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IMPACTS OF THE 2016 AND 2017 MASS CORAL BLEACHING EVENTS ON THE GREAT BARRIER REEF TOURISM INDUSTRY AND TOURISM-DEPENDENT COASTAL COMMUNITIES OF QUEENSLAND

BRUCE PRIDEAUX, JULIE CARMODY AND ANJA PABEL

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Impacts of the 2016 and 2017 mass coral bleaching events on the Great Barrier Reef tourism industry and tourism-dependent coastal communities of Queensland

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Impacts of the 2016 and 2017 mass coral bleaching events on the Great Barrier Reef tourism industry and tourism-dependent coastal communities of Queensland

Bruce Prideaux[1], Julie Carmody[1] and Anja Pabel[1]

[1] Centre for Regional Tourism and Opportunities
School of Business and Law,
Central Queensland University

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ACRONYMS

AIMS ..... Australian Institute of Marine Science
AMPTO ..... Association of Marine Park Tourism Operators
CoGBR..... Citizens of the Great Barrier Reef
COTS …… ..... Crown-of-Thorns Starfish
CQU ..... Central Queensland University
CTRO……. .... Centre for tourism and Regional Opportunities
DAE..... Deloitte Access Economics
EMC ..... Environmental Management Charge
GBR..... Great Barrier Reef
GBRMP ..... Great Barrier Reef Marine Park
GBRMPA ..... Great Barrier Reef Marine Park Authority
GDP ..... Gross Domestic Product
GHG ..... Green House Gas
GSP ..... Gross State Product
IPCC…….. Intergovernmental Panel on Climate Change
LTO …….. ..... Local Tourism Organisation
MEA ..... Millennium Ecosystem Assessment
NRMR ..... Natural Resource Management Regions
NZ ..... New Zealand
OUV ..... Outstanding Universal Values
PNG ..... Papua New Guinea
POM ..... Plan of Management
QPWS …….. Queensland Parks and Wildlife Service
QTIC..... Queensland Tourism Industry Council
RHIS ..... Reef Health and Impact Survey
RTAF ..... Regional Tourism Adaptation Framework
RTSAF..... Regional Tourism Sustainable Adaptation Framework
RTO …….. .... Regional Tourism Organisation
SELTMP ..... Social and Economic Long Term Monitoring Program
SES..... social-ecological-economic
TEQ..... Tourism and Events Queensland
TRA ..... Tourism Research Australia
TTNQ ……. .... Tropical Tourism North Queensland
UK..... United Kingdom
UNWTO..... United Nations World Tourism Organisation
USA..... United States of America
WTMA …… ... Wet Tropics Management Authority

ABBREVIATIONS

km .....kilometres
m .....mean

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EXECUTIVE SUMMARY

The health of the Great Barrier Reef (GBR) is of enormous economic importance and value to the reef-tourism dependent Queensland communities of Cairns, Port Douglas and the Whitsundays. This report investigates concerns by the local community, the tourism industry and tourists about the immediate and longer-term impacts of the 2016 and 2017 coral bleaching events on the Great Barrier Reef and the communities that depend upon its health. The importance of addressing issues associated with coral bleaching is highlighted by a recent Great Barrier Reef Marine Park Authority (GBRMPA) (2017a) report that stated that "…. bleaching events are expected to increase in frequency and severity as a result of climate change" (p. 25). This report has identified a number of strategies that may be used to enhance the overall resilience of communities in the region.

The report had a specific focus on Cairns because of the significance of the GBR as the destination's major tourism pull factor.

Key findings

1. Available scientific evidence suggests that the GBR is likely to bleach with increasing severity and frequency in future (GBRMPA, 2017a).
2. The GBR is the key destination pull factor for international tourists in Cairns, Port Douglas and the Whitsundays. Further coral bleaching may lead to a significant decline in international tourism, with resultant economic impacts.
3. Given the potential for further coral bleaching in the future (NOAA, 2018), there is a need to develop effective response and recovery strategies for each GBR destination and Queensland as a whole.
4. The GBR is not currently a major pull factor for domestic visitors. While a further decline in the GBR will certainly affect domestic tourism, the economic impact is likely to be less than for international tourism.
5. The business community in Cairns and other GBR destinations have shown strong leadership for over a decade in raising awareness and responding to threats to the GBR including climate change and understand that further decline in the health or perceived health of the GBR poses a significant threat to long-term community resilience.
6. The Cairns community is highly engaged with the GBR and places a high level of value on its protection.
7. Findings from recent GBRMPA research, visitor surveys, focus groups and community surveys indicate that coral dependent tourism destinations are unprepared for a future decline in coral reef tourism.
8. To avoid adverse economic impact, urgent action is required to increase the resilience of coral reef dependent economic sectors and communities by revitalising existing marine tourism experiences, broadening the range of tourism experiences on offer over the longer term and creating opportunities for local action against the global phenomenon of mass coral bleaching.
9. The Cairns community understands the danger that coral bleaching could pose but has yet to indicate a high level of concern about their livelihoods being adversely affected by a further decline in the quality of the GBR as a tourism experience.

10. Coastal destinations that have a small GBR tourism sector will have a higher level of resilience to future coral bleaching events than coral dependent communities such as Cairns, Port Douglas and the Whitsundays.
11. The Whitsundays region may experience coral bleaching in the future and could suffer a fall in tourism as a result. However, destinations in the southern part of the GBR are less likely to suffer a significant decline in tourism as the attractiveness of the GBR declines.
12. Strengthening community resilience will require increased co-operation between the scientific community and coral reef dependent tourism destinations.
13. Authorising and funding coral regeneration programs will provide direct economic benefits to the tourism industry and supporting communities.

Recommendations

Mass coral bleaching and mortality events in 2016 and 2017, plus the expected increase in frequency of such events in future, are expected to have a significant economic impact on the tourism-dependent communities of Cairns, Port Douglas and the Whitsundays. Given that the basic cause of mass coral bleaching – climate change due to greenhouse gas emissions – is global, what can be undertaken locally to improve outcomes for our communities?

1. Develop unified communications from the GBR tourism industry supporting both global emissions reductions and local actions for mitigation/adaptation.
2. Increase investment in community resilience research to support reef dependent communities
3. Diversify GBR tourism options including increasing local environmental stewardship to counter potential or perceived declines in GBR health.
4. Diversify land-based tourism options to supplement GBR tourism options.
5. Undertake regular monitoring of tourists, local communities and the business sector.
6. Develop effective response and recovery strategies to deal with future coral bleaching and other events such as cyclones on both destination and state-wide scales.
7. Allocate funding for research into crisis management to improve community resilience.

1. INTRODUCTION

The aim of this research is to report on concerns by the local community, the tourism industry and tourists about long-term impacts of the 2016 and 2017 coral bleaching events on the Great Barrier Reef (GBR). The importance of addressing this issue is highlighted by a recent Great Barrier Reef Marine Park Authority (GBRMPA) (2017a) report that stated that while coral recovery is possible after a bleaching event, corals are less resilient than in the pre-bleaching period and more susceptible to disease. Of particular concern to GBR dependent communities was the observation that "…. bleaching events are expected to increase in frequency and severity as a result of climate change" (p. 25). This concern was amplified by the National Oceanic and Atmospheric Administration (NOAA) coral watch report (issued on 16th January 2018) (NOAA, 2018) that indicated a 60% probability of thermal bleaching stress between January and April 2018 with the most northern part of the GBR on alert level 1 and the remainder of the GBR on warning. The 90% probability was rated at watch, a lower level of concern. Given the importance of the Great Barrier Reef to the health of the tourism industry in a number of GBR destinations, the potential for further coral bleaching raises serious concerns about the preparedness of the GBR region's tourism industry and communities to deal with this challenge both in the short-term through crisis recovery strategies and in the long-term by developing new reef and land based tourism experiences. Moreover, if further decline in the GBR is seen as inevitable, it will be difficult for governments to justify current levels of funding for scientific research and management. It can be expected that this will lead to reduced government funding.

The report is presented in five sections. Section One introduces the report, outlines the research questions that are addressed and provides a brief overview of the value of the tourism industry. Section Two commences with a short discussion on a range of tourism issues relevant to the GBR region followed by a brief discussion on tourism and climate change to provide context to the following discussion on coral bleaching. This is followed by a discussion on climate change and tourism with a specific focus on the study area, community resilience, tourism crisis management and the significance of the tourism industry in each case study region. Section Three outlines the methods used in compiling this report. Section Four outlines the results. Section Five discusses findings and outlines a proposed monitoring framework designed to identify changes in community and tourism views on the impact of coral bleaching (and other climate change events) on local communities.

1.1 Research questions

A number of concerns have been raised in the media and in communities located adjacent to the Great Barrier Reef about the impact of the 2016 coral bleaching event. In response to these concerns, the Reef and Rainforest Research Centre (RRRC) commissioned the Centre for Tourism and Regional Opportunities (CTRO), Central Queensland University (CQU) to investigate the impacts of the 2016 coral bleaching event on local communities. The specific research objectives are:

1. Update selected aspects of SELTMP[1] data on community use and dependency, and well-being in relation to the 2016 coral bleaching event.

[1] The Social and Economic Long Term Monitoring Programme (SELTMP) sought to understand and monitor the impacts of human actions on the Great Barrier Reef (GBR) and the resilience of industries and communities to environmental, governance and cultural changes (see Marshall et al., 2014).

2. Identify tourism industry concerns about the possible long-term impact of the 2016 coral bleaching event.
3. Identify visitor concerns about the quality of their GBR experience post the 2016 coral bleaching event.
4. Provide a methodology that can be used to support ongoing monitoring of communities, industry stakeholders and visitors.
5. Communicate results widely into the stakeholder community.

After the project commenced, a second coral bleaching event occurred in early March 2017. In response to this new bleaching event, the original research questions were modified to include the 2017 event. Given the resources available to undertake this research and that the greatest impact of both coral bleaching events occurred in the Cooktown-Cairns GBR region, data collection for research objectives 1 and 3 was limited to Cairns.

1.2 Study region

For the purposes of this report, the study region is aligned to the Great Barrier Reef and its catchments as defined by the Australian Bureau of Statistics (ABS, 2017) in a recent report that examined experimental environmental-economic accounts for the Great Barrier Reef. The ABS report adopted the *System of Environmental-Economic Accounting: Experimental Ecosystem Accounting* (SEEA-EEA) framework which facilitates the integration of complex biophysical, economic and other human activity to enable tracking of long-term changes. The ABS report adopted the six Natural Resource Management (NRM) regions – Burdekin, Burnett-Mary, Cape York, Fitzroy, Mackay-Whitsunday and Wet Tropics – as the basis for accounting. Resource limitations resulted in the study focusing only on the Burnett-Mary, Mackay-Whitsunday and Wet Tropics NRM regions. Figure 1 shows the study regions, Great Barrier Reef Marine Park sections and NRM regions.

Figure 1: SELTMP map showing the study regions, Great Barrier Reef Marine Park sections and NRM regions. Source: SELTMP

1.3 The scale of the tourism industry

The scale of the global tourism industry is demonstrated by the level of employment it generates (1 in 11 jobs globally) and its contribution to the global economy (estimated to be 9% of global gross domestic product) (Markham, Osipova, Lafrenz Samuels & Caldas, 2016). The United Nations World Tourism Organisation (UNWTO, 2016) reported that in 2015 international tourism arrivals rose by 4.4% to a total of 1.18 billion visitors. Significantly, 2015 was the sixth consecutive year of above average growth with yearly increases of 4% or more.

Nationally, the Gross Value Added by the tourism industry accounted for 3.1% of Australia's national Gross Domestic Product (GDP), a higher contribution than Agriculture, Forestry and Fishing (2.6%) (Tourism Research Australia, 2017a). In the 12 months to June 2017, Tourism Research Australia (TRA, 2017a) reported that 7.9 million international visitors arrived in Australia, up 9% from the previous 12 months. Total expenditure by international visitors rose by 7% to AUD$40.6 billion. In the domestic market, TRA reported that in the twelve months to June 2017 (TRA, 2017b), there were 93.7 million domestic overnight trips (up 5% on the previous 12 months) by Australians who spent $62.6 billion (up 7% on the previous 12 months).

In Queensland, the Department of Tourism, Major Events, Small Business and the Commonwealth Games (2016) reported that the Queensland tourism industry was valued at $23 billion and contributed 7.5% of Gross State Product (GSP).

On a global basis, coral reef-related tourism is a significant nature-based tourism sector (Spalding et al., 2017). Spalding et al. (2017) calculated that on an annual global basis reef tourism is worth US$35.8 billion dollars globally every year. This represents the total within-country expenditure by international and domestic visitors that can be assigned to the presence of coral reefs.

1.4 Tourism activity in the study region

In an analysis of the significance of the tourism industry, the Australian Bureau of Statistics found that the value of tourism expenditure across the whole GBR and catchments for the period 2015-16 was $8.0 billion (ABS, 2017). Direct tourism employment was 46,000 people in 2015-16 and accounted for 8.2% of total employment in the Great Barrier Reef and catchments. The value of tourism expenditure for the three NRM regions included in the ABS (2017) report is $5.4 billion. A more detailed review of the importance of tourism to the destinations discussed in this report are given in Section 2.5.

In 2015-16, a total of 17.8 million people visited the Great Barrier Reef and its catchments staying a total of 43.2 million visitor nights (ABS, 2017). In comparison, a total of 12.0 million people visited the three NRM regions (Burnett-Mary, Mackay-Whitsunday and Wet Tropics) investigated in this report and stayed for 28.4 million nights (ABS, 2017).

In 2015-16, 2.3 million tourists visited the Great Barrier Reef Marine Park, up from 1.9 million in 2007-08. In the same time period (2015-16), 12.9% of all visitors to the Great Barrier Reef and catchments visited the GBR.

In addition to the ABS (2017) report, a number of other reports have examined the significance of the GBR to the community in terms of its asset value, the number of jobs created and its contribution to the community. The most recent report, published by Deloitte Access Economics (DAE) (2017), adopted a different methodology to measure the value of the GBR compared to the ABS (2017). The DAE report estimated the asset value of the GBR, based on its economic, social and iconic values, was $56 billion. This figure was comprised of the value placed on the GBR by people who had already visited the GBR ($29 billion), Australians who had yet to visit the GBR ($24 billion) and people who use the GBR for recreation ($3 billion). The report also claimed that the GBR contributed $6.4 billion in value-added activity and had created over 64,000 direct and indirect jobs (DAE, 2017).

For the purposes of this report, the value of the GBR is based on the ABS (2017) report. The advantage of using the ABS methodology is that it provides a means for direct comparison with other Australian NRM regions. It also provides a useful platform for valuing the economic contribution of the tourism industry vis-à-vis other industry sectors. From a policy perspective, this provides policy makers, and advocates for the protection of the GBR and the industries it supports, with a uniform national benchmark that enables comparisons of the financial benefits from investment in the GBR and catchment region to be compared to other NRM regions such as the Murray-Darling system.

1.5 The importance of the GBR to the study region's tourism industry

The GBR is promoted as one of Queensland's primary tourism attraction and is featured prominently in marketing campaigns funded by Tourism Australia, Tourism and Events Queensland (TEQ) and by Regional Tourism Organisations (RTOs). The GBR is also a central feature of marketing activities undertaken by Tropical Tourism North Queensland (TTNQ) and Tourism Whitsundays.

The Environmental Management Charge (EMC) levied by the Great Barrier Reef Marine Park Authority (GBRMPA) on most GBR visitors provides another useful set of data for comparing patterns of GBR visitation over time and on spatial scales. The EMC is a levee applied to tourists who pay to visit the GBR on a commercial vessel. As illustrated in Figure 2, there has been a rapid growth in the number of people who paid to visit the GBR in the period 2012 to 2016 following a decline over the period 2007 to 2011 that paralleled the high Australian dollar and the Global Financial Crisis. Figures 3 and 4 illustrate the patterns and volumes of visitors to the GBR in the GBRMPA defined regions of Cooktown to Cairns section and the Whitsundays Plan of Management (POM) area of the Whitsundays-Mackey section between 1994 and 2016. It is clear from these figures that the highest level of GBR tourism occurs in the Cooktown to Cairns and the Whitsundays POM sections.

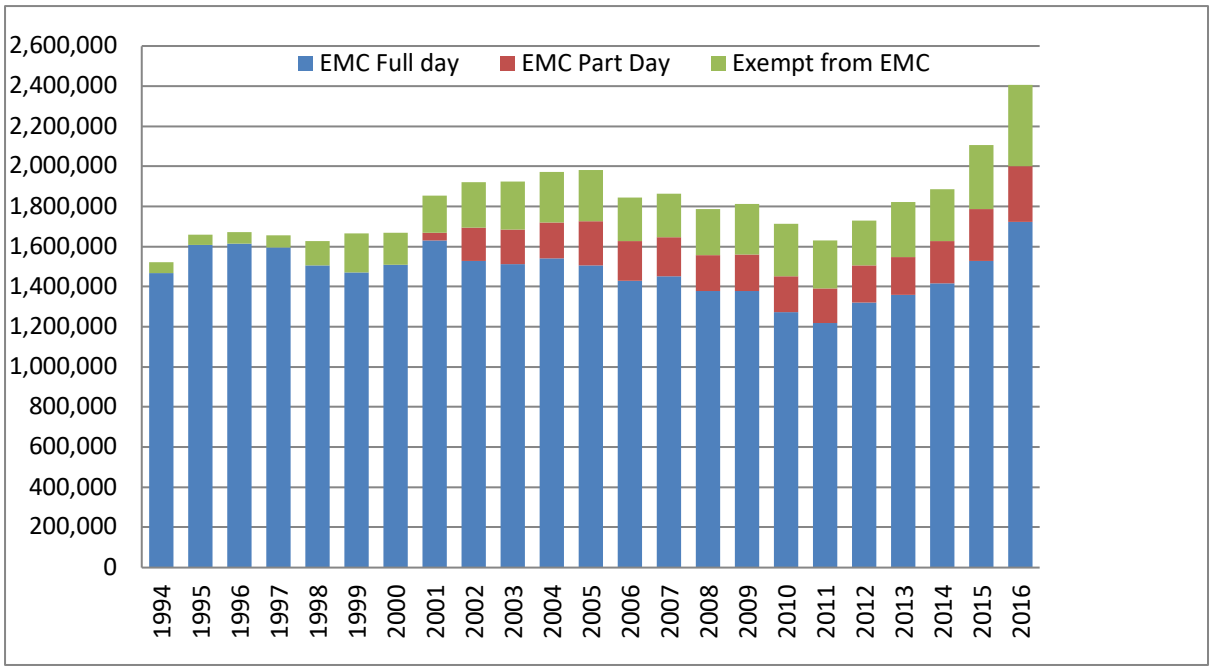

Figure 2: Visitation to the GBR for the period 1994 to 2016

Source: GBRMPA (2017b)

Note: Figures are based on EMC fees collected by commercial marine tourism operators. Not all visitors to the GBR pay the EMC fee.

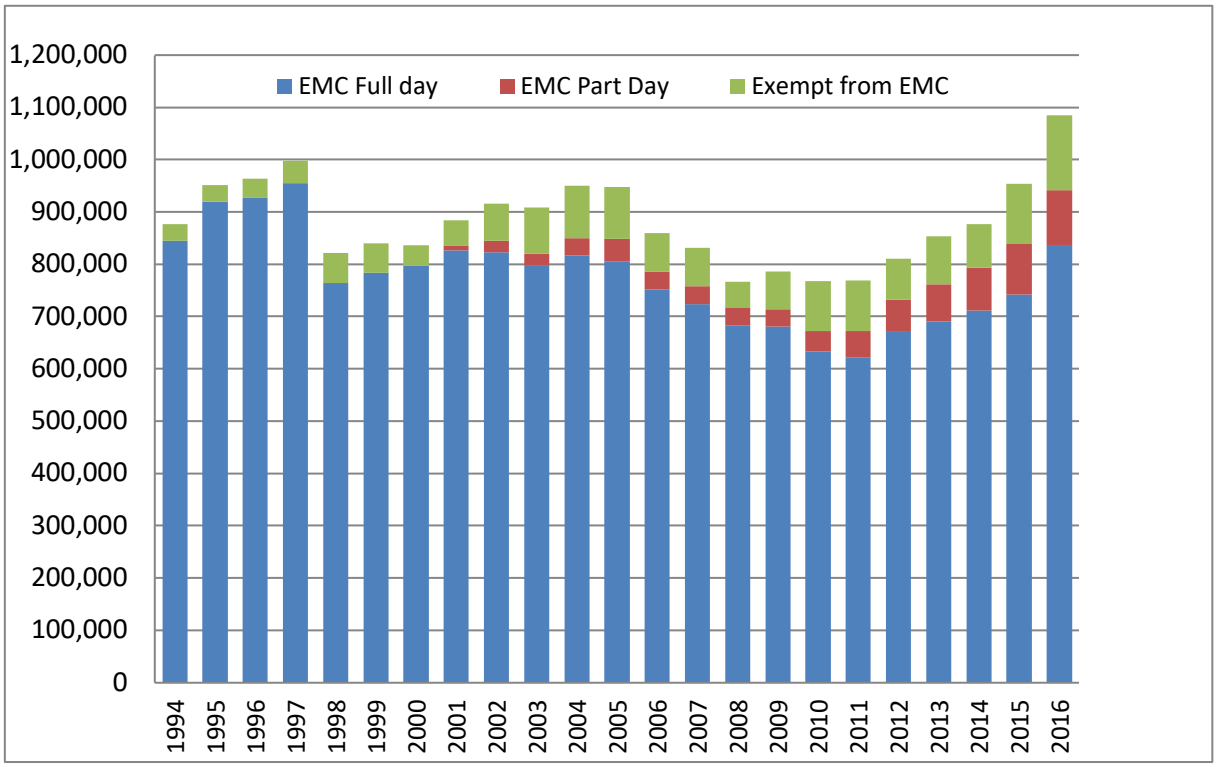

Figure 3: Visitation to the Cooktown to Cairns section of the GBR for the period 1994 to 2016

Source: GBRMPA (2017b)

Note: Figures are based on EMC fees collected by commercial marine tourism operators

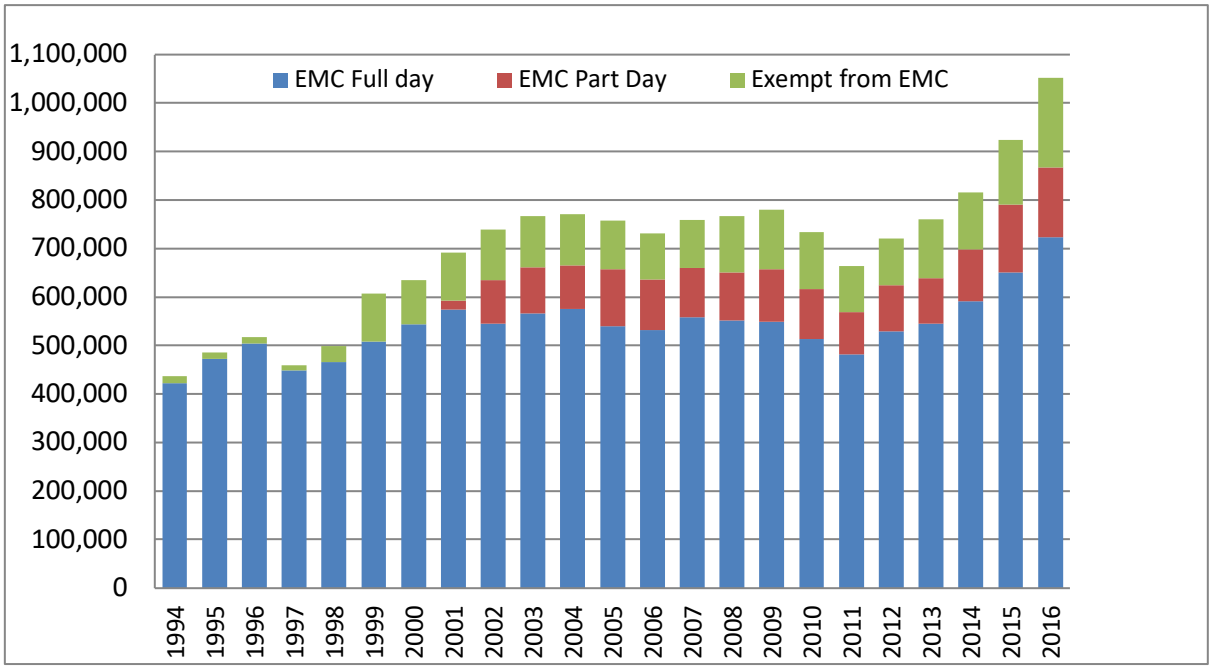

Figure 4: Visitation to the Whitsundays POM section of the GBR for the period 1994 to 2016

Source: GBRMPA (2017b)

Note: Figures are based on EMC fees collected by commercial marine tourism operators

Compared to the Cairns-Cooktown and Whitsundays POM sections of the GBR, the Mackay section of the Mackay-Whitsundays NRM region and the Burnett-Mary NRM area generate a relatively small number of paying visitors to the GBR.

The 2016 and 2017 coral bleaching events attracted wide publicity in the local, national and international press (see Section 4.1). As a number of researchers (Prideaux, 2003; Ritchie, 2009) have highlighted, closely spaced crisis events such as coral bleaching can have a significant, and in some cases, long-running, negative impact on destination image. If the negative impact on destination image is prolonged, affected destinations face the possibility of reduced visitor numbers as the perceived quality of the destination experience declines. While not a direct parallel, reduced demand experienced in major international focused destinations such as Cairns during the period of the high Australian dollar (2008-2011) and the Global Financial Crisis of 2008-2009 illustrates the impact that crisis events have on visitor numbers (see Figure 11). The danger for the study region is that coral bleaching is linked to a series of potential crisis events that may emanate from anthropogenic climate change and, rather than being an isolated marine event, may be the first of a series of events that include ongoing coral bleaching in coming decades.

Given the importance of the GBR as a key destination 'pull' factor in the Cairns and Whitsundays areas, a decline in the quality of the GBR experience that leads to a fall in visitor numbers will have a significant impact on local communities. For example, the number of visitors to Tropical North Queensland (TNQ) declined over the period 2007-2014 before recovering in 2015. This decline, which has been attributed to the high Australian dollar, a fall in Japanese visitors after the downgrading of Jetstar services between Cairns and Japan and the lagged impacts from the GFC, lead to growth in unemployment in Cairns. Unemployment rose to 9.2% in 2009-10 compared to the state average of

5.6%. In the March 2017 quarter, the unemployment rate for Cairns was 6.71% compared to the national average of 5.9% and state average of 6.4% (Department of Employment, 2017).

Apart from the value of the GBR to the tourism industry in the regions (Wet tropics, Whitsundays and Burnett-Mary NRM areas) considered in this report, the GBR also has significant cultural value for the region's Indigenous communities. More than 70 Aboriginal and Torres Strait Islander Traditional Owner clan groups maintain cultural heritage values of the GBR in the region from the Torres Strait to Bundaberg (Marshall & Johnson, 2007). As 'saltwater people' living on the coast, the Traditional Owners of these areas have strong connections to their sea country (AIATSIS, 2016). Although tourism is often considered as a means of gaining economic benefits for Indigenous communities (Taylor, Carson, Carson & Brokensha, 2015) and educating the wider society about local Indigenous cultures (Marrie & Marrie, 2014), participation of Aboriginal and Torres Strait Islander peoples in tourism operations associated with the Great Barrier Reef is relatively low.

2. TOURISM, CLIMATE CHANGE AND CORAL BLEACHING

2.1 Factors underpinning tourism development

The key factors driving tourism interest in a specific destination are a function of tourist demand for the experiences that a destination is able to supply. Several theories consider the relationship between tourism demand and supply. The consumer 'push' and destination 'pull' model suggested by Dann (1977) and Crompton (1979) argues that a range of psychological factors create a demand for travel that in effect 'pushes' consumers to look for a tourism experience that meets their particular set of personal travel needs. Destinations need to be aware that customer push factors change over time and for this reason need to constantly update their suite of experiences and the image that the destination projects in the market place. Typical push factors include interest in travel, a desire to participate in a particular experience and sufficient financial resources to fund travel. On the demand side, a destination will attempt to develop a supply of experiences (its 'pull' factors) which it then markets with the aim of attracting tourists. If consumer push and destination pull factors are not in alignment, destinations can expect to experience a decline in visitor numbers.

From a supply-side perspective, destinations compete with each other to attract the interest of tourists. Two factors are at play in this process. The first is the competitiveness of the destination vis-à-vis the destinations it is competing with. Competitiveness is a function of a number of factors and can be described in terms of comparative and competitive advantages (Ritchie & Crouch, 2003). Comparative advantages are the resources that have the potential to attract tourists but are currently underused or latent. These might include attractive landscapes, unique life styles, local foods, pleasant climate and natural and built heritage. The conversion of these potential resources into tourism experiences or products creates the basis of a destinations' competitive advantage.

The second factor in destination competitiveness is destination image. The ability of a destination to match its competitive advantage with the desires of consumers for a particular tourism experience is in part explained by the image a destination is able to create in the minds of consumers (Dwyer & Kim, 2003). Image is the composite of many elements including activities, previous experiences, media images, reputation, price level and expectations of safety. Destinations build images in a number of ways with the overall intent of creating a favourable impression that will be sufficiently persuasive to encourage consumers to make a positive decision to visit.

As a number of studies (Beerli & Martin, 2004; Pike, 2002) have shown, factors that reduce the positive image of a destination weaken its competitive position in the market place by reducing the strength of its pull factors. Weakening of destination image may occur for a number of reasons on a scale that ranges from the dramatic, often precipitated by a shock generated by a crisis or disaster event, to one of gradual decline in image for reasons that may include non-competitive experiences and attractions.

Irrespective of the cause, weakening of destination image will lead to a decline in competitiveness and in turn, a fall in visitor numbers. The decline in visitor nights in Cairns over the period 2007 to 2014 can to some extent be attributed to a fall in price competitiveness as a result of the strong Australian dollar. Further crisis events or shocks (such as a third GBR bleaching event) will further weaken destination

image and feed into consumer perceptions that the affected destination is not as attractive or competitive as it was prior to the shock.

If a destination enters into a state of decline because of a shock, an urgent review is required to ascertain the impact on its competitive advantage and determine if the loss of competitiveness is short-term or long-term. If the loss is likely to be long-term, the destination must rejuvenate or replace these resources. Replacement resources might include those that were previously considered as comparative but under- or not utilised, as well as new experiences. In the latter case, new experiences might include events, festivals and the development of new or enhanced experiences such as shopping precincts, landscapes, theme parks, lifestyle, gastronomy and museums. If new experiences can be developed quickly and successfully, there may be little impact on overall tourist numbers or on the welfare of the community that supports the tourism industry. If the introduction of new experiences is delayed, visitor numbers are likely to decline.

From a destination perspective, the loss of competitiveness can be expected to be felt in the supporting community in a number of ways based on the extent of the decline in demand and the significance of the tourism industry to the local economy. An extreme example of loss of competitiveness can be drawn from the mining industry where communities may cease to exist if the key mineral resource is exhausted and replacement industries are not established.

