell, 2003; Levinson, 2012; MacKerron & Mourato, 2009; Seghieri & Desantis, 2006; Winkelmann & Winkelmann, 1998)
Employed or unemployed			(Alesina et al., 2004; Brereton et al., 2008; Cuñado & de Gracia, 2013; Ferrer-i-Carbonell & Gowdy, 2007; Frey & Stutzer, 1999; Helliwell, 2003; Levinson, 2012; Luechinger & Raschky, 2009; Welsch, 2007b; Winkelmann & Winkelmann, 1998)
Overall satisfaction with trip	(Alegre & Cladera, 2006; Assaf et al., 2013; Assaker et al., 2011; Chen & Tsai, 2007; Choo & Petrick, 2014; Hui et al., 2007; Jang & Feng, 2007; Kozak, 2001; Kozak & Rimmington, 2000; Ledesma et al., 2005; Moscardo et al., 2004; Neuts, Romão, Van Leeuwen, & Nijkamp, 2013; Petrick & Backman, 2002; Petrick, Morais, & Norman, 2001; Saltzer, 2002b; Yoon & Uysal, 2005)		
Previously visited region	(Alegre & Cladera, 2006; Assaker & Hallak, 2012; Kozak, 2001; Kozak & Rimmington, 2000; Ledesma et al., 2005; Petrick et al., 2001; Yuksel, 2001)	(Alegre & Cladera, 2006; Kozak & Rimmington, 2000; Shahrivar, 2012)	
Trip cost / perceived value for money	(Assaf et al., 2013; Chen & Tsai, 2007; Petrick et al., 2001; Randriamboarison et al.,	(Alegre & Cladera, 2006; Alegre & Garau, 2010; Chen & Tsai, 2007; Lu & Stepchenkova, 2012; Ziegler	

	Probability that a tourist will return	Tourist's overall trip satisfaction	Overall satisfaction with life
	2013; Saltzer, 2002b)	et al., 2012)	
Facilities at tourist destination – accommodation, restaurants etc.	(Assaf et al., 2013; Randriamboarison et al., 2013; Saltzer, 2002b)	(Alegre & Garau, 2011; Casagrandi & Rinaldi, 2002; Cerina, 2007; Giannoni & Maupertuis, 2007; Hernández & León, 2007; Lu & Stepchenkova, 2012; McElroy & Parry, 2010; Saltzer, 2002a; Torres-Sovero et al., 2012)	
Climate	(Assaf et al., 2013; Randriamboarison et al., 2013)	(Alegre & Cladera, 2006; Alegre & Garau, 2011; Coghlan, 2012; Coghlan & Prideaux, 2009)	(Abdallah et al., 2008; Brereton et al., 2008; Cuñado & de Gracia, 2013; Rehdanz & Maddison, 2005)
Economic development	(Alegre & Garau, 2010)	Development increasing tourist dissatisfaction found by (Alegre & Garau, 2010) Peace, quiet and not overcrowded found important by (Alegre & Cladera, 2006; Alegre & Garau, 2010; Brau & Cao, 2008; Cerina, 2007; Hernández & León, 2007; McElroy & Parry, 2010; Ziegler et al., 2012)	(Kountouris & Remoundou, 2011; Welsch, 2007b)
Quality of social capital	(Assaf et al., 2013; Demos, 1992; Randriamboarison et al., 2013)	(Demos, 1992; Handszuh, 2006; Tarlow, 2006).	Various measures studied, including measures of local political autonomy by (Abdallah et al., 2008; Frey & Stutzer, 2000), political stability by (Abdallah et al., 2008), rule of law and control of corruption by (Abdallah et al., 2008), perceptions of crime levels and personal safety by (Michalos & Zumbo, 2000), degree of freedom and personal choice by (Stanca, 2009), and trust in others or society by (Engelbrecht, 2009; Helliwell, 2003; Helliwell & Wang, 2011; MacKerron & Mourato, 2009; Stanca, 2009)
Quality of natural environment	Environmental impacts of tourism discussed by (Commission on Sustainable Development, 1996). The tourist area life cycle model was developed by (Butler, 1980). Environmental impact on sustainable tourism discussed by (Casagrandi & Rinaldi, 2002; Giannoni & Maupertuis, 2007; Hernández & León, 2007,	(Alegre & Garau, 2010, 2011; Brau & Cao, 2008; Casagrandi & Rinaldi, 2002; Cerina, 2007; Coghlan, 2012; Giannoni & Maupertuis, 2007; Hernández & León, 2007, 2013; Saltzer, 2002a)	Pollution effects investigated by (Cuñado & de Gracia, 2013; Levinson, 2012; MacKerron & Mourato, 2009; van Praag & Baarsma, 2005; Welsch, 2002, 2006, 2007a), environmental amenities considered by (Ambrey & Fleming, 2011; Brereton et al., 2008) , whilst proximity to landfill sites studied by (Brereton et al., 2008). Effect of ecosystem services researched by (Abdallah et al., 2008; Vemuri & Costanza, 2006)

