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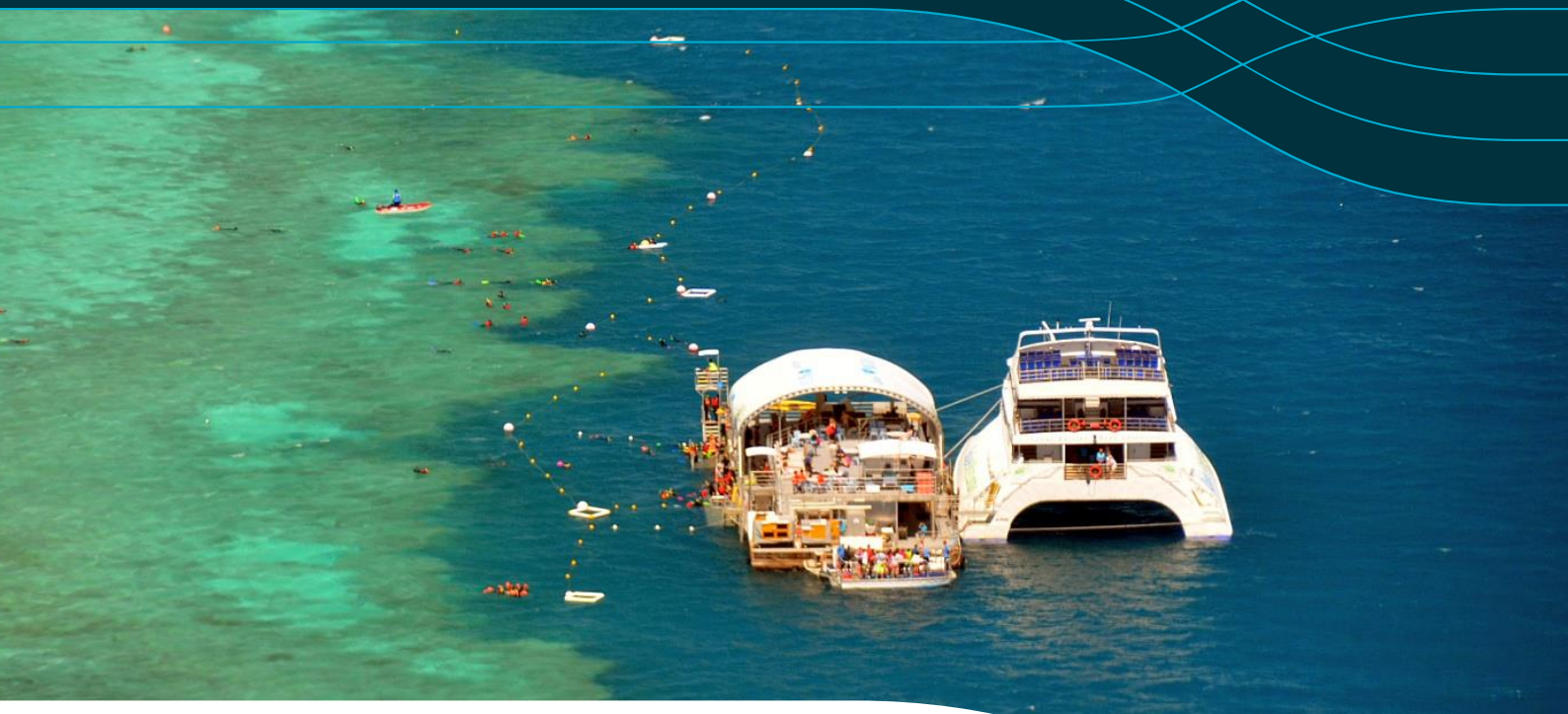
Changes in the state of Great Barrier Reef tourism from 2013 to 2017

a report from the Social and Economic Long-Term Monitoring Program (SELTMP)

Matt Curnock and Nadine Marshall

Report prepared for the ***Great Barrier Reef Marine Park Authority***, May 2019



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Important disclaimer

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Contents

Executive summary

This technical report presents a comparison of 2013 and 2017 socio-economic data and indicators relevant to the state of tourism in the Great Barrier Reef (GBR). The report forms part of a series, presenting survey data from the Social and Economic Long-Term Monitoring Program (SELTMP), describing and comparing indicators of key characteristics of GBR-dependent industries and communities within the GBR region (defined as the GBR World Heritage Area and Marine Park, together with the GBR catchment, bounded by Bundaberg in the south, Cape York in the north and the Great Dividing Range in the west).

In this report we present an in-depth analysis using statistical tests, comparing survey responses in mid-2013 and mid-2017, for (1) international and domestic tourists in the GBR region and (2) Marine Park tourism operators. Between these sampling periods, significant biophysical impacts occurred on the Great Barrier Reef. Mass coral bleaching over the summers of both 2016 and 2017 affected the northern half of the GBR Marine Park, including tourism sites in the Cairns region (Great Barrier Reef Marine Park Authority 2017a; 2018a). In addition, a severe tropical cyclone in March 2017 affected tourism sites in the Whitsundays region (Great Barrier Reef Marine Park Authority 2018a). These two regions account for an estimated 90% of tourism visitation to the Marine Park (Great Barrier Reef Marine Park Authority 2018b). The biophysical impacts from the cyclone and coral bleaching event, and the associated media coverage, have undoubtedly affected tourists' perceptions and experiences associated with the GBR.

Among the results presented in this report, we show significant declines in tourists' ratings of the quality of GBR-based activities, such as snorkelling and scuba diving, as well in as their assessments of the GBR's aesthetic beauty. While tourism operators remained optimistic about the future of their business in the GBR, their trust in institutions providing GBR-related information has fallen. Contrasting with these declines, the results show significant increases in stated values associated with the GBR (e.g. biodiversity value, science and educational value, international icon value), the desire to take action to protect the GBR, and the proportion of tourists and tourism operators who recognise climate change as the greatest threat to the GBR. We present these and other key findings in the context of the latest tourist visitation trends and other emerging industry patterns, and briefly discuss implications and challenges for the GBR tourism industry and its management into the future.

A broad overview of results from all SELTMP 2017 surveys, representing (i) GBR coastal residents, (ii) tourists in the GBR region, (iii) Marine Park tourism operators, (iv) Marine Park commercial fishers, and (v) Australian residents, was presented in a Final Report to the Great Barrier Reef Marine Park Authority in early 2018. Additionally, online dashboards were developed to enable GBR managers, researchers, and the wider community to explore and interrogate SELTMP survey data directly; available at https://research.csiro.au/seltmp/. This report (and this report series) provides a more in-depth analysis of key finding arising from the SELTMP data, relevant to specific Reef community groups and sectors.

Introduction

The Great Barrier Reef (GBR) is an iconic, world renowned tourism attraction. Its associated tourism activity contributes an estimated $5.7 billion annually to Australia's economy, while providing employment (Full Time Equivalent) in the sector for more than 58,000 people (Deloitte Access Economics 2017). Since the development of the first tourist resorts on GBR islands in the early 1930s, the experiences, services and products available to GBR tourists have proliferated. Today, tourism activities in the GBR are set in a range of different environments, ranging from coastal, estuarine and island habitats to the inshore, mid-shelf and outer coral reefs. The perceived health and quality of these environments plays a crucial role in tourists' travel planning decisions, and can strongly influence tourists' experiences and satisfaction when they visit. Understanding how tourists perceive, experience, and value the GBR is important for tourism operators, GBR managers, and tourism-dependent communities who aim to provide (and who benefit from) sustainably managed, high quality GBR tourism experiences that showcase the Outstanding Universal Value of the GBR.

Over the last decade it has been well established that the GBR is an icon under increasing pressure, threatened most significantly by climate change, poor water quality from land-based runoff, coastal development, and some remaining impacts from fishing (Great Barrier Reef Marine Park Authority 2009; 2014a). Over the summers of 2016 and 2017, the GBR experienced concurrent mass coral bleaching events at an unprecedented scale, leaving a substantial impact on coral communities across the northern half of the Marine Park, encompassing tourism sites in the Cairns region (Great Barrier Reef Marine Park Authority 2017a; 2018a). In addition, in March 2017, Severe Tropical Cyclone Debbie severely damaged tourism sites in the Whitsundays region (Great Barrier Reef Marine Park Authority 2018a). Despite these impacts, the GBR remains one of best managed, most intact and resilient coral reef ecosystems on the planet (Great Barrier Reef Marine Park Authority 2017), and regional and Marine Park tourist visitation figures over the period have remained at or near their highest levels (Tourism and Events Queensland 2018a,b; Great Barrier Reef Marine Park Authority 2018b). While the recent GBR impacts and associated media reporting have raised concerns among tourism industry representatives about the GBR's international reputation and potential declines in tourism (e.g. Willacy 2016), the effects of these impacts on tourists' perceptions and experiences in the GBR have so far been unquantified.

In this technical report we present comparative analyses using statistical tests comparing survey responses in mid-2013 and mid-2017 for: (1) English-speaking international and domestic tourists in the GBR region and (2) Marine Park tourism operators. Continued monitoring of changes in GBR perceptions and experiences provides important feedback to GBR managers and communities, and helps to improve our understanding of social-ecological system processes, which is vitally important for adaptive and resilience-based management of the GBR. The recent development of the Reef 2050 Integrated Monitoring and Reporting Program (RIMReP) provides the unprecedented opportunity to integrate human dimensions with other monitoring in the GBR, to enhance our system-wide understanding, and to guide tactical and strategic management decisions in an era of rapid environmental and societal change.

What is SELTMP?

The Social and Economic Long-Term Monitoring Program (SELTMP) for the GBR describes the conditions and trends of the human dimension of the GBR social-ecological system. Designed for long-term monitoring of key indicators relevant to the Reef 2050 Long-Term Sustainability Plan (Commonwealth of Australia 2015), SELTMP provides valuable insights to assist with the day-to-day management of the GBR, and with planning for the future of GBR-dependent associated industries and communities in the face of environmental and societal challenges and drivers of change. These drivers, which include climate change, population and economic growth, technological development, societal attitudes and governance, have direct and indirect effects on human activities and pressures exerted on the GBR (Great Barrier Reef Marine Park Authority 2014b). The state of the GBR, in turn, directly and indirectly affects the wellbeing of people and communities who depend on it, or are associated with it, and/or value it.

SELTMP forms an integral part of the Reef 2050 Integrated Monitoring and Reporting Program (RIMReP), providing primary data for a range of human dimension indicators that are necessary to evaluate progress towards the objectives of four themes within the Reef 2050 Long Term Sustainability Plan (Commonwealth of Australia 2015; 2018), including community benefits, economic benefits, heritage and governance. In early 2018, a comprehensive list of indicators addressing these four themes was proposed by the RIMReP Human Dimensions Expert Group, organised into five clusters: Aspirations, Capacity and Stewardship (ACS), Community Vitality (CV), Culture and Heritage (CH), Economic Values (EV) and Governance (G) (Gooch et al., 2018). A wide range of data sources were identified to address the indicators and their attributes, with notable gaps acknowledged for several indicators. For many indicators and attributes, SELTMP represents the only available data source to enable meaningful assessments of state and trend.

This report (and the report series) builds on the baseline of SELTMP reports over 2011-2014, available at https://seltmp.eatlas.org.au/seltmp, which provided the first comprehensive quantitative snapshots describing how people interact with the GBR, how they value it, perceive it, and how likely they are to respond to environmental and social changes. Following an extensive consultation process to identify knowledge gaps and prioritise human dimension monitoring needs (outlined in Marshall et al., 2014) the first iteration of SELTMP primary data collection commenced in 2013. The large-scale surveys were conducted at 14 coastal centres along the GBR coast, from Cooktown to Bundaberg, and involved more than 6300 participants, including commercial fishers, tourism operators, tourists and coastal residents. In addition, 2000 Australian residents were surveyed online as part of a geographically and demographically representative sample of the broader Australian population. Our second sampling period occurred in mid-2017, involving more than 3900 participants across the GBR region representing the same groups. Recommendations from the RIMReP Human Dimensions Expert Group included biennial SELTMP sampling (Gooch et al., 2018), which would enable correlations and potentially predictive modelling of human-environment responses to significant environmental and/or societal events (e.g. major disturbances like a mass coral bleaching event) through detailed analyses and synthesis in alternate years.

A large and growing number of peer-reviewed scientific papers using SELTMP data are available, which validate SELTMP's conceptual design (e.g. Marshall et al., 2016; Marshall et al., 2018b; Gooch et al., 2017) and reveal new insights into people's values and attachment to the GBR (e.g.

Goldberg et al., 2016; Gurney et al., 2017), their perceptions of its management and institutional trust (e.g. Turner et al., 2016; MacKeracher et al., 2018), their vulnerability and dependence on the GBR (e.g. Marshall et al., 2017), and their responses to the threat of climate change (e.g. Goldberg et al., 2017; Marshall et al., 2019). As longer-term data and knowledge are accumulated over time, the value of SELTMP to GBR managers and the Australian public will grow.

Survey data from SELTMP are made publicly available online via https://doi.org/10.25919/5c74c7a7965dc and can be analysed for myriad purposes. SELTMP 2017 data can also be interrogated through several PowerBI™ online dashboards (https://research.csiro.au/seltmp/).

Methods

Survey questions are provided in Appendix 1, and a detailed description of the survey design (as well as data collection methods) is reported in the SELTMP 2017 Final Report to GBRMPA (Marshall et al., 2018a), as well as in the SELTMP 2014 report on tourism in the GBR (Curnock et al., 2014). We adopted the same method for data collection in 2017 as employed in 2013. Temporal and financial resources available to conduct surveys in 2017 were slightly less than those in 2013; however, sufficient sample sizes were achieved, enabling robust statistical analyses to be conducted.

Face-to-face interviews were conducted with tourists visiting the GBR region (defined as the GBR World Heritage Area and Marine Park, together with the GBR catchment, bounded by Bundaberg in the south, Cape York in the north and the Great Dividing Range in the west) between June and August. The surveys were conducted at regional population centres including Cairns, Mission Beach, Ingham, Townsville, Airlie Beach, Mackay, Yeppoon, Gladstone and Bundaberg, in locations such as public beaches, boat ramps, jetties, parks, shopping centres, caravan parks, markets, and on a limited number of GBR tourism vessels. For the purposes of the survey, tourists were defined broadly as non-resident visitors to the GBR region. Responses to interview questions were entered in situ into an iPad, using the iSurvey application. In 2013, a total of 2877 tourists completed the survey and in 2017 a sample of 1804 respondents was achieved. Note that a limitation of the study was the availability of surveys in English language only; thus some non-English speaking tourist market segments are likely to be under-represented in our results (e.g. the growing Chinese market). These non-English speaking markets are intended to be addressed in subsequent iterations of SELTMP. Telephone interviews were conducted with representatives of tourism businesses operating in the Marine Park, including business owners, managers and/or senior staff who could speak on behalf of the company. Responses were entered directly into the iSurvey tablet app. In 2013, 119 tourism operators completed the survey, and in 2017, 94 operators were sampled.