Decline in the strength of the tourism industry can lead to a decline in community resilience. As tourism revenue declines, and if not compensated for by a new industry sector, a cascading sequence of events is likely to occur, commencing with a rise in unemployment. This will be followed by a rise in business failure and a lack of confidence in the local economy that may then translate into a softening of housing prices. If decline continues, out-migration can be expected to occur leading to a decline in the size of complementary economic sectors such as retail, health, construction and education.

The literature reports on a number of destinations that have suffered a fall in demand because of climate change related factors. For example, Scott, Hall and Gossling (2012) identified a number of winter resorts that have entered into steep decline due to a loss of competitiveness as snow cover declined. Scott, Dawson and Jones (2008) also reported on adaptation strategies adopted by a number of declining winter resorts, noting that in some low altitude areas even adaptive strategies such as snow-making might become unviable in the long-term. In other destinations, the realisation that skiing might become a vulnerable activity (Hopkins, Higham, & Becken 2013) as the impacts of climate change increase over time has generated a deliberate shift into other tourism experiences such as adventure tourism. A shift in experience mix of this type can assist destinations to reorientate their image and regain competitiveness.

A further problem that may be encountered is over-reliance on a particular tourism experience. Research on 'path dependence' and negative lock-in (e.g. Hassink, 2010; Martin & Sunley, 2006) point to the danger of 'locking in' a single dominant destination image. When this occurs the tourism industry may become 'stuck' in established practices, ideas, and networks of embeddedness that no longer yield increasing returns and may even induce negative externalities' (Martin & Sunley, 2006, p. 416). When this occurs, it may be difficult to identify a new path for tourism development. Ski destinations provide one example of path dependence which leads to lock-in. Over-reliance of coral reef associated

tourism could be another example. Escaping lock-in requires a switch to alternative pathways through strategies that include developing new pathways through layering where new features are added to existing experiences, a conversion where the scope of existing experiences is broadened to increase their appeal and amending current pathways through combinations is where new experiences are combined with old experiences and create a new version of existing experiences (Grabher, 1993).

2.2 Tourism and climate change

The latest IPCC report (IPCC, 2014) highlights the potential impacts that climate change will have on global ecosystems. Impacts include changes in precipitation, changes to the number and intensity of wind storms, the propensity for more intense and extensive fire events, rising sea levels, increasing acidification of the world's oceans and significant changes in ecosystems. While the research undertaken for this report is primarily concerned with the impact of coral bleaching on GBR communities and the tourism industry in particular, it is essential to consider the *wider context of other impacts* likely to be experienced in the study area as a result of climate change. These impacts may include changes in the patterns and intensity of precipitation, changes in cyclonic intensity, increased potential for fire and rising sea levels. Collectively, these impacts will have a greater cumulative effect than single climate change-related events such as coral bleaching, and potentially weaken the viability of key regional industries including agriculture and tourism.

There is growing concern about the long-term impacts of climate change on the tourism industry. The UNWTO (2008a; 2008b) has expressed concerns about the impact of climate change on the global tourism industry for nearly two decades. This concern is echoed in the academic literature (Becken, 2013; McKercher & Prideaux, 2011; Scott, Hall & Gossling, 2012). As Scott, Simpson & Sim (2012) note, the global tourism industry is estimated to contribute up to 5% of all carbon emissions. Given that global tourism flows are predicted to increase to 1.8 billion by 2030 (UNWTO, 2012), the level of Green House Gas (GHG) emissions generated by the tourism industry may also increase in coming years. Specific concerns about the impacts of climate change initially focused on ski destinations. However, this concern has now broadened to include concerns about the potential impact of sea level rises on coastal destinations (Scott et al., 2012) and on ecosystems such as coral reefs.

Figure 5 (Prideaux, Coghlan & McNamara, 2010) illustrates how the impacts of global warming flows through natural systems into human systems and then into tourism systems. As the model illustrates, changes in global temperature levels are felt at an ecosystem level through changes in precipitation, temperature, fire events, wind events and sea levels. Specific impacts include sea level rises, increased temperatures, change in rainfall variability, increased severity of wind storms and ocean acidification. The impact of these changes will affect the attractiveness of many marine ecosystems such as coral reefs as well as terrestrial ecosystems including forests and grasslands. Increased temperatures are already affecting some ski destinations and may reduce the desirability of a number of beach destinations as temperatures rise above levels that are comfortable for humans (Patz, Campbell-Lendrum, Holloway & Foley, 2005).

Some destinations will benefit, particularly those where an increase in temperature will provide tourists with more pleasant weather conditions. There will also be numerous negative impacts such as

loss of biodiversity in natural areas that support tourism activity and the impact of rising sea levels on low lying coastal areas. Negatively affected destinations will need to re-evaluate their suite of tourism experiences; in some destinations this might mean building new experiences as substitutes for existing climate affected experiences. The model also incorporates a feedback loop (Figure 5) that enables continual adjustment of tourism experiences as the impact of climate change becomes apparent.

While the scientific community has produced extensive and detailed knowledge on the ecological and physical impacts of climate change, there has been significantly less research on the impact on human systems such as the tourism system and tourism-dependent communities.

Ultimately, the success of adaptation at destination level will depend on the effectiveness of strategies aimed at achieving the long-term sustainability of the supporting environment, community robustness and economic viability. On a global scale, the long-term sustainability of tourism destinations will be a function of the success of adaptation and more importantly, the success of global scale mitigation. Unfortunately, because of the disputed nature of the need for global mitigation, the ultimate level to which temperatures will rise is unknown, as is an understanding of when this will occur. These unknowns make the task of adaptation at destination level extremely difficult.

At the destination level, and where the tourism sector relies on nature based experiences, successful adaption will require close cooperation between the scientific community, the destination community and the tourism industry. As Figure 5 highlights, the ability of communities and the tourism industry to respond to changes in natural systems relies on timely and informed data generated by the scientific community. The scientific community must consider the needs of the destination community and the tourism industry in the development of its research agendas and work in partnership with the community and tourism industry to assist in develop community resilience strategies.

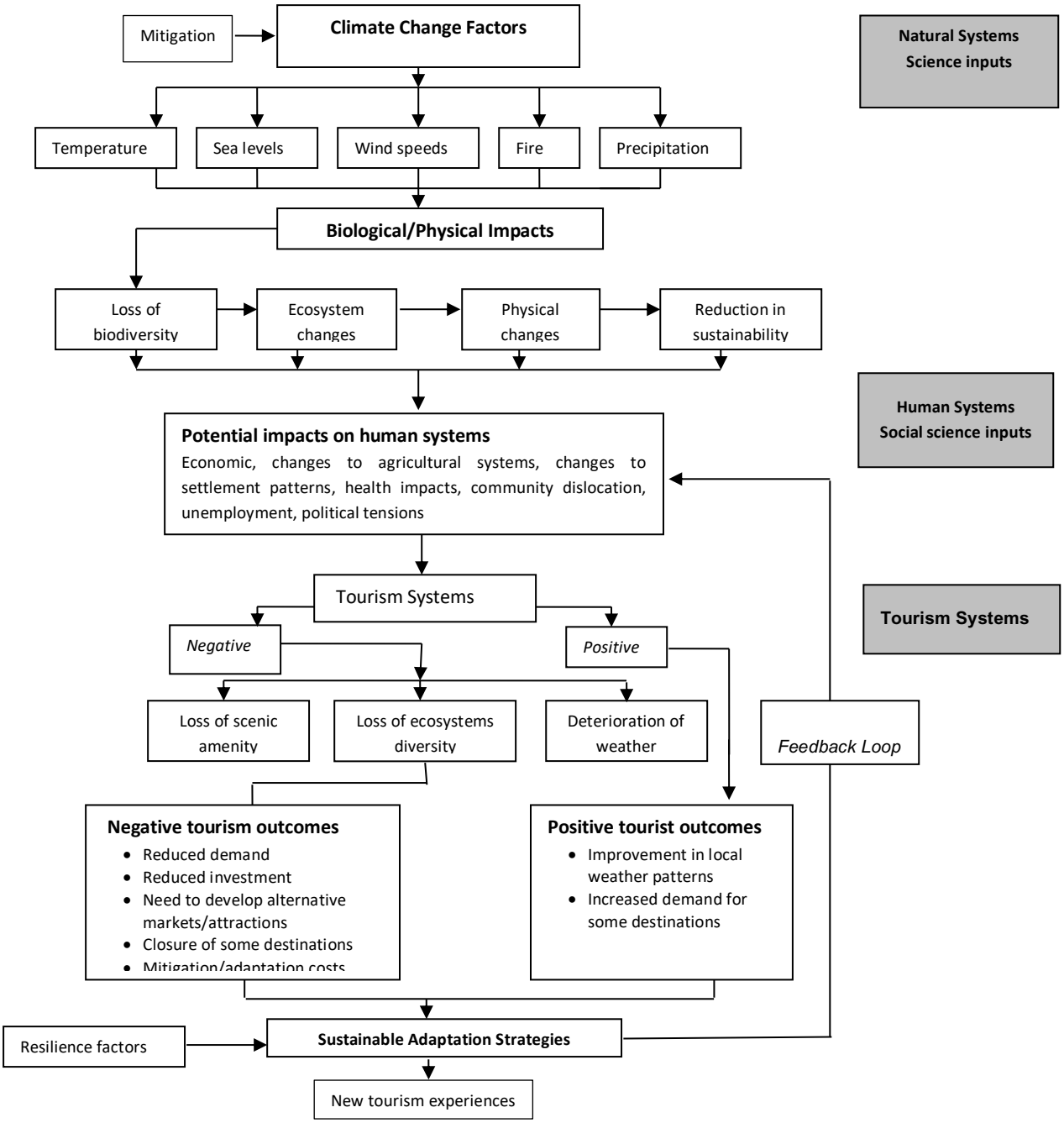

Figure 5: The flow through of climate change impacts from natural to tourism systems. Adapted from Prideaux, Coghlan and McNamara (2010)

Coral bleaching of the type experienced in the study region in 2016 and 2017 can be attributed to increased ocean temperatures and is one of many changes that will occur to natural systems as global temperatures continue to rise in coming decades (IPCC, 2014). Hurricane Harvey which struck Texas (USA) in late August 2017 illustrates another type of impact caused by an increase in ocean temperature. In the case of Hurricane Harvey, increased ocean temperatures resulted in greater uptake of moisture from the ocean which in turn generated increased rainfall leading to severe flooding.

Use of a region's natural ecosystems to attract tourists depends on the ecosystem's long-term health and carrying capacity. A decline in the health of the ecosystem caused by climate change-related factors will reduce its potential tourism carrying capacity. From the perspective of the tourism industry, a reduction in current levels of ecosystem resilience will create problems for long-term sustainable tourism management and ultimately community resilience. Prideaux (2013) suggests that if natural attractions are perceived to be declining in quality because of the impact of climate change, the number of visitors is likely to decline. Destinations that do not consider adaptation strategies to compensate for future loss will be the most vulnerable to change.

In a study into potential adaptation strategies for GBR tourism, Ramis and Prideaux (2013) postulated a modified version of Figure 5. The model (see Figure 6) demonstrates how climate related factors including loss of marine species, coral bleaching and slow recovery, may affect dependent human communities and force them to develop alternative tourism experiences. The ability of human communities to successfully adapt will depend on the communities' levels of resilience, the rate that the ecosystem changes, the level of economic assistance given by the public sector, the willingness of the private sector to invest in new tourism experiences and associated infrastructure, and successfully overcoming business and government inertia.

The danger for tourism destinations that experience a substantial decline in the quality of the ecosystems they rely on is that the public sector may withdraw or downsize public funding for science and management and reallocate those resources to ecosystems that have greater resilience to produce a better return for public funds. In the case of the GRB, continuing reports of its decline are very likely to result in a decline in tourism numbers and weaken the case for additional funding support particularly in circumstances where there are many ecosystems in need of additional public funding. It is interesting to note that while many of the coral reefs in the Caribbean have been severely affected by anthropogenic factors, the region's tourism industry continues to flourish and while damaged, coral reefs continue to be a major attraction of the Caribbean (Prideaux & Pabel, forthcoming).

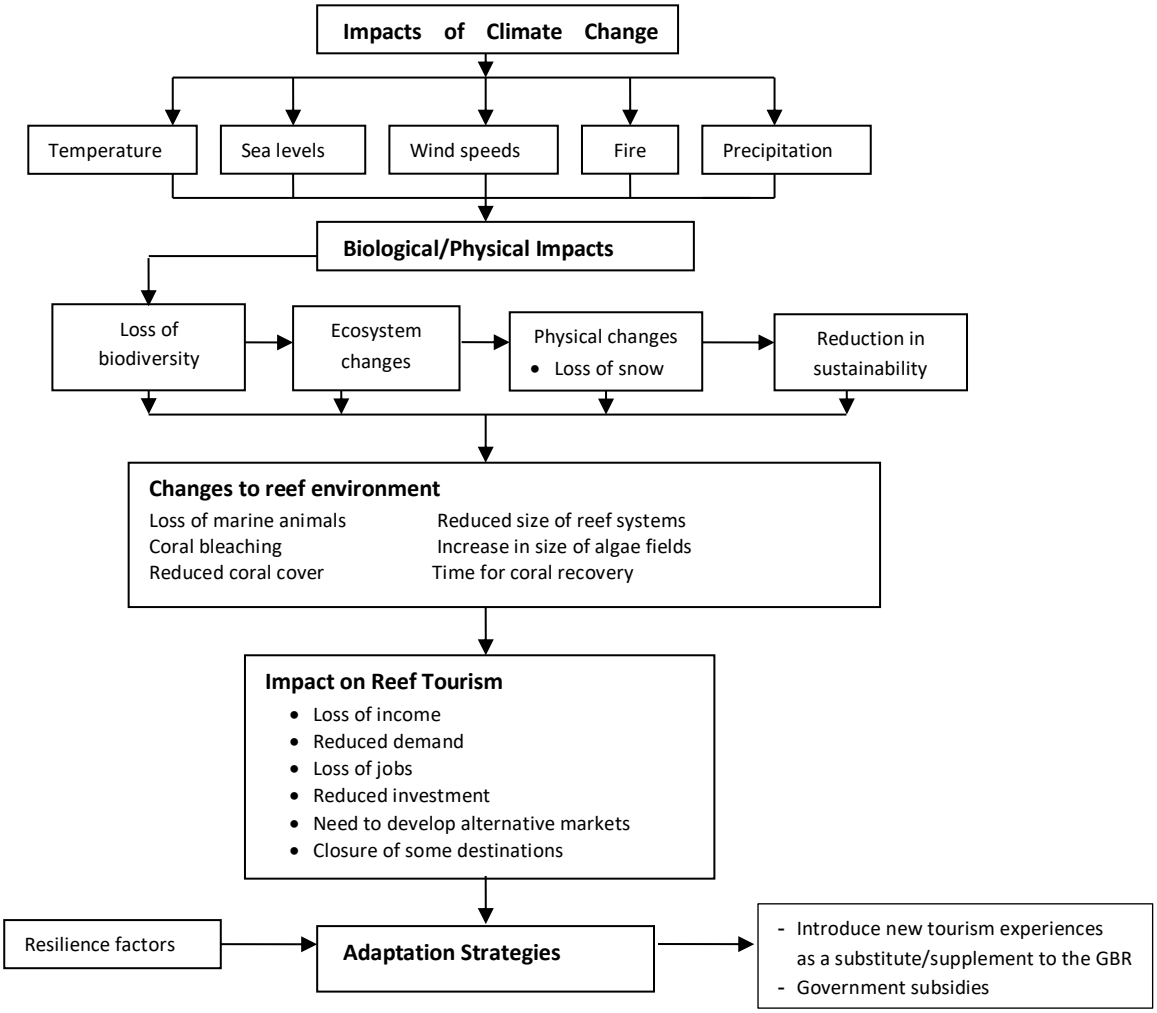

Figure 6: Impacts of climate change on coral reef tourism. Adapted from Ramis and Prideaux (2013)

2.3 Coral bleaching

Coral bleaching results from stress that causes corals to expel algae (zooxanthellae) and unless the causes of stress are removed, the coral dies giving a white bleached appearance (GBRMPA, 2016; The Ocean Agency, 2017). The coral bleaching events discussed in this report are part of a global phenomenon that has been attributed to climate change (GBRMPA, 2017a). In the most recent coral bleaching events, corals were exposed to warmer than normal ocean temperatures causing thermal stress leading to bleaching. Corals may recover from bleaching if ocean temperatures or other conditions (such as increased sediment loads or changes in salinity) that caused the bleaching event, return to normal within a short period. Long exposure to increased heat stress reduces the possibility for recovery (GBRMPA, 2017a).

As Figure 7 illustrates, numerous coral reefs suffered from coral bleaching over the period 2014-2017a. A number of reef systems including the GBR experienced multiple bleaching events. The National Oceanic and Atmospheric Administration (NOAA, 2017) described the event as the longest, most widespread and possibly most damaging coral bleaching event on record.

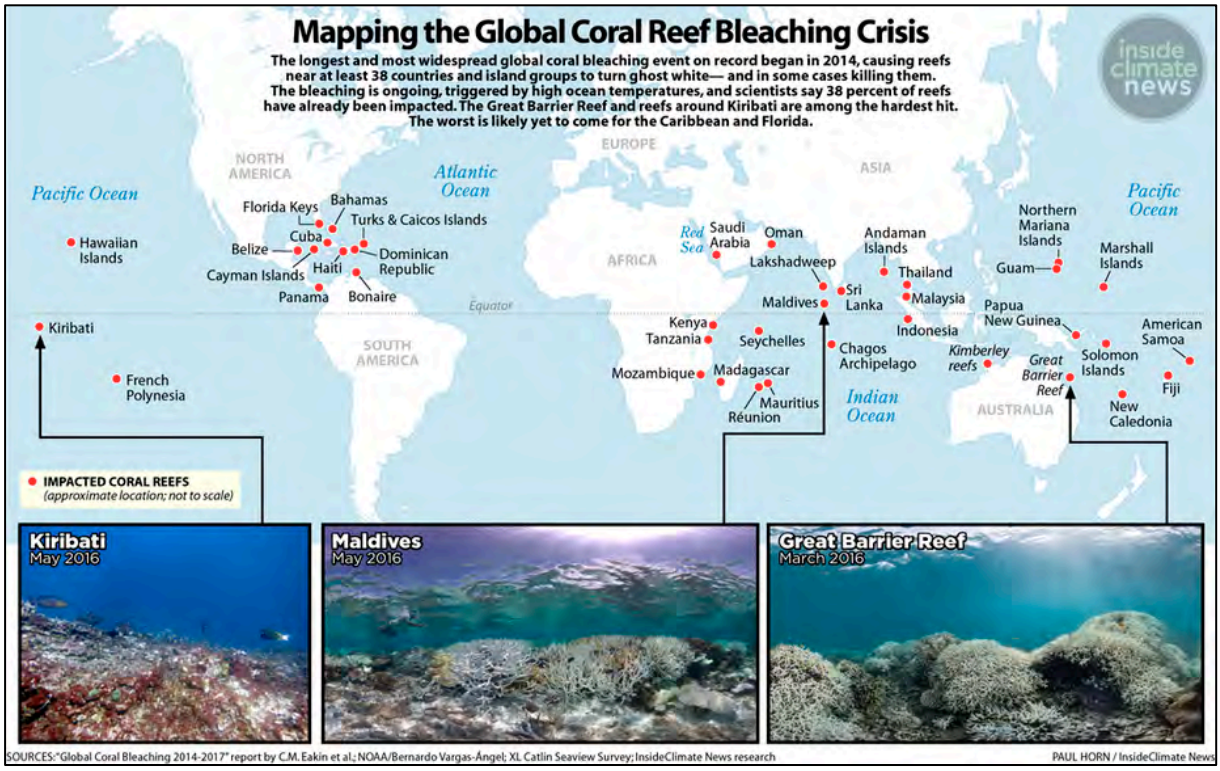

Figure 7: Global coral bleaching 2014-2017 (NOAA, 2017)

Although localised bleaching has been recorded since the early 1900s beginning with Bird Key Reef, Florida in 1911, the first mass coral bleaching was not recorded until the 1980s when Hawaii experienced two consecutive El Niño events (Glynn, 1991). The GBR and many other locations first experienced a major bleaching event in 1998.

The first localised bleaching in the GBR was recorded in 1929 at Low Isles off Port Douglas. The 2016 coral bleaching event was the third known mass coral bleaching event; others occurred in 1998 and 2002. The 2016 coral bleaching event occurred during the strongest El Niño event recorded since 1998. In the lead up to the bleaching event there was a significant rise in ocean temperature. As Hoegh-Guldberg and Ridgway (2016) observed, February 2016 was the hottest month on record (as of 2016) with average ocean temperatures rising 1.35°C above the average of ocean temperatures between 1951 and 1980. The northern and eastern marine environments (Evans, Bax & Smith, 2016) suffered the greatest level of coral bleaching.

The potential impact of the 2016 coral bleaching event was first brought to public attention by media stories (see Smail (2016) for an example) based on a press release issued by the ARC Centre of Excellence Coral Reef Studies (https://www.coralcoe.org.au/media-releases/only-7-of-the-great-barrier-reef-has-avoided-coral-bleaching) that stated that 93% of the GBR had suffered bleaching. This assessment was based on an aerial survey of 911 of the GBRs 2700 reefs and did not included a more detailed in-water assessment. The media release was quickly picked up by the global media (see section 4.1 for a discussion on media reporting of both the 2016 and 2017 mass bleaching events) and widely reported. The problem with the media reporting of the 2016 mass bleaching event was that the

93% of bleached reefs referred to in the ARC Centre of Excellence Coral Reef Studies media release were reported as the entire GBR, not a section of the reef. As Figure 8 indicates, many reefs were not affected in the 2016 bleaching event. This map was included in the original media release but apparently ignored by most media. A later media release (30th May, 2016) by the ARC Centre of Excellence Coral Reef Studies (https://www.coralcoe.org.au/media-releases/coral-death-toll-climbs-on-great-barrier-reef) that stated that reefs from Cairns south had suffered an average of 5% mortality does not appear to have been widely reported in the media

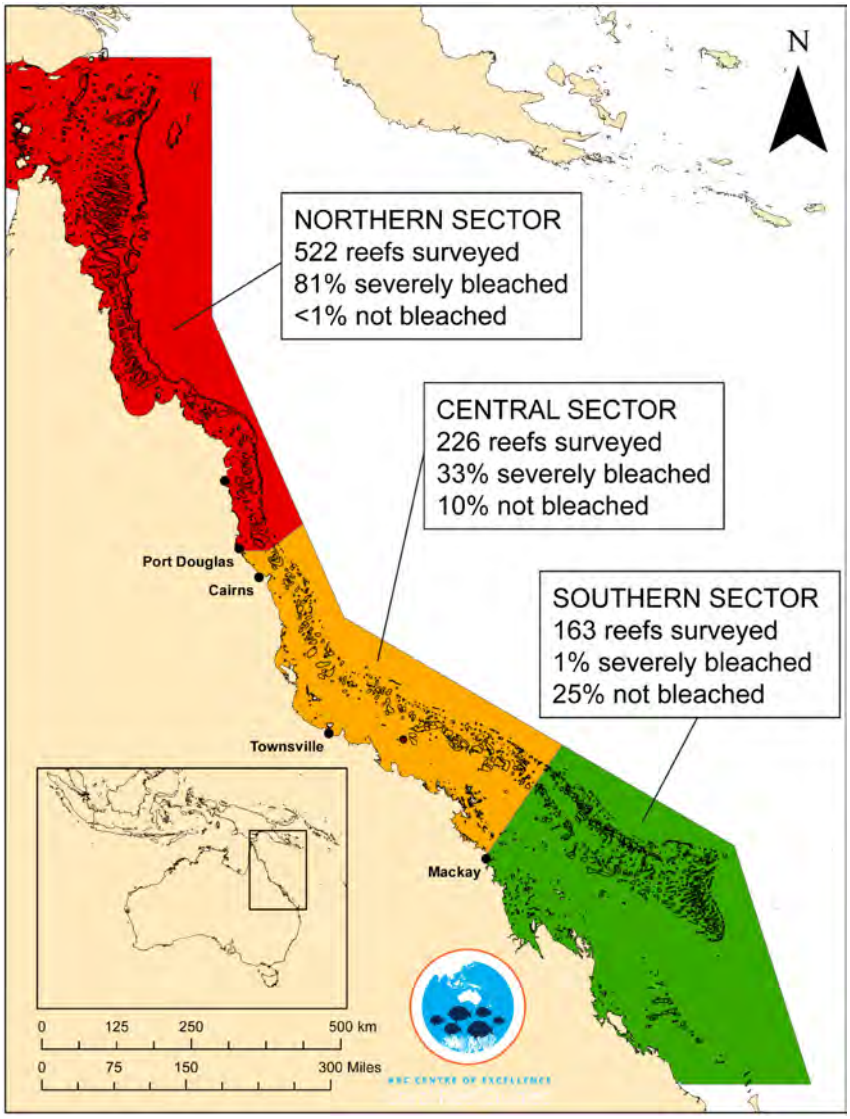

Figure 8: Map of the Great Barrier Reef showing results of 2016 aerial surveys for 911 reefs. ARC Centre of Excellence for Coral Reef Studies (2017)

Conflicting views on the extent of damage soon emerged. In response to the initial reports of heavy bleaching in the northern section, the Reef and Rainforest Research Centre (RRRC) and the Association of Marine Park Tourism Operators (AMPTO) undertook an extensive in-water survey. During a 13-day period between March and April 2016, 252 kilometres of reef between Cairns and the Ribbon Reefs just south of Lizard Island was surveyed, with a specific emphasis on reefs that were important tourism sites. The RRRC and AMPTO survey (RRRC & AMPTO, 2016) found that while bleaching had occurred it

was not as extensive as initial reports indicated and that many high tourist value reefs were only mildly affected. Moreover, later maps of the extent of the 2016 bleaching produced by the ARC Centre for Excellence for Coral Reef Studies show some bleaching between Cairns and Townsville but almost none south of Townsville (Figure 9).

A second coral bleaching event occurred in March 2017. This event was largely restricted to reefs north of Townsville (see Figure 9). The NRM regions of Burdekin, Burnett-Mary, Fitzroy and Mackay Whitsunday experienced minor or no coral bleaching.

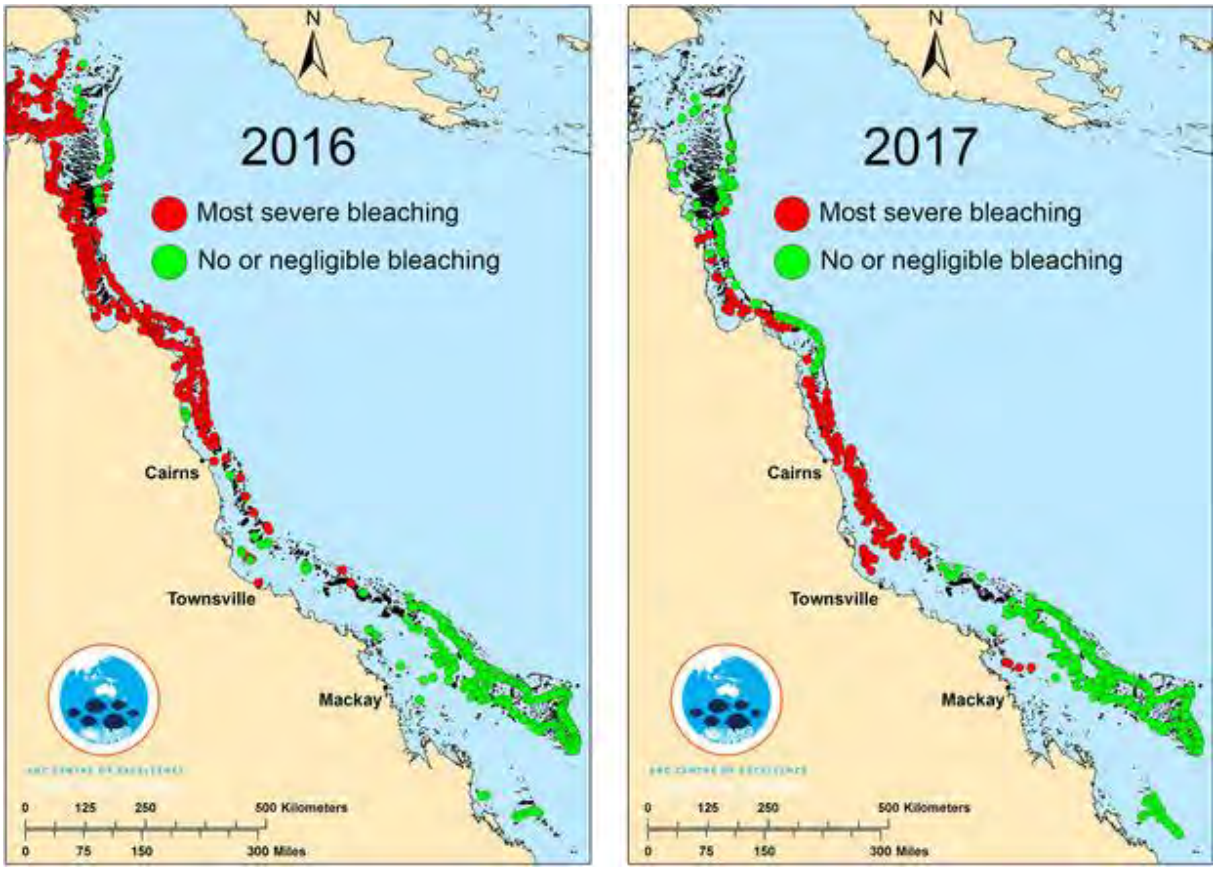

Figure 9: Coral bleaching of the Great Barrier Reef in 2016 and 2017. ARC Centre of Excellence for Coral Reef Studies (2017)

The GBRMPA has for some time recognised the potential impacts of climate change, and in the 2009 Outlook Report (GBRMPA, 2009) stated that climate change posed a large challenge to the long-term future of the GBR. The report also stated that it was important to support mitigation on a global scale and at the local scale to build GBR resilience to climate change. The 2014 Outlook Report reiterated that climate change remained the greatest threat to the long-term survival of the GBR (GBRMPA, 2014). The GBRMPA has also published a climate change adaptation strategy and action plan (GBRMPA, 2012) that recognised the potential impact of coral bleaching on the tourism and commercial fishing industries but did not articulate specific actions to enhance community resilience. The plan does recognise the need to support policies designed to assist the GBR recover from climate change events. However, as Hughes et al. (2017) state, local management of coral reef fisheries and

water quality will provide little, if any, resistance to recurrent severe bleaching events or other significant natural disturbance, "even the most highly protected reefs and near-pristine areas are highly susceptible to severe heat stress" (p. 376). However, they did note that higher levels of protection and better water quality may improve the prospects of recovery after bleaching.