	Probability that a tourist will return	Tourist's overall trip satisfaction	Overall satisfaction with life
	2013; Wilkinson, 1989).		whilst environmental disasters, (e.g. forest fires, flooding) studied by (Kountouris & Remoundou, 2011; Luechinger & Raschky, 2009)

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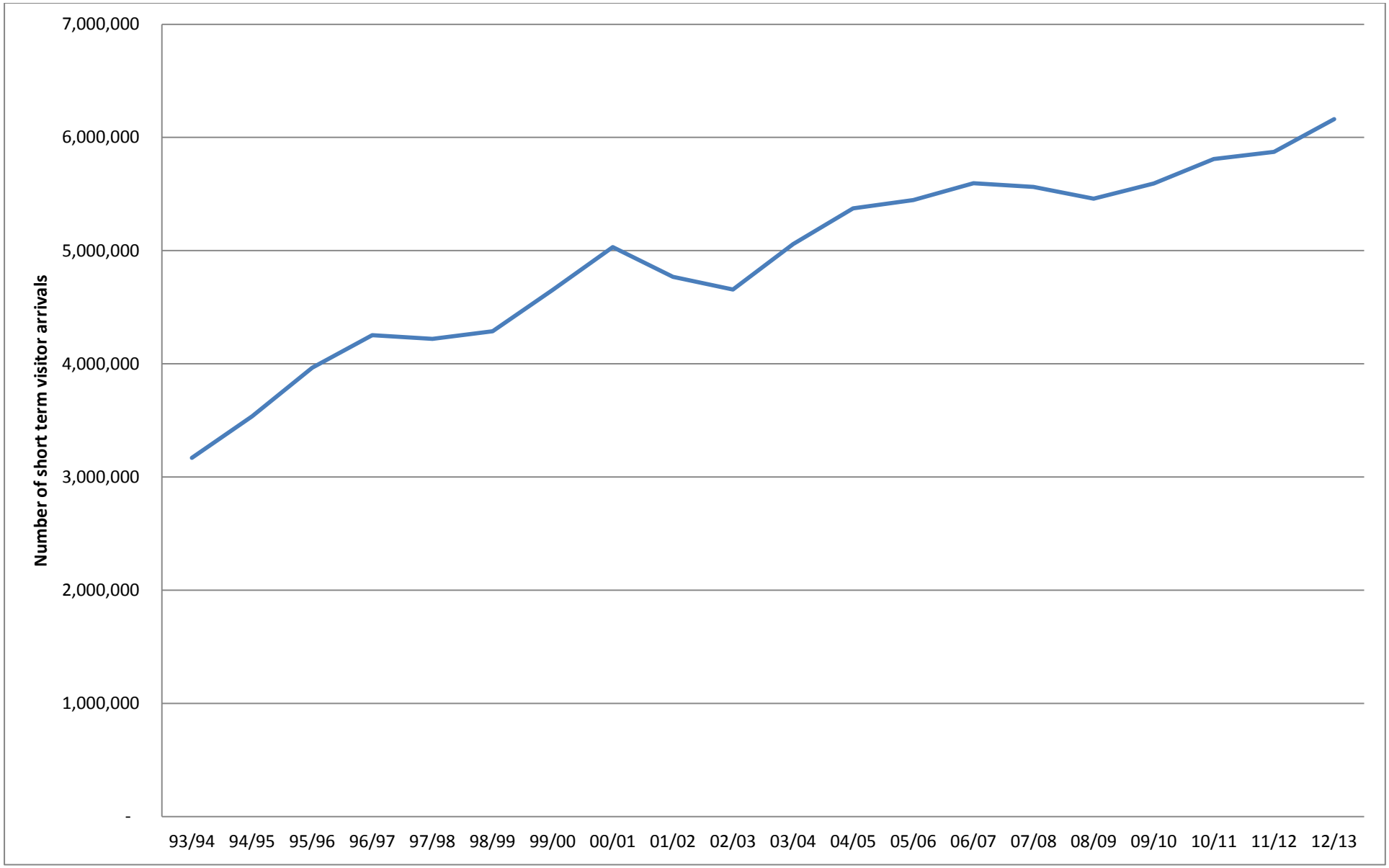
Figure 1