Analysis and presentation of results

Numeric data were analysed using MS Excel and SPSS statistics software. Most of the results below show comparisons of mean ratings from scaled response questions (i.e. respondents were asked to give a rating from 1 to 10 indicating their level of disagreement/agreement with a statement). Statistical tests comparing mean rating scores between years included non-parametric Mann-Whitney U Tests, and Spearman's Rho tests were used to identify the strength and significance of correlations between particular questions. Sample sizes varied for some questions (e.g. comparisons of ratings of the quality of different GBR-based activities were limited to respondents who reported participating in those activities), and standard errors are displayed to account for and indicate the effect of these differing sample sizes. Responses to the open-ended question "what do you think are the three (3) most serious threats to the Great Barrier Reef" were

coded thematically via qualitative content analysis, to produce frequencies of different major threat themes as they occurred (e.g. climate change, pollution, fishing, and tourism).

Results are presented in two sections (Part 1: Tourists, and Part 2: Tourism operators) and a brief explanation is provided of the significance and potential implication of each result. We note that spatial comparisons (i.e. differences between regions) have not been made in this report, due to the varied travel behaviour of tourists and difficulties in attributing their GBR perceptions and experiences to a single location. In Appendix 1, a table is provided summarising the mean rating scores for all survey questions. This table indicates significant differences (where applicable) from 2013, the direction of change (higher or lower), and the relevance of each question to the RIMReP human dimension indicator clusters and attributes proposed by Gooch et al. (2018).

Part 1 Results: Tourists in the GBR region

Sample description

Sample sizes, basic demography, place of origin and previous GBR visitation for respondents in 2013 and 2017 are shown below (Table 1), including a comparison of samples collected in 2013 and 2017, as well as tourists of domestic and overseas origin.

Table 1 SELTMP tourist sample demographics in 2013 and 2017

	2013 Domestic tourists (n=1557)	2017 Domestic tourists (n=831)	2013 International tourists (n=1286)	2017 International tourists (n=805)
Mean age (±SE; range)	48.9 (±0.45; 15-94)	43.5 (±0.64; 15-87)	28.5 (±0.34; 15-81)	27.4 (±0.42; 16-94)
Gender (F:M; %)	46:54	51:49	55:45	57:43
Visited GBR this trip?	58%	58%	85%	67%
Took a paid GBR tour?	22%	25%	52%	46%
First time visitor to GBR region?	23%	23%	84%	86%
Top 5 states/countries of origin (ranked)	QLD (37%) NSW & ACT (28%) VIC (24%) SA (4%) WA (4%)	QLD (40%) NSW & ACT (26%) VIC (22%) WA (5%) SA (3%)	UK (25%) Germany (18%) France (12%) USA (8%) New Zealand (5%) *(54 countries total)*	Germany (19%) UK (19%) USA (11%) France (11%) Netherlands (6%) *(35 countries total)*

As shown above (Table 1), the demographic composition of both domestic and English-speaking international tourists is comparable for both years; however, in 2017 the mean age of domestic tourists was lower than that for 2013. The largest proportion of domestic visitors to the region were from within Queensland (outside the GBR region, predominantly from southeast Queensland), followed by visitors from New South Wales and the Australian Capital Territory (ACT), and then Victoria. Less than a quarter of domestic tourists (23% in both years) were first time visitors to the GBR region, and more than half (58% in both years) visited the GBR during their stay in the region. In 2013, 22 per cent of domestic visitors had participated in a commercial tourism trip to the GBR during their stay (when surveyed), and in 2017, 25 per cent had taken a commercial GBR tour.

English-speaking international tourists were typically younger than domestic tourists (in both years). Noting that SELTMP surveys were conducted in English language only, the largest proportion of international respondents came from Europe and North America, with just four countries (Germany, the UK, USA and France) representing more than 60 per cent of the sample in both years. Most of the international tourists were first time visitors to the GBR region (84% in 2013, 86% in 2017) and a large proportion had visited the GBR during their trip (85% in 2013 and 67% in 2017). Around half of the sample in both years (52% in 2013, 46% in 2017) had taken a

commercial tour to the GBR during their stay. A higher ratio of females to males was represented among the international tourists in both years (55% female in 2013, and 57% in 2017), despite sampling protocols to minimise potential biases for gender, age and nationality.

Tourist satisfaction and GBR perceptions

Mean scores for both English-speaking international and domestic tourists' ratings of their "overall satisfaction with your experience of the Great Barrier Reef" (on a 1-10 scale; 1=extremely dissatisfied; 10=extremely satisfied) were significantly lower in 2017 than in 2013 (Figure 1 below). Similar significant declines were found in responses indicating tourists' level of agreement with the questions "the aesthetic beauty of the GBR is outstanding", "the coral reefs that I have seen are in good condition", and "I feel optimistic about the future of the GBR" (Figure 1).

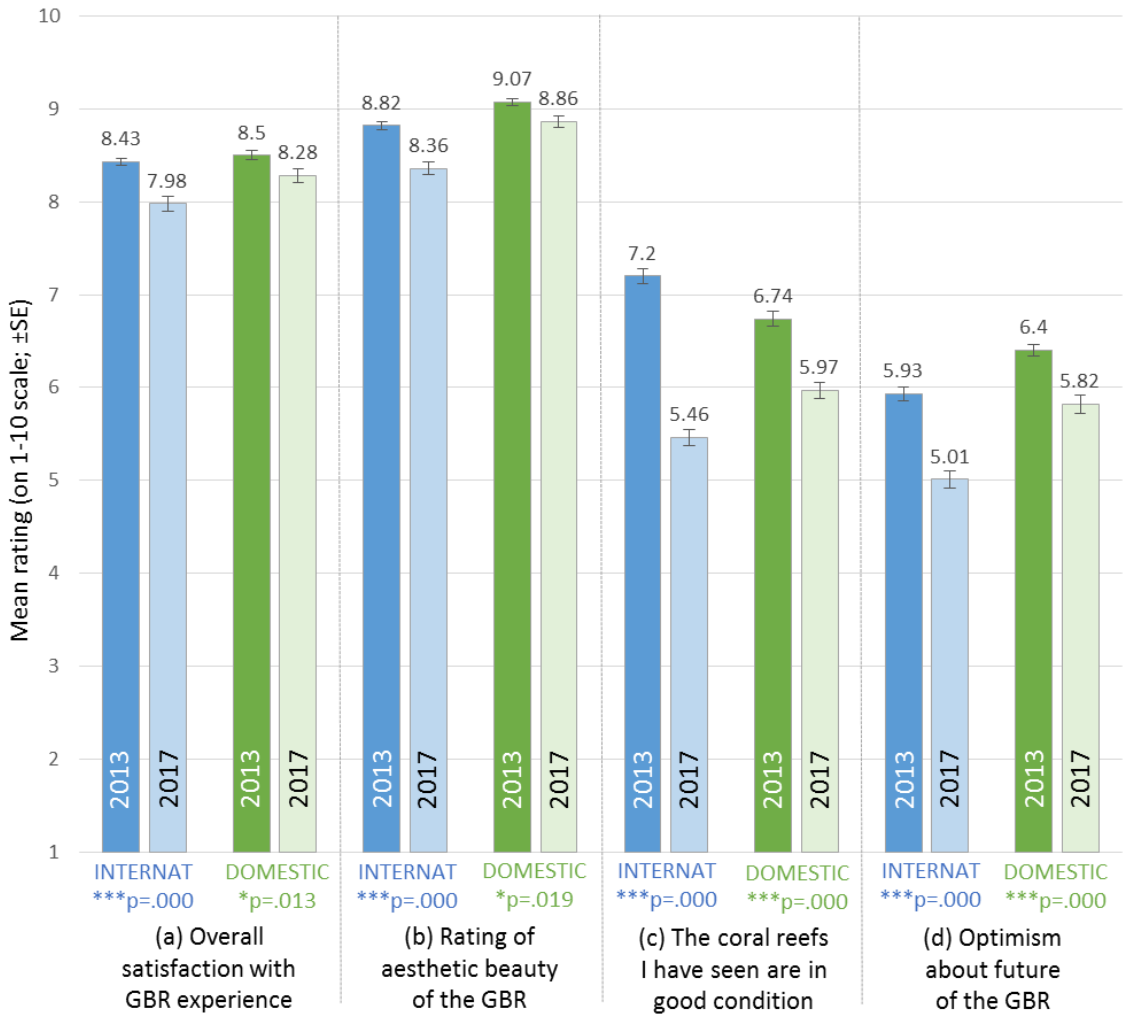

Figure 1 Comparison of mean ratings (1-10 scale; 2013 and 2017; ±SE) and statistical test results (p value) for English-speaking international and domestic tourists in the GBR region, comparing ratings of (a) their overall satisfaction with their GBR experience, (b) perceived aesthetic beauty of the GBR, (c) perceived condition of coral reef(s) that they saw during their visit, and (d) levels of optimism for the future of the GBR

While overall tourist satisfaction ratings have remained relatively high (all mean scores above 7.9 out of 10), the decline from 2013 to 2017 among both domestic and English-speaking international tourists is notable, as are the significant declines in ratings of GBR aesthetics, perception of coral reef condition and optimism about the GBR's future. It is important to acknowledge that myriad factors can influence tourists' satisfaction. Tourists' perceived aesthetic beauty of the GBR, and their perceptions of coral reef condition were correlated with each other (r=.221**) and with satisfaction ratings (r= .391** and r=.296** respectively; Spearman's rho, p<.01, 2-tailed). Similarly, optimism about the future of the GBR was significantly positively correlated with perceived aesthetics and coral reef condition (r= .166** and r=.244** respectively; Spearman's rho, p<.01, 2-tailed).

Quality of Reef-related activities

In both years, tourists were asked to indicate which Reef-related activities they had participated in, and to rate the quality of those activities on a ten-point scale (1=very low quality, 10=very high quality). We found significant declines from 2013 to 2017 among the international tourists for quality ratings of snorkelling and wildlife watching; and among domestic tourists for snorkelling and scuba diving (Figure 2). There was no significant difference between years in ratings of the quality of sightseeing for either group.

There were strong, significant positive correlations between tourists' overall GBR satisfaction rating (cf. Fig. 1) and their quality ratings for different reef activities. Among the activities listed above, snorkelling had the strongest correlation with overall satisfaction (r= .526**; Spearman's rho, p<.01, 2-tailed), followed by scuba diving (r=.484**; p<.01), sightseeing (r=.452**; p<.01) and wildlife watching (r=.394**; p<.01). Ratings of the quality of snorkelling and scuba diving were also significantly positively correlated with ratings of GBR aesthetic beauty (Spearman's rho; r= .378** and r=.341** respectively; p<.01, 2-tailed) and perceived coral reef condition (r= .338** and r=.335** respectively; p<.01, Spearman's rho, 2-tailed).

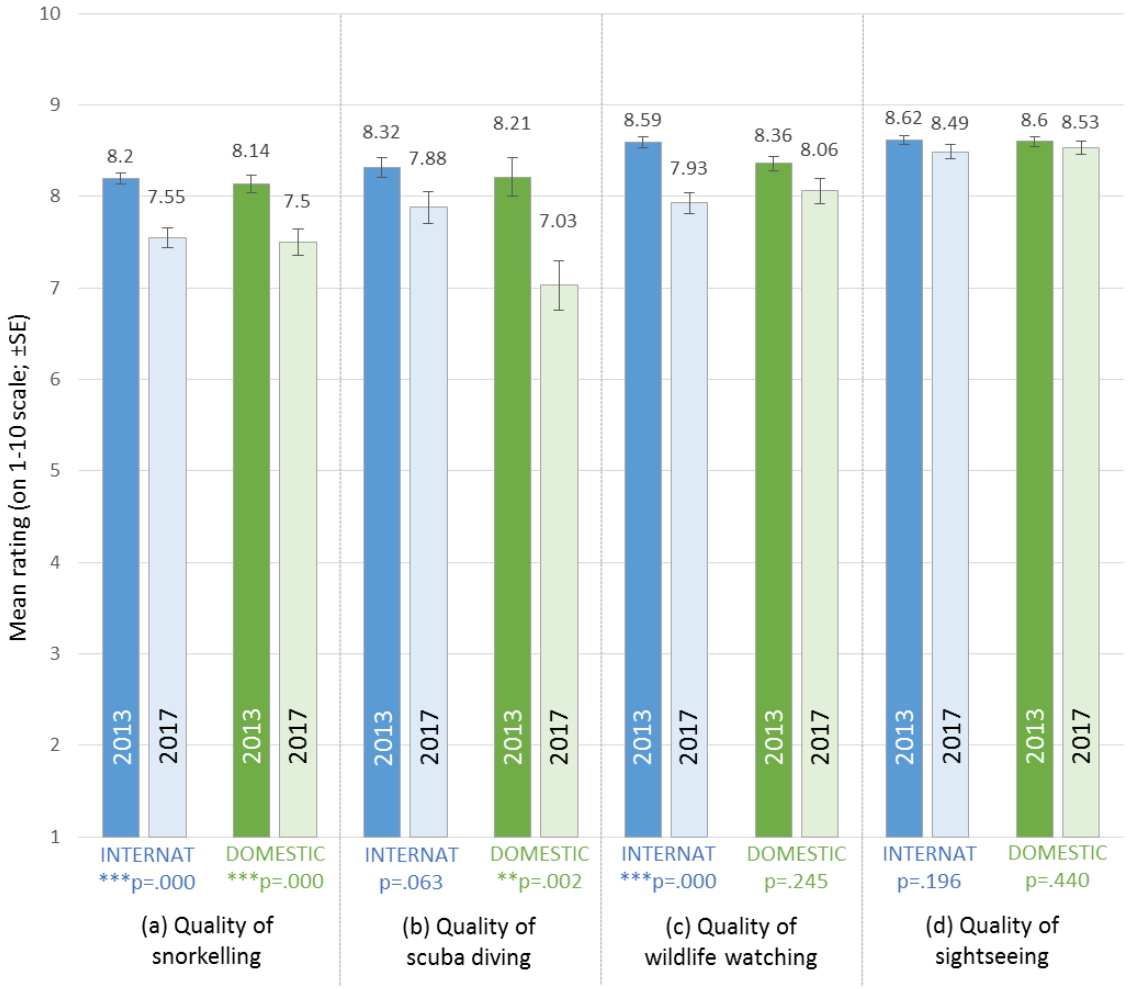

Figure 2 Comparison of mean ratings (2013 and 2017; ±SE) and statistical test results (p value) for English-speaking international and domestic tourists in the GBR region, comparing ratings of the quality of GBR-related activities, including (a) snorkelling, (b) scuba diving, (c) wildlife watching, and (d) sightseeing

NB. Ratings were provided by respondents who had participated in that activity, thus sample sizes varied for each question

Values attributed to the GBR

The relative strength of different values attributed to the GBR were elicited from respondents through ratings of agreement (1=very strongly disagree; 10=very strongly agree) with a range of statements, including: (a) "I value the GBR because it supports a variety of life, such as fish and corals" (biodiversity value), (b) "I value the GBR because we can learn about the environment through scientific discoveries" (scientific and education value), (c) "I value the GBR because it supports a desirable and active way of life" (lifestyle value), (d) "I value the GBR because it attracts people from all over the world" (international icon value), and (e) "I value the GBR for the fresh seafood it provides" (food provisioning value). In contrast with the declines in ratings of satisfaction and quality of Reef activities reported above (cf. Figs 1 and 2), we found significant increases from 2013 to 2017 in ratings of values attributed to the GBR, including its biodiversity value, scientific and education value, lifestyle value and international icon value (Figure 3).