In response to the 2016 and 2017 bleaching events, the GBRMPA (2017a) observed that climate change is internationally recognised as one of the largest threats to all coral reefs systems. The report also noted that while the GBR has been able to recover in the past, severe bleaching is anticipated to have a lasting impact on the health of the GBR and the resilience of affected reefs (GBRMPA, 2017a).

Aside from the strategies suggested by the GBRMPA, a number of technical solutions have been suggested including: mixing cooler deep water with shallow warm water to cool surface water; using umbrella-like structures on buoys to shade corals in high tourist visitation areas (Simpson, Gössling, Scott, Hall & Gladin, 2008); replanting affected areas with heat resistant coral species harvested from reef systems that are adapted to higher water temperatures; and replanting coral to regenerate affected reef systems. The Florida Reef Resilience Program is an example of a reef regeneration project that is currently underway in Florida, USA (Florida Reef Resilience Program http://frrp.org/coral-restoration/). The Florida program has reported considerable success in regenerating affected areas of coral reefs. In the Cairns region, the Reef Restoration Foundation plans to commence trials of techniques to grow and replant coral in damaged reefs in late 2017 (https://www.f6s.com/reefrestorationfoundation). From a tourism industry perspective, regenerating coral in high use and high value tourism destinations offers considerable potential for countering the adverse impacts of future coral bleaching events. A number of other relevant research projects on the Great Barrier Reef are planned to commence in January 2018 and are funded through the Australian Government's National Environmental Science Programme's Tropical Water Quality Hub.

2.4 Coastal communities, tourism and the GBR

Many of Queensland's coastal communities were established to support primary industries such as logging, mining, cattle grazing and sugar production. In recent decades, tourism has been added to these industries. In several locations where the GBR is close to shore, the tourism industry has emerged as a major economic sector. Examples include Port Douglas, Cairns and the Whitsundays.

The significance of GBR tourism as a pull factor for coastal communities is illustrated in Figures 2 to 4. As Figures 3 and 4 highlight, the bulk of tourist visits in the Cooktown to Cairns section and the Whitsundays POM section of the GBR. While Bundaberg promotes itself as the southern gateway to the GBR, the actual number of visits to the GBR from this destination is very small.

The importance of the GBR to residents of coastal communities was investigated by Stoeckl et al. (2014). In their analysis of the non-market goods and services provided by the GBR, Stoeckl et al. (2014) found that, "environmental non-use values such as healthy corals, reef fish and iconic marine species are of highest importance to the quality of life of local residents" (Stoeckl et al., 2014, p. 12). These values were found to be more important than recreational values, and were even more important than jobs and incomes associated with GBR industries. Stoeckl et al. (2014) concluded that degradation of

the GBR was likely to have a significant adverse effect on the tourism industry through loss of visitation and repeat visitation of shorter stays.

Environmental damage caused by natural events such as coral bleaching and cyclones has the potential to disrupt tourism businesses in destination communities, particularly if recovery of the affected resources is slow (Tsai, Wu, Wall & Linliu, 2016). In circumstances where the image of a destination has suffered because of a crisis event, there may be a need to build an alternative image that does not include the previous imagery built around the experience that has suffered from a crisis (Ritchie, 2004). A strategy of this type will be needed in the long-term by some GBR dependent communities as further coral bleaching occurs.

The GBR also provides Traditional Owners with cultural ecosystem services. Cultural ecosystem services refer to the "non-material benefits people obtain from ecosystems through spiritual enrichment, cognitive development, reflection, recreation and aesthetic experience, including knowledge systems, social relations and aesthetic values" (Millennium Ecosystem Assessment, 2005, p. 40). In the GBR these include: practices, observances, customs and lore; spiritual and religious (sacred sites and places of significance); educational (stories, songs, totems and languages); and knowledge (Indigenous structures, tools, technology and archaeology) (ABS, 2015).

2.5 Community and tourism resilience

The concept of resilience was first discussed in the field of ecology and has been widely applied in the social and environmental sciences (Becken, 2013). Resilience is concerned with how humans and nature respond to shocks and disturbances such as cyclones and climate change by triggering renewal and innovative thinking (Stockholm Resilience Centre, 2015). Resilience is a measure of the capacity of a system to resist and recover from a disturbance while continuing to retain the functions, structures and integrity that were present prior to the disturbance. A resilient tourism destination requires functioning linkages between the ecosystem and social system (individuals, communities and industries), and the capacity to return to economic health after a disturbance or impact.

Community resilience is also a measure of the sustained ability of a community to utilise available resources to respond to, withstand and recover from adverse situations (RAND Corporation, 2017). Price-Robertson and Knight (2012) observed that a resilient community has the ability to adapt to changes in the physical, economic and social environment by learning from experiences and improving response mechanisms over time. The key themes of resilience are capacity, an ability to recover from a disturbance, and the mechanisms utilised to return to a healthy state, function or structure. As Becken (2013, p. 508) observed, "A business or community that is vulnerable and has limited adaptive capacity is likely to be less robust to stress and therefore less resilient".

Recognising and enhancing resilience is important for communities and industries facing significant climate change impacts (Marshall, Capon, Curnock, Edgar, Race & Scherl, n.d.). At a destination level, Lew (2014) suggested that it will be necessary to change the composition of tourism experiences if a destination suffers from a modification, deterioration or complete loss of existing tourism experiences, cultural and natural tourism resources or tourist markets. Increasing adaptive capacity to reduce

vulnerability and increase resilience is therefore an essential action for responding to both slow and fast moving climate change-related events.

From a tourism perspective, resilience refers to the capacity of a destination to attract tourists in circumstances where either the demand for tourism experiences changes or there are changes in the supply of tourism experiences. When a disconnect emerges between the demand for attractions and experiences and the supply of experiences, destinations will usually respond by changing their supply mix. This is not always possible and where substitute experiences are not able to be supplied the destination is likely to experience decline. The decline of a key tourism resource may occur over a time spectrum that ranges from slow to rapid. If decline is slow, the impact might be apparent for some time.

The degree of resilience can be measured in a number of ways; the capacity of the destination to adapt existing experiences, the time taken to develop substitute experiences and, the success substitute experiences enjoy in the market place. The ability of a destination to respond will depend on a range of factors including: the speed of decline; the willingness of the destination to recognise the problem and respond; an understanding by the destination of its comparative and competitive advantages; the role of innovation; and the strength of public and private sector leadership. The speed of adapting tourism supply will also affect the supporting community. If the adaptation process is slow, the community may experience hardship including a rise in the level of unemployment and business failure. From a tourism perspective, a decline in key resources (natural or built) must be offset by the development of alternative experiences. As the discussion later in this section highlights, a decline in the quality of the GBR will have a relatively small impact in NRM regions in the Great Barrier Reef where the significance of the GBR as a key destination pull factor is relatively small.

In relation to natural systems, change from one state to another may be either slow, such as that caused by some climate-related variables including long-term changes in climatic conditions (Becken & Hay, 2007) or rapid, such as those associated with disturbances caused by natural disasters including floods, earthquakes and fire. Slow moving change provides destinations with time to adjust through adaptation within the parameters of the business cycle and policies designed to assist community resilience. Fast moving change however, may be very disruptive and impede the ability of businesses and communities to adapt, particularly where a significant tourism experience is lost or significantly degraded (Faulkner, 2001).

Dale, Vella and Cottrell (2014) point out that in communities facing the need to develop adaptation strategies to respond to climate change there is a need to respond to many social and economic factors including: demographic change; economic vulnerabilities of the local economy; capacity of emergency response systems; vulnerabilities of core economic industries; and community well-being. Dale et al. (2015) also highlight the disconnect between the views of the scientific and social science communities in relation to ecological and social resilience concepts. In addition, Dale et al. (2015) note that there have been few effective linkages between social assessment and social impact assessment in the literature.

Studies that have discussed the need to enhance tourism resilience have often focused on developing frameworks that assist communities improve their adaptive capacity. Davoudi (2012) noted that

frameworks of this type can be grouped into three types: ecological approaches where adaption assists in the emergence of a new post-crisis equilibrium; engineering approaches that aim to achieve a 'business as usual' situation after the crisis has finished; and synoptic approaches that reject the idea of a return to equilibrium and/or stability as an illusion. From another perspective, Porter & Davoudi (2012) suggest that participatory decision making by all stakeholders should be considered. In the future, it is likely that all of these approaches will have a place in how communities decide to deal with crisis events that affect the community's long-term welfare.

Cochrane (2010) proposed a sphere of tourism resilience employing resilience theory as a framework to firstly analyse the factors that cause vulnerability in the tourism system and secondly increase the system's capacity to absorb disturbances. Using the Resilience Cycle or 'Holling Loop' stages of reorganisation, exploitation, conservation and release (Holling, 2001), the sphere of tourism resilience is focused on the sustainable management of resources. Cochrane's (2010) model identifies three principal elements: an awareness of market forces and the ability to harness them; stakeholder cohesion; and strong and consistent leadership expressed through clear vision and good management. The broader contextual elements include flexibility, adaptability and learning.

For coastal communities in the GBR catchment, community and tourism resilience thinking is an interlocking concept. The ideal outcome to any slow or fast moving disturbance is successful adaptation of the community and the tourism industry to change to achieve a new community, natural resource and economic state of social-ecological-economic (SES) balance.

In discussing the difficulties faced by researchers when attempting to find ways of assessing and applying social resilience indicators Dale et al. (2016, p. 26) note that the two dominate approaches are "(i) generalised measures that integrate data into composite indices and (ii) approaches that pursue multiple lines of evidence". Both approaches have advantages and disadvantages. Dale et al. (2016) suggested an alternative that links both approaches into four clusters referred to as: knowledge, aspirations and capacity; governance; economic viability; and community vitality.

As the previous comments about tourism resilience have highlighted, if a substitute experience can be provided in a manner that minimises disruptions to tourist flows it is unlikely that there will be significant social disruption except for the experience sector that is in decline.

Irrespective of what approach is taken, a wide range of data will be required to provide a baseline for monitoring and later assessing the success or failure of adaptation strategies. The type of knowledge required will include:

- Detailed knowledge of the region's natural resources
- Access to the latest research about the impact of climate change events on the health of natural systems
- The vulnerability of natural resources (ecosystems) to disruption by climate change
- Detailed knowledge of the resilience of affected communities across a range of social and economic indicators
- Detailed knowledge of the region's comparative and competitive tourism resources and how these might be developed in the future in response to changed consumer markets
- Detailed understanding of consumer markets and how these are changing at a global level

- A community-based crisis management plan to assist with post-crisis recovery
- A governance system that is flexible enough to facilitate and assist adaptation
- An informed community able to participate in debates about resilience and adaptive strategies.

Achieving these outcomes may mean new structures and will involve a range of actions designed to understand the factors of vulnerability, stress and resilience on destinations and their capacity to adapt and/or re-establish their tourism industry. Sustainable adaptation to climate change in tourism destinations refers to approaches that reduce a destination's vulnerability and improves resilience without compromising economic viability, social justice and environmental integrity (Njoroge, 2014). As Becken (2013) observed, some tourist destinations are more resilient than others and have the capacity to change the mix of tourism attractions in the short-term.

Njoroge (2014) proposed an enhanced Regional Tourism Sustainable Adaptation Framework (RTSAF) for a sustainable adaptation process to reduce a destination's vulnerability to climate change risks and advance sustainable economic development. The framework builds on the principles of sustainable adaptation suggested by Ericksen et al. (2011) and the Regional Tourism Adaptation Framework (RTAF) by Jopp et al. (2010). Njoroge (2014) noted a number of weaknesses of the RTAF including a lack of a feedback loop between local and global processes, a propensity to enhance the 'business as usual' approach, a gap in the mechanisms for evaluating adaptation options to address the three pillars of sustainability, and neglecting to include host community involvement throughout the adaptation process. However, it should also be noted that some interventions may disadvantage the social, economic or environmental viability of other individuals, groups or sectors. The RTSAF model (Njoroge, 2014) adopts adaptation interventions that reduce the vulnerability of regional tourism and includes measures to enhance social justice, environmental integrity and economic sustainability at the destination level.

The modified RTSAF model (Njoroge, 2014) proposes four key phases (Figure 2.6). Phase one involves an assessment of the destination's tourism industry. Phase two is concerned with identifying risks and opportunities while phase three identifies the adaptive capacity of the destination. Phase four focuses on the adaptation process and involves six steps for identifying and assessing adaptation options, testing and ranking, implementation, and evaluating the viability of the options. The aim of the model is to enhance sustainability during the adaptation process. While useful, the model does not outline how the various phases may be implemented and does not include a start point where the community is asked to develop a vision of the future they wish the community to pursue. However, as in any model of this type where complex relationships and interceptions are reduced to a series of simple steps, it does provide a useful starting point for a more general discussion by stakeholders on the process that should be adopted by the community in moving forward and adapting to a new reality. Figure 10 illustrates a modified version of the Njoroge's (2014) RTSAF model where a community vision element and feedback loop enabling ongoing reassessment of the success of adaptation are added.

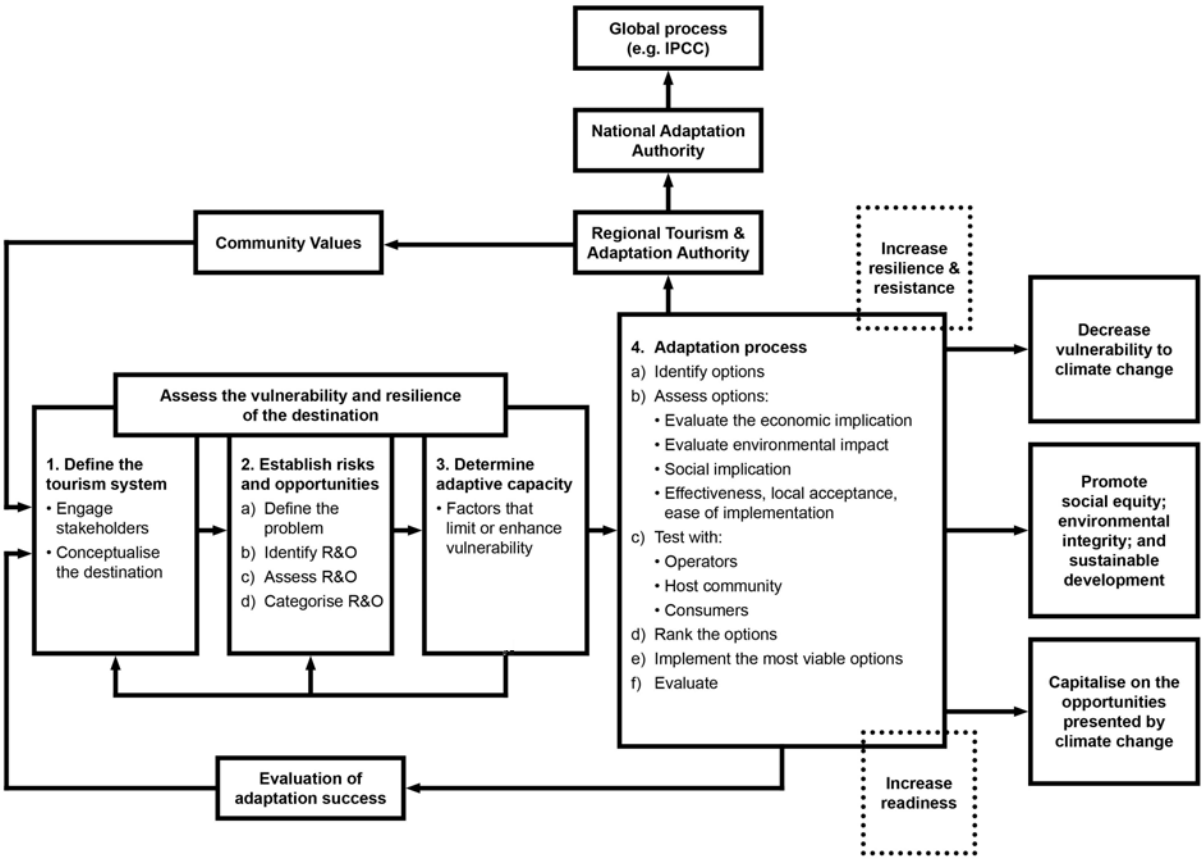

Figure 10: Modified version of the Enhanced Regional Tourism Sustainability Framework (ERTSF) after Njoroge (2014) and Jopp et al. (2010)

2.6 Tourism and crisis events

The 2016 and 2017 coral bleaching events can be described as crisis events that have the potential to disrupt the tourism industries of all GBR catchment communities, including those that depend on places in the GBR that experienced little or no bleaching. In the mind of consumers, the GBR is seen as a single attraction, not the series of reef locations that it actually is. This is an outcome of the manner in which the GBR has been promoted as a tourism attraction. Consumers simply do not have sufficient information to see the GBR as a series of locations, some of which remain in pristine condition while others have been severely affected.

A number of researchers who specialise in crisis and disaster management advocate the need for destinations to develop crisis and disaster management plans. While much debated, the six-step plan advocated by Faulkner (2001) for tourism disaster planning, management and recovery continues to provide a useful framework for disaster management. The model advocates the need for pre-crisis/disaster planning and also emphasises the need for post crisis/disaster communications in the recovery stage. Many of the elements advocated by Faulkner (2001) were absent in the response to the bleaching events of 2016 and 2017. Destinations that fail to adopt crisis recovery planning have a high probability of experiencing a downturn in visitors (Ritchie, 2009).

The most effective method of dealing with the economic impacts of future bleaching and other climate-related events in marine and terrestrial environments is the development of a comprehensive crisis recovery plan at state and local destination levels. This may require the establishment of a dedicated crisis management team.

The potential for further mass coral bleaching as early as 2018 (NOAA, 2018) highlights the urgent need to invest in a crisis recovery plan. Failure to develop a crisis recovery plan may lead to short and possibly long-term decline in visitation that will be difficult to recover from given the competitiveness of the global tourism industry.

2.7 Cases study regions

This research focuses on three of the GBR's six NRM regions. The following discussion briefly highlights the significance of the tourism sector vis-à-vis other economic sectors. The demographic, economic and tourism profiles of Cairns, the Whitsundays, Mackay and Bundaberg are highlighted.

2.7.1 Cairns

Cairns was first established as a port in 1876 to service a range of extractive industries that initially included minerals and logging, followed later by agriculture. These industries continued to be the mainstays of the local economy for many decades. The Cairns region's attractive tropical climate encouraged the development of the tourism industry which remained relatively small in terms of overall visitor numbers until the last three decades of the 20th Century. By 1947, the city's population had grown to 16,444 rising to 30,000 in 1967 (Schofield, n.d.), 48,557 in 1991 and 161,932 in 2016 (ABS, 2016). Much of the growth after 1967 can be attributed to the growth in the tourism industry and the sectors that support the tourism industry such as health, education, retail and construction. The rapid growth in hotel rooms provides one example of the rapid expansion of the city's tourism industry. For example, between 1960 and 1980 the number of hotel rooms grew from 700 to 6,500 (Queensland Places, 2015).

The opening of the Cairns International Airport in 1984 and the significant Japanese led investment that followed provided the trigger for the rapid growth of international tourism in Tropical North Queensland (TNQ). Passenger movements at the Cairns domestic and international terminals increased from 85,000 in 1965 to more than 2.2 million in 1994-95, growing to 5.2 million for the 12 months to June 2017 (Cairns Airport Corporation, 2017).

Figure 11 highlights the trend in domestic and international visitors over the period 1999 to 2016. It is interesting to note that during the period 1999 to 2016, TNQ experienced 17% growth in international visitors while in the same period total international arrivals almost doubled from 664 million to 1.2 billion (UNWTO, 2017). In the same period international arrivals into Australia as a whole increased by 93% from 4.4 million in 1999 to 8.5 million in the 12 months to March 2017 (Tourism Research Australia, 2017a).

Based on these figures, the TNQ region has failed to keep pace with the increase in national and global arrivals over the 17 year period from 1999 to 2016.

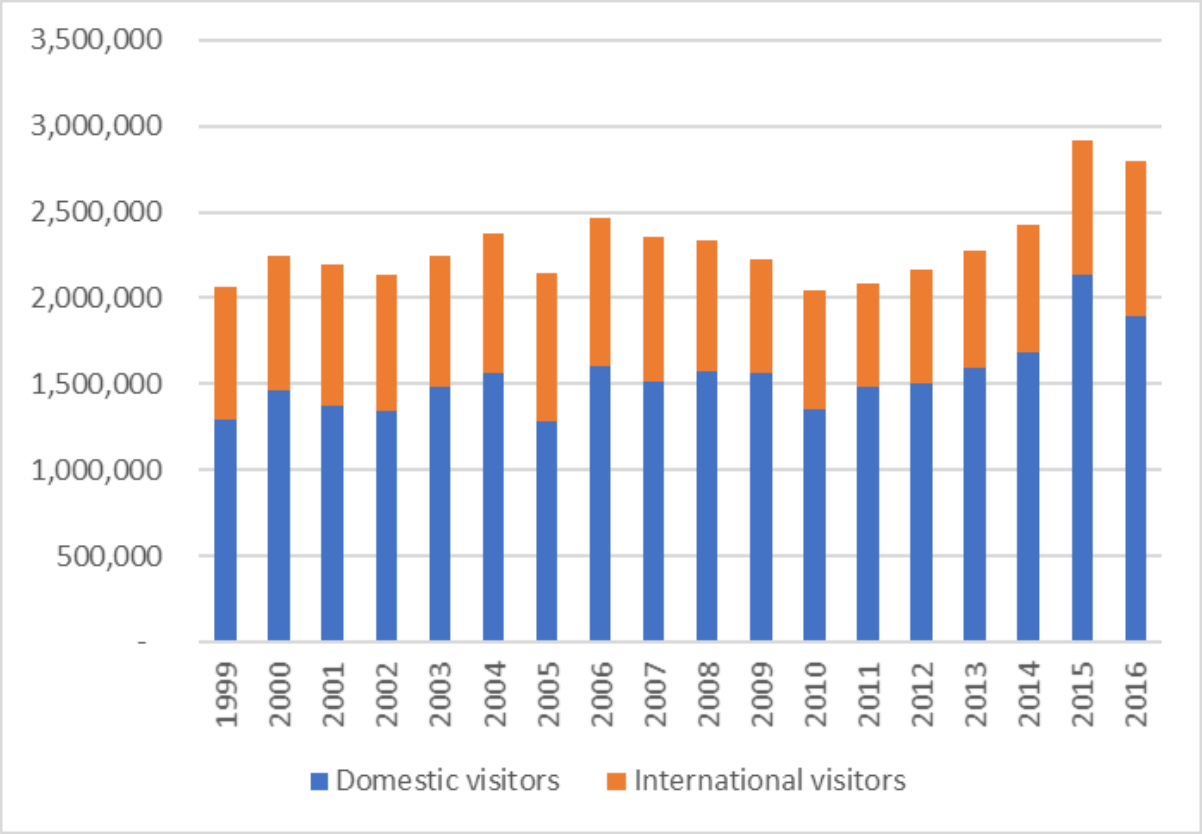

Figure 11: Total Visitors (Domestic and International) in TNQ for the period 1999–2016

Source: Tourism Research Australia, Tourism and Events Queensland

In the year ending June 2017, TNQ attracted 2,704,000 overnight visitors (TEQ, 2017a). The bulk of these visitors stayed in Cairns and Port Douglas. Domestic visitor numbers (1.8 million) were down 4% on the previous year. Interstate holiday visitor numbers were down 20.1% and expenditure by interstate visitors declined by 9.1% ($211 million) to $1.9 Billion. Over the 12 month period to June 2017 total bed nights fell by 8.2%. International visitor numbers (0.898 million) grew 4.5% over the 12 month period to June 2017. Total visitor expenditure was estimated by Tourism and Events Queensland (TEQ, 2017a) to be $2,950 million, down 6.1% on the previous 12 month period. In comparison, overall visitor numbers to Queensland grew by 6.2% in the same period while bed nights increased by 6.3%.

The top three international markets were China, Japan and the UK with an average stay of seven nights (TEQ, 2017a).

2.7.2 Whitsundays

The Whitsundays includes the towns of Proserpine, Airlie Beach and Bowen. Almost all on-shore tourism activity is centred on Airlie Beach. Off-shore tourism activity is centred on a number of island resorts including Hamilton Island, Hayman Island, Long Island and Daydream Island.

In the year ending June 2017, the Whitsundays attracted 760,000 overnight visitors (TEQ, 2017b). Domestic visitation (518,000) was up on the previous year while international visitation (241,000) was

up 8.7% on the previous 12 month period. Total visitor expenditure was estimated by TEQ (2017b) to be $721.74 million, up 1.9% on the previous 12 month period. The top three international markets were UK, Germany and China. Figures for the 12 months to June 2017 show a fall in both holiday and VFR visitors but an increase in business visitors. The rise in the business sector can be attributed to the influx of workers undertaking post-cyclone reconstruction.

2.7.3 Mackay

First settled in 1862, the Mackay region soon emerged as a major sugar cane producing region. In the latter part of the 20th Century, the opening of coal mines in the hinterland added a new sector to the local economy. Mackay's tourism industry is relatively small compared to other sectors of the local economy.

In the year ending June 2017, the Mackay region attracted 928,000 overnight visitors. Domestic visitation (873,000) was up 10.4% on the previous year while international visitation (45,000) had no increase in numbers over the 12 month period. Compared to the other regions discussed in this report, the bulk of domestic visitors to Mackay are Visiting Friends and Relatives (190,000) and business travellers (445,000). Total domestic visitor expenditure was estimated by TEQ (2017c) to be $380 million, up 8.8% on the previous 12 month period. No figures were published for international overnight expenditure. Europe was the top market in the region's international visitors.

2.7.4 Bundaberg

The first European settlers in the Bundaberg region were attracted by an abundance of timber. Forest clearing opened the area for a range of pastoral and agricultural activities. By the latter part of the 20th Century, the region had become popular with tourists. However, the GBR has never been a major 'pull' factor for Bundaberg's tourism industry. While Bundaberg is promoted as the 'Southern Gateway' to the Great Barrier Reef, including Lady Musgrave and Lady Elliot Islands, terrestrial tourism experiences including beaches constitute the region's major pull factors. The coastal town of Bargara has become increasingly important in the region's tourism sector.

In the year ending June 2017, the Southern Barrier Reef section centred on Bundaberg attracted 2,102,000 overnight visitors (TEQ, 2017d). Domestic visitation (1.95 million) was up 6.5% on the previous year while international visitation (148,000) was up 10.0% on the previous 12 month period. Total visitor expenditure was estimated by TEQ (2017d) to be $1.188 million, up 12% on the previous 12 month period. The top international markets were the UK and Germany.

2.7.5 Demographic profiles

Table 1 highlights the demographic characteristics of the study region while Table 2 highlights the study regions' tourism profiles.

Table 1: Comparative demographic characteristics for the research region

	Cairns	Whitsundays	Mackay	Bundaberg
Council	Cairns Regional Council	Whitsunday Regional Council	Mackay Regional Council	Bundaberg Regional Council
Population	161,932 (2016)	34,270 (2016)	123,540 (2016)	94,640 (2016)
Aboriginal & Torres Strait Islander	13,438 (2011)	1,333	4,912 (4.4%) (2011)	2,981 (2011)
Employed population	69,915	15,468 (2011)	44,770 (2011)	38,406 (2016)
Unemployment	7.1% (2016)	6.6% (2016)	5.3% (2014)	9.6% (2016)
Median Age[1]	36.5	37.9	36	45
Education				
No qualification	42.8%	27.8%	44.6%	
Bachelor or higher degree	13.8%	14.5%	11.4%	8.6%
Adv. Diploma or diploma	8.0%	11.5%	7.4%	5.4%
Vocational	22.1%	43.7%	30.0%	21.3%
Not stated	13.4%	2.4%	2.4%	
Total Dwellings	64,962	38,023	38,560 (2011)	38,785 (2011)
Average Household Size	2.49	n/a	2.7	
Employed				
Full time employed	44,132	6,437	n/a	n/a
Part time employed	23,801	3,954	n/a	n/a
Median Income	$624/week individual (2011)	$621/week individual (2011)	$705/week	$423/week individual (2011)
Industry sector of employment	1. Health care and social assistance 2. Retail trade 3. Accommodation and food services	1. Accommodation and food services 2. Retail trade 3. Construction	1. Retail trade 2. Manufacturing 3. Health care & social assistance	1. Agriculture, forestry & fishing 2. Health care & social assistance 3. Construction

[1] Source: ABS 3235.0, Population by Age and Sex, Regions of Australia, 2015).

Table 2: Tourism statistics for the research area

	Cairns	Whitsunday	Mackay	Bundaberg
Tourism businesses[1]	**2,140**	**578**	**1,000**	**791**
Non-employing	864	225	378	297
1-4 employees	671	155	268	267
5-19 employees	446	156	263	186
20+ employees	159	42	91	41
Visitors ('000)[2]	**2,691***	**720***	**926***	**1,290***
International	890	243	48	35
Domestic overnight	1,801	477	878	447
Domestic day	2,290	243	673	808
Nights ('000)[1]	9,276	3,446	2,102	2,488
International	4,710	1,336	538	848
Domestic overnight	4,566	2,111	1,564	1,640
Average stay (night)[1]	**6**	**7**	**4**	**5**
International	7	5	14	24
Domestic overnight	5	5	3	4
Spend ($m)[1]	**2,065**	**721**	**411**	**369**
International	753	139	24	30
Domestic overnight	1,153	534	268	200
Domestic day	159	48	118	139
Average spend per trip ($)[1]	**751**	**753**	**349**	**286**
International	1,120	730	618	851
Domestic overnight	1,161	1,143	565	448
Domestic day	146	159	179	172
Average spend per night ($)[1]	**206**	**195**	**139**	**92**
International	160	104	45	35
Domestic overnight	253	253	171	122
Average spend (commercial accom) per night ($)[1]	**228**	**228**	**162**	**89**
International	179	116	61	36
Domestic overnight	290	305	198	132
Top Source Markets[2]	**Top Source Markets[2]**	**Top Source Markets[2]**	**Top Source Markets[2]**	**Top Source Markets[1]**
1	China (218,000 visitors) (753,000 nights)	UK (54,000 visitors) (355,000 nights)	Germany (9,000 visitors) (46,000 nights)	United Kingdom (6,000 visitors) (102,000 nights)
2	Japan (111,000 visitors) (679,000 nights)	Germany (34,000 visitors) (141,000 nights)	New Zealand (7,000 visitors) (45,000 nights)	Germany (5,000 visitors) (74,000 nights)
3	USA (109,000 visitors) (597,000 nights)	China (21,000 visitors) (83,000 nights)	UK (6,000 visitors) (59,000 nights)	New Zealand (4,000 visitors) (40,000 nights)

[1]Source: Tourism Research Australia, Local Government Area Profile (2015)

[2]Source: Tourism and Events Queensland, Regional Snapshot Year Ending March 2017

*Total of domestic overnight and international overnight visitors

2.8 Research gaps

Despite a number of reports that have examined aspects of climate change on the GBR and its ecosystem values, relatively little research has been undertaken into the impacts of a decline in the health of the GBR on human communities. The only current work in this area are several papers by Dale et al. (2014) and Dale et al. (2016) and a series of reports on the Natural Resource Management Regions (NRMR) within the Great Barrier Reef and its catchments by Gooch et al. (in draft).