7,000,000
6,000,000
5,000,000
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1,000,000
-
Number of short term visitor arrivals
93/94
94/95
95/96
96/97
97/98
98/99
99/00
00/01
01/02
02/03
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Figure 2

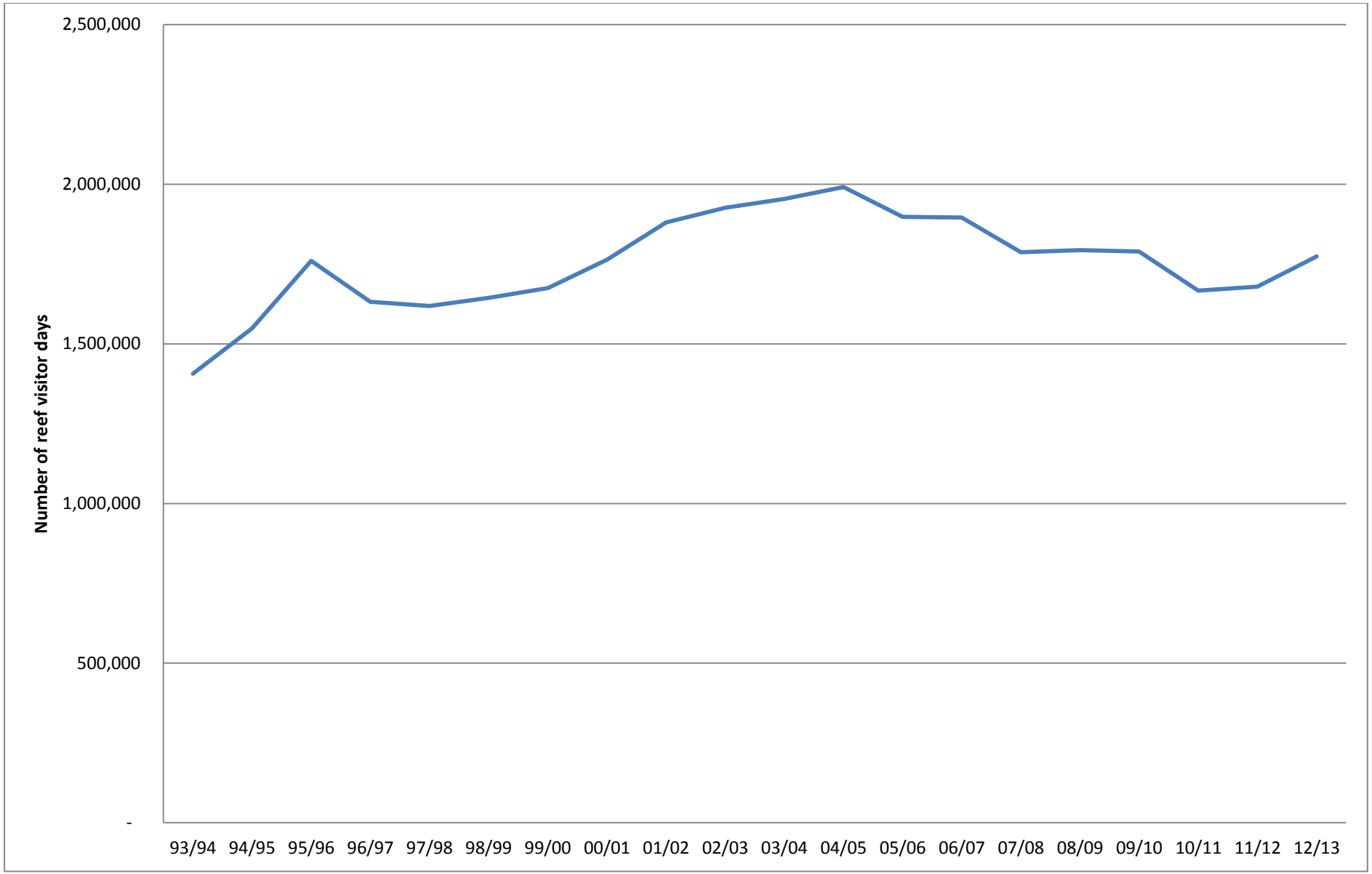
Number of reef visitor days
2,500,000
2,000,000
1,500,000
1,000,000
500,000
-
93/94
94/95
95/96
96/97
97/98
98/99
99/00
00/01
01/02
02/03
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Figure 3