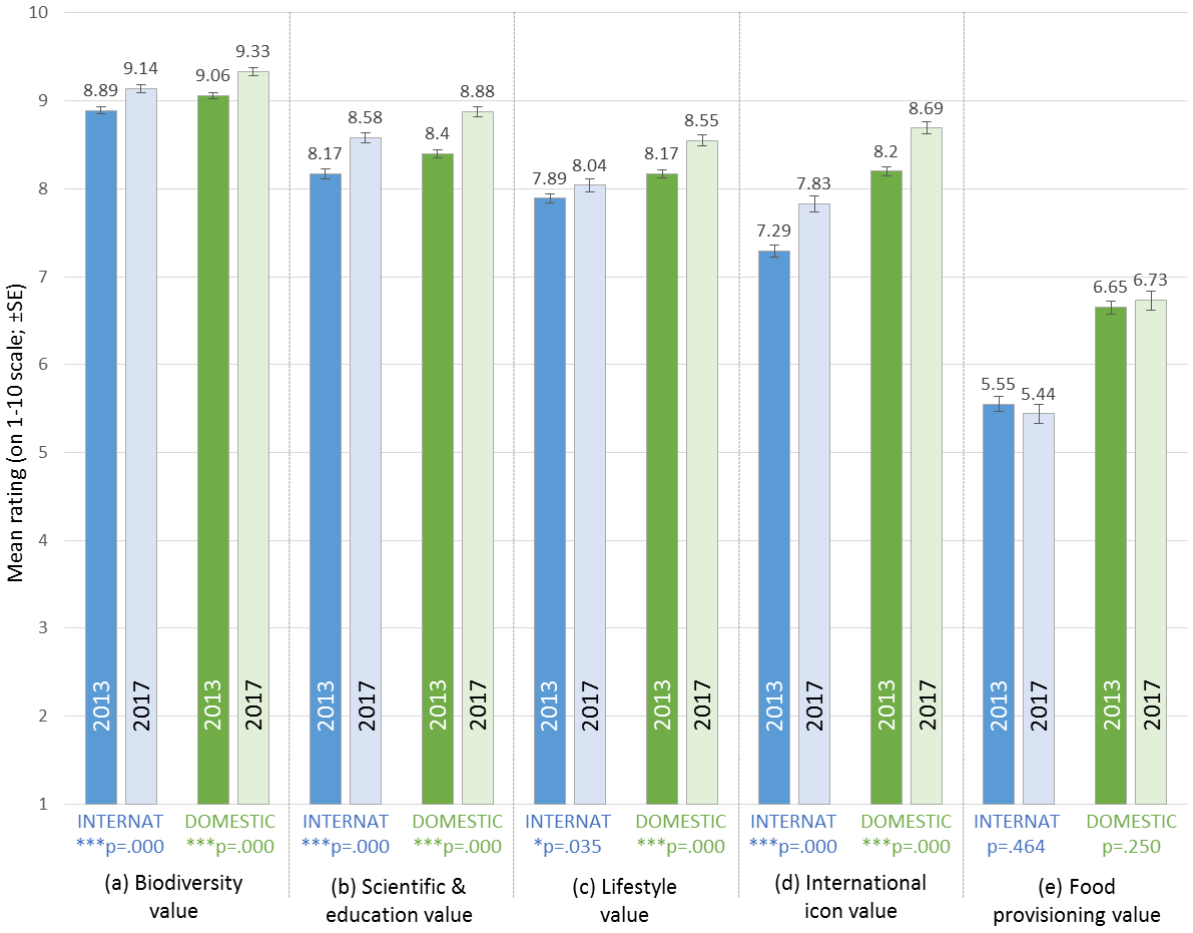

Figure 3 Comparison of mean ratings (2013 and 2017; ±SE) and statistical test results (p value) for English-speaking international and domestic tourists in the GBR region, comparing ratings of relative strength of values associated with the GBR, including (a) biodiversity value, (b) scientific and education value, (c) lifestyle value, (d) international icon value, and (e) food provisioning value

While ratings of the aesthetic beauty of the GBR were strongly positively correlated with ratings for these values (biodiversity r=.489**; science and education r=.418**; lifestyle r=.397**; international icon r=.346**; food provisioning r=.234**; Spearman's rho, p<.01), the relationship between these values and perceived coral reef condition was weak or not significant (e.g. biodiversity r=.005; science and education r=-.010; p>0.05).

Personal relationship with the GBR

Tourists indicated characteristics of their personal affective relationship with the GBR through ratings of agreement with the statements: (a) "I feel proud that the GBR is a World Heritage Area" (GBR pride), (b) "The GBR is part of my identity" (GBR identity), and (c) "I would NOT be personally affected if the health of the GBR declined" (affective vulnerability; NB. agreement ratings were inverted due to the negative framing of this statement). Ratings of GBR pride in 2017 were significantly higher than in 2013 for both domestic and international tourists. Ratings for GBR identity were higher in 2017 for both groups; however, this was only significant for domestic tourists. Ratings of affective vulnerability were slightly lower (statistically significant) among

domestic tourists in 2017, while the decline in affective vulnerability among English-speaking international tourists was non-significant (Figure 4).

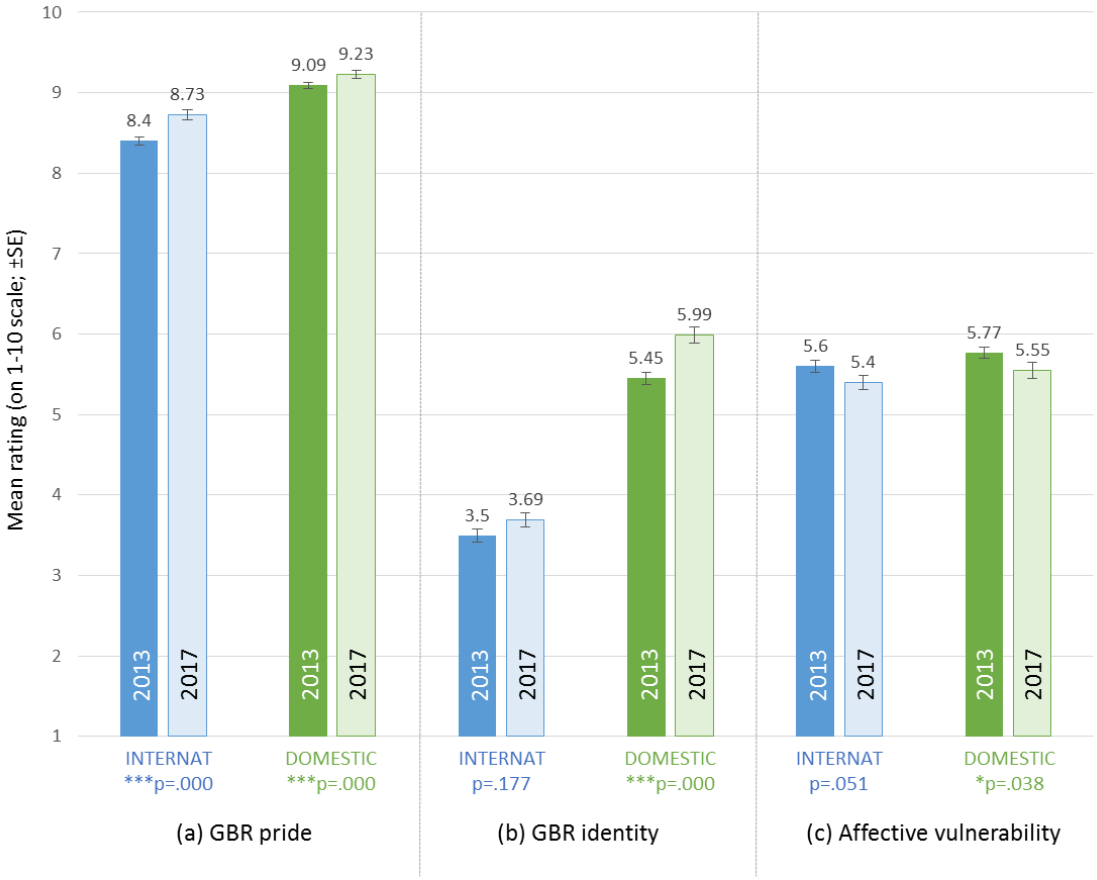

Figure 4 Comparison of mean ratings (2013 and 2017; ±SE) and statistical test results for English-speaking international and domestic tourists in the GBR region, comparing agreement ratings indicating tourists' personal relationship with the GBR. Specific indicators include: (a) GBR pride, (b) GBR identity, and (c) affective vulnerability (to declines in GBR health)

NB. Rating of agreement for negatively worded statement (c) is inverted

GBR pride was strongly positively correlated with values attributed to the GBR (biodiversity r=.550**; scientific and education r=.477**; lifestyle r=.429**; international icon r=.372**; Spearman's rho, p<.01), as was GBR identity (e.g. lifestyle r=.304**; international icon r=.259**; scientific and education r=.256**; biodiversity r=.210**; p<.01). Affective vulnerability was similarly correlated with some values (including biodiversity, r= .195**; scientific and education, r= .172**; lifestyle r= .134**; p<.01) as well as with GBR pride and GBR identity (r= .181** and .166** respectively; p<.01).

Stewardship sentiment and empowerment

Tourists' stewardship sentiments and empowerment to take action to reduce impacts and/or protect the GBR were assessed via ratings of agreement with the following statements: (a) "It is NOT my responsibility to protect the GBR" (sense of responsibility), (b) "I CANNOT make a personal difference in improving the health of the GBR" (sense of agency), (c) "I would like to do more to help protect the GBR" (willingness to act), (d) "I would like to learn more about the condition of the GBR" (willingness to learn), (e) "I have the necessary knowledge and skills to reduce any impact that I might have on the GBR" (capacity to act), and (f) "I DO NOT have the time or opportunity required to reduce any impact that I might have on the GBR" (opportunity to act). Note that in the results below, responses to the negatively worded questions (a, b, f) are inverted for ease of interpretation (Figure 5). For both the domestic and international tourists, there was a significant increase in 2017 ratings of their willingness to act and willingness to learn; however, there was a significant decrease in both groups' self-assessed capacity to act. There was also a slight but significant decrease in domestic tourists' ratings of their sense of responsibility. Responses from international tourists indicated significant increases in their sense of agency and opportunity to act; however, the slight increases in these ratings among domestic tourists were not statistically significant (Figure 5).

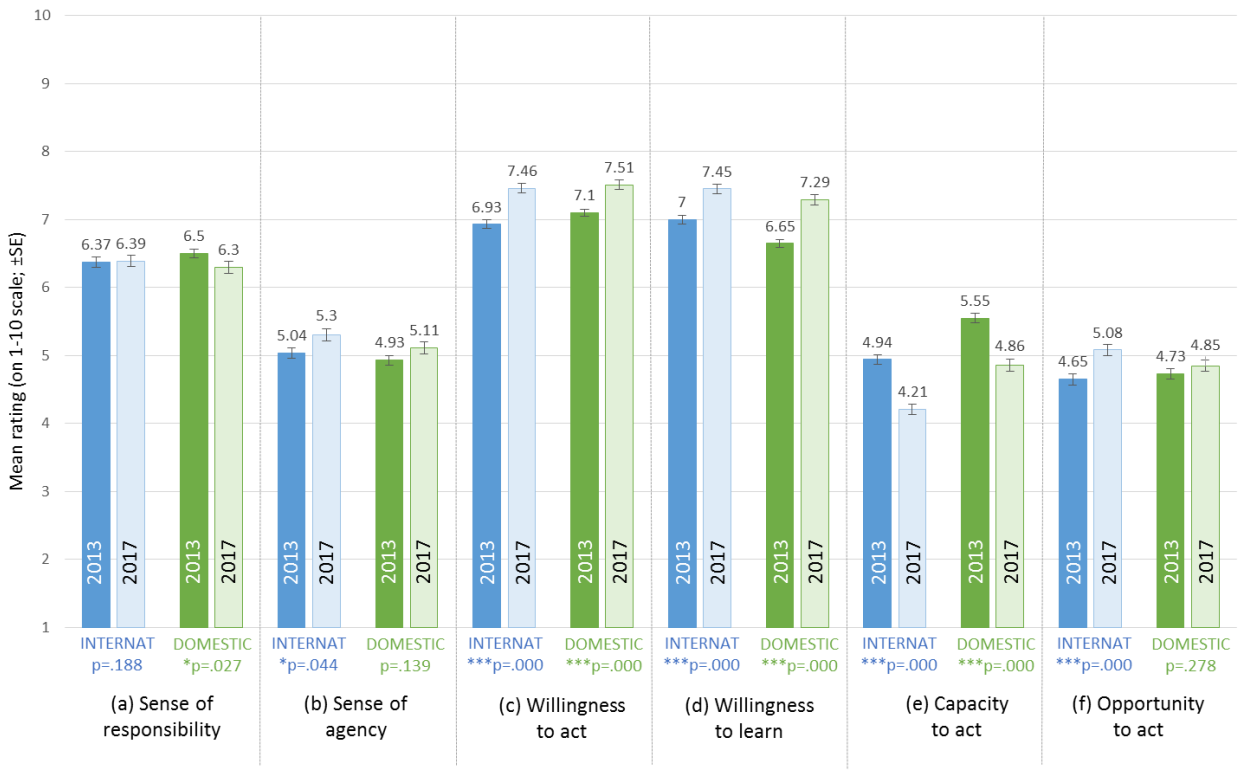

Figure 5 Comparison of mean ratings (2013 and 2017; ±SE) and statistical test results (p value) for English-speaking international and domestic tourists in the GBR region, comparing agreement ratings indicating stewardship sentiment and empowerment to take action to reduce impacts on the GBR. Specific indicators include (a) sense of responsibility, (b) sense of agency, (c) willingness to act, (d) willingness to learn, (e) capacity to act, and (f) opportunity to act

NB. Ratings of agreement for negatively worded statements (a, b, f) are inverted

For the combined tourist sample, willingness to act was positively correlated with willingness to learn (r=.570**), sense of responsibility (r=.326**), sense of agency (r=.190**), opportunity to act (r=.182**), and capacity to act (r=.149**). Willingness to act was also significantly positively correlated with GBR pride (r=.377**) and GBR identity (r=.301**), as well as with values associated with the GBR (e.g. scientific and education value r=.409**, biodiversity value r=.377**; lifestyle value r=.344**; international icon value r=.201**; p<.01), and with affective vulnerability (r=.241**; Spearman's rho, p<.01, 2-tailed).