Other significant gaps in understanding include:

- An understanding of how a long-term decline in the GBR will affect the tourism industry particularly in the coral dependent tourist destinations of Cairns, Port Douglas and the Whitsundays.
- There is a lack of research that takes a tourism centric perspective into how a decline in the GBR will affect the economic health of the tourism industry and supporting communities.
- An understanding of how post-crisis planning can assist in response and recovery management.
- At what stage in the crisis event cycle will affected communities recognise the extent of the problem and adopt strategies to deal with the aftermath of the crisis event?
- At what level of ecosystem decline will the government consider withdrawing funding for research and management?

3. METHODS

3.1 Introduction

https://www.coralcoe.org.au/media-releases/only-7-of-the-great-barrier-reef-has-avoided-coral-bleaching

The aim of this research is to investigate the impact of the 2016 and 2017 coral bleaching events on a range of stakeholders including the tourism industry, tourists and local communities in the GBR region. One major outcome of the research is a suggested methodology that can be used to support ongoing monitoring of communities, industry stakeholders and visitors. Early in the research, it became apparent that the GBR south of Townsville had avoided significant coral bleaching to date, and as a consequence the main focus of the research was on the northern section of the GBR around Cairns.
A mixed methods approach based on four separate studies was employed.

3.1.1 Media Monitoring

The aim of this study was to identify the extent of coverage given to the 2016 and 2017 coral bleaching events by the media. The results were used to assist in the development of items to inform the focus groups and community survey.

The first news of the impact of the bleaching event came from a media release from the ARC Centre of Excellence Coral Reef Studies which stated that only 7% of 911 reefs surveyed by light plane and helicopter had avoided bleaching. This report was reported by Smail (2016) as 97% of the reef had been bleached. Although the 2016 event was part of a larger global wide event, the media release gained immediate attention and was picked up by media outlets in numerous countries. Later research found that the level of damage was not as great as first feared but this was not widely reported by the media.

Swann and Campbell (2016), using the Factiva research database, identified 2,887 articles globally containing a reference to the Great Barrier Reef and coral bleaching between 1 January and 1 June 2016. For the same period between 1 January and 1 June 2015, there were 90 articles published in the media. Of the 2,887 articles, 36% were stories from news publications and 61% were identified in 'web news' sites. For this reason, media articles discussing the 2016 and 2017 GBR coral bleaching events were collected between January 2016 and June 2017. Media stories that were published prior to the 2016 coral bleaching event were analysed to gain insights into content being discussed and to provide a baseline to identify changes in content during and after the bleaching event. A total of 130 media articles were analysed using the content analysis software, Leximancer.

Leximancer, a textual analysis software tool, was used to analyse the content of media articles published from January 2016 to June 2017. The program examines textual material for the presence and frequency of concepts and then extracts key themes which are presented in visual concept maps. The key themes that emerge during analysis in the concept maps are 'heat-mapped' where warm colours (red, orange, brown) indicate the most important themes and cool colours (blue, green) signify less important themes (Leximancer, 2011).

3.1.2 Focus Groups

Participatory research methods such as focus groups allow for discussions with local stakeholders. The focus group format enables participants to express their opinions on issues under discussion as well as facilitating knowledge exchange and value-sharing. Focus groups also facilitate the collection of qualitative data that enables better understanding of the participants' perspectives on a specific topic (Stewart, Shamdasani & Rook, 2007). A major benefit of focus groups is the creation of an interactive group environment that is able to provide rich insights based on the participants' opinions, attitudes and impressions (Krueger & Casey, 2009; Smith, 2010; Stewart, Shamdasani & Rook, 2007).

Four focus group meetings were held in Cairns, Airlie Beach, Mackay and Bundaberg. The objective of the focus groups was to identify the impacts of the 2016 and 2017 coral bleaching events on the social, environmental and economic life of these communities. Participants (see Table 3) were selected from tourism and governance organisations that have a role in economic and tourism development in the study regions. Local regional councils, regional tourism organisations (RTOs), regional development organisations and reef and island tourism operators were invited.

The research team also conducted a small number of interviews with stakeholders who were not able to attend the focus groups. Their responses were added to the responses of participants in the focus groups.

After identifying 30 suitable invitees from RTOs, regional councils, tourism bodies and economic development organisations, CEOs and senior managers were contacted by telephone and followed up with an email invitation. A project information sheet was sent to each invitee explaining the aims of the project, information that would be sought and identified the end users of the research. The process resulted in 15 invitees agreeing to participate in a focus group or telephone interview (if they were unable to attend the focus group).

Focus groups were held in Airlie Beach, Mackay and Bundaberg over the period 10th to 14th July 2017. The Cairns focus group was held on the 29th May 2017. Participants (n=15) represented a range of organisations including regional tourism organisations, economic development organisations, local government, tourism operations and regional transport organisations.

Each focus group or individual interview took between 45 minutes and two hours. An informed consent form and project information sheet were first provided to each participant. The aim of the project, expected outcomes and final end users of the project were explained. All focus groups and interviews were recorded and transcribed for data analysis.

A bank of questions was developed to guide the discussions and to identify the level of awareness of the 2016 and 2017 coral bleaching events. The questions guiding the discussion in the focus groups and in interviews were:

1. Are you aware of the recent GBR coral bleaching events?
2. How did you find out about the recent GBR coral bleaching events?

3. Did the recent coral bleaching events (or reports of it in the media) affect your lifestyle or business?
4. Were there noticeable impacts on the community and/or tourism industry?
5. If it (coral bleaching) had happened in this region, what do you think the impacts would/may have been?
6. If coral bleaching events become a regular occurrence, how do you think it will impact on the community and businesses?
7. Are you concerned about Crown-of-Thorns Starfish (COTS) outbreaks and its impact? Are you aware of the control program and is it effective?
8. Are you concerned about cyclones and other possible threats to the GBR?
9. Do you have strategies in place for the short and/or long term if there was another bleaching event, COTS outbreak, major cyclone or other threat to the GBR?
10. Are you concerned about reports of the current 2017 coral bleaching event?

Analysis was undertaken using the qualitative data analysis software program NVivo v.11. After transcribing the interviews and focus groups, the text was thematically analysed to identify concepts of bleaching awareness, communication, impacts and well-being, and resilience and strategies. Both negative and positive intonation of the responses is reported.

Table 3: Focus group invitees and participation

	Cairns	Airlie Beach	Mackay	Bundaberg
Regional Council	✓	✓	×	✓
State Development	✓	n/a	n/a	n/a
Regional Tourism Organisation	n/a	✓	✓	✓
Regional Development Australia	✓	n/a	n/a	n/a
Regional Airport	✓	×	✓	Owned and managed by Council
Tourism Operator	×	×	✓	✓
CoGBR	✓	n/a	n/a	n/a
Regional Economic Agency	✓	×	✓	×
Chamber of Commerce	×	×	×	n/a

n/a=not willing or able to participate;
× = not in the region or contactable

The focus group element of the research was delayed for several months to reduce any possible overlap of respondents' views on coral bleaching and Tropical Cyclone Debbie, both of which occurred in a similar time frame. As Figure 9 highlights, both the 2016 and 2017 coral bleaching events had a relatively small impact on reefs from the Whitsundays south. In the Whitsundays, Tropical Cyclone Debbie had a far greater impact on coral cover than either the 2016 or 2017 coral bleaching events.

While a useful research tool to identify the views of key regional stakeholders, the lack of participation in some destinations may mean that the views of some key stakeholders are not included in this analysis.

3.1.3 Cairns Airport Survey

The aim of the Cairns Airport Survey was to discover visitors' views on coral bleaching. In late 2015, it became apparent that a major coral bleaching event could occur in 2016. To enable comparisons to be made of the pre, during and post event reactions of visitors, a survey was designed to capture visitors' views on the impact of coral bleaching in the Cairns region. The airport survey is part of a long running survey undertaken by CQU researchers.
The survey was undertaken in the domestic lounge of Cairns International Airport. The views of visitors who travelled to the region by other forms of transport including road and cruise ship were not recorded. While there are limitations to the survey site and the use of English only in the survey instrument, it did enable the researchers to capture the views of intrastate and international visitors leaving through the domestic terminal of the airport. Surveys were conducted twice monthly between January 2016 and June 2017. Participants generally took about 10 minutes to complete the survey instrument.

Aside from the limitations of the site and language, there are a number of more general limitations to the survey that need to be acknowledged. The first is that the survey does not provide data on the actual number of visitors to Cairns. That data is gathered by Tourism Australia. Second, the survey only gathered the views of respondents who were leaving the region via air. It is unable to provide data on consumers who may have cancelled a trip to Cairns because of concerns about the quality of the experience. International tourists in particular are likely to book many months ahead while domestic tourists appear to have a shorter period between the decision to travel and the purchase of travel. Finally, it should be noted that the data relate to Cairns only and should not be generalised across other Queensland destinations or visitor sectors that were not surveyed.

3.1.4 Community Survey

To develop an understanding of the views of the community regarding the threat posed to the GBR by coral bleaching in particular and climate change in general, a community survey was undertaken in Cairns. A number of the items were drawn from the SELTMP conceptual framework which was based on the Millennium Ecosystem Assessment (MEA) and focused on the linkages between ecosystems and human well-being (MEA, 2005). The SELTMP sought to understand and monitor the impacts of human actions on the reef and the resilience of industries and communities to environmental, governance and cultural changes (Marshall et al., 2014). The original SELTMP framework was modified to enable identification of the impact of coral bleaching on the community. Questions focused on perceptions of coral bleaching and its impact on individuals, use of the GBR, the value of the GBR to residents and climate change beliefs.

The survey (Appendix 1) was undertaken in Cairns between July and September 2017. A filter question was first used to establish if respondents viewed themselves as residents of the region. A total of 252 useable surveys were collected. The date and location of completed surveys was recorded on the front of each survey form. An incentive prize of a trip for two to the GBR was offered for completing the survey. Respondents were asked to include their name and contact number on the front page of the survey. The option was also given to receive an e-copy of the final report. This information was detached from the survey before data entry to ensure anonymity of the survey responses.

3.2 Limitations

A number of limitations should be noted. First, this research does not include all of the NRM regions contained in the ABS (2017) report on the GBR and its catchments. Second, the airport survey and the community survey were only conducted in Cairns. The decision to focus on Cairns was taken on a number of grounds including: funding available for this study; reefs in the vicinity of Cairns suffered coral bleaching in both 2016 and 2017 while those to the south did not; and Cairns has the highest number of GBR visitors of all regions examined in this report and the highest potential to suffer from any long-term decline in tourist numbers caused by crisis events such as repeated coral bleaching.

4. RESULTS

4.1 Media monitoring

4.1.1 Results

As highlighted in Section 2.1, the media can have a significant impact on consumer perceptions which form the basis for a purchasing decision. Social media in particular can exert an enormous influence on consumer opinions (Leung, Law, van Hoof & Buhalis, 2013). The influence of the media can be seen in three ways: first in alerting users that something is happening; second, in alerting users that the event has finished; and third, in alerting users that the situation has returned to normal. The following discussion highlights the main messages that emerged from media reporting of the 2016 and 2017 coral bleaching events. Eight themes were identified: bleaching; temperatures; reef; climate; stress; tourism; area; and government. Figure 12 represents the summary of themes that were identified from analysing the 2016 (n=80) and 2017 (n=50) media articles.

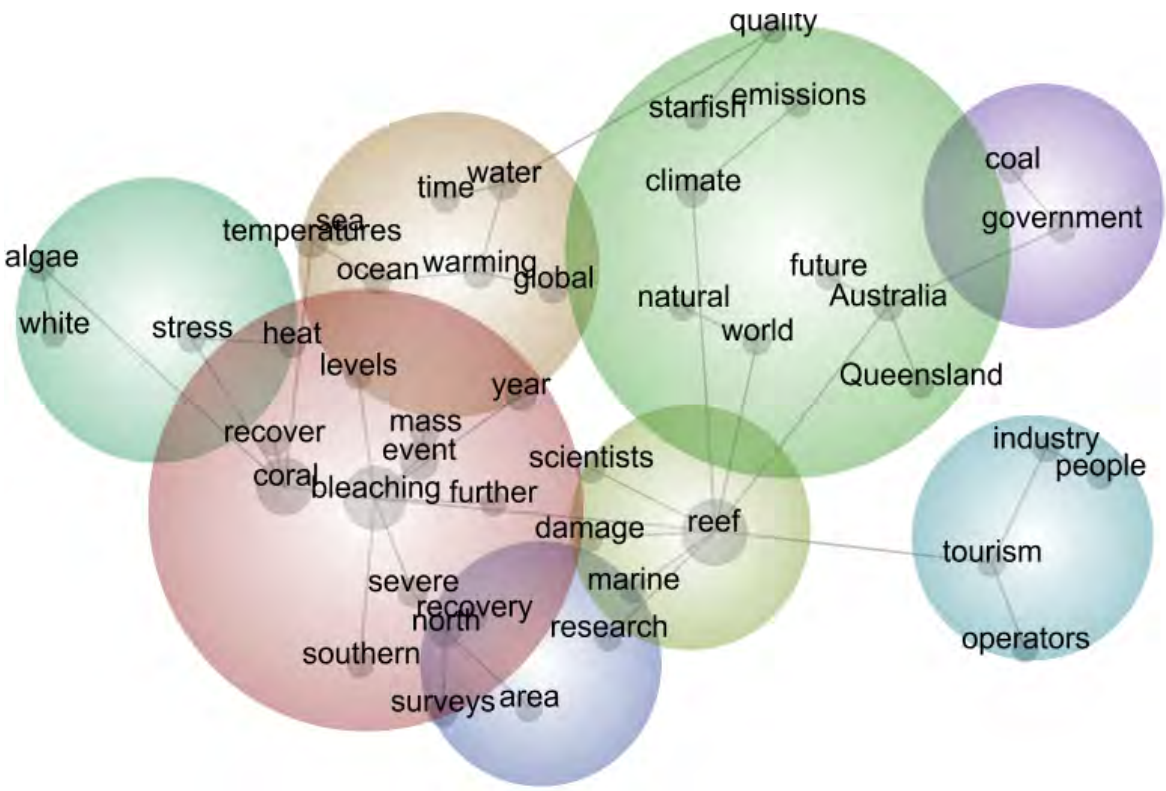

Figure 12: Concept map of media articles 2016/2017

The themes and connectivity shown in Table 4 and are ranked in terms of their relative importance.

Table 4: Themes and connectivity of media articles

Theme	Connectivity
Bleaching	100%
Temperatures	44%
Reef	43%
Climate	25%
Stress	10%
Tourism	9%
Area	7%
Government	6%

Many of the articles highlighted the impact of the bleaching events on the Great Barrier Reef. The theme of '*bleaching*' was most closely related to concepts such as coral, mass event, severe, levels, recovery, north and southern. These concepts show that the content of the media articles included descriptions on the severity of coral bleaching and location based information on the regions that were most prone to bleaching (north) and those that had a reduced chance of bleaching (southern parts).

'Temperatures' was the second most reported theme and was closely located with concepts such as water, warming, year, global, time, ocean and sea. Several articles reported that the temperature had increased by 2 degrees Centigrade. The factor 'time' appeared particularly important in this regard since coral bleaching events are more likely to happen when water temperatures rise for a sustained period of time.

'Reef' was the third most reported theme and included concepts such as scientists, damage and marine. Many of the articles referred to the work conducted by multiple reef scientists and the possible damaging outcomes further bleaching events would have on the network of marine species (i.e. possible collapse). Interestingly, the theme of 'reef' has a link to the theme of 'tourism' indicating that damage to the Great Barrier Reef can also have damaging effects on the tourism industry and tourism operators.

'Climate' was the fourth most reported theme and was closely related to concepts such as emissions, starfish, natural, quality, future, Queensland, Australian and world. Greater predation by the crown-of-thorns *starfish* was mentioned in conjunction with runoffs from farms and coastal development. Several of the articles recognised that the climate had changed and that *Queensland* weather patterns had changed in recent decades. Concern for ongoing and future climate impacts were raised and *Australia*'s lack of planning in dealing with effects of climate change was criticised. If *emissions* were not reduced the *natural* values associated with habitat loss would also be reduced.

The theme of *'stress'* was closely linked to concepts such as algae, heat and white. Many of the articles were written from an educational perspective and appeared to be attempts to educate the public about what happens when coral suffers from prolonged heat *stress.*

The theme of *'tourism'* included concepts such as industry, operators and people. Some articles also referred to the predominantly negative publicity that the GBR has received and how this will impact on people's decision to travel to the region.

The themes of *'area'* and *'government'* emerged as the final two themes. *'Area'* as a theme was closely linked to concepts such as research and recovery. Some media articles included clear details about the areas of the GBR where monitoring and research took place, while other articles discussed the possibilities for recovery after substantial periods of time. The final theme of *'government'* included the concept of coal, meaning that several of the media articles included detailed discussions on the government's decisions regarding coal mines, fossil fuels and options of shifting to more renewable energy sources.

The use of concept tags for 2016 and 2017 (Figure 13) indicates a change in the emphasis of the media. A comparison of publication year tags (2016 and 2017) indicated that some of the themes have changed. In 2016, the focus was more on the *'reef'* while in 2017, the focus was more on *'another year'* of bleaching and *'starfish'* (i.e. Crown-of-Thorns starfish outbreaks).

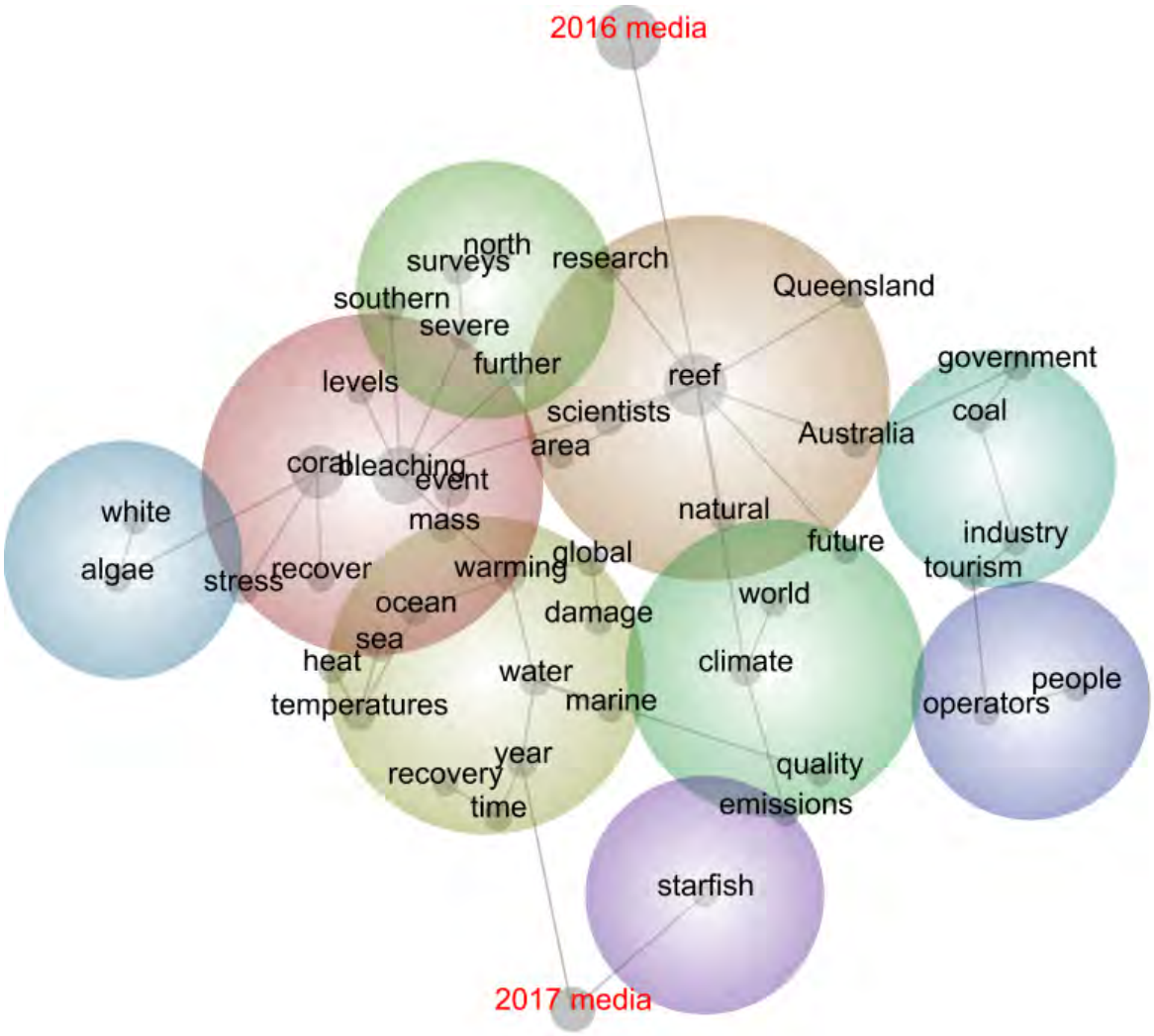

Figure 13: Concept map of media articles with 2016 and 2017 tags

Table 5 shows the strength of connectivity which emerged from the analysis by including the tags of 2016 and 2017.

Table 5: Themes and connectivity of media articles with 2016 and 2017 tags included

Theme	Connectivity
Bleaching	100%
Reef	65%
Temperatures	61%
North	26%
Climate	18%
Government	14%
Algae	5%
Operators	5%
Starfish	1%

'Bleaching' was again identified as the strongest theme. This theme was most closely related to coral, mass event, stress, recovery and levels of bleaching. The second strongest theme was *'reef'* and was closely related to the Great Barrier Reef Marine Park Authority, Australia, scientists, area and Queensland. The third strongest theme of *'temperatures'* was closely related to water, year, warming, global and time. Many of these related concepts were used in the context of sea temperature averages and global temperature rise.

4.1.2 Discussion of results

The analysis of media reports about the coral bleaching events is an effective measure of the content and volume of reporting and the audience that the reports are reaching. This understanding will be useful for developing a crisis recovery communication strategy.

4.2 Focus group and interview results

The following discussion outlines the results of the focus group element of the research. Five key themes were identified. These are awareness and communication; the impact of coral bleaching on tourism and visitation; the impact on business and community; resilience strategies; and strategies to deal with coral bleaching.

4.2.1 Awareness and communication

All respondents were aware of the 2016 and 2017 GBR coral bleaching events. The level of awareness varied only on the basis of a respondent's length of residence in the study region.

Respondents were asked how they found out about the coral bleaching events. This question was used to develop an understanding of the significance of formal and informal communication channels. Media was the main source of information, particularly for the 2016 event. Negative messaging and mixed messaging were of most concern. Comments on this question included: *"the media is responsible in 'cherry picking'* and *'if exaggerated or misinterpreted – then wrong influence, [it] affects*

the resilience of the tourism industry". In relation to the southern sector of the GBR, one respondent stated that while there was relatively little comment in the local media (*"not so much in the local media"*) members of the local community were aware of the sensational nature of the global media response. One participant stated that the local community did *"pick up on global sensationalised media"* and added that *"some environmental tourism operators were horrified by the global media"*.

The role of GBRMPA as the lead management authority for the GBR was mentioned frequently. Formal networks were cited as a communication tool, more so for the 2017 event when GBRMPA kept in touch with RTOs. One RTO indicated they were contacted regularly by GBRMPA and the Australian Institute of Marine Science (AIMS). *"[We] had contact with AIMS and GBRMPA and so were aware of the aerial surveys and their concerns of the 2017 one".* This gave them an early insight into the results of the Reef Health and Impact Survey (RHIS), and indirectly, garnered support from TEQ (Tourism and Events Queensland). A number of participants commented on the positive role of the GBRMPA, *"GBRMPA [was] sending out information about reef health plus sediment, pesticides, water quality and COTS".*

One participant from the Bundaberg group stated that *"GBRMPA always keep in contact – yes, we are a reef guardian council – the last council in their boundary".* Reef operators noticed minimal coral bleaching. One Bundaberg participant was unsure if they had received communication from GBRMPA.

Overall, participants acknowledged the positive role played by TEQ which was reported by a number of respondents as being better prepared to deal with the 2017 event by regular communications with RTOs. *"TEQ ensured all RTOs were informed" (Bundaberg)* and *"TEQ called up and said what had happened"* and *"we formed a small group of RTOs with TEQ about four weeks beforehand (Mackay)"* to discuss strategies to deal with the event. *"The TEQ channel stepped up this time – had clear messaging for all of the regions"*; and *"the coral bleaching impact was not so evident down here but yes communication was okay"*.

Only one focus group participant stated that they had personally witnessed the impacts of the 2016 coral bleaching event.

Overall, participants voiced the view that the US, UK and European markets were very aware of the coral bleaching events. One respondent, echoing the views of other focus group members, stated, *"the media was massive in Europe and North America"*. However, it appeared that the Chinese market had been shielded from the global media attention, *"China has very little awareness of the bleaching"* and the coral bleaching was *"not impacting on some airlines' strategic decisions (in Cairns)".* The perception from participants regarding the Chinese market was that the *"Chinese market hadn't heard of coral bleaching through the media – [the] message hadn't got through to that band of [current] Chinese travellers coming to the reef"*.

Participants generally agreed that the second bleaching event appears to have been the 'wake-up call' that climate change impacts were becoming a reality, *"The second bleaching has affected everybody"*. One Cairns respondent observed that the 2017 event *"changed people's thoughts (about climate change) in Cairns".*

4.2.2 Impact of coral bleaching on tourism and visitation

Participants from the Cairns focus group in particular believed that bleaching will have a significant impact. As one participant noted *"the impacts of coral bleaching and its links to tourism figures will become more evident in the next few years"*. There was a strong view that the GBR's position as a key destination pull factor was likely to be adversely affected if there were future coral bleaching events. The view of one participant sums up the view in Cairns and to a lesser extent, participants in other regions, *"bleaching affects visitors (and will affect us) because a visit to the GBR is top on the list"*.

In the Whitsundays group, one participant indicated there was no immediate impact on visitor numbers, *"We were on track for the greatest number of visitors ever to visit the GBR from the Whitsundays than any other destination in Queensland [before the cyclone]",* adding *"Cairns had a 0.8% decline whereas we had a 17% increase here".* Participants in the Whitsundays thought that bleaching had been minor this time around. As one participant observed *"those that go to the same reef everyday did see some minor bleaching but not at the outer reef – unless you are well educated in bleaching. It is the difference between a scientist and visitor – hard to distinguish bleaching of coral".* There was however, an acknowledgement that the 2017 bleaching event was having an impact on business. One participant observed that "*The message was loud at the beginning, now messaging is coming back that real life isn't the same, visitors have dropped off, businesses are worried and so is council about economic recovery. Not just the bleaching, it is also the cyclone, a cumulative impact"*.

In the Mackay region the view was that the coral bleaching event had little impact. One participant summed up the general views of the group, "*the region was already in an economic cycle that could not be related to coral bleaching"*, *"if anything at all, Proserpine and Mackay experienced growth in the leisure market, directly related to the island experience which the reef is a part of".* The view was that most people visiting the GBR were private fishing parties. *"Mackay had the highest boat ownership up to three years ago - private recreational fishing access to the GBR rather than the tourism product accessing the GBR"*. Discussion on the impact of changes in the strength of the resources sector was seen as a more important factor on the health of the regional economy. As one participant observed, "*there was a population shift about four years ago, Mackay is now at the bottom of the cycle and seeing growth in property rental, business investment, housing, economic drive … now in a growth cycle"* and *"we're not seeing any downward turn or trend in fishing"*. One participant in the Mackey group expressed the view that the issue of climate change was being used by some environmental groups to attack the resources sector stating, *"the green movement's connection of trying to link coral bleaching with warming of the ocean and the resource sector"*. In general however, the Mackay tourism industry has not felt any major impact from coral bleaching in part because the GBR is not a major attraction for the region's tourism industry. One participant noted that *"The reef is there but Keswick Island doesn't directly market the GBR – the weather dictates 100% of the market"*.

Participants in the Bundaberg focus group agreed that the recent coral bleaching events had little impact on the region's tourism industry: *"we can't directly relate coral bleaching to the recent fall in demand, in last quarter to March".* In relation to the 2017 event, one respondent stated that *"the 2017 event has had more impact after TC Debbie due to the media saying all of Queensland was 'closed'".*

4.2.3 Impact on business and community

Participants in the Cairns focus group voiced a high level of concern about the impacts of the 2016 and 2017 coral bleaching events. This view was summed up by one participant: *"the greatest fear of the community is to lose the GBR".* The consensus of the group was that *"the negative publicity of bleaching, the validity of what's said, how things are said and if exaggerated or misinterpreted – have a strong influence on tourists"*. *"Negative media affects the resilience of the tourism industry and it has a corrosive effect on community confidence".* The Regional Council is responsible for healthy waterways, but there is no funding currently allocated for the impacts of coral bleaching on tourism and the community, apart from their funding agreement with TTNQ, the tourism marketing body.

In the Whitsundays region, Tropical Cyclone Debbie was seen as having a greater impact on the community than coral bleaching. In relation to the cyclone, the following comment indicated the level of concern about the cyclone rather than bleaching *"funding and counselling is going to be required now the impact on businesses (of the cyclone) is clear – it has definitely had an impact on the region".* However, a positive element is that "*industry engagement is really strong and we realise social and environmental measures are important"*.

While the GBR is not a major drawcard for the Bundaberg region the Mon Repos turtle hatchery is a major attraction, particularly for the region's large backpacker market. The view of participants was that any impact on the reef that affected the turtle hatchery would be felt by the region's tourism industry. As one participant noted: *"The backpacker market is an economic driver of the region. If this disappeared due to coral bleaching or other impacts it would affect the region economically – 25% of the nation's produce is from the region, so yes, it would affect the region economically – much of the agricultural labour is performed by the backpacker market"*. The main concern voiced was that development along the region's coast line needed to be monitored for possible impacts on the region's fringing reefs, *"The biggest impact is the ability [for the turtles] to access beaches afterwards, the fringing reefs are at risk with poor land use, infrastructure built on creek banks – historical plus new developments – planning doesn't consider possible impacts on the fringing reefs"*.

Aside from coral bleaching and Tropical Cyclone Debbie, concerns were raised about the possible impact of COTS in the long-term. In Bundaberg one participant noted that the industry is *"aware of the COTS program but there is not really any outbreaks down here in Bundaberg – the reef is in much better condition than up the coast"*. In Mackay, it was noted that *"the three largest threats are agriculture run-off, COTS and major weather events like coral bleaching and climate change; dredging is also perceived as another threat but that is managed and regulated; and shipping is not considered a threat – the GBR has one of the most regulated navigable crossings in the world"*. In Airlie Beach there was also concern about COTS but while aware of the danger it was not seen as significant, "… *we are* a*ware of that and the eradication program but there are not many here"*.