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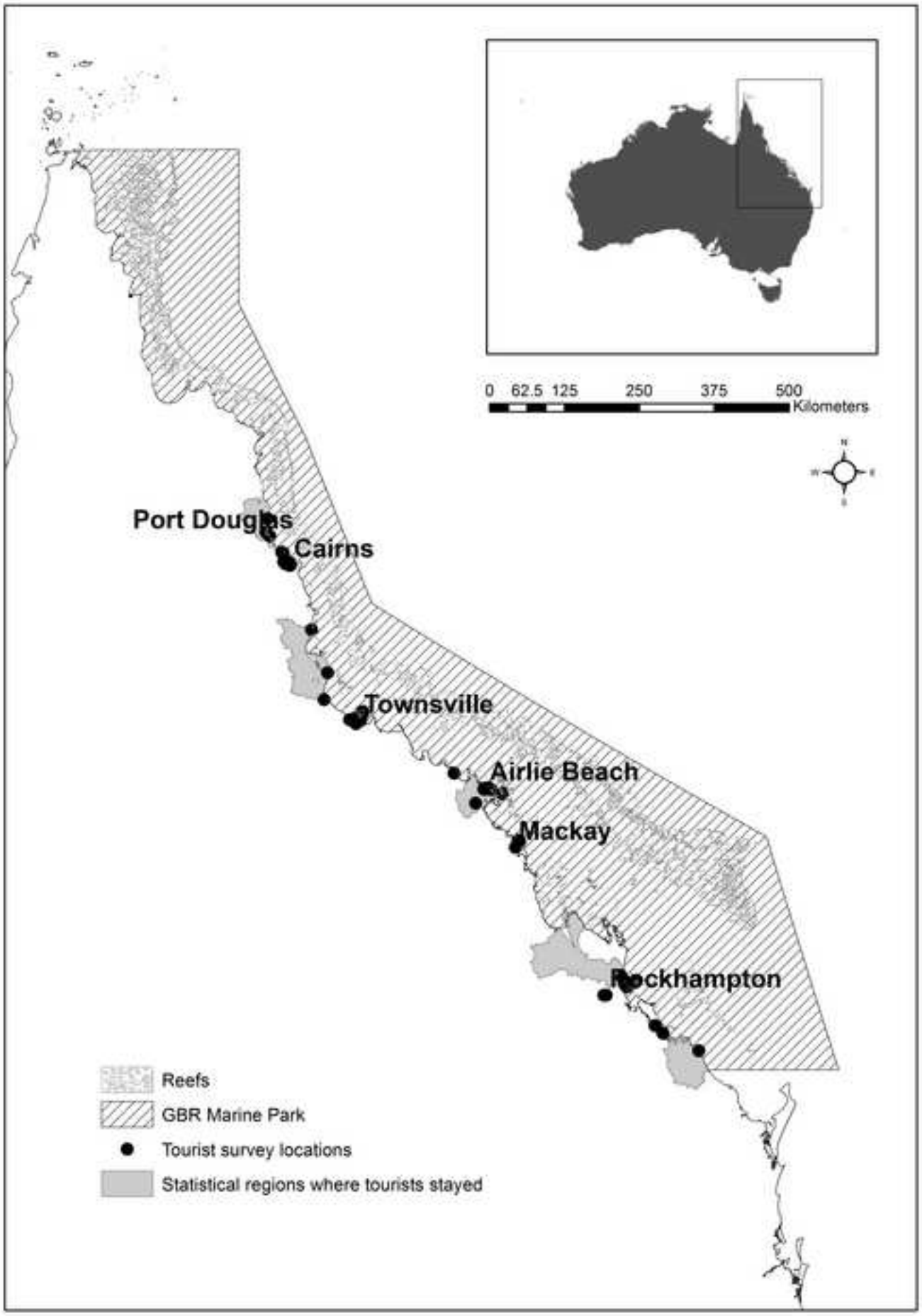

Author Biographies

Diane Jarvis is studying for her PhD at James Cook University, within the field of environmental economics. Her research focuses on socio-economic impacts from natural resource exploitation.

Professor Natalie Stoeckl completed her PhD in Economics at the Australian National University. She spent many years at the University of Canberra, before moving to Townsville where she worked with the CSIRO (Sustainable Ecosystems). In 2003 she joined James Cook University, where she is now a Professor of Economics and Tropical Leader. She has a keen interest in the environmental and social/distributional issues associated with economic growth, and has a track record of collaborative, cross-disciplinary research using models that combine economic, environmental and social variables to explore interactions between complex systems.

Dr Hong-Bo Liu is a lecturer in Economics at School of Business, James Cook University. Her research focuses on tourist economics and environmental economics and natural resource management, especially on food consumption and its impacts on sustainability.

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