Trust in sources of information about the GBR

Respondents indicated their level of trust (1-10 scale; 1=do not trust at all, 10=trust very strongly) in the information they received about the GBR from different groups/sources. Trust ratings for both the international and domestic tourists were significantly lower in 2017 for (a) the news media, (b) social media, and (c) family, friends and colleagues (Figure 6).

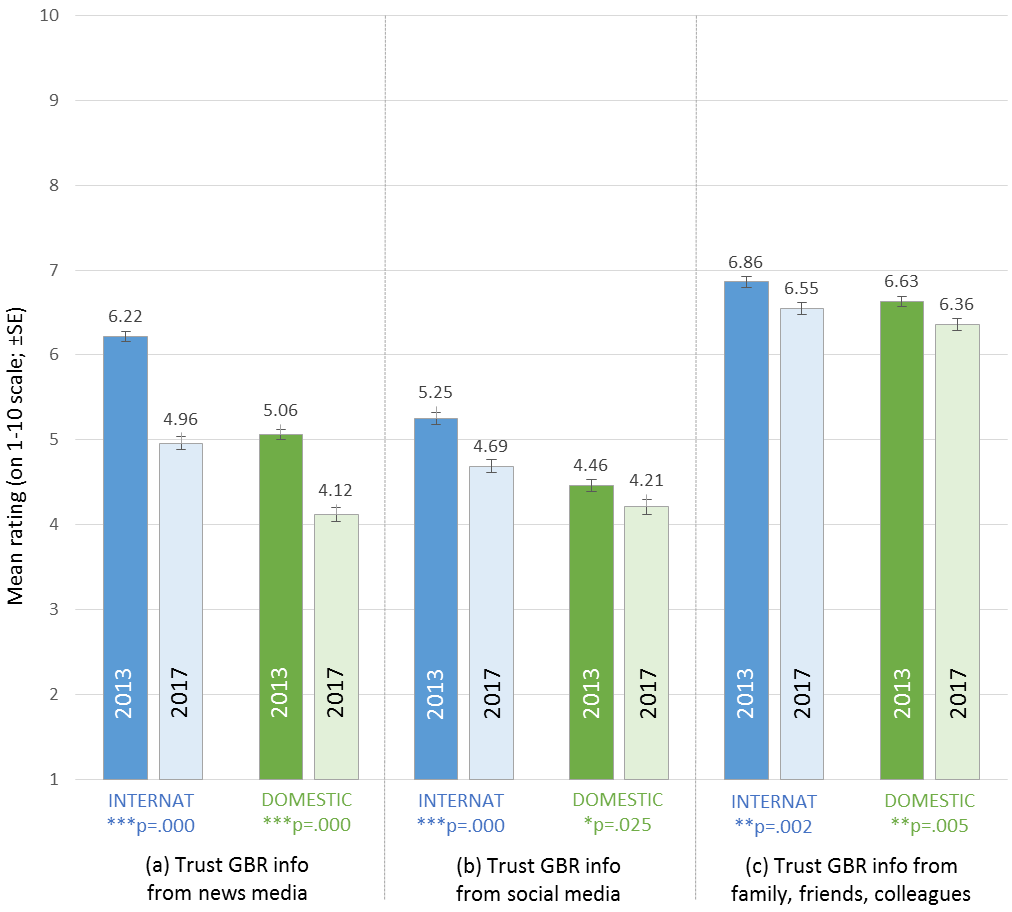

Figure 6 Comparison of mean ratings (2013 and 2017; ±SE) and statistical test results for English speaking international and domestic tourists in the GBR region, comparing ratings of trust in GBR-related information from different sources, including (a) news media, (b) social media, and (c) family, friends and colleagues

Trust in each information source above was significantly correlated with optimism about the future of the GBR (social media r=.183**; family, friends & colleagues r=.158**; news media r=.110**; p<.01). Ratings of perceived coral reef condition were weakly, but significantly, positively correlated with trust levels (news media r=.143**; family, friends & colleagues r=.096**; social media r=.087**; Spearman's rho, p<.01).

Climate change beliefs

We evaluated tourists' beliefs about climate change by asking respondents to select one statement from five options, which best reflected their beliefs. The five statements were: (i) "climate change is an immediate threat requiring action", (ii) "climate change is a serious threat, but the impacts are too distant for immediate concern", (iii) "I need more evidence to be convinced of the problem", (iv) "I believe that climate change is not a threat at all", and (v) "I do not have a view on climate change". The proportion of tourists identifying with the first statement (i) increased substantially from 2013 to 2017, while the proportions for all other statements fell (Figure 7).

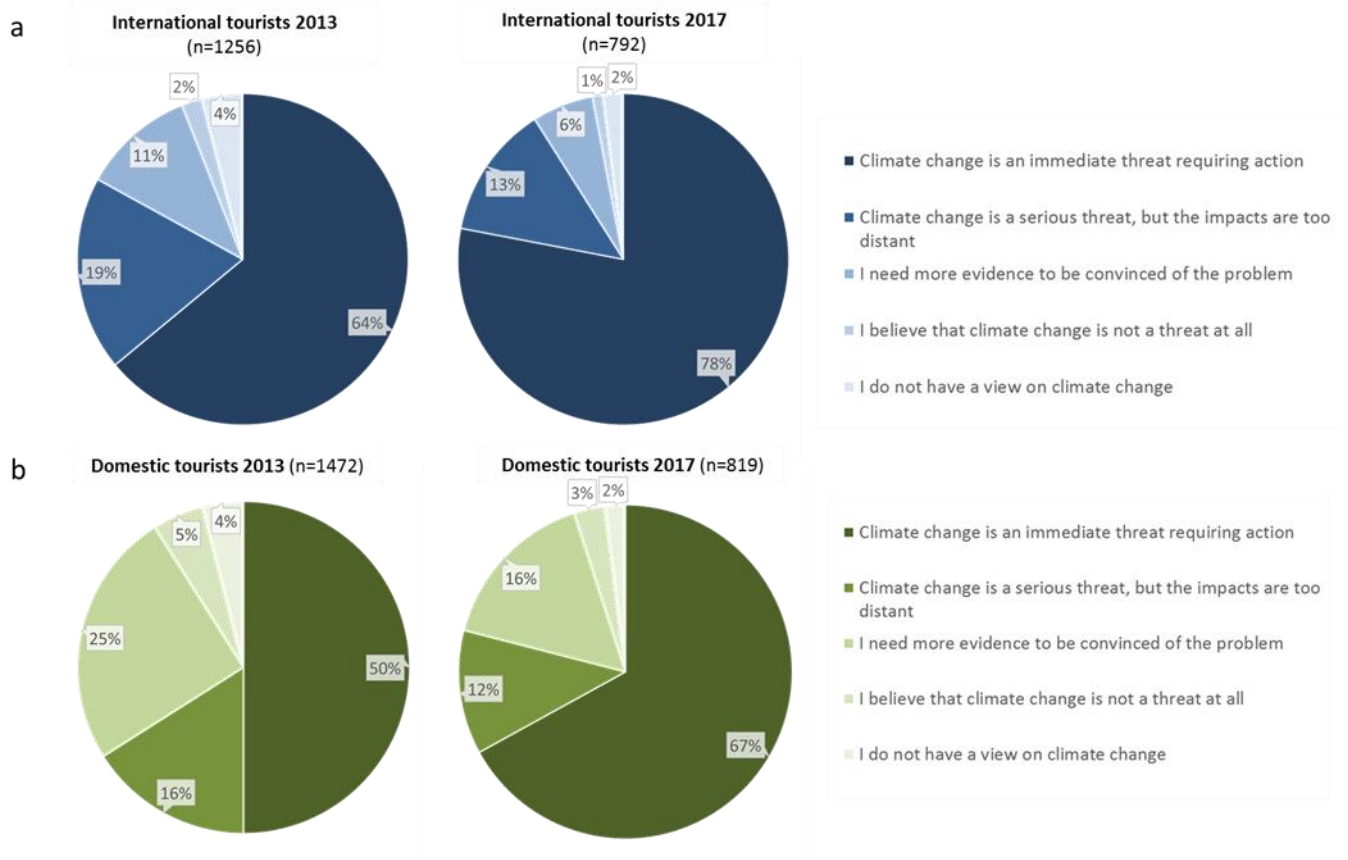

Figure 7 Comparison of the proportion of tourists (2013 and 2017; including (a) domestic and (b) English-speaking international tourists) in categories representing their climate change beliefs, indicated by agreement with one of five statements

Among the international tourists, the proportion identifying with statement (i) increased from 64 per cent in 2013 to 78 per cent in 2017, while among domestic tourists the proportion increased from 50 per cent in 2013 to 67 per cent in 2017. Conversely, the proportion of respondents who indicated that they believe 'climate change is not a threat at all' decreased from 2013 to 2017 among the international tourists from two to one per cent, and among domestic tourists from five to three per cent.

Perceived threats to the GBR

Tourists were asked to list what they thought were the "three most serious threats to the Great Barrier Reef" in an open-ended format. Responses were coded thematically, and frequencies of the major emergent themes were compared between the groups and years sampled. For both the international and domestic tourists, the proportion of respondents identifying climate change among the most serious threats to the GBR increased substantially from 2013 to 2017 (English-speaking international 44% to 54%; domestic 36% to 46%) – making climate change the most frequently cited threat overall (Figure 8).

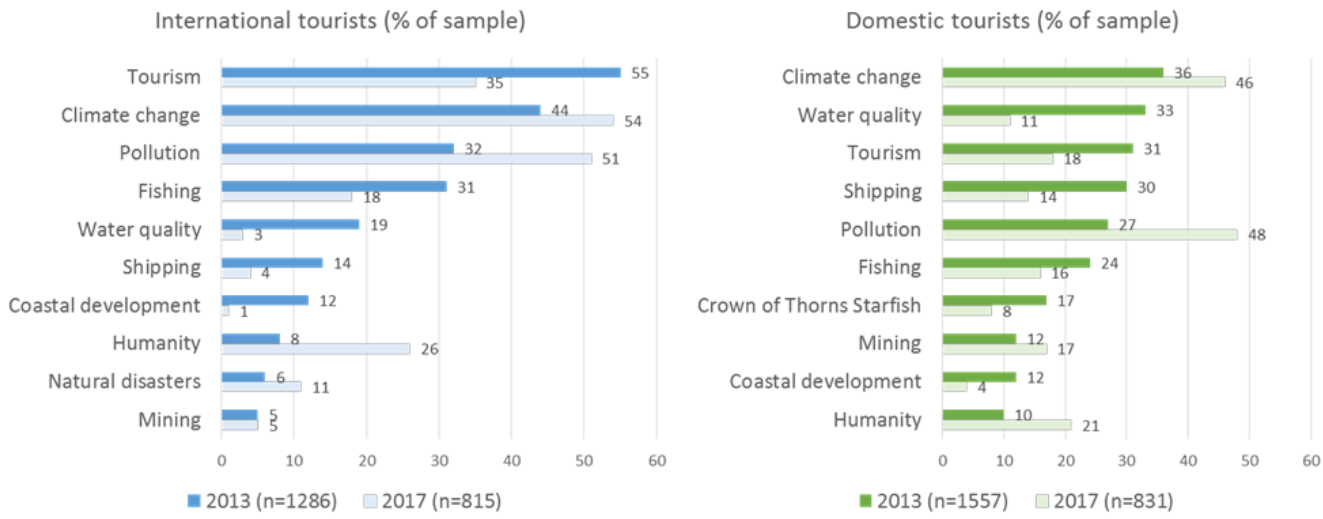

Figure 8 Comparison of the proportion of English-speaking international and domestic tourists (2013 and 2017) who identified specific threats among their perceived 'three most serious threats to the Great Barrier Reef'

NB. Ranking of top ten response themes shown for each group based on 2013 responses

In 2013, the international tourists identified tourism (e.g. responses included: ‘tourism boats’, ‘mass tourism’, ‘careless tourists’, ‘poorly managed tourism’) as a leading threat to the GBR more frequently than they did any other threat (55%). This proportion dropped in 2017 to 35 per cent (3rd ranked), and among domestic tourists the proportion fell from 31 to 18 per cent (3rd to 4th ranked). Pollution as a category included a wide range of responses (e.g. ‘litter’, ‘marine debris’, ‘urban pollutants’) and was identified in 2017 by a much greater proportion of both the international (51% cf. 32% in 2013) and domestic tourists (48% cf. 27% in 2013). The other category that displayed a notable increase in its occurrence was humanity (English-speaking international tourists: 8% in 2013 to 26% in 2017; domestic tourists 10% in 2013 to 21% in 2017), which included responses such as ‘overpopulation’, ‘human activity’, and ‘anthropogenic threats’.

Perceptions of threats to the GBR are very likely influenced by issues that are prominent in the media at the time (e.g. Abbot Point port development in 2013; mass coral bleaching in 2016-2017; cf. Lankester et al., 2015) and we note a forthcoming paper by Curnock et al. (in review) that explores factors that were likely to have influenced threat perceptions among tourists in 2017.

Part 2 Results: GBR tourism operators

Sample description

Sample sizes, basic demography, and years of experience and operation in the GBR tourism industry for respondents in 2013 and 2017 are shown below (Table 2). All operations that were surveyed in 2017 had also been surveyed in 2013; however, some interview participants in 2017 were surveyed for the first time (i.e. they were different/new staff in the same company). Respondents were interviewed on the basis that they were either the business owner, manager or a senior member of staff who understood the scope and state of the company's business and could speak on its behalf. Respondents were mostly male (79% in 2013, 72% in 2018), had extensive experience working in the GBR tourism industry (mean 17.3 years in 2017), and their companies had operated in the GBR for a relatively long time (mean >20 years in 2017; Table 2).

Table 2 SELTMP tourism operator sample description in 2013 and 2017

	2013 Tourism operators (n=119)	2017 Tourism operators (n=94)
Mean age (±SE; range)	47.5 (±0.93; 24-75)	49.2 (±1.17; 26-75)
Gender (F:M; %)	21:79	28:72
Years (personal) experience in GBR tourism industry (±SE; range)	14.4 (±0.89; 1-44)	17.3 (±1.05; 1-40)
Years (company) operating in GBR (±SE; range)	18.6 (±1.78; 1-130)	20.1 (±1.15; 4-47)

While the smaller tourism operator sample size (cf. tourist sample sizes) limits the statistical power of comparative tests between years, the involvement of repeat respondents and the participation by a significant proportion of the industry (i.e. the 2013 sample was estimated to include more than 50% of operating Marine Park tourism business; Curnock et al., 2014) suggest that any substantive changes in responses to interview questions between years should be considered noteworthy, even if not statistically significant.