4.2.4 Resilience strategies

Participants were asked about the perceived resilience of their destination if coral bleaching or other threats to the GBR occurred regularly and if they were aware of any strategies in place to deal with events of this type.

Many of the strategies suggested for increasing resilience focused on the media. One participant stated "*The challenge is two mixed messages. We need to communicate the disaster and impacts, factual information and flow on effects so experts, business and government can action to reduce the impact, but because of the tourism environment we have a message to put out we are open to business"*. The same participant summed up the view across all focus groups by stating *"(the) notion of saying nothing (and) it will go away doesn't work, we need to have a strategy to positively message all year round with facts about the reef – bring travel agents from the UK to see the reef"*. One local government participant stated that *"as local government we need to listen to our members – hear what the needs are and we can turn around and facilitate that and help them".*

Many thought that the sensationalising of the coral bleaching event by the media was confusing. *"We get 'dudded' as a community because we are confused, because there is no cohesion". "Negative media affects the resilience of the tourism industry".*

The link between mining and coral bleaching was raised several times, *"Mining does not affect the reef as such, but affects it through emissions in that it affects climate change. It is important to separate this discussion from the environmental debate"* and *"there was a lot of counter marketing/ up tempo marketing with the environmental movement – we did see a lot of negative media but the upswing was that it was not very discernible"*.

Communication was considered as a key element in reducing confusion about the impact of future coral bleaching events. One participant felt that the *"tourism industry may be able to come up with one single position"*, that there was a *"need for a central information source"* with *"the right message".* It was suggested that this needed to be undertaken in cooperation with other agencies including GBRMPA, QTIC and TEQ. Another participant expressed the view that there was *"a need for a particular individual or organisation to be the central coordinating message point"*. This was supported by participants in all focus groups. For example, one participant stated that, *"there is a need for significant cohesion in developing the 'voice' that communicates the messages"* and that the *"tourism industry has the opportunity to be a more powerful voice for the reef"*. The point was also made that any marketing message should highlight that *"access to the GBR is not just by boat, other options are helicopter, sea walker, and the aquarium as a landing pad."*

On this topic one Cairns participant stated that there needed to be a *"change in communication, a need for consistent messages that they can communicate to airlines and stakeholders at the same time, to have a plan in place before the message is released".* Advertising in the airport arrivals lounge was one option put forward. In the Mackay group one participant stated that there was a need to *"work with TEQ and QTIC to get the messaging right with the rest of the RTOs"* even though they only *"have one operator that goes to the GBR at the moment, once the product builds we will put strategies in place to ensure it [the reef] is protected"*.

The recovery campaign by Tourism Whitsundays in the aftermath of TC Debbie was given as an example of the strength in a unified voice. As one participant noted *"the Whitsundays has been a great example of rallying the operators together to put out the sunny blue sky and beach water images after the cyclone"*. The participant added that *"It was important that all businesses help each other by not competing against each other, but rather against other global destinations"*. In Mackay it was noted

that *"We work with TEQ because we are a small RTO, we have been speaking with Daniel Gschwind and Kate Jones weekly to discuss messaging".*

In relation to social media, there was general consensus that the industry needed to *"prepare for the outcome of social media – having a unified message across social media". S*uggestions included use of hashtags and Google Analytics. As part of any disaster management plan there was a view that "*embedding social communication is critical".* It was also agreed that that inclusion of a communication plan is critical in any post event recovery plan. As one participant added *"as part of a disaster management strategy, we do have a communication plan in that"*.

Citizens of the GBR (CoGBR) was generally viewed as an organisation able to spearhead positive communications. There was also agreement that positive messages need to be consistent across the tourism sector and regions. *"Collectively the GBR destinations must embrace this [CoGBR] and drive it as a social movement… if it is going to work"*. Participants felt that the CoGBR had a critical role to play. As one participant stated "*if a 2018 bleaching event were to occur, the role of the CoGBR is to be real, authentic and honest. We aim to be involved in any mitigation techniques"*.

A number of participants also stated that some operators have also introduced their own strategies to combat the poor media image that has emerged as a consequence of the bleaching event. One participant stated that "*some Queensland businesses do 'stuff' about it in educating their customers".* In the Bundaberg group, one participant stated that *"it needs education of the public – all reefs go through coral bleaching, it is a natural cycle, the messaging needs to be bigger"* and *"education of coral bleaching would be important to tourism and the community"*. Another participant stated that the Bundaberg council had implemented a program to educate the community about coral bleaching through *"reef guardian schools plus on the back of other services to the community about how we are connected to the reef"*.

Very limited concerns were expressed about the role of the GBRMPA. One participant stated that there was a *"need to be discreet when messages go against GBRMPA because they issue the permits – advocacy of position versus economic realism"*.

4.2.5 Strategies to deal with coral bleaching

Several participants stated that some agencies had failed to consider climate change as an impact in their disaster management planning. Participants in the Bundaberg focus group noted that *"coral bleaching is not in our current crisis management plan but we are aware of the need to include it as soon as possible in our crisis management and risk management plans"*. The participants in the Bundaberg focus group observed that the city was keen to be proactive in promoting sustainability and protecting the GBR through the Sustainable Bundaberg 2020 Plan, *"it is focused particularly on energy but we promote the region through council and the importance of protecting the reef… obviously we have a heavy agricultural area and we are looking at more sustainability and connection to the reef"*.

Many of the participants equated resilience of the community and tourism industry with disaster management, particularly after Tropical Cyclone Debbie. One Mackay participant noted that *"there are disaster management groups in place that would be deployed if needed. If there was a disaster, response is ingrained [from the tourism industry]"* and *"as part of the disaster management strategy*

we do have a communication plan". In relation to Tropical Cyclone Debbie one Mackay participant stated that "*there was small groups in place to get the economy back on its feet – all are now wound up except for the Whitsundays to get everything up and running"*.

In the Whitsundays region, one post-cyclone strategy that had been implemented was "*all staff were asked not to post anything negative [on social media], we did extremely well – generated by feedback from industry. We provided updates on a daily to weekly basis on who was open and who was not, we called all members together – messaging is very important"*.

Participants in Mackay and Bundaberg stated that while there was a new marketing campaign showcasing access to the southern GBR there remained the realisation that there was a need to promote other land based attractions as the basis for future tourism growth, *"the new GBR marketing plan is coming out soon – The Ultimate Guide to Driving the GBR – all of the RTOs were involved up to Cairns, Townsville has been the lead on this… don't just come to one point to see the GBR, do all of the attractions along the way".* One Whitsundays participant commenting on this point observed that the Whitsundays is looking at *"diversifying their product mix – Indigenous, food trails, and three small walks for dive operators - above water products. If we want to be sustainable going forward we need to be realistic, develop diversity now before being reactive"*.

A similar observation was made in the Mackay group. There is *"limited GBR product out there – Megaforce Charters is the only operator promoting the reef, but fishing is still good out there, growth is occurring"*. Moreover, *"we don't have large operators on the reef and so the impact was not noticed as much, but once the product builds, we will put strategies in place"*. The RTO is concentrating on *"building the tourism pie first – getting the attractions first and more positive marketing rather than defending the negative. The domestic visitor spend is bigger than the international market but we are doing trade mentoring at the moment – we need the product to be ready for markets. We are still working with the western market and now operators need to be savvy for the eastern market – this is paying up, international visitation is up 25% in the past 12 months"*.

Lady Elliott and Lady Musgrave are two reef islands that can be reached from Bundaberg. When discussing their tourism markets, participants stated that the *"backpacker market is quite strong – majority come here for the work; leisure visitors go to Fraser Island, but Lady Musgrave is getting a few more visitors, backpackers have already booked into the Whitsundays for a reef experience. Lady Musgrave cruises started in 2015 – this new experience is up and running and we just got some great new markets with the Chinese. The Chinese have not previously been a traditional market and we are preparing for them now, it is good that he [Lady Musgrave Cruises] will have Chinese visitors three days a week"*. It was also noted that *"93% of visitation to Bundaberg is the drive market, so when the media is saying all of Queensland is wiped out [from the cyclone], it stops a lot of tourists"*.

In relation to the first media on the 2016 event, a number of comments were made about the need for a more fact-based approach. One participant states *"the science needs to be funded better to show the facts to the right areas – there should be resources around equitable funding".* There was a feeling if the scientists received more funding they would not have made the initial statement that *"93% of the reef is dead*".

4.2.6 Discussion of results

The low level of participation in the focus groups, except for the Cairns group, may reflect a lack of concern about the impact of the most recent coral bleaching event. This is reflected in the views expressed above. In part, this can be attributed to the relatively small size of GBR-related tourism south of the Whitsundays and the absence of coral bleaching in these areas. There was a far greater level of concern about the impacts of Tropical Cyclone Debbie.

From a community resilience perspective, there was relatively little concern that future coral bleaching could weaken community resilience except in the Cairns group. Moreover, there was little evidence that participants had considered that the recent bleaching events may have been the first of a number of climate change related events that will affect marine and terrestrial tourism resources in the future. Where there was concern, it was mainly short-term and more concerned with strategies to deal with the adverse media generated.

There was a reasonable level of understanding that climate change could pose a problem in the future but this understanding has yet to be translated into calls for action.

4.3 Cairns Airport survey

4.3.1 Results

A total of 1,817 valid surveys were collected with domestic visitors comprising 45% of respondents and international visitors comprising 55% of respondents. Not all questions were completed by all respondents and as a result the 'n' value may vary between questions. Fifty-four percent of respondents were female and 46% were male. Of the 1,817 visitors who participated in the survey, 69% reported that they visited the GBR on this trip to the Cairns region. All results presented in Section 4.3 are courtesy of CQU (2017).

Figure 14 indicates the age range of respondents by domestic and international markets. For both the domestic and international visitors, the largest group of respondents was aged 20-29 years.

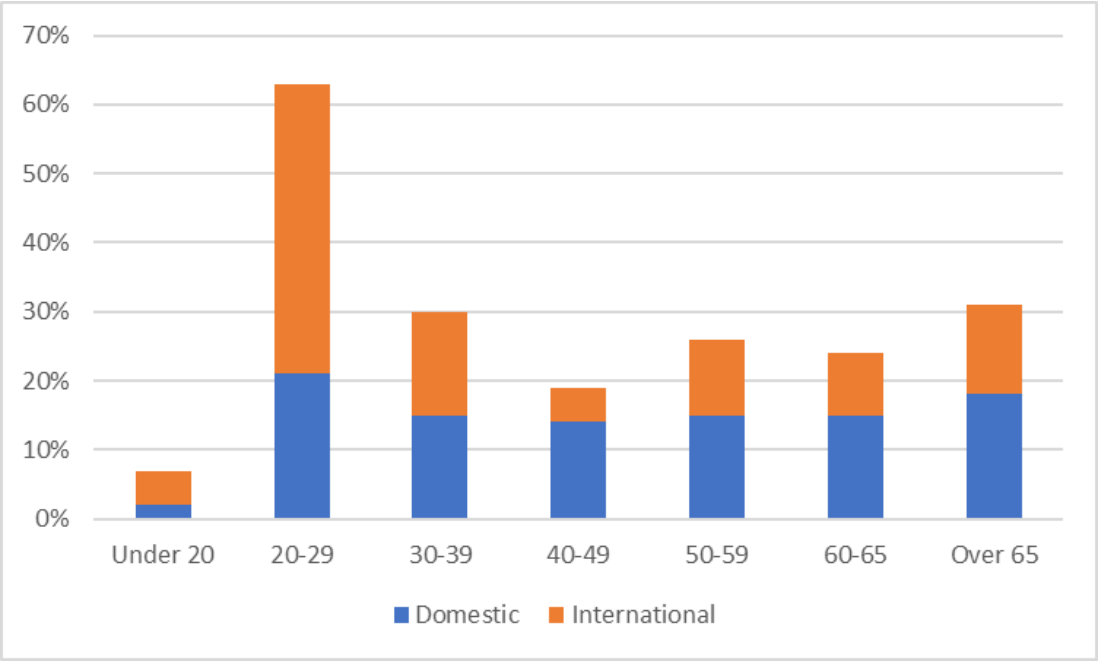

Figure 14: Age groups by international and domestic respondents (n=1,795). Results courtesy of CQU (2017).

Respondents were asked to indicate their motives for visiting Cairns using a 5-point Likert scale, where 1 indicated 'not at all important' and 5 indicated 'very important'. Table 6 highlights the average position of the GBR as a motive for domestic visitors over the 18-month period of the survey. During the 18 months of the survey, the average ranking of the GBR as a key motive for domestic visitors fell from third to ninth position. Lifestyle attributes such fun, rest and relaxation, tropical lifestyle and climate were ranked higher than the GBR (see Table 6). Nature remains a major motive although behind lifestyle motives such as fun and rest and relaxation. Interestingly, the motive 'the price matched my budget' was important but ranked 8th overall.

Table 6: Top ten motives for all domestic respondents averaged over the 18 months of the survey (n=804). Results courtesy of CQU (2017).

Rank	Activity	Mean
1	To Have Fun	4.44
2	Rest & Relaxation	4.24
3	Experience the Natural Environment	3.97
4	Enjoy the Tropical Lifestyle	3.97
5	Experience the Climate	3.94
6	Visit the Wet Tropics Rainforest	3.70
7	Visit the Great Barrier Reef	3.67
8	The price matched my budget	3.67
9	Visit the Beaches	3.67
10	Visit National Parks	3.57

Over the 18-month period the GBR consistently ranked as the top motive for international tourists visiting the Cairns region (Table 7). As highlighted in Table 7, seven of the eight top motives for visiting the Cairns region were environmental. 'To have fun' ranked second to 'visit the Great Barrier Reef'.

Table 7: Top ten motives for all international respondents (n=985). Results courtesy of CQU (2017).

Rank	Activity	Mean
1	Visit the Great Barrier Reef	4.66
2	To Have Fun	4.56
3	Go Snorkelling/Diving	4.12
4	See Australian Wildlife	4.11
5	Experience the Natural Environment	4.06
6	Visit the Wet Tropics Rainforest	3.94
7	Visit National Parks	3.75
8	Learn about the Natural Environment	3.75
9	Rest and Relaxation	3.72
10	Visit World Heritage Area	3.66

Figure 15 compares changes in the positioning of the GBR as a motive on a quarterly basis between domestic and international respondents. The importance of the GBR as a motive for visiting Cairns fell sharply after the first coral bleaching event, declining from 3rd position in Quarter 1, 2016 to 12th position in Quarter 3, 2016 before climbing to 7th position in Quarter 1, 2017. After the 2017 coral bleaching event the GBR fell to 9th position in Quarter 2, 2017.

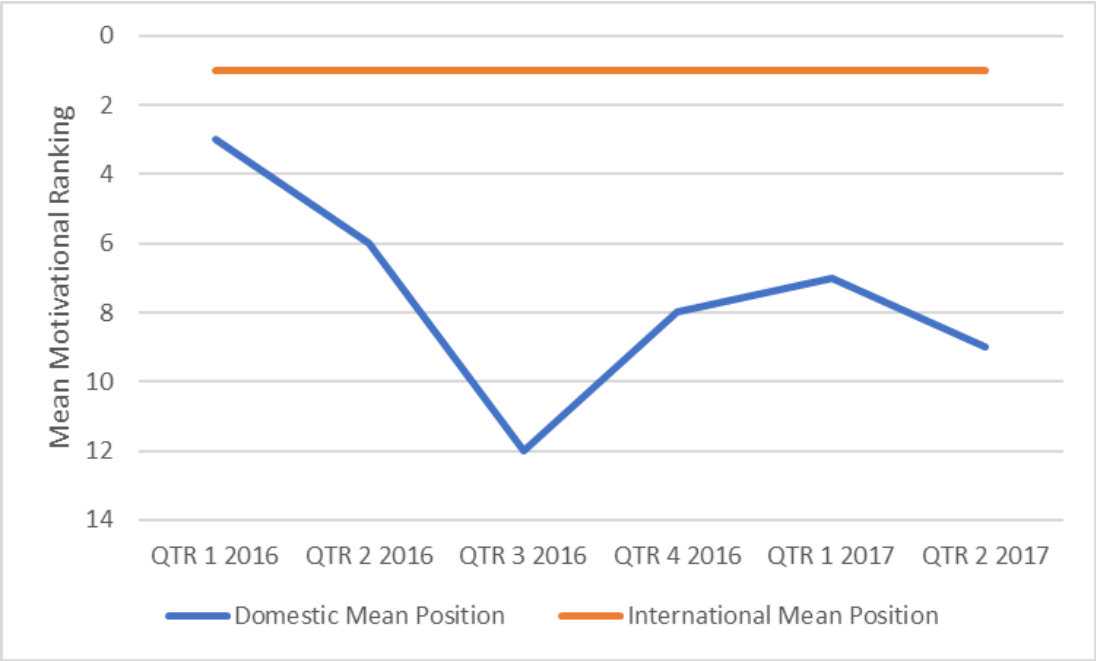

Figure 15: Ranking of the GBR as a travel motive for domestic and international respondents between Q1 2016 and Q2 2017. Results courtesy of CQU (2017).

Respondents were asked if they had visited the GBR during this trip. The percentage of international respondents who had visited the GBR was much higher (88%) than for domestic respondents (48%).

Figure 16 indicates the pattern of GBR visitation over the six quarters of the survey. Of interest is the dip in visitation rates by domestic respondents between Quarter 2 (April to June 2016) and Quarter 3 (July to September 2016) possibly indicating a response to domestic media about coral bleaching. A similar pattern was not observed amongst international respondents, possibly because many international trips for the last three quarters of 2016 may have been booked before news of the bleaching event became public knowledge.

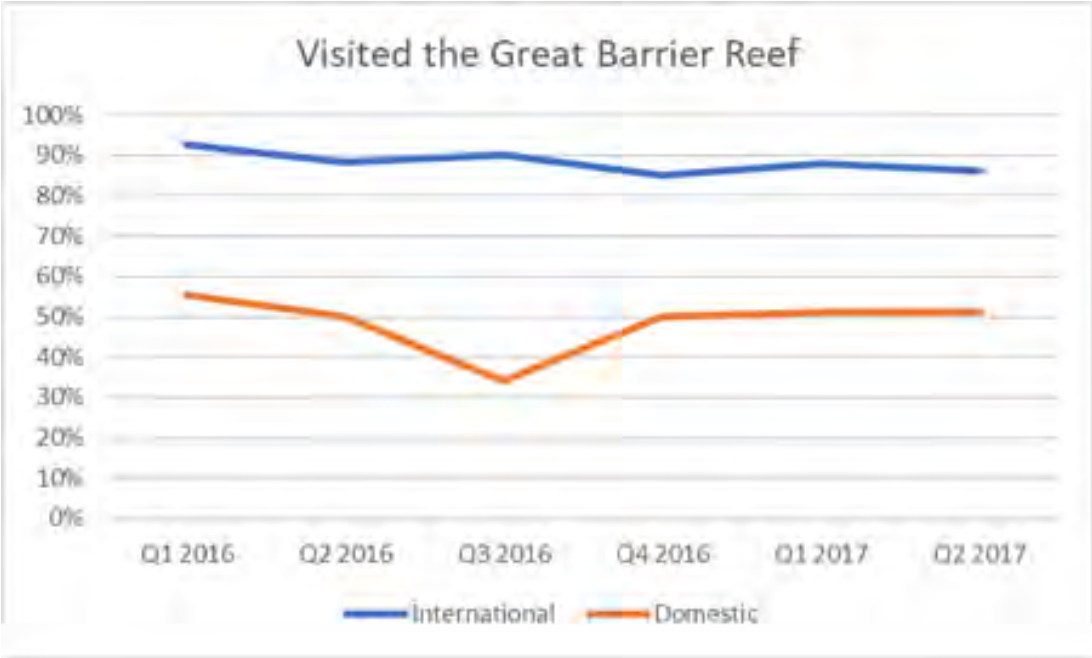

Figure 16: Pattern of reef visitation for domestic and international respondents over the period January 2016 to June 2017. Results courtesy of CQU (2017).

Figure 17 illustrates the percentage of respondents reporting that this was their first visit to the GBR. After a small dip in Quarter 2, 2016 the number of international visitors visiting the GBR for the first time showed a small increase. The pattern for domestic respondents was quite different with numbers falling substantially until Quarter 1, 2017.

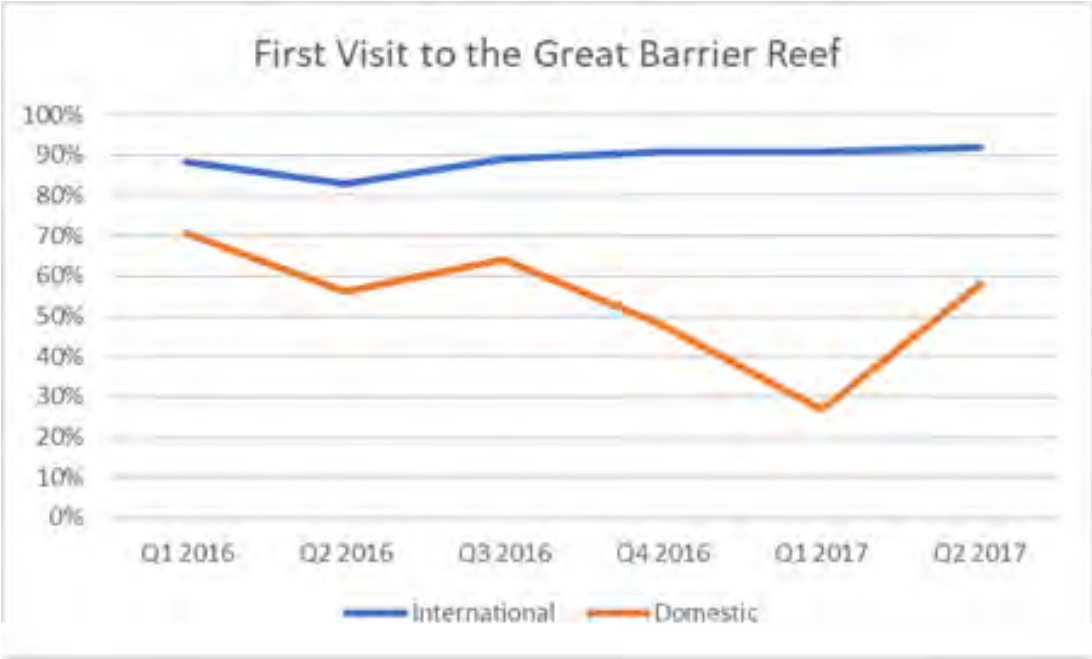

Figure 17: Pattern of first time visitation to the GBR for domestic and international respondents over the period January 2016 to June 2017 (n=997). Results courtesy of CQU (2017).

Figure 18 outlines how domestic respondents (n=382) rated their GBR experience based on a four-point scale from 'good' to 'awful'. It is interesting to note that the rating 'good' only declined in Quarter 2, 2016, about the same time that reports about coral bleaching first appeared in the media. The rating of 'good' recovered substantially in subsequent quarters until Quarter 2, 2017 when it again declined. Research undertaken by RRRC and AMPTO (2016) indicated that the quality of their GBR experience in reef systems frequently visited by tourists in the Cairns region suffered only minor bleaching in 2016, although the impacts on coral health on these reefs was more serious in 2017. The bounce back in respondents' rating of their GBR experience in Quarter 3, 2016 indicates that part of the decline in Quarter 2 can be attributed to the impact of the media message, not the quality of the coral itself. This is an important observation and indicates the role that media can play in future post-crisis recovery communications; provided that future bleaching does not noticeably reduce the quality of the coral cover experienced by visitors.

Figure 18: Rating of GBR experience by domestic respondents on a four point scale from good to awful (n=382). Results courtesy of CQU (2017).

Figure 19 outlines the rating that international respondents (n=865) gave for their GBR experience. It is interesting to note that the rating 'good' declined slightly in Quarter 2, 2016, about the same time that media comments about coral bleaching first appeared. The rating of 'good' substantially recovered in subsequent quarters but then declined in Quarter 2, 2017. The rapid bounce back in positive ratings by respondents indicates that a part of the decline in the ranking can be attributed to the impact of negative media reporting, not the quality of the coral itself.

Figure 19: Rating of GBR experience by international respondents on a four-point scale from good to awful (n=865). Results courtesy of CQU (2017).

Figure 20 reports on the results of a question that asked all domestic respondents to recall if they had seen or read reports on coral bleaching on the GBR prior to their holiday in Cairns. This question was included in the survey from Quarter 2, 2016, resulting in a sample of n=1,446. In Quarter 2, 2016, 75% of respondents recalled seeing media reports about coral bleaching. By Quarter 2, 2017, 85% of respondents reported seeing reports about coral bleaching.

Figure 20: Domestic respondents who recall seeing or reading media reports on coral bleaching on the GBR prior to their visit (n=681). Results courtesy of CQU (2017).

Compared to domestic respondents, fewer international respondents were aware of the 2016 bleaching event in Quarter 2, 2016 (see Figure 21). While the percentage of international respondents who reported seeing media prior to their visit continued to increase over the course of the survey it never reached the level of recall reported by domestic respondents.

Figure 21: International respondents who recall seeing or reading media reports on coral bleaching on the GBR prior to their visit (n=765). Results courtesy of CQU (2017).

Figures 22 and 23 report on the level of concern about coral bleaching expressed by domestic and international respondents who remembered seeing media reports about bleaching. The level of concern expressed by domestic respondents increased during 2016, fell in Quarter 1, 2017 and then increased after the 2017 bleaching event. The level of concern expressed by international respondents was lower than for domestic respondents in Quarter 2, 2016 but continued to climb over following quarters to equal that of domestic respondents by Quarter 2, 2017.

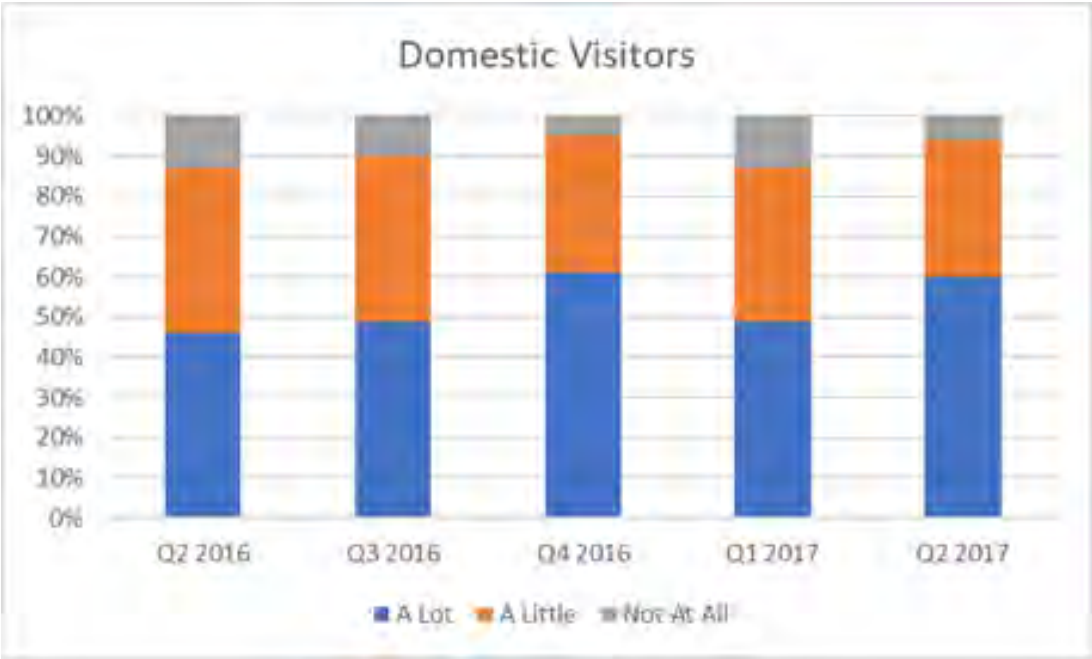

Figure 22: Level of concern about coral bleaching by domestic respondents who saw media reports about the event (n=656). Results courtesy of CQU (2017).

Figure 23: Level of concern about coral bleaching by international respondents who saw media reports about the event (n=709). Results courtesy of CQU (2017).

Figure 24 compares the level of concern about coral bleaching by domestic respondents together with their recall of seeing media reports about the bleaching event. By Quarter 2, 2016 over 75% of respondents recalled seeing media reports on bleaching with this level of response continuing throughout subsequent quarters. The most interesting result was that by Quarter 1, 2017, the correlation between seeing media and concern had begun to fall. By Quarter 2, 2017 however, the level of concern had again increased while the level of recall of seeing media also continued to increase. Between Quarter 1, 2016 and Quarter 2, 2017 the level of concern about coral bleaching increased by 15%.

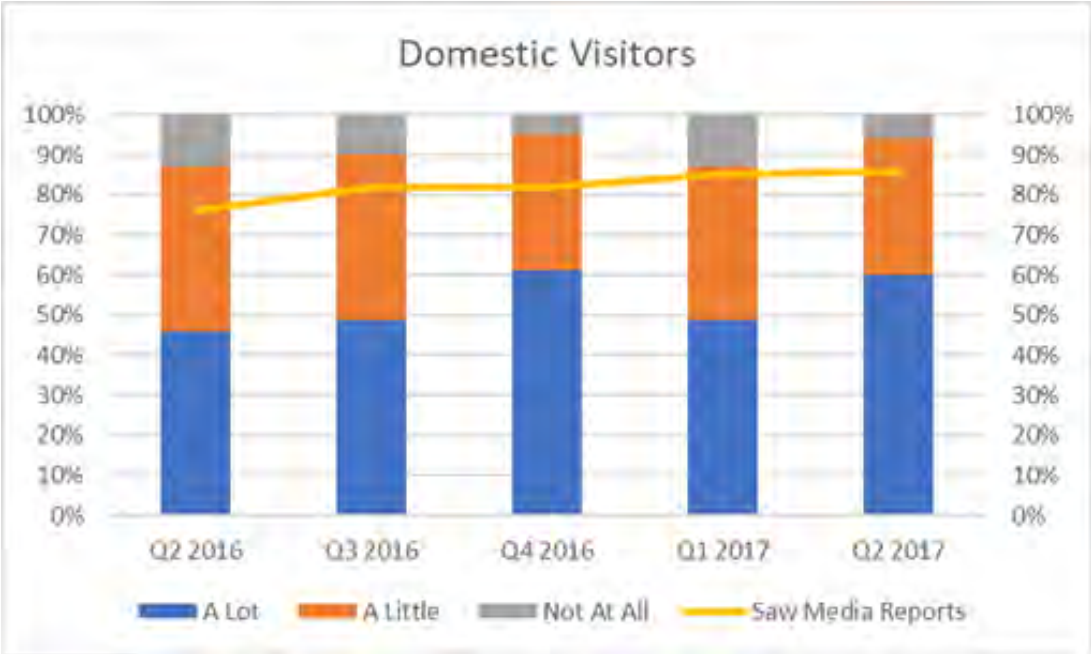

Figure 24: Comparison of concern by domestic respondents about coral bleaching with viewing of media reports. Results courtesy of CQU (2017).