GBR perceptions and optimism

Tourism operators' ratings of the aesthetic beauty of the GBR were lower in 2017 than in 2013, as were ratings for their optimism about the future of the GBR, though these differences were not statistically significant (Figure 9). There was no effective difference in rated levels of optimism about the future of their business in the GBR; however, there was a significant increase in 2017 ratings of lower business performance for the year, compared with the preceding year (Figure 9; NB. It should be noted that this significant result does not mean that businesses' performance had dropped below that of 2013, as regional and GBR tourist visitation figures indicate growth over the intervening four years; Great Barrier Reef Marine Park Authority 2018; Tourism and Events Queensland, 2018a, 2018b).

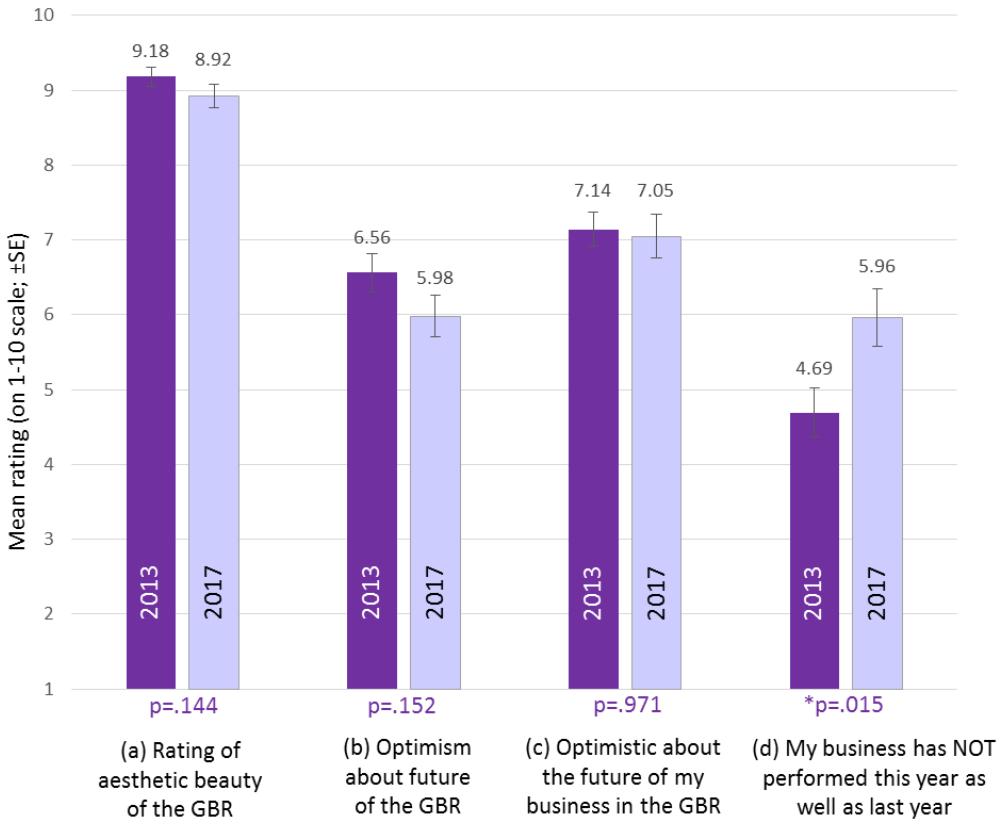

Figure 9 Comparison of mean ratings (1-10 scale; 2013 and 2017; ±SE) and statistical test results (p value) for GBR tourism operators, comparing (a) perceived aesthetic beauty of the GBR, (b) levels of optimism in the future of the GBR, (c) levels of optimism about the future of their business in the GBR, (d) self-assessed relative performance of their business over the previous two years

There was a significant negative correlation between respondents' duration of work experience in the GBR tourism industry and their ratings of optimism in the future of their business in the GBR ($r=-.142^*$, Spearman's rho, $p<.05$, 2-tailed); i.e. the longer a person had worked in the GBR tourism industry, the more likely they were to be less optimistic about the future of their business in the GBR.

Values attributed to the GBR

Values attributed to the GBR were elicited from tourism operator respondents using the same rating scales and statements as per the tourist survey. We found significant increases from 2013 to 2017 in ratings of values attributed to the GBR, including its biodiversity value, economic value (agreement with the additional statement: "The GBR is a great asset for the economy of this region") and international icon value. Ratings of lifestyle value and scientific and education value were also higher in 2017 but the differences were not statistically significant (Figure 10).

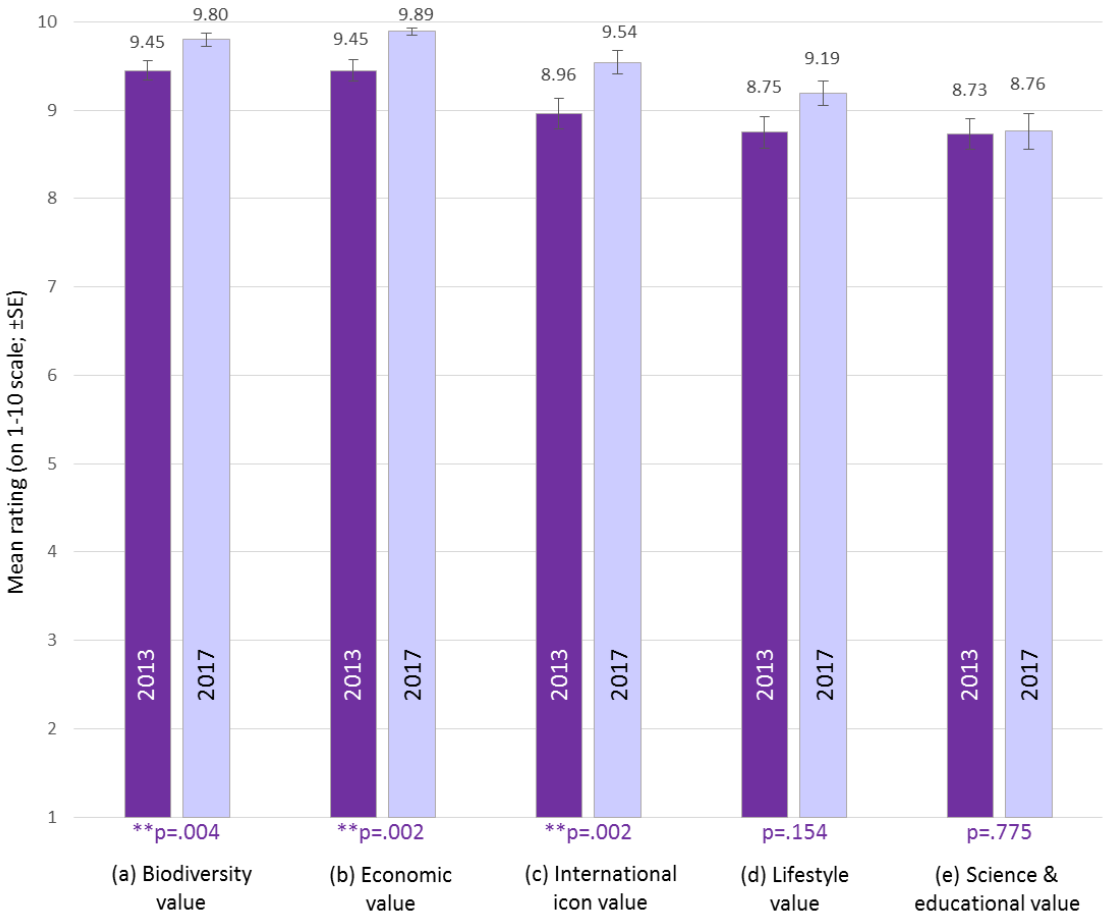

Figure 10 Comparison of mean ratings (1-10 scale; 2013 and 2017; ±SE) and statistical test results (p value) for GBR tourism operators, comparing ratings of relative strength of values associated with the GBR, including (a) biodiversity value, (b) economic value, (c) international icon value, (d) lifestyle value, and (e) scientific and education value

Ratings of these values were strongly correlated with each other; however, ratings for scientific and educational value were significantly negatively correlated with respondents' duration of work experience in the GBR tourism industry (industry experience; r=-.183**, Spearman's rho, p<.01, 2-tailed); i.e. more experienced tourism operators were more likely to give lower ratings for this value.

Relationship with the GBR, identity and occupational attachment

Tourism operators indicated characteristics of their personal relationship with the GBR, identity and occupational attachment, through ratings of agreement with the statements: (a) “I feel proud that the GBR is a World Heritage Area” (GBR pride), (b) “The GBR is part of my identity” (GBR identity), (c) “The GBR contributes to my quality of life and wellbeing” (GBR contribution to wellbeing), (d) “The tourism industry to me is not just a job – it is my lifestyle” (occupational attachment), and (e) “I would NOT be personally affected if the health of the GBR declined” (affective vulnerability; NB. agreement ratings inverted due to negative framing of statement). Ratings of GBR pride in 2017 were significantly higher than in 2013. Between-year differences for other variables were non-significant (Figure 11).

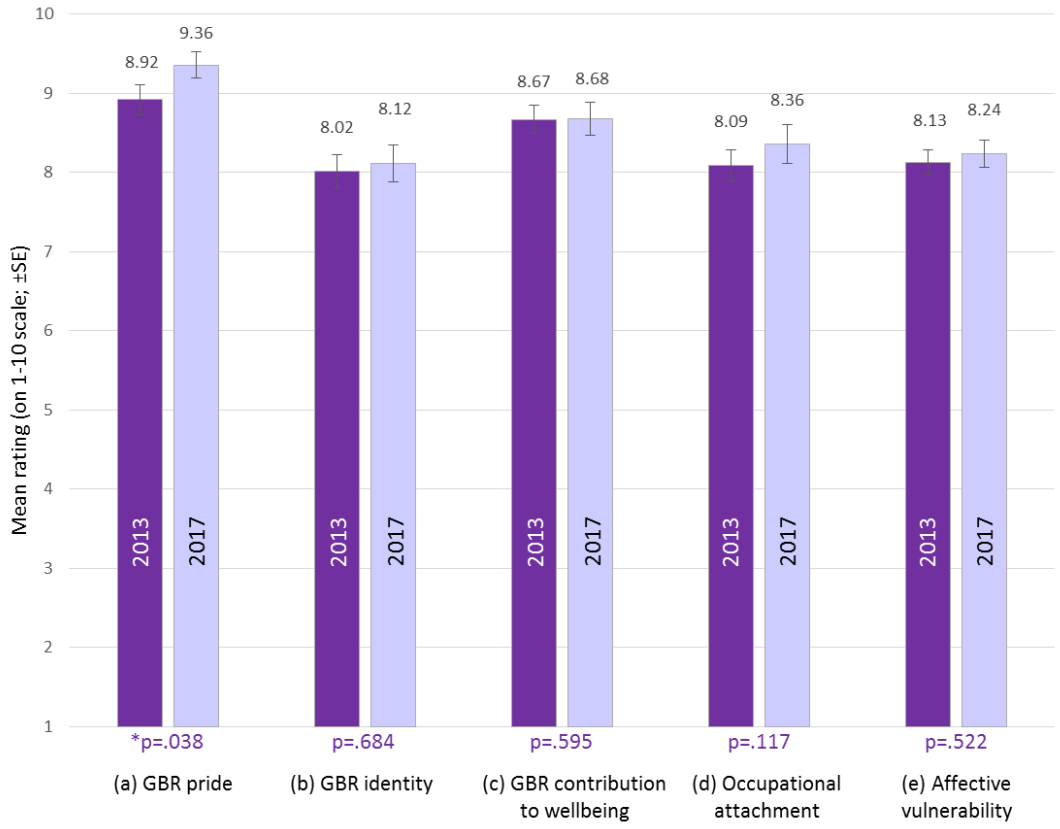

Figure 11 Comparison of mean ratings (1-10 scale; 2013 and 2017; ±SE) and statistical test results (p value) for GBR tourism operators, comparing agreement ratings indicating respondents’ personal relationship with the GBR, identity and occupational attachment. Specific indicators include: (a) GBR pride, (b) GBR identity, (c) GBR contribution to wellbeing, (d) occupational attachment, and (e) affective vulnerability (to declines in GBR health)

NB. Rating of agreement for negatively worded statement (e) is inverted

Respondents’ ratings of affective vulnerability were significantly correlated with their ratings for GBR pride (r=.267**), GBR identity (.321**), GBR contribution to wellbeing (r=.361**), and occupational attachment (r=.277**; Spearman’s rho, p<.01). GBR identity was significantly correlated with respondents’ industry experience (r=.170*; p<.05), and there was a non-significant correlation between industry experience and affective vulnerability (r=.115; p=.097).

Perceptions of GBR management

Tourism operators were asked to give ratings of agreement (1-10; 1=very strongly disagree, 10=very strongly agree) with a series of statements indicating their perceptions of GBR management, including: (a) “I feel confident that the GBR is well managed” (confidence in GBR management), (b) “I support the current rules and regulations that affect access and use of the GBR” (support for regulations), and (c) “I DO NOT have fair access to the GBR compared to other user groups” (perceived equity for GBR use; NB. agreement ratings inverted due to negative framing of statement). There were no substantive or significant differences in these three variables between years (Figure 12).

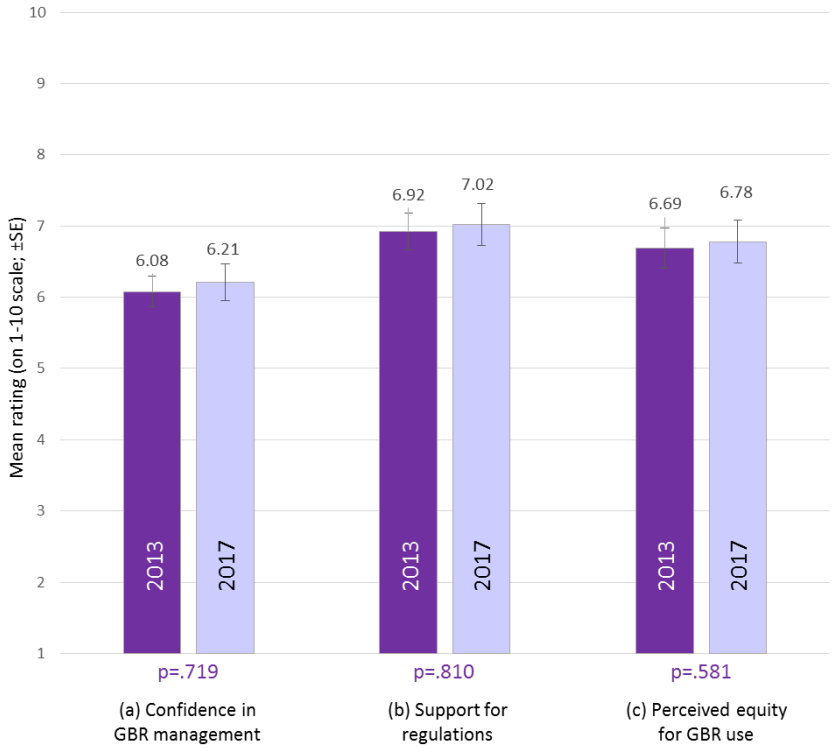

Figure 12 Comparison of mean ratings (1-10 scale; 2013 and 2017; ±SE) and statistical test results (p value) for GBR tourism operators, comparing agreement ratings indicating respondents’ perceptions of GBR management. Indicators include: (a) confidence in GBR management, (b) support for regulations, and (c) perceived equity for GBR use

NB. Rating of agreement for negatively worded statement (c) is inverted

The above three variables (Figure 12) were strongly correlated with each other (e.g. confidence in GBR management with support for regulations r=.527**, p<.01), as well as with GBR pride (confidence in GBR management r=.195**; support for regulations r=.341**; perceived equity for GBR use r=.225**; Spearman’s rho, p<.01, 2-tailed). There was also a significant negative correlation between support for regulations and industry experience (r=-.219**, p<.01); i.e. those respondents who had more experience working in the industry were more likely to rate their support for regulations lower.