Figure 25 compares the level of concern about coral bleaching expressed by international respondents with their reported viewing of media about the bleaching event. Overall, fewer international respondents reported seeing media about the bleaching events compared to domestic respondents. Figure 25 does however indicate a positive relationship between exposure to media and level of concern particularly in Quarter 2, 2017. Moreover, the level of concern about coral bleaching increased by 25% over the period of the survey.

Figure 25: Comparison of concern by international respondents about coral bleaching with viewing of media reports. Results courtesy of CQU (2017).

Respondents were asked if they selected holiday destinations based on environmental protection. As Figure 26 indicates, less than half of the domestic respondents indicated that they usually or always selected destinations based on that destination's level of environmental protection. However, as Figure 27 indicates, international respondents were more likely to 'sometimes' select destinations based on the destination's level of environmental protection.

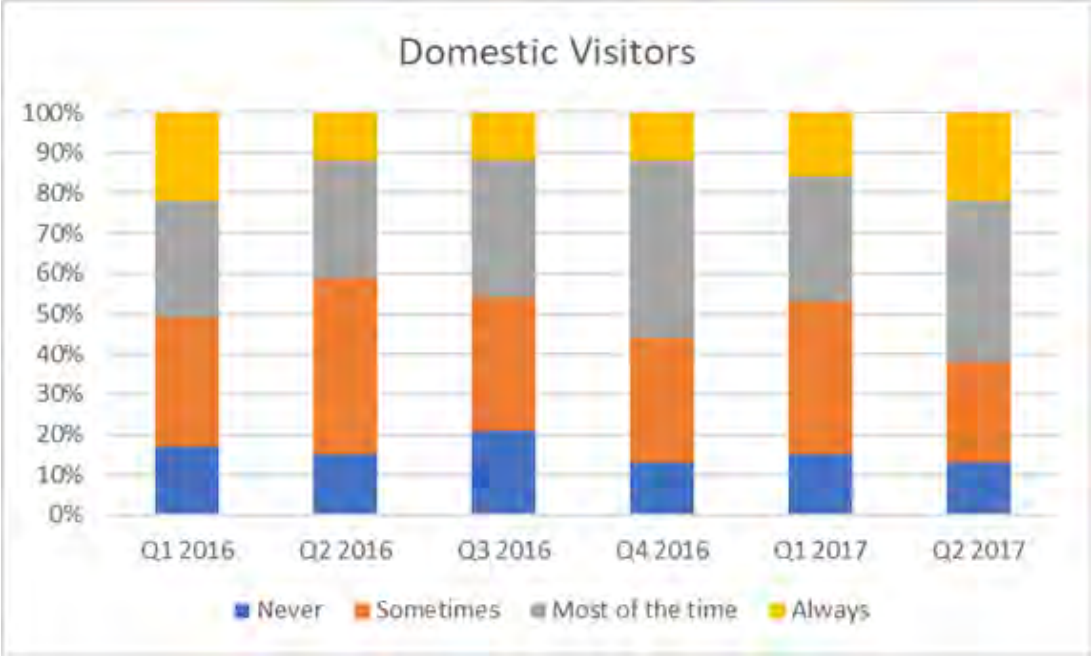

Figure 26: The level of concern for environmental protection in destination choice by domestic respondents (n=801). Results courtesy of CQU (2017).

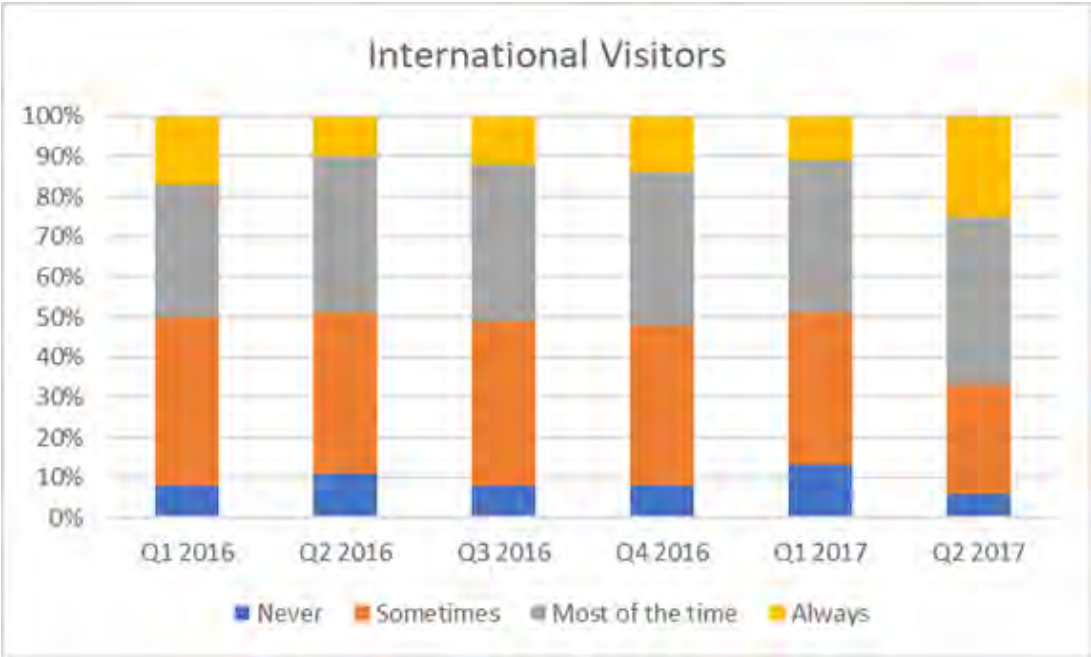

Figure 27: The level of concern for environmental protection in destination choice by domestic respondents (n=978). Results courtesy of CQU (2017).

Figures 28 and 29 report on the responses by domestic and international visitors to a question that asked if Cairns appears to be protecting its environment. Overall, nearly two thirds of the entire domestic sample (n=797) indicated that they believed that Cairns was protecting its environment while the number who felt that the environment was not being protected was consistently less than 10%. The 'not sure' response increased from Quarter 2, 2016 to Quarter 1, 2017. International respondents (n=972) expressed similar views about the level of protection of the environment.

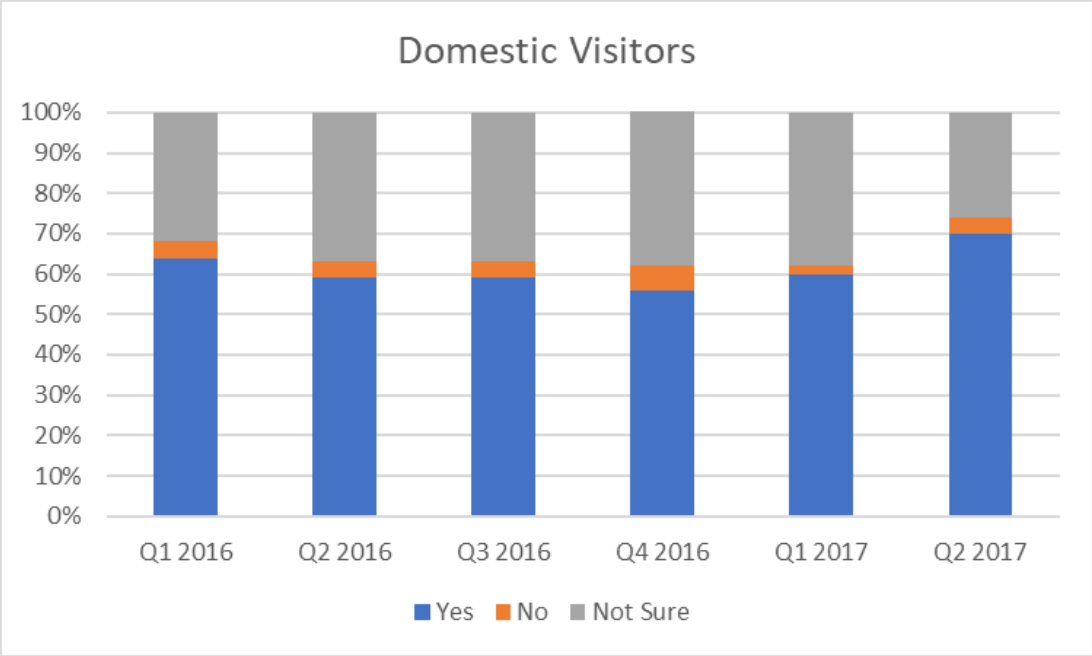

Figure 28: Does Cairns seem to be actively protecting its environment? (Domestic respondents n=797). Results courtesy of CQU (2017).

Figure 29: Does Cairns seem to be actively protecting its environment? (International respondent's n=972). Results courtesy of CQU (2017).

4.3.2 Discussion of results

The results of the Cairns airport survey (CQU, 2017) indicate that respondents were generally aware that coral bleaching was occurring through media reports and that there was a high and increasing level of concern about the bleaching events. This result suggests that if further coral bleaching events occur in the near future the destination's target markets will quickly become aware of the event and base may purchase decisions on concerns about the level of reported damage (see Figures 24 and 25). The danger for the destination is that repeated bleaching events will form a pattern in the mind of consumers and may generate a long-term negative image.

One positive result was the response given by respondents to their GBR experience during and after the coral bleaching events. As Figure 18 (domestic respondents) and Figure 19 (international respondents) indicate, even at the height of the coral bleaching event less than 5% of respondents rated their GBR experience as poor or awful. This positive message was never picked up in the media or used effectively by the destination to combat the generally poor media coverage.

The actual level of decline in visitor numbers following a further bleaching event will to some extent depend on the strength of the GBR as the destination's major pull factor and how the event is reported in the media. Determining if the GBR is the proximate reason for visiting Cairns thus becomes important. The legal term "*sine qua non*" or the "but for" rule holds that if an action is proximate (in this case visiting Cairns because of the GBR), the absence of the GBR would mean the visit to Cairns would not have been considered. The strength of the "but for" position of the GBR requires further research. Any further research should include surveying of potential consumers in key domestic and international generating regions to ascertain the significance of the GBR as the primary reason to consider a visit to the destination.

Results outlined in Figures 26 and 27 in relation to the importance of environmental protection indicate that the environment was a key push factor in the selection of Cairns as a holiday destination. Results of Figures 28 and 29 indicate that the majority of both domestic and international respondents consider that Cairns is actively protecting its environment. The strength of the environment as a destination push factor for consumers is apparent. The danger for Cairns is that future coral bleaching events, or other climate-related events, may lead tourists to feel that either the environment has been degraded or that not enough has been done to protect it. In either case, the destination needs to rethink how natural asserts such as the GBR and the Wet Tropics Rainforest are used as destination pull factors.

Collectively, these results indicate that the environment is a key factor in the continued health of the Cairns tourism industry and that strategies to protect the environment are important. Programs such as the COTS control program to prevent further loss of coral cover and new technologies to preserve coral in future coral bleaching events are therefore of considerable importance. Given the significance of the media in destination image building and marketing, a more comprehensive media strategy designed to promote the GBR and the investment in new technologies should be considered.

The results also indicate that there is a need for the development of a robust GBR region crisis recovery strategy to deal with future crisis events such as coral bleaching, cyclones and flooding.

4.4 Community survey

The community survey recorded the views of 252 Cairns residents and provides a snapshot of how community members engage with the GBR and their concerns about coral bleaching.

Figure 30 indicates the length of time respondents have lived in Cairns (n=252). Nearly two thirds of respondents have lived in the region for more than ten years.

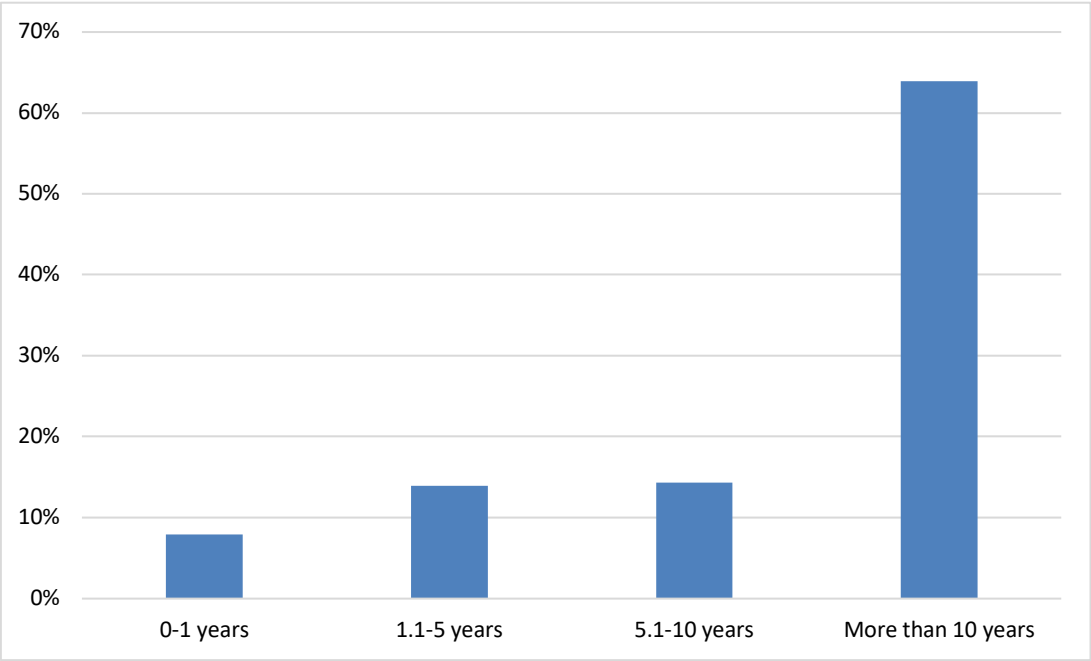

Figure 30: Length of time living in Far North Queensland (n=252)

Figure 31 reports on the highest level of education attained by respondents. 44% of respondents reported having a postgraduate degree. Other qualifications included advanced diplomas, certificates, commercial pilot license, marine engine driver (MED) and dive master.

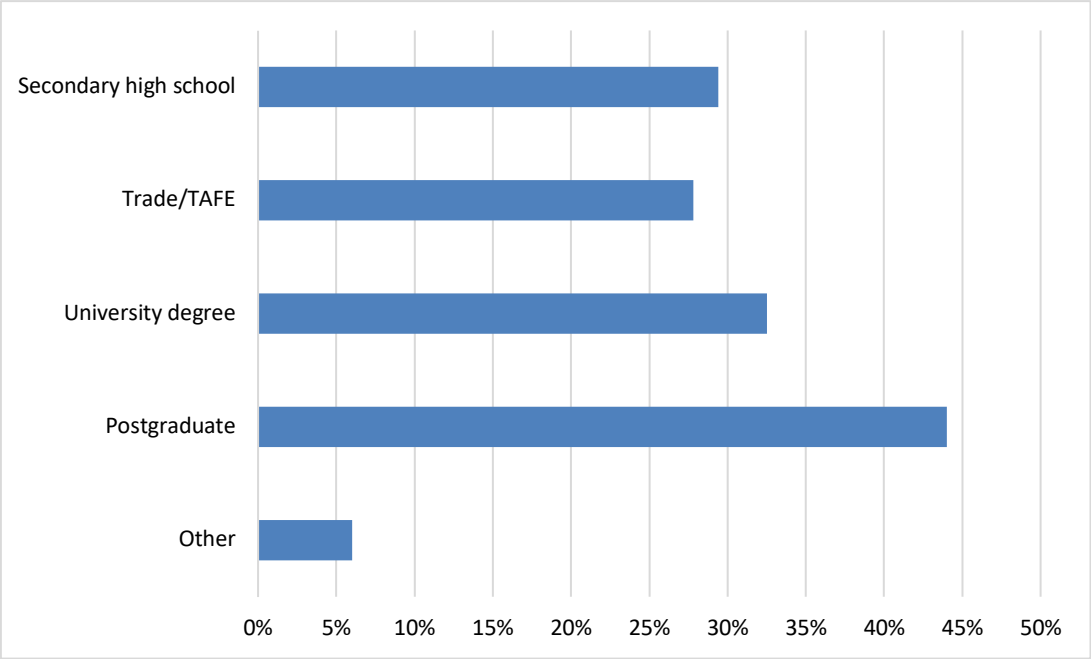

Figure 31: Educational qualifications of respondents (n=252)

Figure 32 indicates respondents' employment. The largest employment sectors were tourism (19.6%), education and training (12.4%) and retail (10.8%).

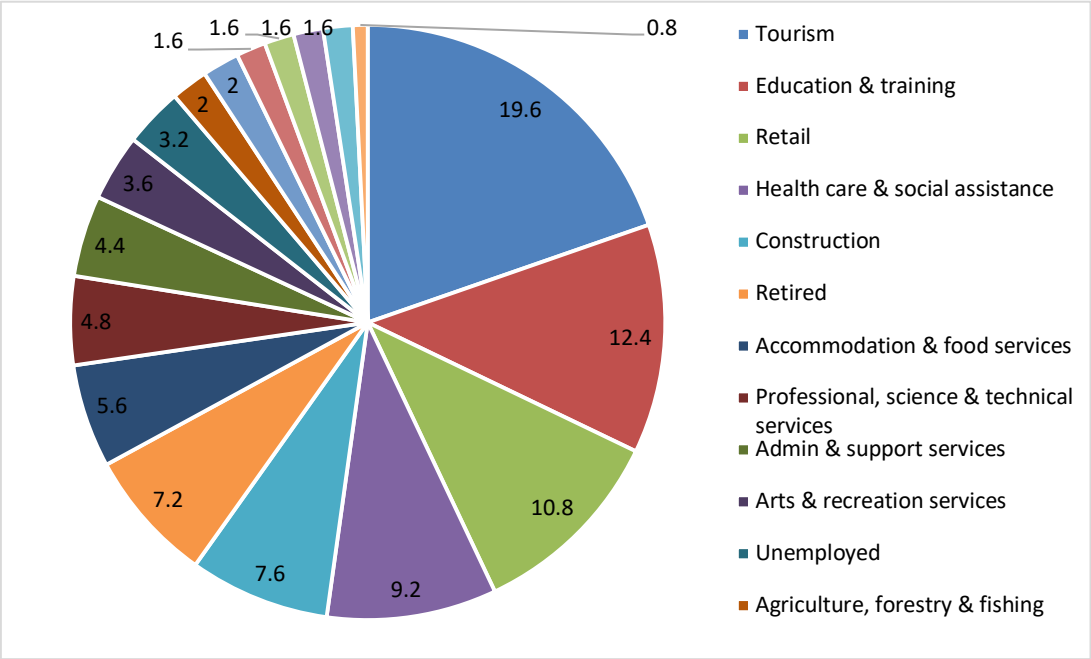

Figure 32: Employment by sector (n=250)

Respondents were asked to indicate when they last visited the GBR. As Figure 33 indicates, 40% of respondents had visited the GBR in the last six months. Given that the survey was conducted between June and September 2017, 55% of respondents had visited the GBR in the period following the first bleaching event in 2016. Only 5% of respondents had never visited the GBR.

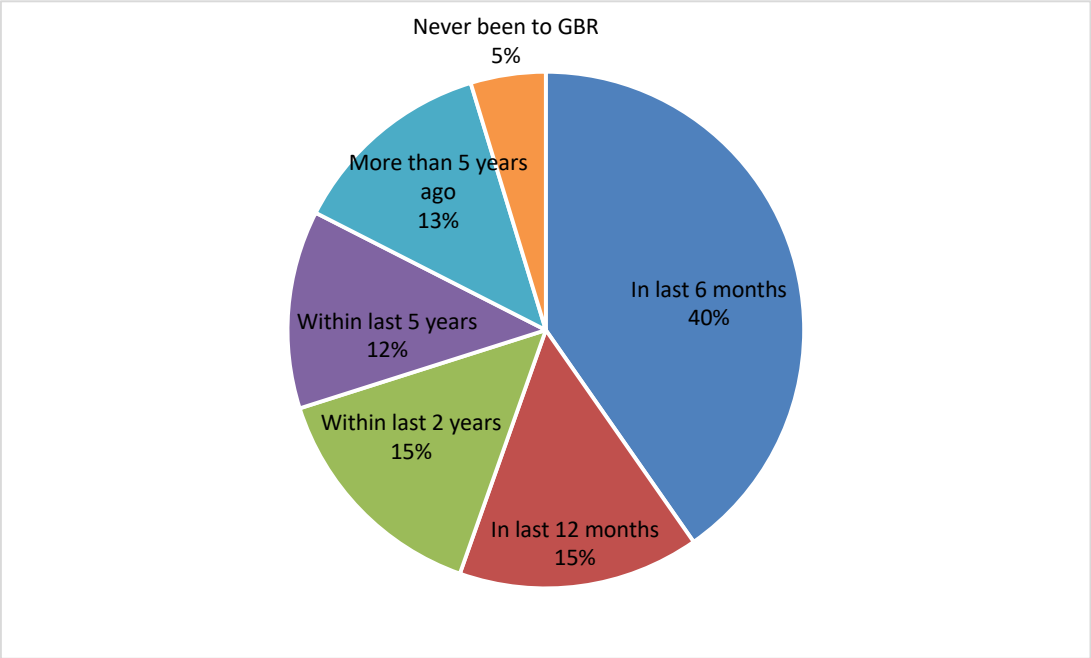

Figure 33: Last visit to the Great Barrier Reef

The types of transport respondents used to travel to the GBR are illustrated in Figure 34. The majority of respondents travelled to the GBR by tourist boat (59%), private boat (27%) or dive boat (8%).

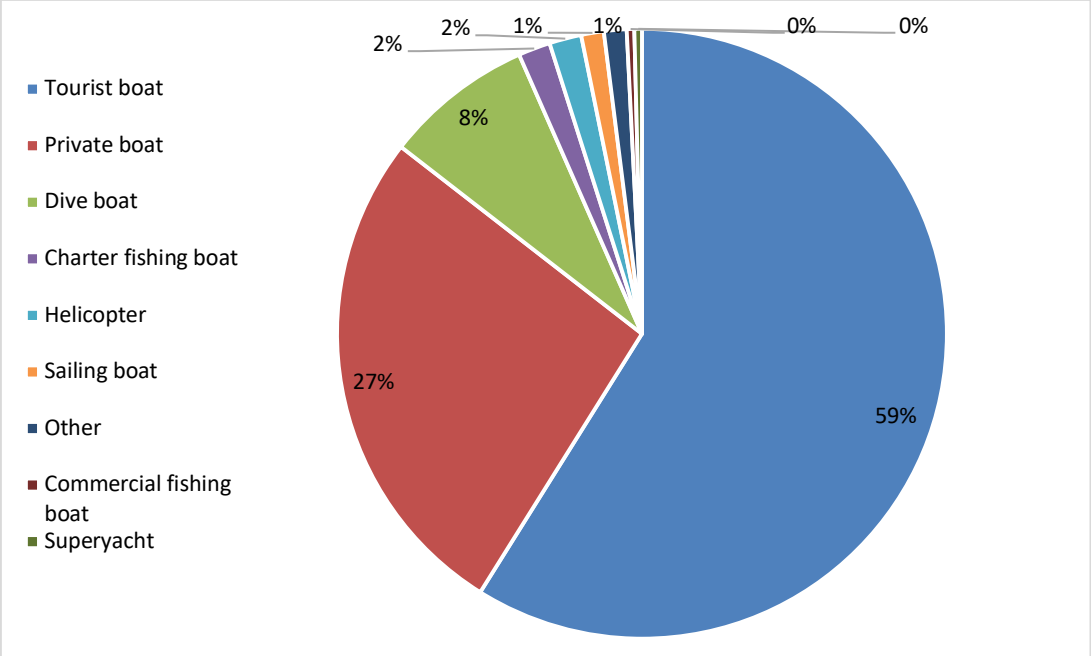

Figure 34: Travel to the GBR on last visit (n=241)

Most respondents reported visiting the GBR on a day trip (85%) (Figure 35). Most overnight trips were for one night's duration.

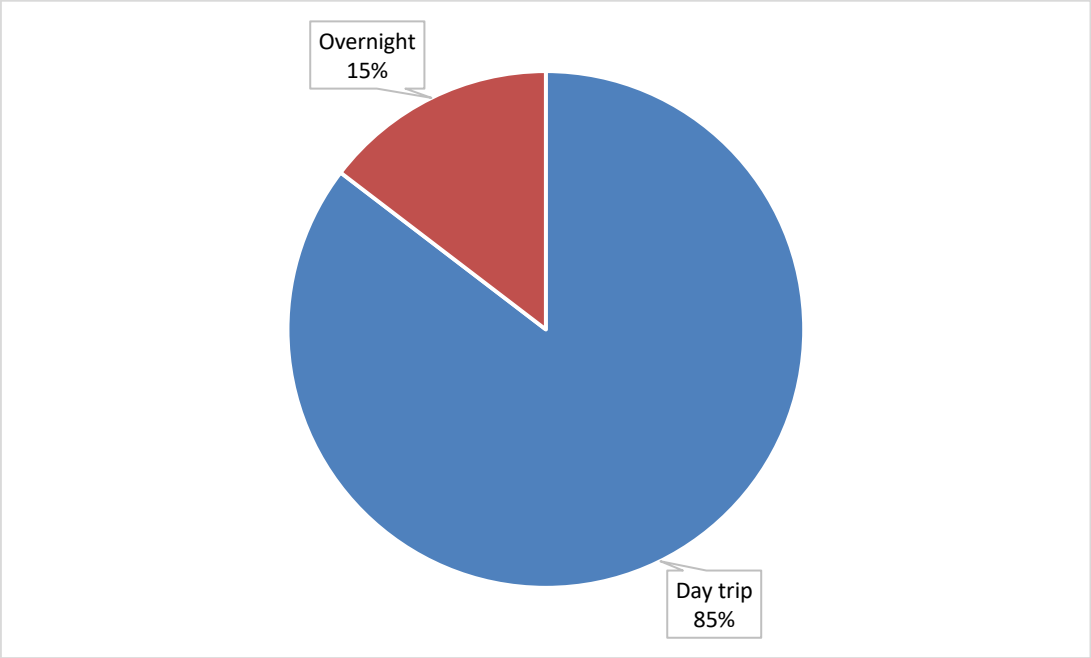

Figure 35: Comparison of day trips and overnight trips to the GBR

Respondents were asked where they spent the most time on their last trip to the GBR. As illustrated in Figure 36 the most popular GBR experience was islands (Green Island and Fitzroy Island), followed by the outer reef, pontoons and coral cays. Fifteen percent of respondents indicated that they stayed on their boat.

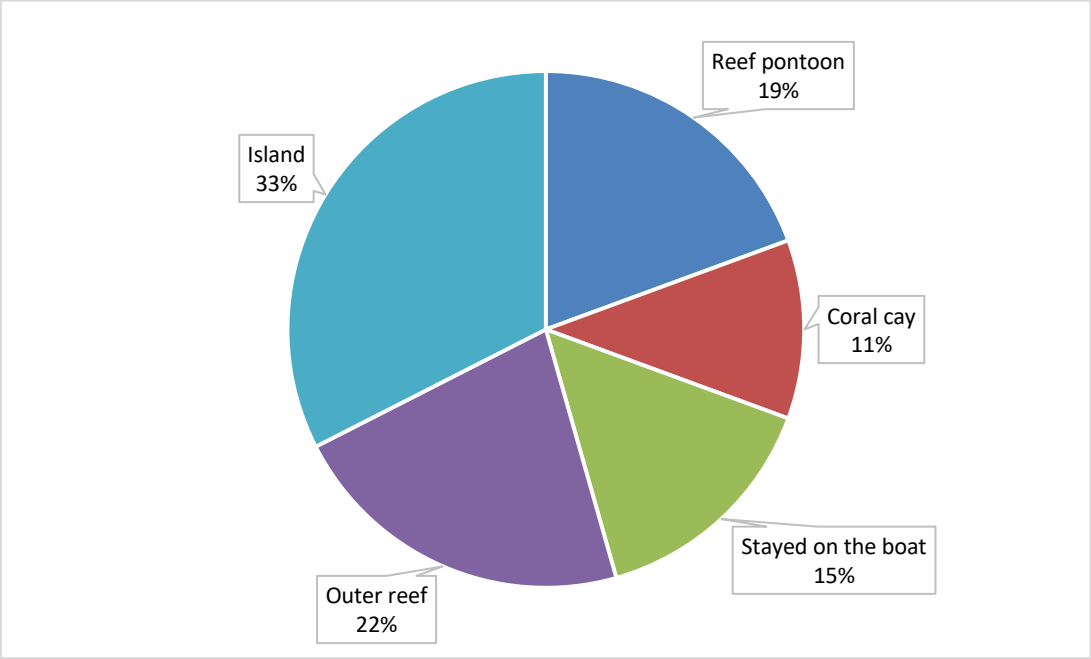

Figure 36: Where people visited on their last visit to the GBR (n=239)

Figure 37 reports on respondents' overall satisfaction with their last visit to the GBR. The majority of respondents were either 'very satisfied' (47.9%) or 'extremely satisfied' (29.2%). Just over 20% reported they were 'somewhat satisfied' and only 2% were 'not satisfied'. This is a significant finding given that 55% of respondents had visited the GBR after at least one of the two coral bleaching events of 2016 and 2017.

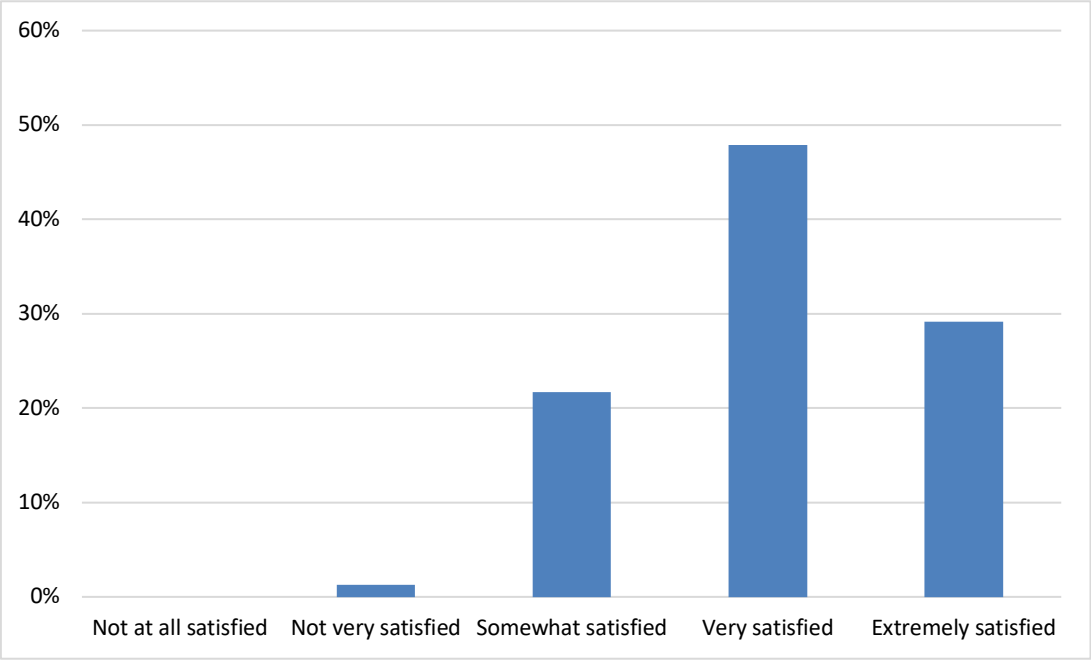

Figure 37: Overall satisfaction with last visit to GBR (n=240)

Respondents were asked to indicate what activities had the greatest influence on their satisfaction during their last GBR visit. As illustrated in Figure 38, snorkelling/diving, seeing fish, spending time with family/friends and seeing coral were the most important factors influencing satisfaction.