Stewardship sentiment and empowerment

Tourism operators' stewardship sentiments and empowerment to take action to reduce impacts and/or protect the GBR were assessed via ratings of agreement with the following statements: (a) "I would like to do more to help protect the GBR" (willingness to act), (b) "It is NOT my responsibility to protect the GBR" (sense of responsibility), (c) "I CANNOT make a personal difference in improving the health of the GBR" (sense of agency), (d) "I have the necessary knowledge and skills to reduce any impact that I might have on the GBR" (capacity to act), and (e) "I DO NOT have the time or opportunity required to reduce any impact that I might have on the GBR" (opportunity to act). Note that in the results below, responses to the negatively worded questions (b, c, and e) are inverted for ease of interpretation (Figure 13). Ratings for capacity to act were lower in 2017 than in 2013 (means of 8.31 in 2013; 7.85 in 2017), although the difference was not statistically significant. There were no significant or substantive differences between years among the remaining variables.

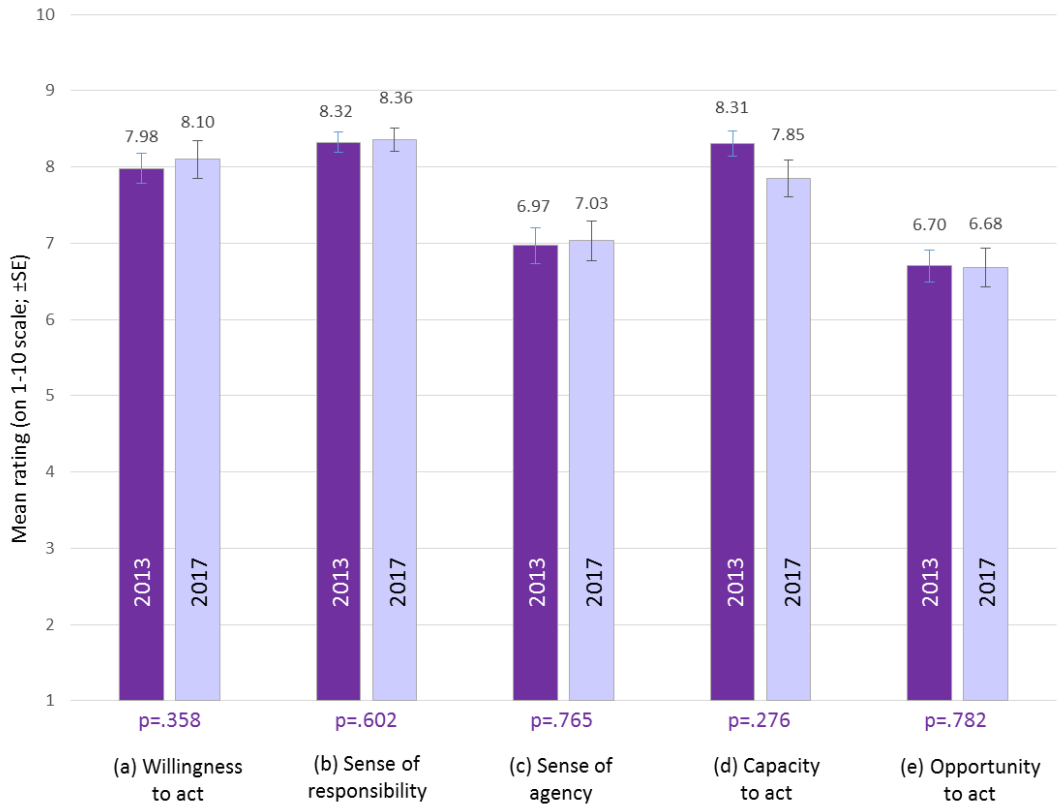

Figure 13 Comparison of mean ratings (1-10 scale; 2013 and 2017; ±SE) and statistical test results (p value) for GBR tourism operators, comparing agreement ratings indicating stewardship sentiment and empowerment to take action to reduce impacts on the GBR. Indicators include: (a) willingness to act, (b) sense of responsibility, (c) sense of agency, (d) capacity to act, and (e) opportunity to act

NB. Ratings of agreement for negatively worded statements (b, c, e) are inverted

Ratings for willingness to act were significantly correlated with those for sense of responsibility (r=.291**), sense of agency (r=.316**), GBR identity (r=.217**), GBR pride (r=.332**) and affective vulnerability (r=.262**; Spearman's rho, p<.01). Ratings for capacity to act and opportunity to act were strongly correlated with each other (r=.448**), as well as with occupational attachment (r=.214**, p<.01 and r=.172*, p<.05 respectively) and with affective vulnerability (r=.193**, p<.01 and r=.158*, p<.05 respectively).

Trust in sources of information about the GBR

Interviewees indicated their level of trust (1-10 scale; 1=do not trust at all, 10=trust very strongly) in the information they received about the GBR from different groups/sources. Rated trust in GBR information from scientists was significantly lower in 2017. Trust ratings also fell for other information sources, including the Great Barrier Reef Marine Park Authority (GBRMPA), industry groups, and social media, but these differences were not statistically significant (Figure 14).

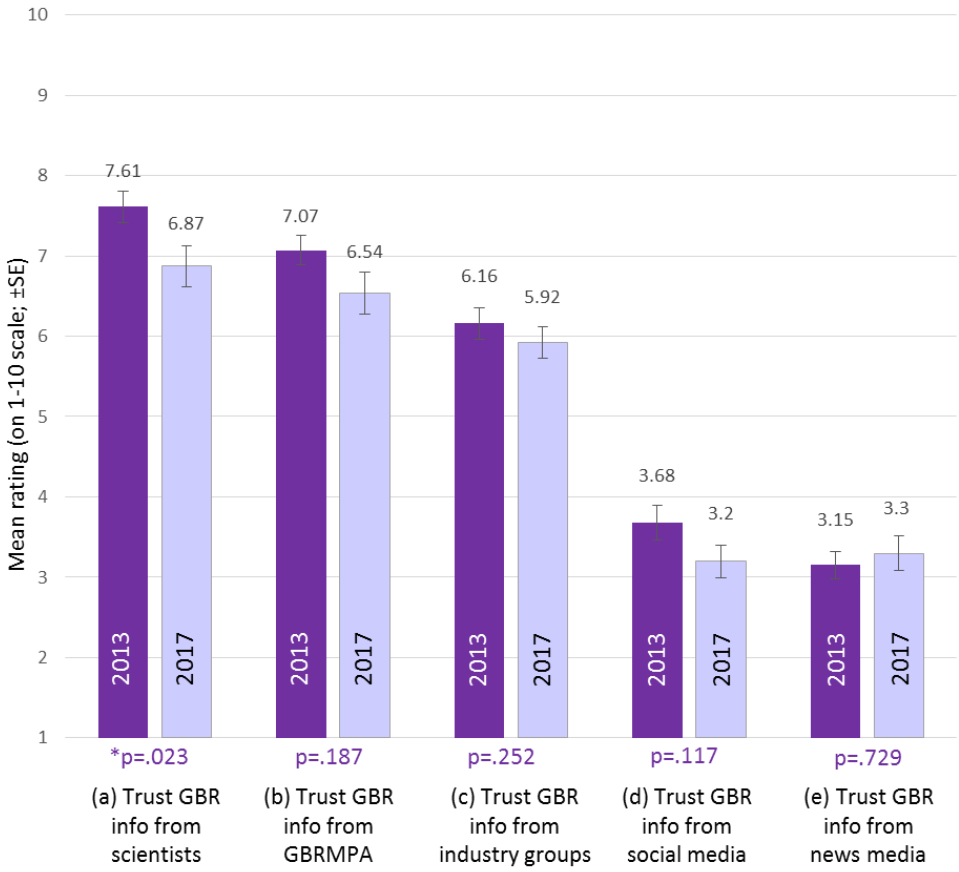

Figure 14 Comparison of mean ratings (1-10 scale; 2013 and 2017; ±SE) and statistical test results (p value) for GBR tourism operators, comparing ratings of trust in GBR-related information from different sources, including (a) scientists from research institutions, (b) the Great Barrier Reef Marine Park Authority, (c) industry groups (e.g. representing tourism, fisheries), (d) social media, and (e) news media

Ratings of trust in different groups were significantly correlated with each other (e.g. GBRMPA with scientists r=.259**; with industry groups r=.299**; with news media r=.379**; with social media r=.270**; p<.01). Trust in GBRMPA was strongly correlated with confidence in GBR management (r=.339**), support for regulations (r=.495**), and perceived equity for GBR use (r=.378**; p<.01). However, trust in GBRMPA was negatively correlated with industry experience (r = -.197**), i.e. more experienced operators were more likely to be less trusting of GBRMPA. Trust in the news media was positively correlated with support for regulations (r=.184**, p<.01), but negatively correlated with capacity to act (r=-.163*, p<.05).

Climate change beliefs

Tourism operators' beliefs about climate change were elicited by asking respondents to select one statement from five options (standard statements as per tourists and all other SELTMP groups surveyed in both 2013 and 2017), which best reflected their beliefs. The proportion of tourism operators identifying with the statement (a) "climate change is an immediate threat requiring action" increased substantially from 2013 to 2017 (50% to 63%), while the proportion who identified with the statement (b) "climate change is a serious threat, but the impacts are too distant for immediate concern" fell substantially (18% in 2013 to 5% in 2017). The proportions of climate change sceptics (i.e. those who indicated "I need more evidence to be convinced of the problem") and climate change deniers ("I believe that climate change is not a threat at all") remained consistent (Figure 15).

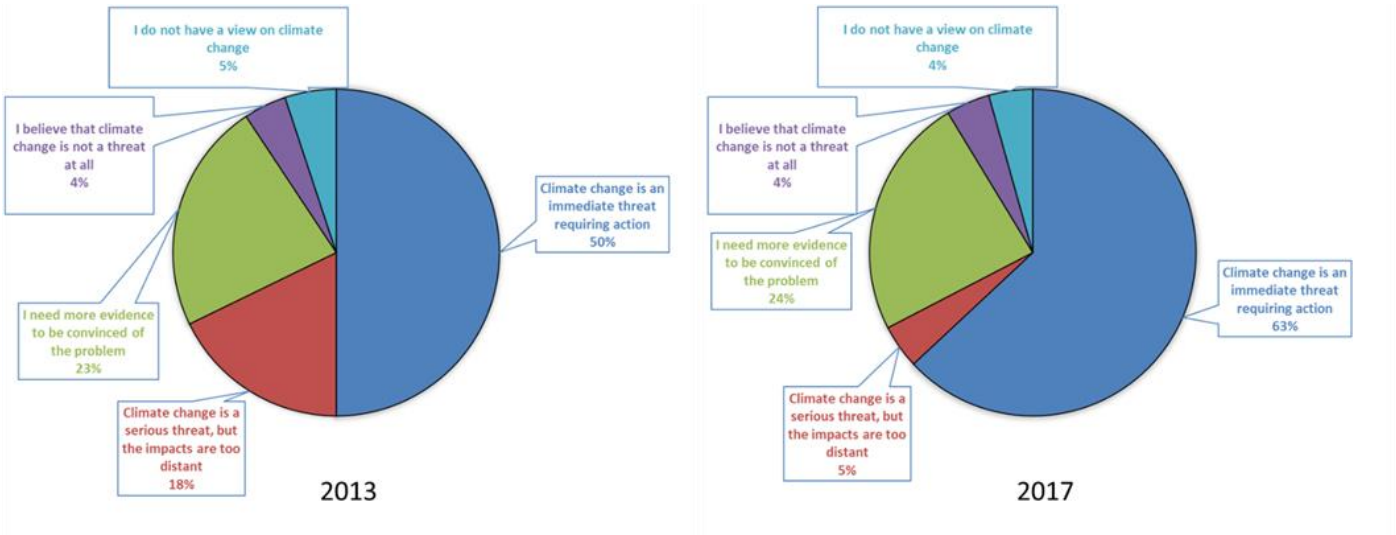

Figure 15 Comparison of the proportion of tourism operators (2013 and 2017) in categories representing their climate change beliefs, indicated by agreement with one of five statements

While the small sub-sample size of respondents in the category "I need more evidence to be convinced of the problem" (climate change sceptics; n=27/119 in 2013, and n=22/94 in 2017) is a limitation for statistical comparisons, this group showed generally lower ratings than climate change believers (respondents who selected statements a or b) for trust in scientists (mean over both years = 6.2/10 cf. 7.65/10) and for trust in GBRMPA (mean over both years = 5.96/10 cf. 7.36/10).

Respondents in the category "I believe that climate change is not a threat at all" (climate change deniers) were few in number (n=5/119 in 2013, and n=4 in 2017), had a longer duration of industry experience compared with climate change believers (mean over both years = 24.3 years cf. 15.4 years), and gave lower ratings of trust in GBRMPA (mean over both years = 4.67/10 cf. 7.36/10).

Perceived threats to the GBR

Tourism operators were asked to list what they thought were the "three most serious threats to the Great Barrier Reef" in an open-ended format. The proportion of respondents identifying climate change increased substantially from 2013 to 2017 (38% to 49%) – making climate change the most frequently cited threat overall (Figure 16).