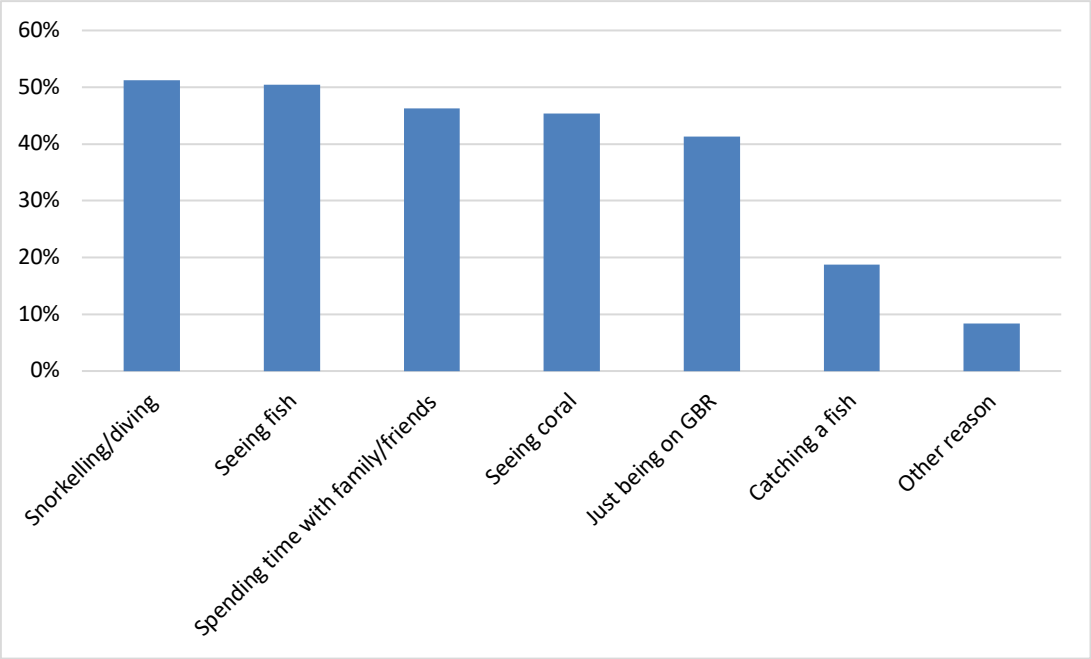

Figure 38: Factors influencing on overall satisfaction with the GBR

Respondents were asked to rank their impression of the health of the section of the GBR they visited on their last trip. Figure 39 indicates, almost a third of respondents thought the GBR looked either 'very healthy' or 'healthy' while 50.4% considered the section of the GBR they visited was 'somewhat healthy'. Only 17% of respondents thought the section of the GBR they visited was either 'not at all healthy' or 'not very healthy'.

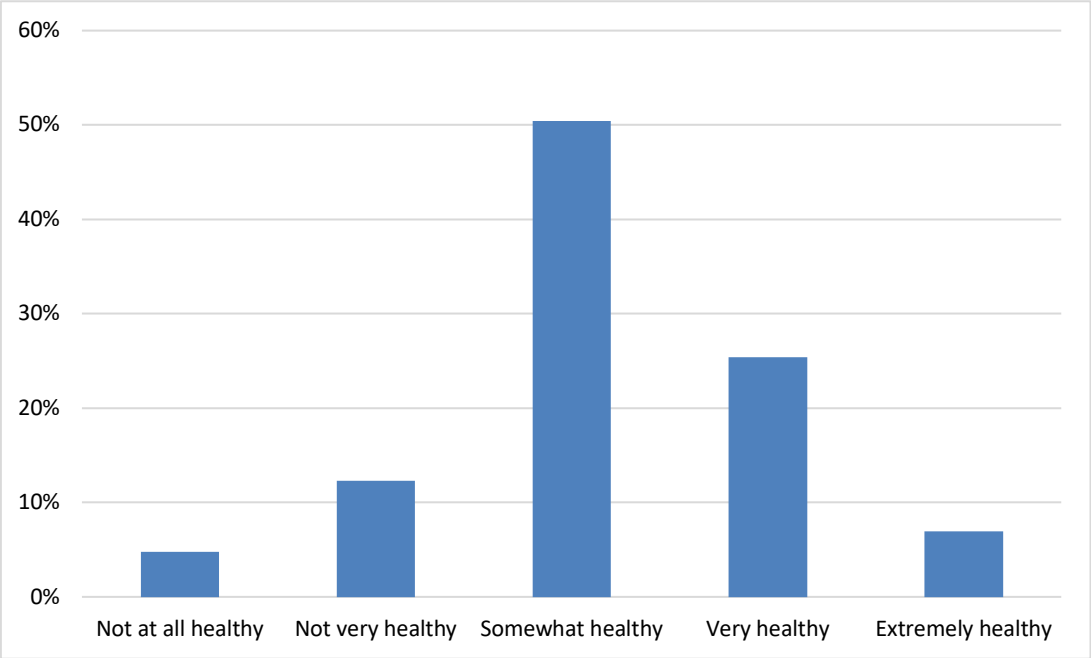

Figure 39: Perceptions of reef health on last visit to GBR (n=228)

To develop an understanding of how Cairns residents valued various aspects of the GBR, they were asked to respond to 15 statements using a Likert scale of 1 (strongly disagree) to 5 (strongly agree). Table 8 shows the mean for each statement. These statements were developed by the SELTMP and for future comparison repeated in the community survey. Respondents strongly agreed with the statement that "The GBR is the region's most important tourism asset" (m=4.57), followed by "The GBR is a great asset for the economy of the region" (m=4.53), "I feel proud that the GBR is a World Heritage Area" (m=4.48) and "I value the GBR because it supports a variety of life such as fish and coral" (mean = 4.43). The level of response to the statement "There are many other places that are better that the GBR for the recreation activities I enjoy" (m=2.75) adds further meaning to the strength of the top five value statements. These results also indicate that respondents understood the value of the GBR to the region's tourism economy.

The response to the statements "I am worried the next generation will not see the GBR" (m=3.67) and "I feel optimistic about the future of the GBR" (m=3.14) indicates concern about the future health of the GBR. The response to the statement "I live here because of the GBR" (m=2.98) is interesting in that it indicates that the GBR is not a major factor in attracting people to live in Cairns. However, the response to the statement "The GBR contributes to my quality of life and well-being" (m=3.78) indicates that the GBR makes a positive contribution to the overall quality of life once a person resides in the region.

Table 8: Values of the GBR

Statement	Mean
The GBR is the region's most important tourism asset	4.57
The GBR is a great asset for the economy of the region	4.53
I feel proud that the GBR is a World Heritage Area	4.48
I value the GBR because it supports a variety of life such as fish and coral	4.43
The aesthetic beauty of the GBR is outstanding	4.33
I value the GBR because we can learn about the environment through scientific discoveries	4.18
I value the GBR because it attracts people from all over the world	4.17
I value the GBR because it supports a desirable and active way of life	4.11
I value the GBR for the fresh seafood it provides	3.78
The GBR contributes to my quality of life and well-being	3.78
I am worried the next generation will not see the GBR	3.67
I feel optimistic about the future of the GBR	3.14
The place I most recently visited in the GBR is NOT in great condition	3.05
I live here because of the GBR	2.98
There are many other places that are better than the GBR for the recreation activities I enjoy	2.75

4.4.1 Concerns for coral bleaching

Respondents were asked to indicate their level of concern about reports of coral bleaching on the GBR (see Figure 40) using a Likert scale of 1 to 5, where 1 indicated 'not at all concerned' and 5 indicated

'extremely concerned'. Results indicate strong concern about coral bleaching, with 28% of respondents reported being somewhat concerned, 22% being very concerned and 20% were extremely concerned.

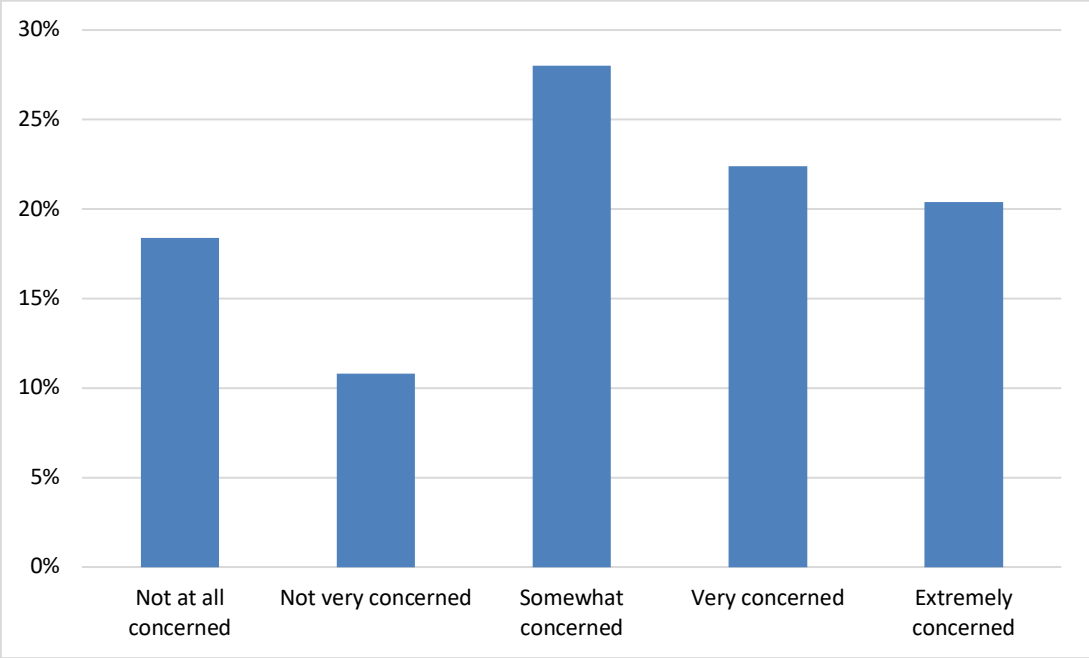

Figure 40: Concern over reports of coral bleaching (n=250)

Analysis (Figure 41) of the level of concern for reported coral bleaching and the length of time respondents have lived in Cairns did not indicate any level of significance (Pearson's r 0.865 and Spearman correlation 0.943) based on the time respondents had resided in the region.

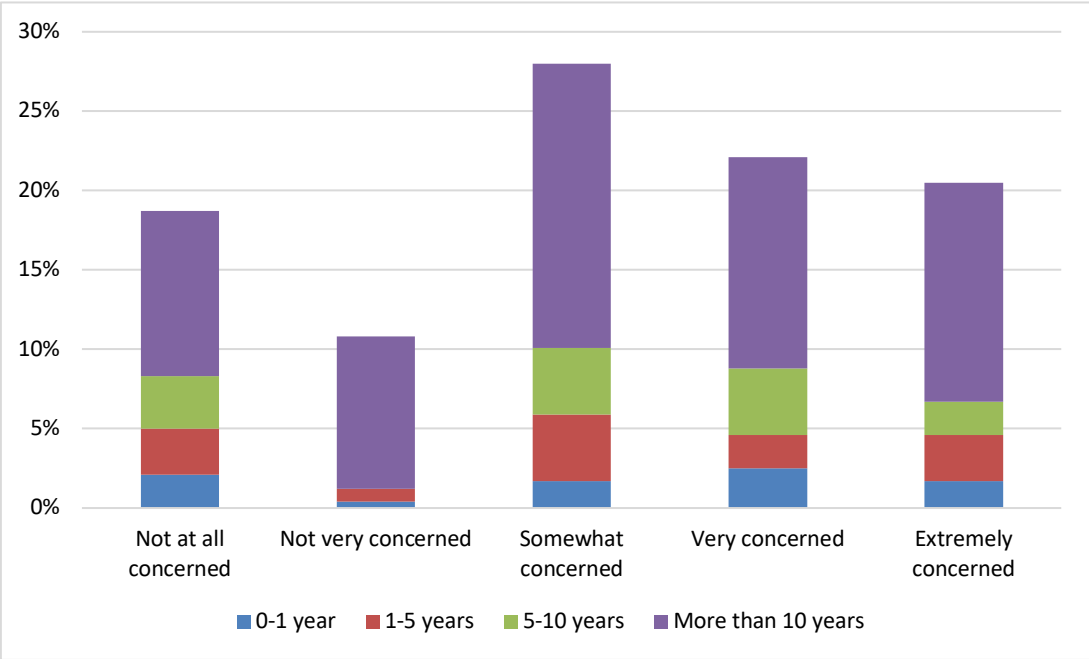

Figure 41: Level of concern for coral bleaching by length of time living in far North Queensland (n=179)

Respondents were asked to indicate their level of knowledge about the causes of coral bleaching using a three-point scale of low (I am unsure why coral bleaching occurs), medium (I know a little about the causes) and high (I understand the science). Results outlined in Figure 42 indicate that 85.6% of respondents had either a medium or high level of understanding. This is an interesting finding and one that can be used in developing future adaptation strategies for the destination.

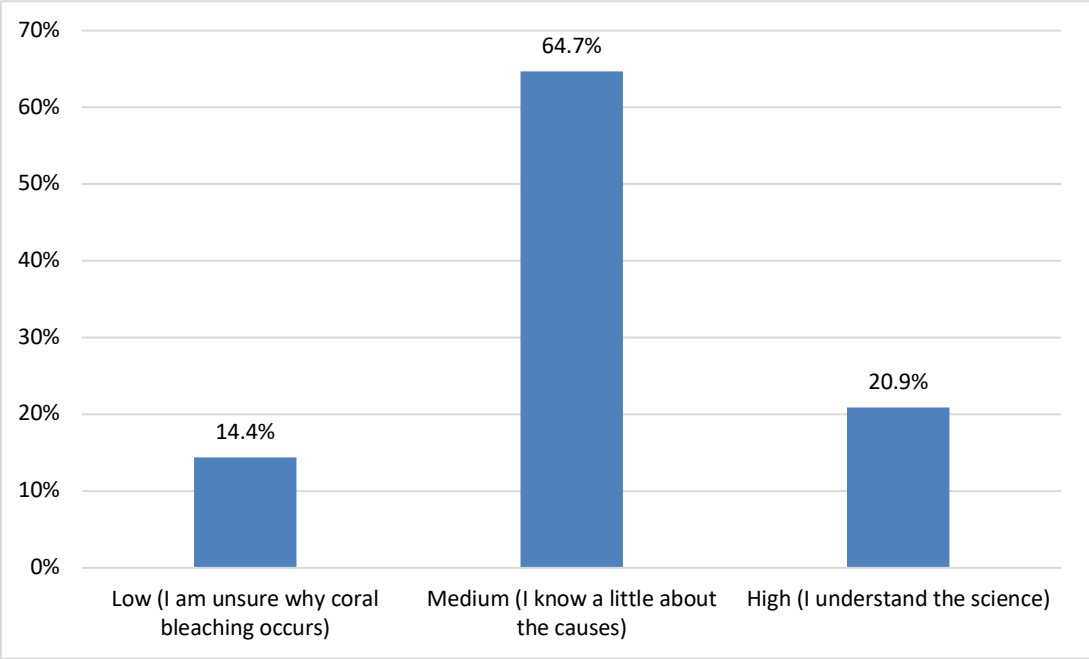

Figure 42: Level of knowledge of the causes of coral bleaching (n=187)

Figure 43 illustrates the response to a question asking respondents if they thought that coral bleaching will affect them on a personal level. A three-point scale of yes, no and maybe was used. Sixty-eight percent of respondents indicated they believed that coral bleaching will or could impact them personally. This finding, when considered with the results of Figure 42, indicates an informed community who are concerned that coral bleaching will have an impact on them at a personal level.

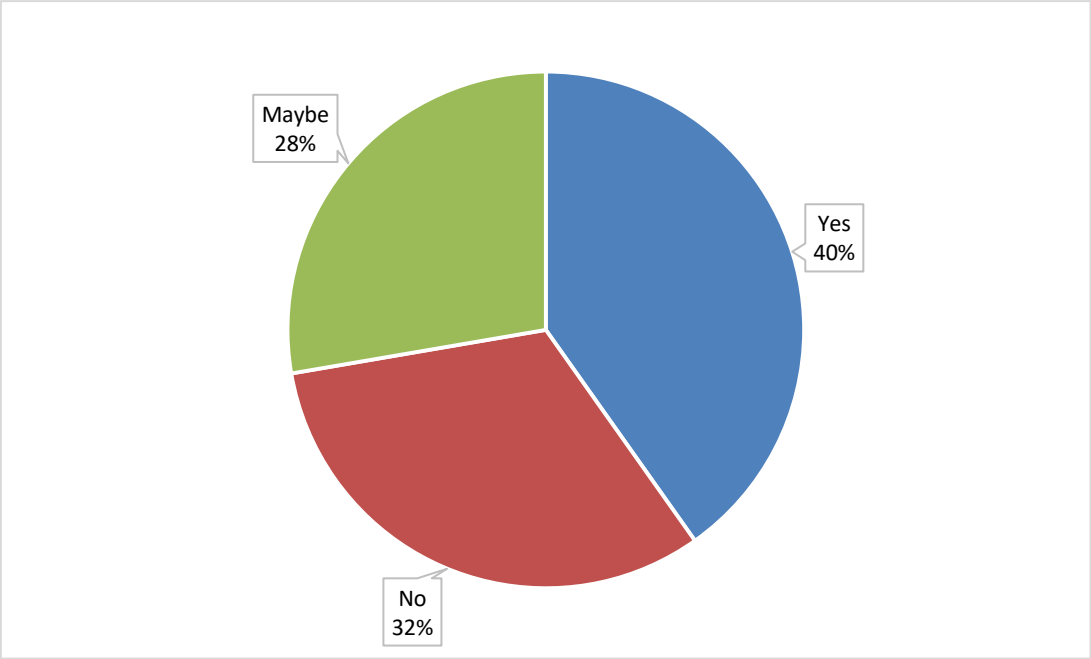

Figure 43: Perceptions of coral bleaching affecting respondents personally (n=249)

To understand the level of support respondents have for strategies that were aimed at arresting the decline of the GBR, respondents were asked to respond to the question, "Should we stop trying to fix the reef and direct funding into the protection of other natural attractions instead?" A three-point scale of yes, no, maybe was used. Findings illustrated in Figure 44 indicate very strong support for ongoing funding to assist GBR recovery.

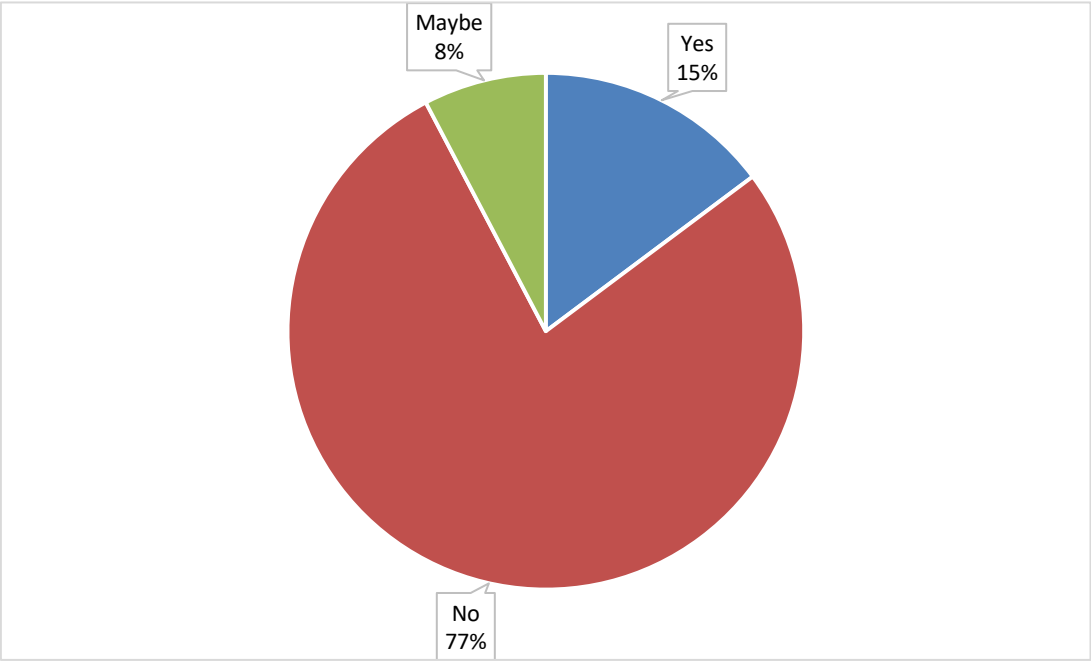

Figure 44: Should we stop trying to fix the reef? (n=183)

Respondents were asked to indicate their level of agreement with 17 statements (Table 9) that related to various aspects of the health and management of the GBR and how they may be affected. A five-point Likert scale was used with 1 indicating 'strongly disagree' and 5 indicating 'strongly agree'. The results show a high level of concern about the possible impact of coral bleaching on the destination's tourism industry (m=4.11) and support for additional funding to protect the GBR (m=3.86). The response to the statement "I feel confident that the GBR is well managed" (m=2.97) appears to indicate some concern about the management of the GBR. Interestingly, respondents indicated that even if there were further coral bleaching events they would not move away from Cairns. This could indicate that while respondents understand that the local tourism industry may decline if there are further coral bleaching events, they do not equate the overall health of the region's economy to the continued health of the tourism industry.

Agreement with the statements "it is the responsibility of all Australians to protect the GBR" (m=4.10) and "coastal residents should take steps to reduce their impacts on the GBR" (m=4.02) indicate that respondents accept ownership of the GBR and agree that they should be engaged in some way in its protection. Disagreement with the statements "It is NOT my responsibility to protect the GBR" (m=2.00), "I CANNOT make a personal difference to improving the health of the GBR" (m=2.61) and "I do NOT have the time and opportunity required to reduce any impact that I might have on the GBR" (m=2.57) further supports the notion that respondents do realise their actions can affect the health of the GBR and that they can become actively involved in the protection of the GBR.

Table 9: Agreement with statements on the health and management of the GBR

Statement	Mean
The local tourism industry will decline if coral bleaching becomes a regular event	4.11
It is the responsibility of all Australians to protect the GBR	4.10
Coastal residents should take steps to reduce their impacts on the GBR	4.02
I believe more money needs to be spent by the government to save the reef	3.86
Current management zones should be revised to protect several bleached parts of the reef	3.76
I would like to do more to help protect the GBR	3.69
I try to encourage other people to reduce their impacts on the GBR	3.66
I support the current rules and regulations that affect access and use of the GBR	3.49
I have the necessary knowledge and skills to reduce any impact I might have on the GBR	3.09
I feel confident that the GBR is well managed	2.97
I CANNOT make a personal difference to improving the health of the GBR	2.61
I do NOT have the time and opportunity required to reduce any impact that I might have on the GBR	2.57
I would NOT be personally affected if the health of the GBR declined through coral bleaching	2.45
It is too expensive for me to reduce any impact I might have on the GBR	2.31
If coral bleaching becomes a regular event I will need to find a new job	2.12
If coral bleaching becomes a regular event I will need to move away from Cairns	2.02
It is NOT my responsibility to protect the GBR	2.00

Respondents were asked to indicate which of five statements described their personal beliefs about climate change. As illustrated in Figure 45, over half of the respondents (53.1%) believed climate change is an immediate threat requiring action while a significant number of respondents (26.1%) viewed bleaching as a seasonal problem and that the GBR will adapt to climate change. A small number of respondents indicated that they needed more evidence to be convinced that climate change is a problem. Only 0.4% of respondents believed that climate change is not a threat.

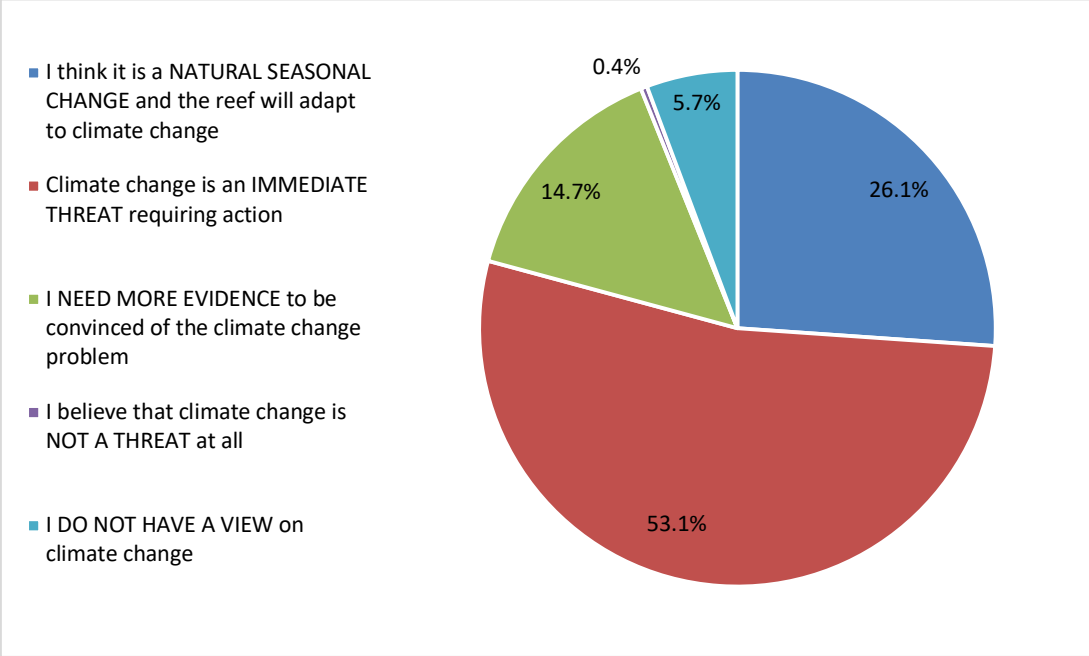

Figure 45: Perceptions of climate change (n=245)

Respondents were asked to respond to the following question, "What was the best experience you had on your last visit to the GBR?" The results are illustrated with a word cloud (see Figure 46). Most responses were positive and indicated the quality and beauty of the GBR.

Figure 46: My best experience on my last visit to the GBR?

Respondents were asked to indicate what they perceived as the five largest threats to the GBR in an open-ended question. The responses are grouped thematically and shown in Table 10. Climate related threats were the main concern (25.3% of responses), citing coral bleaching, climate change and global warming as the three biggest climate related threats to the GBR. This was followed by pollution related threats (14.8%), fishing related threats (10.5%) such as overfishing, and tourism related threats (8.7%). It is interesting to note that climate change was viewed as the second most significant threat after coral bleaching.

Table 10: Community perceptions of threats to the GBR

	Frequency	Percent
CLIMATE RELATED		
Coral bleaching	79	9.3%
Climate change	44	5.2%
Global warming	42	4.9%
Water temperature rise	18	2.1%
Cyclones	11	1.3%
Weather events	9	1.1%
Ocean acidification	4	0.5%
Marine life disturbed/lost	2	0.2%
Algae	1	0.1%
Climate change denial	1	0.1%
Environment changes	1	0.1%
Evaporation	1	0.1%

Fish health	1	0.1%
Greenhouse gases	1	0.1%
Meteorite	1	0.1%
	216	**25.3%**
POLLUTION RELATED		
Pollution	80	9.4%
Litter/ Rubbish	29	3.4%
Plastics	15	1.8%
Poisons	1	0.1%
Raw sewage	1	0.1%
	126	**14.8%**
FISHING RELATED		
Overfishing	52	6.1%
Fisheries	22	2.6%
Illegal fishing	7	0.8%
Ghost nets	4	0.5%
Fishing policy	2	0.2%
Indigenous fishing	2	0.2%
Shell collecting	1	0.1%
	90	**10.5%**
TOURISM RELATED		
Tourism	20	2.4%
Tourists	14	1.6%
Over-visitation	12	1.4%
Damage by too many people	8	0.9%
Uneducated tourists	8	0.9%
Standing on coral	5	0.6%
Sunscreen	3	0.4%
Irresponsible tourism	2	0.2%
Demonization of tour operators	1	0.1%
Fish feeding	1	0.1%
Pontoons	1	0.1%
	75	**8.7%**
FARMING RELATED		
Agriculture chemical runoff	25	2.9%
Sediment runoff	13	1.5%
Farming industry	12	1.4%
Farm run-off	9	1.1%
Run-off	9	1.1%
Non-sustainable farming	2	0.2%
Silt	2	0.2%
Nutrient run-off	1	0.1%
Pesticides	1	0.1%
	74	**8.6%**
PESTS AND DISEASE		
COTS	56	6.6%

Pests and disease	3	0.4%
	59	**7.0%**
PEOPLE RELATED		
People	31	3.7%
Ignorance	6	0.7%
Overuse	5	0.6%
Research scientists	5	0.6%
Bad media	3	0.4%
Attitude change to protect nature	2	0.2%
Destruction of reef	2	0.2%
Impact	1	0.1%
Safety hazards	1	0.1%
	56	**6.6%**
BOATING AND SHIPPING		
Oil pollution/spills	23	2.7%
Shipping	19	2.2%
Careless anchoring	6	0.7%
Boats	2	0.2%
Lack of training - big ship captains	1	0.1%
Water sports	1	0.1%
	52	**6.0%**
POLITICAL		
Political interference	8	0.9%
Lack of consultation between politics and researchers	6	0.7%
Government inaction	5	0.6%
Activists	3	0.4%
Politicians	3	0.4%
Government	2	0.2%
The Greens	2	0.2%
Government collusion with fossil fuel industry	1	0.1%
Government policy	1	0.1%
Liberal Party	1	0.1%
Michael Trout	1	0.1%
One Nation Party	1	0.1%
	34	**3.9%**
DEVELOPMENT RELATED		
Dredging	18	2.1%
Coastal development	4	0.5%
Population	3	0.4%
Water quality	3	0.4%
Other land activities	1	0.1%
Overdevelopment	1	0.1%
Urban development	1	0.1%
	31	**3.7%**
RESOURCE INDUSTRY RELATED		
Mining	10	1.2%

Adani/Abbott Point	9	1.1%
Oil rigs	2	0.2%
Fracking	1	0.1%
	22	**2.6%**
REEF MANAGEMENT RELATED		
Funding	4	0.5%
Improper management	3	0.4%
Inability to agree on what to do	2	0.2%
No protection	2	0.2%
Lack of sea rangers	1	0.1%
Regulation	1	0.1%
	13	**1.5%**
OTHER		
None	1	0.1%
	1	**0.1%**
TOTAL RESPONSES	**849**	**100.0%**

4.4.2 Discussion of results

The aim of the community survey was to develop an understanding of how the local Cairns community views the impacts and possible consequences of coral bleaching in terms of its impact on the future health of the GBR, the community they live in and at a personal level. Results indicate a high level of concern about the impact of coral bleaching on the future health of the GBR, the community and on respondents.