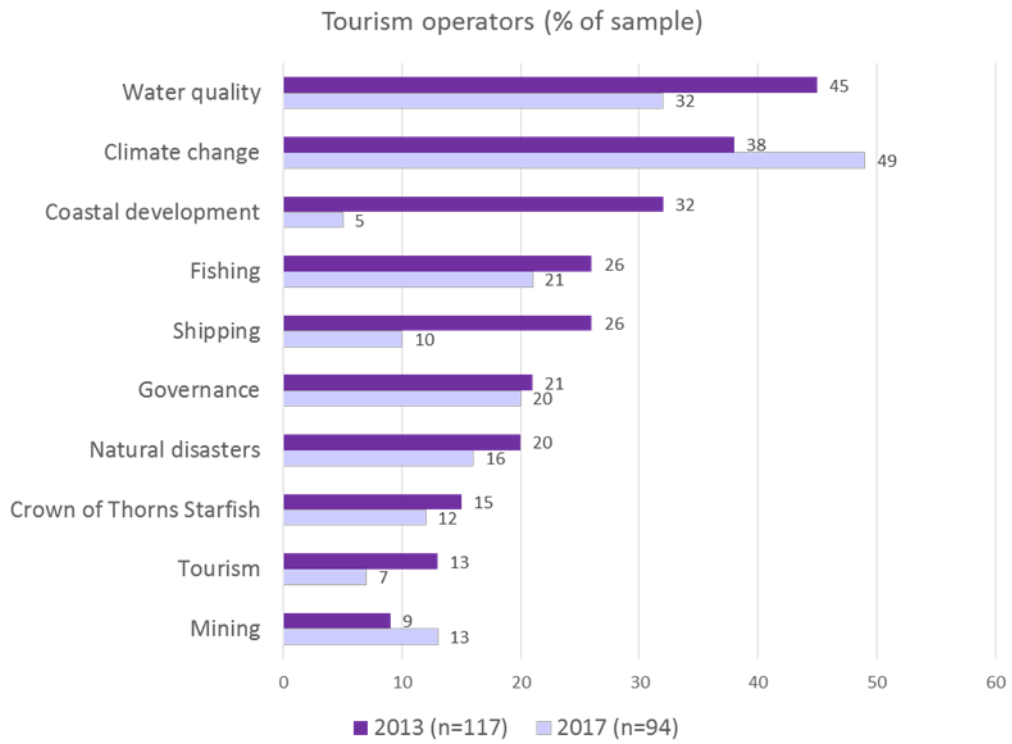

Figure 16 Comparison of the proportion of tourism operators (2013 and 2017) who identified specific threats among their perceived 'three most serious threats to the Great Barrier Reef'

NB. Top ten response themes shown and ranked based on 2013 responses

The threat posed by (poor) water quality was identified by a high proportion of respondents in both years, but dropped in its ranking from the most frequently cited threat in 2013 to the second most cited in 2017 (45% of respondents in 2013 to 32% in 2017). Despite the recency of Severe Tropical Cyclone Debbie and its impact on tourism sites in the Whitsundays region, natural disasters (which included cyclones) were not cited by the majority of respondents as being among the top three threats, and the proportion of respondents who identified natural disasters fell from 20% in 2013 to 16% in 2017. Interestingly, the identification of mining as a serious threat increased from 9% of respondents in 2013 to 13% in 2017, possibly due to its association with climate change in media reports (e.g. in reference to the proposed Adani coal mine – Volling 2017).

Summary of key findings

Tourists in the GBR region

Key findings from statistical comparisons of SELTMP 2013 and 2017 tourist survey data included:

- The decline in tourists' satisfaction with their experience of the GBR in 2017 was statistically significant, and this was correlated with similar significant declines in their ratings of the GBR's aesthetic beauty, and perceived coral reef condition (Fig. 1). While the mean satisfaction ratings in 2017 remained relatively high on the ten-point scale, we note that in a benchmarking review of tourism satisfaction studies, Pearce (2006) identified an inherent positivity bias in such ratings, and found that seemingly small changes in the mean rating can indicate a qualitative difference in the tourist experience.
- Tourists' ratings of optimism about the future of the GBR were also significantly lower in 2017 (Fig. 1). This finding is consistent with the recent identification of 'last chance tourism' (Piggott-McKellar & McNamara, 2017) and is of concern for the potential growth of this travel motivation among GBR tourists.
- Tourists' ratings of the quality of popular GBR activities, such as snorkelling, scuba diving and wildlife watching, also fell significantly (Fig. 2). There were strong correlations between the quality ratings for these activities and tourists' overall satisfaction, as well as with perceived coral reef condition.
- Contrasting with the statistically significant declines in ratings of satisfaction and quality of GBR activities, the rated strength of tourists' values associated with the GBR (e.g. biodiversity value, scientific and education value, lifestyle value, international icon value) increased significantly in 2017 (Fig. 3). Tourists' ratings of *GBR pride* also increased significantly, and domestic tourists gave higher ratings for *GBR identity* (Fig. 4).
- Tourists' rated willingness to take action to help protect the GBR was significantly higher in 2017. Tourists in 2017 also indicated a stronger willingness to learn more about the condition of the GBR. However, tourists' perception of their capacity to take such action (i.e. possession of necessary knowledge and skills) fell significantly in 2017 (Fig. 5).
- Trust in GBR-related information fell, including such information received from the media, social media, and from family, friends and colleagues (Fig. 6). Potential reasons for this decline in trust, including the role of the media and reporting of the 2016-2017 coral bleaching events, are explored in forthcoming papers (e.g. Curnock et al. in review).
- The overwhelming majority of tourists now recognise climate change as "an immediate threat requiring action" (Fig. 7), and overall, climate change was the most frequently identified threat among the 'three most serious threats to the GBR', increasing substantially in its recognition by both domestic and English-speaking international tourists in 2017 (Fig. 8).

Marine Park tourism operators

Key findings from comparisons of SELTMP 2013 and 2017 tourism operator survey data included:

- Tourism operators' ratings of the aesthetic beauty of the GBR, and of their optimism about the future of the GBR fell in 2017, although the difference was not statistically significant (Fig. 9). More experienced operators (i.e. those respondents who had worked in the industry for longer) were generally less optimistic about the future of their business in the GBR.
- Tourism operators' values associated with the GBR (e.g. biodiversity value, economic value, international icon value) were given significantly higher ratings in 2017 (Fig. 10). This increase is similar to that shown by tourists (cf. Fig. 3), and may be a response to impacts from mass coral bleaching over 2016 and 2017. Similarly, ratings of pride associated with the GBR rose significantly, and there were non-significant increases in ratings of GBR identity and occupational attachment (Fig. 11). More experienced tourism operators gave higher ratings indicating that the GBR is part of their identity.
- Tourism operators' perceptions of GBR management were consistent between years, with moderate to high ratings given for confidence in GBR management, support for regulations, and perceived equity for access and use of the GBR (Fig. 12). More experienced tourism operators, however, gave lower ratings of support for rules and regulations that affect access and use of the GBR.
- Indicators of tourism operators' GBR stewardship sentiment were consistent between years, with slight (non-significant) increases in ratings for their willingness to act, their sense of responsibility, and sense of agency (i.e. the belief that they can make a personal difference in improving the health of the GBR; Fig. 13). Ratings for their capacity to act (i.e. belief that they have the necessary knowledge and skills to reduce impacts on the GBR) dropped slightly in 2017, though the result was not significant.
- Trust in information about the GBR declined for most sources of information, including for scientists, GBRMPA, industry groups and social media sources. The greatest decline in stated trust was that for scientists; however, overall scientists remained the most trusted source of information about the GBR, followed by GBRMPA (Fig. 14). More experienced tourism operators were also less trusting of GBRMPA.
- The proportion of tourism operators who indicated belief that "climate change is an immediate threat requiring action" increased substantially (50% in 2013 to 63% in 2017); however, the proportion of climate change sceptics and climate change deniers among GBR tourism operators (while in the minority) remained constant (Fig. 15).
- Climate change was the most frequently identified threat among the 'three most serious threats to the GBR', increasing in its prominence in 2017. Other leading threats to the GBR identified by tourism operators included poor water quality, fishing, governance, natural disasters (e.g. cyclones and floods), mining, and crown of thorns starfish (Fig. 16).

Conclusion

Tourist perceptions of the health and aesthetic appeal of the Great Barrier Reef form an important part of their travel planning decisions, and can strongly influence their experiences and satisfaction when they visit. The results in this report reveal that significant changes have occurred in tourists' perceptions, experiences and satisfaction with the GBR, and it appears likely that the impacts of coral bleaching and a severe tropical cyclone over 2016 and 2017 contributed to these changes. The effect of these changes on future tourist visitation remains unclear. Tourist visitation statistics (currently available only to end-2017) for the Marine Park (GBRMPA 2018) and major GBR tourist regions (Tourism and Events Queensland 2018a, b), show peak tourist visitation in 2016 that declined slightly, but remained high through 2017. While recent reports of coral recovery at some affected reefs (e.g. Reef and Rainforest Research Centre 2018) give hope that tourist satisfaction may improve to earlier levels in the short-term, the extensive international media publicity associated with coral bleaching event (e.g. Jacobsen 2016) may have longer-lasting effects on the GBR's reputation and tourist visitation patterns.

Associated with the noted declines in perceptions of coral reef condition and aesthetic appeal, are increases in tourists' and tourism operators' pride in the GBR, their values associated with it, and their willingness to take action to help protect it. Similar increases in these values have also been shown within the GBR coastal resident population (Marshall & Curnock 2019). These attributes can potentially assist GBR managers in their efforts to encourage greater GBR stewardship and participation in specific initiatives; however, barriers that have been identified among tourism operators, both in these results (e.g. lingering climate change scepticism among some operators, declining trust in scientists and managers) and in other recent studies (e.g. operators' reluctance to discuss GBR threats and climate change with tourists; Goldberg et al., 2017), will need to be overcome.

Ongoing monitoring of the human dimension of the GBR, including those indicators presented in this report, provides important contextual information about the changing state of different communities' use and relationship with the GBR. Such data can inform and assist GBR managers in multiple ways, including in their assessment of management effectiveness, in their spatial planning for different activities and user types within the Marine Park (e.g. Plans of Management), and in their development of engagement strategies that aim to improve GBR stewardship among different community and industry groups. The ability to utilise up-to-date information, and our understanding of cause-and-effect relationships within the social-ecological system, will continue to improve as longitudinal human dimensions monitoring data are accumulated.

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Appendix A SELTMP 2013 and 2017 tourist and tourism operator survey questions and results in human dimension indicator framework for Reef 2050 benchmarking

Table A: SELTMP TOURIST survey questions as human dimension indicators for Reef 2050 integrated monitoring under RIMReP. Human dimension clusters and attributes organised according to Gooch et al.'s (2018) framework for human dimension benchmarking for targets and objectives of the Reef 2050 Plan. Results for English-speaking international and domestic tourists are combined unless otherwise shown

Human Dimension Cluster	HD Attribute	SELTMP indicator (survey question)	Mean 2013	Mean 2017	Direction of change and significance
Aspirations, capacity & stewardship	ACS1: Levels of community awareness & education about the GBR	How would you rate the overall condition of this site (that you visited on this trip) within the Great Barrier Reef?	N/A	7.12	N/A
		What do you think are the three most serious threats to the GBR?	Qual	Qual	See Fig 8
		I am *not* worried about climate change impacts on the GBR	N/A	3.13	N/A
		Climate change beliefs (% believe CC is an immediate threat)	56%	73%	↑ (%)
	ACS2: Community capacity for stewardship	I would like to do more to help protect the GBR	7.02	7.31	↑ p=.000
		I would like to learn more about the condition of the GBR	6.81	7.19	↑ p=.000
		I *cannot* make a personal difference in improving the health of the GBR	5.02	4.64	↓ p=.021
		It is *not* my responsibility to protect the GBR (domestic)	3.50	3.70	↑ p=.027
		It is *not* my responsibility to protect the GBR (international)	3.63	3.61	↓ p=.188
		I feel a social expectation to reduce any impact that I might have on the GBR	N/A	6.19	N/A
		I have the necessary knowledge and skills to reduce any impact that I might have on the GBR	5.28	4.37	↓ p=.000
		I *do not* have the time or opportunity required to reduce any impact that I might have on the GBR	5.31	4.82	↓ p=.004
	ACS3-6: Adoption of responsible/ best practices	I make every effort to use energy efficiently in my home and workplace	N/A	7.42	N/A
		I rarely consider the environmental impact of the production process for goods and services that I purchase	N/A	3.96	N/A
		I don't usually make any extra effort to reduce the waste I generate	N/A	3.33	N/A
		I re-use or recycle most goods and waste (2013 = 'how often do you recycle?')	N/A	7.39	N/A
Community vitality	CV4: Community wellbeing/ satisfaction assoc. with the GBR	How would you rate your overall satisfaction with this experience of the Great Barrier Reef?	8.46	8.07	↓ p=.000
		Rating of quality of Reef activities: snorkelling	8.18	7.46	↓ p=.000
		Rating of quality of Reef activities: scuba diving	8.30	7.48	↓ p=.000
		Rating of quality of Reef activities: fishing, crabbing, spear-fishing	7.03	6.39	↓ p=.113
		Rating of quality of Reef activities: swimming	N/A	7.97	N/A
		Rating of quality of Reef activities: sailing	N/A	7.81	N/A
		Rating of quality of Reef activities: motorised boating	N/A	7.39	N/A
		Rating of quality of Reef activities: non-motorised water sports	N/A	7.16	N/A
		Rating of quality of Reef activities: motorised water sports	N/A	5.97	N/A
		Rating of quality of Reef activities: sightseeing / exploration	8.61	8.49	↓ p=.069
		Rating of quality of Reef activities: photography	N/A	8.38	N/A
		Rating of quality of Reef activities: viewing coral and reef habitats	N/A	7.47	N/A
		Rating of quality of Reef activities: viewing coastal habitats	N/A	7.65	N/A
		Rating of quality of Reef activities: visiting islands / sand cays	N/A	8.20	N/A
		Rating of quality of Reef activities: visiting mainland beaches	N/A	7.99	N/A
		Rating of quality of Reef activities: wildlife watching	8.50	7.97	↓ p=.000
		Rating of quality of Reef activities: camping / hiking	8.28	7.83	↓ p=.030
		Rating of quality of Reef activities: flights (helicopter / seaplane)	N/A	7.11	N/A
		Rating of quality of Reef activities: eating GBR seafood	8.4	8.04	↓ p=.300
		Rating of quality of Reef activities: socialising with family / friends	N/A	8.75	N/A

		Rating of quality of Reef activities: showing the Reef to visitors	N/A	7.45	N/A
		Rating of quality of Reef activities: studying/learning	N/A	7.48	N/A
		The GBR contributes to my quality of life and well-being	N/A	5.44	N/A
		I feel optimistic about the future of the GBR	6.18	5.20	↓ p=.000
		I would *not* be personally affected if the health of the GBR declined	4.31	4.37	↑ p=.001
		Thinking about coral bleaching makes me feel depressed	N/A	6.81	N/A
		I love that I have visited the GBR	N/A	7.79	N/A
		I value the GBR because it makes me feel better physically and/or mentally	N/A	6.23	N/A
		There is too much rubbish (plastics and bottles) on the beaches	N/A	6.72	N/A
		The coral reefs that I have seen are in good condition (2013: The place that I most recently visited in the GBR is NOT in great condition; *inverted*)	6.95	4.85	↓ p=.000
		I like the colour/clarity of water along the beaches	N/A	6.50	N/A
Culture and heritage	CH3: Contemporary culture	What are the first words that come to mind when you think of the Great Barrier Reef?	Qual	Qual	N/A
		I feel proud that the GBR is a World Heritage Area	8.77	8.83	↑ p=.000
		The GBR is a great asset for the economy of this region	N/A	8.78	N/A
		The GBR is part of my identity (domestic tourists)	5.45	5.99	↑ p=.000
		The GBR is part of my identity (international tourists)	3.50	3.69	↑ p=.177
		The aesthetic beauty of the GBR is outstanding	8.95	8.36	↓ p=.000
		I value the GBR because it supports a variety of life, such as fish and corals	8.98	9.05	↑ p=.000
		I value the GBR because it supports a desirable and active way of life	8.04	8.07	↑ p=.000
		I value the GBR because we can learn about the environment through scientific discoveries	8.29	8.37	↑ p=.000
		I value the GBR because it attracts people from all over the world	7.79	7.95	↑ p=.000
		I value the GBR for the fresh seafood it provides	6.16	5.80	↓ p=.613
		I value the GBR because it is spiritually important to me	N/A	4.87	N/A
		I value the GBR because it inspires me in artistic or thoughtful ways	N/A	5.69	N/A
		I value the GBR simply because it exists, even if I don't use or benefit from it	N/A	8.15	N/A
		I value the GBR because of its rich Traditional Owner Heritage	N/A	6.68	N/A
		I value the GBR because it provides a place where people can continue to pass down wisdom, traditions and a way of life	N/A	6.60	N/A
		I value the GBR because it is an important part of my culture	N/A	4.52	N/A
Economic values	EV3: Economic viability of GBR-dependent industries	For how many days will you be in the GBR region during this visit?			
		What was the main reason you travelled to the region?	Qual	Qual	N/A
		Is this your first visit to the GBR region?	50%	55%	↑ (%)
		Have you visited the Great Barrier Reef during this current visit to the region?	70%	62%	↓ (%)
		Location of place visited most recently within GBR	Qual	Qual	N/A
		Did you pay to go on an organised tour on this trip?	36%	35%	–
		Where was your point of departure?	Qual	Qual	–
		How long was this trip to the Great Barrier Reef?	Qual	Qual	–
		How many other people went with you in your group?	Qual	Qual	–
Governance	G3: Adaptive governance capacity of decision making institutions & sectors	In general, would you consider yourself to be more traditional or progressive?	N/A	6.21	N/A
		I think enough is being done to effectively manage the GBR	N/A	3.50	N/A
		Trust rating for GBR information: the Australian Government	N/A	5.39	N/A
		Trust rating for GBR information: the Queensland Government	N/A	5.42	N/A
		Trust rating for GBR information: friends, family, work colleagues	6.74	6.00	↓ p=.000
		Trust rating for GBR information: GBRMPA	N/A	6.90	N/A
		Trust rating for GBR information: Scientists	N/A	7.61	N/A
		Trust rating for GBR information: industry groups	N/A	4.67	N/A
		Trust rating for GBR information: Australian-based NGOs	N/A	5.94	N/A
		Trust rating for GBR information: International NGOs	N/A	6.38	N/A
		Trust rating for GBR information: News media	5.59	4.23	↓ p=.000
		Trust rating for GBR information: Social media	4.86	3.77	↓ p=.000
		Trust rating for GBR information: Lobby groups	N/A	3.65	N/A
		Reliance for news: local newspapers	N/A	4.72	N/A
		Reliance for news: state/regional newspapers	N/A	4.40	N/A
		Reliance for news: magazines	N/A	3.51	N/A
		Reliance for news: free-to-air TV	N/A	5.02	N/A
		Reliance for news: pay TV	N/A	3.48	N/A
		Reliance for news: digital streaming services	N/A	4.20	N/A
		Reliance for news: local radio	N/A	4.99	N/A
		Reliance for news: national/regional radio	N/A	4.93	N/A

		Reliance for news: online discussion forums	N/A	3.76	N/A
		Reliance for news: Facebook	N/A	4.26	N/A
		Reliance for news: Twitter	N/A	2.69	N/A
		Reliance for news: Instagram	N/A	2.80	N/A
		Reliance for news: Snapchat	N/A	2.28	N/A
		Reliance for news: Youtube	N/A	3.24	N/A
		Reliance for news: News media websites	N/A	4.55	N/A
		Reliance for news: Word of mouth	N/A	4.77	N/A
	Demographic information	Year of birth (age)	40	35	↓
		Gender (F:M)	50:50	54:46	F↑ (%)
		Identify as Aboriginal Australian (domestic tourists)	2.8%	1.8%	↓ (%)
		Identify as Torres Strait Islander (domestic tourists)	0.9%	0.4%	↓ (%)
		Identify as a backpacker	34%	41%	↑ (%)
		Place of residence (postcode or country)	Qual	Qual	N/A

NB. A p value of .05 or smaller indicates a statistically significant difference in rating scores between years (95% confidence interval).

Table B: SELTMP TOURISM OPERATOR survey questions as human dimension indicators for Reef 2050 integrated monitoring under RIMReP. Human dimension clusters and attributes organised according to Gooch et al.'s (2018) framework for human dimension benchmarking for targets and objectives of the Reef 2050 Plan.

Human Dimension Cluster	HD Attribute	SELTMP indicator (survey question)	Mean 2013	Mean 2017	Direction of change and significance
Aspirations, capacity & stewardship	ACS1: Levels of community awareness & education about the GBR	What do you think are the three most serious threats to the GBR?	Qual	Qual	See Fig 16
		I am *not* worried about climate change impacts on the GBR	N/A	3.18	N/A
		Climate change beliefs (% who believe CC is an immediate threat)	50%	63%	↑ (%)
	ACS2: Community capacity for stewardship	I would like to do more to help protect the GBR	7.98	8.10	↑ p=.358
		I would like to do more to improve water quality in my waterways (including rivers, creeks)	N/A	8.33	N/A
		I would like to learn more about the condition of the GBR	N/A	7.64	N/A
		I *cannot* make a personal difference in improving the health of the GBR	3.03	2.97	↓ p=.765
		It is *not* my responsibility to protect the GBR	1.68	1.64	↓ p=.602
		I feel a social expectation to reduce any impact that I might have on the GBR	N/A	7.70	N/A
		I have the necessary knowledge and skills to reduce any impact that I might have on the GBR	8.31	7.85	↓ p=.276
		I *do not* have the time or opportunity required to reduce any impact that I might have on the GBR	3.30	3.32	↑ p=.782
	ACS3-6: Adoption of responsible/ best practices	I make every effort to use energy efficiently in my business	N/A	8.98	N/A
		I *rarely* consider the environmental impact of the production process for goods and services that my business uses	N/A	3.23	N/A
		I *don't* usually make any extra effort to reduce the waste my business generates	N/A	2.08	N/A
		My business re-uses or recycles most goods and waste	N/A	7.18	N/A
		Does your operation: have fuel efficient engines?	88%	94%	↑ (%)
		Does your operation: use an emissions calculator to plan your business operations?	28%	27%	↓ (%)
		Does your operation: use carbon offsets to counter emissions?	19%	17%	↓ (%)
		Does your operation: have green energy, such as solar panels?	43%	39%	↓ (%)
		Does your operation: use alternative fuels such as biodiesel and ethanol?	8%	6%	↓ (%)
		Does your operation: participate in best practices via a code of practice, or MOU?	83%	91%	↑ (%)
		Does your operation: participate in GBRMPA's Eye on the Reef program?	45%	56%	↑ (%)
		Does your operation: contribute to Crown of Thorns Starfish control?	N/A	36%	N/A
		Does your operation: employ formally trained guides providing interpretation about the Reef?	N/A	58%	N/A
Community vitality	CV4: Community wellbeing/ satisfaction	I love that I live beside the GBR	N/A	9.57	N/A
		The GBR contributes to my quality of life and well-being	8.67	8.68	↑ p=.595
		I feel optimistic about the future of the GBR	6.56	5.98	↓ p=.152
		I would *not* be personally affected if the health of the GBR declined	1.87	1.76	↓ p=.522
		Thinking about coral bleaching makes me feel depressed	N/A	6.31	N/A

	assoc. with the GBR	I value the GBR because it makes me feel better physically and/or mentally	N/A	7.40	N/A
		There is too much rubbish (plastics and bottles) on the beaches	N/A	6.70	N/A
		The coral reefs in my region are in good condition	N/A	5.77	N/A
		I like the colour/clarity of water along the beaches	N/A	5.89	N/A
		The mangroves in my region are in good health	N/A	7.63	N/A
		The estuarine and marine fish in my region are in good condition	N/A	7.40	N/A
		The freshwater areas (e.g. rivers, creeks) in my region are not in good condition	N/A	4.16	N/A
Culture and heritage	CH3: Contemporary culture	What are the first words that come to mind when you think of the Great Barrier Reef?	Qual	Qual	N/A
		I feel proud that the GBR is a World Heritage Area	8.92	9.36	↑ p=.038
		The GBR is a great asset for the economy of this region	9.45	9.89	↑ p=.002
		The GBR is part of my identity	8.02	8.12	↑ p=.684
		The aesthetic beauty of the GBR is outstanding	9.18	8.92	↓ p=.144
		I value the GBR because it supports a variety of life, such as fish and corals	9.45	9.80	↑ p=.004
		I value the GBR because it supports a desirable and active way of life	8.75	9.19	↑ p=.154
		I value the GBR because we can learn about the environment through scientific discoveries	8.73	8.76	↑ p=.775
		I value the GBR because it attracts people from all over the world	8.96	9.54	↑ p=.002
		I value the GBR for the fresh seafood it provides	N/A	7.38	N/A
		I value the GBR because it is spiritually important to me	N/A	6.19	N/A
		I value the GBR because it inspires me in artistic or thoughtful ways	N/A	6.70	N/A
		I value the GBR simply because it exists, even if I don't use or benefit from it	N/A	8.69	N/A
		I value the GBR because of its rich Traditional Owner Heritage	N/A	5.89	N/A
		I value the GBR because it provides a place where people can continue to pass down wisdom, traditions and a way of life	N/A	6.81	N/A
		I value the GBR because it is an important part of my culture	N/A	5.98	N/A
		I couldn't think of being anything other than a tourism operator	6.21	6.80	↑ p=.148
		The tourism industry to me is not just a job – it is my lifestyle	8.09	8.36	↑ p=.117
Economic values	EV3: Economic viability of GBR-dependent industries	I am optimistic about the future of my business in the GBR	7.14	7.05	↓ p=.971
		My business has *not* performed this year as well as last year	4.69	5.96	↑ p=.015
		What are the primary types of tourism activity that your company offers?	Qual	Qual	N/A
		Which tourism activity contributes MOST to the total income for your business?	Qual	Qual	N/A
		About how many days in the previous 12 months were you operating in the GBR?	233	222	↓
		Where is your home port?	Qual	Qual	N/A
		Do you use multiple ports?	Qual	Qual	N/A
		What proportion of your household income came from tourism in the last financial year?	Qual	Qual	N/A
		How many employees (FTE) did your operation employ over the previous 12 months?	22	36	↑
		Do you have insurance for your business assets?	92%	98%	↑
		Could you please indicate (approximately) your business turnover (entire revenue) for the past 12 months, in broad categories?	Qual	Qual	N/A
Governance	G3: Adaptive governance capacity of decision making institutions & sectors	I *do not* have fair access to the GBR compared to other user groups	3.31	3.22	↓ p=.581
		I feel confident that the GBR is well managed	6.08	6.21	↑ p=.719
		I support the current rules and regulations that affect access and use of the GBR	6.92	7.02	↑ p=.810
		I support the current rules and regulations that affect access and use of freshwater areas (rivers and creeks) in my region	N/A	7.40	N/A
		In general, would you consider yourself to be more traditional or progressive?	N/A	7.28	N/A
		I feel like I can contribute to GBR management	N/A	8.14	N/A
		I think enough is being done to effectively manage the GBR	N/A	4.12	N/A
		I feel that future generations have been adequately considered in the management of the GBR	N/A	4.98	N/A
		Trust rating for GBR information: the Australian Government	N/A	4.44	N/A
		Trust rating for GBR information: the Queensland Government	N/A	4.47	N/A
		Trust rating for GBR information: friends, family, work colleagues	N/A	6.89	N/A
		Trust rating for GBR information: GBRMPA	7.07	6.54	↓ p=.187
		Trust rating for GBR information: Scientists	7.65	6.87	↓ p=.023
		Trust rating for GBR information: industry groups	6.16	5.92	↓ p=.252
		Trust rating for GBR information: Australian-based NGOs	N/A	5.58	N/A
		Trust rating for GBR information: International NGOs	N/A	4.94	N/A
		Trust rating for GBR information: News media	3.14	3.30	↑ p=.729

		Trust rating for GBR information: Social media	3.68	3.20	↓ p=.117
		Trust rating for GBR information: Lobby groups	N/A	3.77	N/A
		Reliance for news: local newspapers	N/A	4.38	N/A
		Reliance for news: state/regional newspapers	N/A	3.88	N/A
		Reliance for news: magazines	N/A	3.12	N/A
		Reliance for news: free-to-air TV	N/A	4.64	N/A
		Reliance for news: pay TV	N/A	2.75	N/A
		Reliance for news: digital streaming services	N/A	3.92	N/A
		Reliance for news: local radio	N/A	4.42	N/A
		Reliance for news: national/regional radio	N/A	4.44	N/A
		Reliance for news: online discussion forums	N/A	3.48	N/A
		Reliance for news: Facebook	N/A	4.16	N/A
		Reliance for news: Twitter	N/A	2.01	N/A
		Reliance for news: Instagram	N/A	2.50	N/A
		Reliance for news: Snapchat	N/A	1.87	N/A
		Reliance for news: Youtube	N/A	2.87	N/A
		Reliance for news: News media websites	N/A	4.34	N/A
		Reliance for news: Word of mouth	N/A	5.84	N/A
	Demographic information	Year of birth (age)	47	49	↑
		What is your role in your company?	Qual	Qual	N/A
		How long have you been involved in the GBR tourism industry? (yr)	14	17	↑
		How long has your current business been operating? (yr)	19	20	↑
		For how many years have you lived in the GBR region? (yr)	20	24	↑
		Gender (F:M)	Qual	Qual	N/A
		Current home postcode	Qual	Qual	N/A
		Marital status	Qual	Qual	N/A
		Do you have university or TAFE education (beyond high school)?	Qual	Qual	N/A

NB. A p value of .05 or smaller indicates a statistically significant difference in rating scores between years (95% confidence interval).

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FOR FURTHER INFORMATION

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