As Figure 30 indicates nearly two thirds of respondents have lived in the region for 10 or more years. When considered with the results of Figure 33 (55% of respondents had visited the GBR within the last 12 months and 82% within the last 5 years) it is apparent that respondents have a high level of familiarity with the GBR. The level of firsthand knowledge about the GBR and the length of residence in the region gives the sample a high level credible as an indicator of how the local community views the GBR and coral bleaching. The credibility of the sample is further enhanced by the number of respondents (86%) claiming to have some knowledge of the causes of coral bleaching (Figure 42).

Findings outlined in Figure 39 indicate that respondents thought that the GBR was reasonably healthy but as the responses to Figure 40 indicate, they were generally concerned about coral bleaching. Respondents also viewed the GBR as the region's most important tourism asset (Table 8) but did not move to the region because of its location adjacent the GBR. Respondents also expressed a high level of concern (Table 8) about the possible impact of coral bleaching on the destination's tourism industry (m=4.11).

As indicated in Figure 44, 75% of respondents thought that funding for the GBR should not be reduced. Two thirds of respondents (see Figure 43) thought that coral bleaching will affect them on a personal level.

The response to the question on respondents' views on climate change (Figure 45) indicates that while just over half (53%) see climate change as a major issue, about a quarter believe that the GBR can adapt (26%) and 15% require additional evidence. Table 9 indicates some interesting results on how respondents do realise their own and others' actions individually and nationally can affect the health of the GBR and the importance of being actively involved in sustainable solutions to protect the GBR. This is indicated by the level of disagreement with the statements "I CANNOT make a personal difference to improving the health of the GBR" (m=2.61) and "I do NOT have the time and opportunity required to reduce any impact that I might have on the GBR" (m=2.57).

In summary, the results indicate that the community is very engaged and well informed about the GBR and the causes of coral bleaching. The community is also concerned about the future impacts of coral bleaching and supports efforts to protect the GBR. At a personal level there is enthusiasm to become personally engaged in strategies to support GBR protection. The response to the statements "If coral bleaching becomes a regular event I will need to find a new job" (m=2.12) and "If coral bleaching becomes a regular event I will need to move away from Cairns" (m=2.02) indicate that many respondents do not feel that their employment will be affected by a further decline in the GBR.

5. DISCUSSION, CONCLUSION AND RECOMMENDATIONS

The aim of this report was to examine the concerns of tourists, the local community and the tourism industry about the long-term impacts of the 2016 and 2017 coral bleaching events on the Great Barrier Reef (GBR). Specific research objectives were to:

1. Update selected aspects of SELTMP data on community use and dependency, and well-being in relation to the 2016 (and 2017) coral bleaching event.
2. Identify tourism industry concerns about the possible long-term impact of the 2016 (and 2017) coral bleaching event.
3. Identify visitor concerns about the quality of their GBR experience post the 2016 (and 2017) coral bleaching event.
4. Provide a methodology that can be used to support ongoing monitoring of communities, industry stakeholders and visitors.
5. Communicate results widely into the stakeholder community.

As the discussion in Section 4 highlighted, the community survey undertaken to address research objective 1 was modified to provide a greater focus on the impacts of coral bleaching and on the GBR in general. The Community Survey was conducted in Cairns only. This decision was based on the size of the Cairns tourism industry (visitor numbers and total revenue) vis-à-vis other tourism destinations in the study region, the number of tourists who visited the GBR from Cairns, and that the GBR south of Townsville suffered relatively little damage from the 2016 and 2017 coral bleaching events.

In any discussion of the impact that future coral bleaching and other possible climate change-related crisis events may have on local communities and the tourism industry, a number of factors need to be considered. These include:

- The potential for coral bleaching in the future;
- The severity and extent of future bleaching;
- The rate of recovery of corals following a bleaching event;
- The cumulative impact of other events such as new COTS outbreaks and the severity and frequency of future tropical cyclones;
- The ultimate level that ocean temperatures will rise to;
- The potential for transplanting heat resistant coral species in popular tourism areas;
- The success of technological solutions such as pumping cooler water to the surface;
- The level of support that state and federal governments may give to mitigation and adaptation strategies; and
- The level of resilience of coral reef dependent communities to further coral bleaching.

The timing, extent and severity of many of these factors will not be known for some time.

The following discussion highlights key issues that were identified in this research. These points are then used as the basis for the construction of a methodology (Section 5.2) that may be used to support ongoing monitoring of communities, industry stakeholders and tourists.

5.1 Key findings

5.1.1 Potential for future coral bleaching events

The recently released GBRMPA report (2017a) on the 2016 coral bleaching event makes sober reading. The report, for example, notes that while coral recovery is possible after a bleaching event, corals are less resilient than in the pre-bleaching period and more susceptible to disease. The report also states that "bleaching events are expected to increase in frequency and severity as a result of climate change, making recovery processes important for reefs to persist as coral-dominated systems" (p. 25). The report further notes that "further loss of coral as global warming continues is inevitable and can be minimised rather than prevented if the aspirational goal of the 2015 Paris Agreement is reached" (p. 25). The 16th January 2018 NOAA (2018)) coral watch report showing a 60% probability of thermal bleaching stress between January and April 2018 reinforces this concern about future bleaching.

5.1.2 Importance of the GBR to the tourism industry in the GBR study region

As the tourism-related data outlined in Table 2 and the discussion in Section 2.7 highlights, Cairns is the leading tourism destination in the study region in terms of visitor numbers, visitor nights and revenue generated by the tourism industry. It is also the most significant source of GBR visitors, with the Whitsundays being a close second. On this basis, Cairns, Port Douglas and the Whitsundays have the most to lose from a decline in tourists because of climate change events such as coral bleaching.

While the Whitsundays was not affected by the most recent coral bleaching events, the destination will encounter problems if future coral bleaching occurs in that region. During the period of this study, the most significant crisis event to affect the Whitsundays was Tropical Cyclone Debbie. The other destinations included in this research (Mackay and Bundaberg) have small GBR tourism sectors and are unlikely to encounter problems of the magnitude that could be faced by Cairns and the Whitsundays following future coral bleaching events.

On a national scale, images of the GBR are prominently featured in international tourism promotion although only a little over 10% of all international tourists visit the key GBR tourism destinations of Cairns, Port Douglas and the Whitsundays. A downgrading of the quality of the GBR tourism experience will have some impact on international tourism promotion but comment on the extent is outside of the scope of this research.

In relation to the importance of GBR tourism to Cairns, the findings outlined in Table 7 show that the GBR remains the top motive for international tourists selecting Cairns as a holiday destination. The role of nature as a key destination pull factor is highlighted by the observation that seven of the eight top motives are nature-based. While heavily promoted in international markets, the region's international markets have shown little growth until quite recently (see Figure 10). The impact of future coral bleaching events, and other climate change related events, is therefore a matter of considerable concern.

Domestically, the position of the GBR as a major destination pull factor has fallen dramatically over the period January 2016 to June 2017 (Table 6). Parallel to this fall has been a decline in interstate tourism revenue of $211 million in the 12 months to June 2017. While Cairns suffered a decline in domestic

visitors in the 12 month period to June 2017, domestic tourism in both Queensland as a whole and Australia increased. The importance of lifestyle motives as illustrated in Table 6 indicates options for developing new tourism experiences in Cairns and other GBR dependent destinations.

Findings highlighted in Table 8 indicate that the Cairns community recognises the importance of the GBR as a key tourism resource while findings outlined in Figure 40 indicate a high level of concern about coral bleaching. Findings outlined in Table 9 indicate that the community supports strong national and local action to address climate change impacts experienced by the GBR and realise the importance of taking personal responsibility for implementing sustainable actions.

5.1.3 Tourist Perspectives

Cairns is one of a large number of domestic and international holiday destinations that consumers may choose from when selecting a holiday location. The GBR and the Wet Tropics Rainforests have been central to the destination's brand and image in the past. Both are nature-based and likely to suffer adverse impacts from climate change in coming decades. As the visitor patterns outlined in Figure 11 highlight, the tourism industry in Cairns has suffered from two periods of significant decline in domestic and international tourist arrivals over the period 1999 to 2016, however, on a global scale, growth in international arrivals has been positive over the same period.

Figure 15 paints a picture of declining domestic tourist interest in the GBR as a reason for visiting Cairns with the ranking of the GBR falling from 3rd in Quarter 1, 2016 to 9th position in Quarter 2, 2017. The potential impact on international visitors is of particular concern given its role as the primary motive to visit Cairns. Figures 22 and 23 indicate growing concern amongst tourists to the region about coral bleaching. In part this could be a result of increased awareness via media reports of coral bleaching. However, despite a high level of concern the quality of respondents' GBR experience remained high over the survey period (see Figures 18 and 19).

If the image of Cairns as a gateway to nature-based tourism experiences is weakened by events such as coral bleaching and if effective crisis recovery strategies are not implemented, tourists may look for alternative holiday locations either in Australia or internationally. Based on concerns about coral bleaching (see Figures 24 and 25) this could eventually translate into a significant loss of visitors. This suggests that there is a need to re-examine the current mix of experiences and identify areas that need to be strengthened or rejuvenated to reduce the danger of the destination entering another period of negative or low growth.

5.1.4 Business and tourism industry views on coral bleaching

As indicated in Section 4.2, the highest level of concern about coral bleaching was expressed in the Cairns and Port Douglas regions. Participants in regions that did not suffer from coral bleaching were aware that coral bleaching could be a problem in the future but apart from the Whitsundays did not express a high level of concern. One reason for the lack of concern can be attributed to the relatively small contribution that GBR tourism makes to the tourism industry in Mackay and Bundaberg.

Participants in the focus group held in Cairns as well as interviews with senior members of the tourism industry in Cairns and Port Douglas expressed a high level of concern about coral bleaching and how

future bleaching events may adversely affect the health of the tourism industry. In most cases, concern was limited to considerations of short-term strategies to counter adverse media. The Cairns group voiced concern about community resilience but did not suggest any significant strategies aside from continued promotion of the GBR as the world's best reef system vis-à-vis other reef ecosystems that had also suffered from coral bleaching. There was little discussion about alternatives to the GBR as a major destination pull factor except for strategies to attract events such as the World Mountain Biking Championships and expansion of the Cairns Convention Centre.

Apart from the establishment of the Citizens of the Great Barrier Reef as a strategy to galvanise support for the protection and promotion of the GBR, there has not been a concerted GBR-wide campaign to counter the large number of adverse media stories about the health of the GBR. In the past, when destinations such as Bali and Thailand have been affected by major crisis events, post-crisis recovery strategies were quickly developed to rebuild destination image (Gurtner, 2007). Although the GBR region has now been affected by three natural crisis events in a little over 12 months (coral bleaching in 2016 and 2017 and Tropical Cyclone Debbie), a well-resourced tourism adaptation and recovery strategy has yet to be implemented.

5.1.5 The perspective of the community

Section 4.4 reports on the views of the Cairns community on the recent coral bleaching events. The survey found that the community is very engaged with the GBR, actively uses the GBR and is well informed about the causes of coral bleaching. The results also indicate a high level of concern about the future of the GBR and possible impacts of further coral bleaching events. The survey found that the community understands the role that tourism plays in the local economy and that the GBR is a central feature of the ongoing health of the tourism industry.

Overall, the findings indicate that there is a high level of understanding of the problem and, based on this observation, there is potentially a high level of support for the development of adaptive strategies that can provide alternative experiences to support the city's tourism industry. Application of a suitably modified version of the model suggested in Figure 9 may provide one avenue for suggesting a new activities/attraction mix that can provide alternatives to, but not replace, the GBR as a tourism experience.

The community survey provides a valuable snap-shot of local opinions on the GBR and the role that the GBR plays in the well-being of local residents. Extending the community survey to include at least Port Douglas and the Whitsundays would provide policy makers with valuable insights into local concerns and may suggest options that could be included in adaptation strategies. Extending the survey to all NRM regions in the GBR region would provide a comprehensive picture of the views of the entire GBR community and their reaction to GBR-wide adaptation strategies as well as building a more comprehensive baseline for future impact assessment.

5.1.6 Community resilience

While the need to consider community resilience has been acknowledged by the GBRMPA, the approach to resilience has been within the context of how problems experienced by the GBR will flow on to nearby communities. Tourism has been acknowledged as one area of concern. A GBR-centric

approach of this type fails to acknowledge many of the broader issues related to community resilience. Recent research by Gooch, Dale, Marshall and Vella (in press) has begun to address this gap. Of particular note is a series of reports that assess the human dimensions of the Great Barrier Reef in each GBR NRM region and earlier publications on community resilience by Dale et al. (2016) and Dale et al. (2014).

This report into coral bleaching has attempted to provide an alternative narrative on resilience by taking a tourism-centric rather than a GBR-centric view. From the perspective of the tourism industry, this is an appropriate perspective given that over time all destinations experience changes in the popularity of their key experiences. Normal practice for destinations is to identify and promote new experiences to replace those in decline.

The danger for destinations such as Cairns, Port Douglas and the Whitsundays is that if the GBR is a proximate attraction and past promotion of the GBR as the key destination pull factor has effectively 'locked in' the role of the GBR as the key destination image, there is a danger of path dependence occurring. The extent of path dependence (on the GBR) will strongly influence the ability of the destination to invest in other types of tourism experiences. From this perspective, the appropriate strategy for destinations such as Cairns, Port Douglas and the Whitsundays, is to look for new experiences to supplement but not replace the GBR as a key pull factor. In many cases, new experiences will be drawn from potential experiences that may currently be classified as comparative rather than competitive advantages (see Section 2.1 for a discussion on comparative and competitive advantage). The type of experiences that could be considered include tropical city lifestyle, food tourism, events and festivals and promoting further tourism development on the Atherton Tablelands and in the Mission Beach area. The recently announced Queensland state government Global Tourism Hub for the Cairns region has the potential to become a key element in future destination development.

Developing new experiences is usually time consuming, requires new investment and may possibly need government assistance. Ideally, decisions of this type are best left to the market which is able to identify the potential rate of return on new investments and on that basis, make sound investment decisions. However, there is also a need for the destination communities to actively participate in this process. This may require the establishment of a secretariat with sufficient funding to investigate and promote alternatives.

5.1.7 Responding to further coral bleaching events

The likelihood of further and more severe coral bleaching events for coral reef dependent tourism destinations such as Cairns, Port Douglas and Whitsundays is alarming given their dependence on the GBR as a major destination pull factor and should act as an urgent 'wake-up call' for further action to protect the GBR. If predictions of further and more severe bleaching are correct, these destinations will face a future of declining tourism interest, at least for those groups of tourists who rank the GBR as the key motive for visiting the affected destinations. This suggests the need for a range of response strategies including measures to enhance the quality of the remaining coral cover, positive rather than negative media on the future of the GBR, developing crisis recovery strategies for the tourism industry and in the longer term, developing new tourism experiences.

As discussed earlier in this report, there are a range of strategies that have been put into place to strengthen the resilience of the GBR including COTS control and reduction of agricultural run-off of pesticides and fertilisers. The significant investment in the protection of the GBR by the Queensland and federal governments highlighted by the Reef 2050 Long Term Sustainability Plan will ensure that the GBR will continue to be the best managed reef system in the world. This is a key point that must be included in all future communications strategies that discuss the health, and attractiveness, of the GBR as a tourism experience. From the perspective of the tourism industry urgent research, policy changes and support for coral restoration must be supported by government and its agencies. There is also a need for GBR tourism operators to improve the quality of the visitor's GBR experience. This may include better interpretation, introduction of additional above water activities and more effective use of transit times to and from the GBR to improve the visitor experience.

Recent research by Prideaux and Thompson (2017) into the impact of commission charges for reef tours indicates that retail reef tour prices are much higher than they should be if standard industry commission charges applied. Excessive commissions reduce the international competitiveness of marine tourism operators, terrestrial tourism operators and the destination. Action to bring the level of commission paid on local tours to internationally accepted levels will make an additional contribution to increasing destination competitiveness and enhancing community resilience

5.2 Methodology for establishing ongoing monitoring of communities, industry stakeholders and visitors

5.2.1 Suggested methodology

The data collected in this research was based on four studies: an analysis of media; a series of focus groups held in four coastal destinations; a visitor survey; and a community survey. Results provided a mix of qualitative and quantitative data that together provide a comprehensive picture of how key stakeholders within the region, including tourists, were affected by the coral bleaching event, how they responded and what their thoughts were on the likely consequences of future events of this type. The media survey provided a very useful external view on how the bleaching events were perceived. Collectively, the four studies provide a very useful baseline for a framework that could be used to monitor impacts on tourists, tourist businesses, community members and organisations responsible of the economic development of the study region. The methodology outlined below plus the complementary actions recommended in Section 5.2.2 draw on Dale et al. (2016) who recommend that strategies for enhancing resilience should take a four cluster approach based on: knowledge, aspirations and capacity; governance; economic viability; and community vitality.

As discussed earlier in the report, coral bleaching represents the first of what could be a number of ongoing climate change-related events that will affect the GBR region. For this reason, the methodology suggested below is designed to measure the impacts of coral bleaching as well as other events including cyclones, on the tourism industry, the business community in general and community resilience.

The following methodology suggests a framework that may be used to monitor the views of the business community, the public sector, the local community and tourists.

1. *Media monitoring on an annual basis*. Analysis of media stories enables a rapid assessment of the GBR related themes that appear in news outlets. An understanding of the specific issues that the media has focused on will assist in the development of a communication strategy able to deal with future crisis events in the period during and after future crisis events.
2. *Business and Tourism Industry Monitoring*. While focus groups provide useful insights they do not provide an effective baseline for monitoring degrees of change. A more effective approach based on statements, such as those outlined in Tables 8 and 9, will provide data able to identify changes in attitude of both the business sector and more specifically the tourism industry. Business surveys are regularly used to measure business confidence in other areas of the economy. A survey of this nature could be administered in an on-line format when required and provide rapid feedback on business concerns.
3. *Tourist attitude survey*. The survey instrument outlined in Section 4.3 provides a useful tool for monitoring changes in the perceptions of tourists over time and as events are occurring. This approach allows change to be measured on a monthly, quarterly and annual basis. Extension of the survey beyond Cairns will facilitate the development of a more comprehensive view of tourist attitudes. Surveys of this type also provide opportunities for rapid assessment of tourists' concerns and provide valuable inputs into the development of strategies to overcome these concerns.
4. *Community Survey*. The community survey outlined in Section 4.4 provides valuable insights into community views about attitudes towards the GBR and the willingness of the community to participate in strategies to protect the GBR. The survey also provides insights into concerns held by the community and may be used as a measure of resilience. Questions such as concerns over jobs and views on the potential for respondents to leave the region also provide useful data on resilience levels. Data of this type will provide a valuable input into strategies to build community resilience. The survey can also be used to test community responses to adaption strategies. Ideally, surveys should be regularly conducted in each NRM region affected by coral bleaching.
5. *Monitoring of tourist attitudes*. The current airport survey undertaken by CQU should be continued and a similar survey undertaken in the Whitsundays. However, the survey is unable to provide data on the competitiveness of the region or how its external image has been affected. The most effective approach to gathering data of this type is to survey potential tourists outside of the region. Tourism Australia uses this method when developing marketing campaigns.

Implementing the methodology outlined above will require the establishment of an administrative structure that could be either stand-alone or administered by an organisation such as the RRRC. Irrespective of the administrative structure, ongoing input will be required from a range of stakeholders representing the tourism industry, the public sector, the business community and the community. The proposed methodology can be used to monitor the views of individual NRM regions as well as the GBR and catchment (ABS, 2017) as a whole.

5.2.2 Complementary actions

As highlighted earlier in this report, complementary actions required to assist destinations affected by climate change events such as coral bleaching (and other crisis events such as cyclones) include the development of a *coordinated crisis recovery strategy*. The strategy suggested by Faulkner (2001) provides a useful start point for the development of a strategy of this type. Given concerns about a

possible third bleaching event in 2018 (NOAA, 2018) action of develop a crisis recovery strategy should be ranked as urgent.

The report has also highlighted the need to *develop alternative tourism experiences* to counter a potential decline in the image of the GBR as a key destination pull factor. Based on the falling significance of the GBR as a key destination pull factor in the domestic market, urgent attention is required to rebuild the appeal of the GBR in the domestic market in addition to building new experiences particularly in Cairns, the Whitsundays and Port Douglas. Investigations of alternative experiences will require additional resources to fund initial and ongoing activity.

An ongoing *social science monitoring system* is required to assess the impact of climate change-related events such as coral bleaching and to monitor community resilience.

The report recognises *the key role science* has in assisting communities and the tourism industry in particular, to understand the likely impact of climate change events such as coral bleaching. To date, no formal mechanisms have been established to facilitate this process. A *permanent Scientific Advisory Committee* at state and local levels would greatly assist the tourism industry understand the extent to which climate change events such as coral bleaching may affect the tourism industry and more generally affect community resilience. Such a committee will also assist the scientific community understand the research needs of the community, industry in general and the tourism industry. The membership of such a committee should include RTOs, LTOs, Councils, QTIC, TEQ, AIMS, GBRMPA, QPWS, WTMA and AIMS.

Although ongoing monitoring is important, the translation of monitoring based knowledge into specific actions is more important. Some of the actions recommended above are ahead of the level of community concern identified in the community survey. While it is useful from a public policy perspective to have the support of the community, the temptation to wait for the community to recognise the dangers posed by climate change related events on the health of the tourism industry in Cairns, Port Douglas and the Whitsundays will result in lost time and weaken the potential to retain the region's customer base.

5.3 Summary of findings

1. Available scientific evidence suggests that the GBR is likely to bleach with increasing severity and frequency in future (GBRMPA, 2017a).
2. The GBR is the key destination pull factor for international tourists in Cairns, Port Douglas and the Whitsundays. Further coral bleaching may lead to a significant decline in international tourism, with resultant economic impacts.
3. Given the potential for further coral bleaching in the future (NOAA, 2018), there is a need to develop effective response and recovery strategies for each GBR destination and Queensland as a whole.
4. The GBR is not currently a major pull factor for domestic visitors. While a further decline in the GBR will certainly affect domestic tourism, the economic impact is likely to be less than for international tourism.

5. The business community in Cairns and other GBR destinations have shown strong leadership for over a decade in raising awareness and responding to threats to the GBR including climate change and understand that further decline in the health or perceived health of the GBR poses a significant threat to long-term community resilience.
6. The Cairns community is highly engaged with the GBR and places a high level of value on its protection.
7. Findings from recent GBRMPA research, visitor surveys, focus groups and community surveys indicate that coral dependent tourism destinations are unprepared for a future decline in coral reef tourism.
8. To avoid adverse economic impact, urgent action is required to increase the resilience of coral reef dependent economic sectors and communities by revitalising existing marine tourism experiences, broadening the range of tourism experiences on offer over the longer term and creating opportunities for local action against the global phenomenon of mass coral bleaching.
9. The Cairns community understands the danger that coral bleaching could pose but has yet to indicate a high level of concern about their livelihoods being adversely affected by a further decline in the quality of the GBR as a tourism experience.
10. Coastal destinations that have a small GBR tourism sector will have a higher level of resilience to future coral bleaching events than coral dependent communities such as Cairns, Port Douglas and the Whitsundays.
11. The Whitsundays region may experience coral bleaching in the future and could suffer a fall in tourism as a result. However, destinations in the southern part of the GBR are less likely to suffer a significant decline in tourism as the attractiveness of the GBR declines.
12. Strengthening community resilience will require increased co-operation between the scientific community and coral reef dependent tourism destinations.
13. Authorising and funding coral regeneration programs will provide direct economic benefits to the tourism industry and supporting communities.

Recommendations

Mass coral bleaching and mortality events in 2016 and 2017, plus the expected increase in frequency of such events in future, are expected to have a significant economic impact on the tourism-dependent communities of Cairns, Port Douglas and the Whitsundays. Given that the basic cause of mass coral bleaching – climate change due to greenhouse gas emissions – is global, what can be undertaken locally to improve outcomes for our communities?

1. Develop unified communications from the GBR tourism industry supporting both global emissions reductions and local actions for mitigation/adaptation.
2. Increase investment in community resilience research to support reef dependent communities
3. Diversify GBR tourism options including increasing local environmental stewardship to counter potential or perceived declines in GBR health.
4. Diversify land-based tourism options to supplement GBR tourism options.
5. Undertake regular monitoring of tourists, local communities and the business sector.
6. Develop effective response and recovery strategies to deal with future coral bleaching and other events such as cyclones on both destination and state-wide scales.
7. Allocate funding for research into crisis management to improve community resilience.

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APPENDIX 1

COMMUNITY SURVEY

You are invited to complete a survey about the Great Barrier Reef and living in this region. The survey should take no more than 15 minutes to complete.

The survey results will contribute to a project focused on determining community perceptions of the impacts of the 2016 and 2017 Great Barrier Reef (GBR) coral bleaching events on coastal communities and the tourism industry.

Taking part in this study is completely voluntary. You may skip any question that you do not wish to answer. Completion of the survey will be consent to use the data for research purposes. Please return the survey to the person who gave it to you.

The data from the study will be published as a publicly accessible report and in tourism research publications.

You will not be identified in any way as your responses are de-identified and remain strictly confidential and anonymous. Data will be securely stored for five (5) years in accordance with the CQUniversity policy.

If you have any questions about the study, please contact Professor Bruce Prideaux:
Tel: 07 4037 4715
E-mail: b.prideaux@cqu.edu.au
Mailing address: Level 3 Cairns Campus, Cnr Abbott & Shields Sts, Cairns QLD 4870

Should there be any concerns about the nature and/or conduct of this research project, please contact CQUniversity's Office of Research:
Tel: 07 4923 2603
E-mail: ethics@cqu.edu.au
Mailing address: Building 32, CQUniversity, Rockhampton, QLD 4702

This project has been approved by the CQUniversity Human Research Ethics Committee, approval number H17/04-062.

If you would like to receive an electronic copy of the final project report, please leave your name and email address here:
_____

To thank you for your time we are offering a chance to win a day trip for 2 people to the Great Barrier Reef. If you would like to enter, please leave your name and contact phone number here:
Name: _____
Phone: _____
The draw will take place on 31 August 2017 at CQUniversity Cairns. The winner will be contacted by telephone.

THIS FRONT PAGE WILL BE REMOVED FROM THE SURVEY BEFORE DATA ENTRY.

Office Use Only - Survey date: Survey location:

1. ***Where do you normally live?*** _____ (suburb/town)
2. ***How long have you lived in far north Queensland?*** _____ (years)
3. ***What year were you born?*** _____
4. ***In which industry do you currently work?***
   - o Retail
   - o Tourism
   - o Manufacturing
   - o Mining
   - o Construction
   - o Accommodation & food services
   - o Finance & insurance
   - o Transport
   - o Administrative & support services
   - o Education & training
   - o Health care & social assistance
   - o Arts & recreation services
   - o Wholesale trade
   - o Agriculture, forestry & fishing
   - o Electricity, gas, water & waste
   - o Professional, science & technical services
   - o Public administration
   - o Retired

5. ***What is the highest level of education that you have received so far?***
   - o Secondary high school
   - o Trade/TAFE
   - o University degree
   - o Other _____

6. ***When did you last visit the GREAT BARRIER REEF (GBR)?***
   - o In the last 6 months
   - o In the last 12 months
   - o Within the last 2 years
   - o Within the last 5 years
   - o More than 5 years ago
   - o Never been to the GBR

7. ***What are the first words that come to mind when you think of the GBR?***

   _____

8. ***If you have never been to the Great Barrier Reef, could you tell us why?***

   _____ (go to Q16)

THINKING ABOUT YOUR LAST VISIT TO THE GREAT BARRIER REEF:

9. ***How did you travel to the GBR?***
   - o Private boat
   - o Tourist boat
   - o Sailing boat
   - o Charter fishing boat
   - o Dive boat
   - o Commercial fishing boat
   - o Superyacht
   - o Helicopter
   - o Other _____

10. ***Was this trip:***
    - o A day trip
    - o Overnight trip – How many nights? _____

11. ***Where did you spend the most time on your last trip to the GBR? (Please name the reef, cay, island if possible)***
    - o Reef pontoon _____
    - o Coral cay _____
    - o Stayed on the boat
    - o Outer reef _____
    - o Island _____
    - o Other _____

12. ***How satisfied were you overall with your last visit to the GBR? (please circle one)***

Not at all satisfied	Not very satisfied	Somewhat satisfied	Very satisfied	Extremely satisfied
1	2	3	4	5

13. ***What was the greatest influence on your level of satisfaction? (Tick all that apply)***
    - o Spending time with family/friends
    - o Snorkelling/diving
    - o Seeing coral
    - o Seeing reef fish
    - o Just being on the GBR
    - o Catching a fish
    - o Other_____

14. ***What was the best experience you had on your last visit to the GBR?***

    _____

15. Did the reef look healthy on your last visit? (please circle)

Not at all healthy	Not very healthy	Somewhat healthy	Very healthy	Extremely healthy
1	2	3	4	5

YOUR VIEWS ON THE GREAT BARRIER REEF IN GENERAL

16. Please circle your level of agreement with the following statements:

	Strongly disagree	Disagree	Neither	Agree	Strongly agree
There are many other places that are better than the GBR for the recreation activities I enjoy	1	2	3	4	5
I feel proud that the GBR is a World Heritage Area	1	2	3	4	5
I live here because of the GBR	1	2	3	4	5
I value the GBR because it supports a variety of life such as fish and corals	1	2	3	4	5
I value the GBR because it supports a desirable and active way of life	1	2	3	4	5
I value the GBR because we can learn about the environment through scientific discoveries	1	2	3	4	5
I value the GBR because it attracts people from all over the world	1	2	3	4	5
The GBR is a great asset for the economy of this region	1	2	3	4	5
I value the GBR for the fresh seafood it provides	1	2	3	4	5
The GBR contributes to my quality of life and well-being	1	2	3	4	5
The aesthetic beauty of the GBR is outstanding	1	2	3	4	5
The place I most recently visited in the GBR is NOT in great condition	1	2	3	4	5
I feel optimistic about the future of the GBR	1	2	3	4	5
I am worried the next generation will not see the GBR alive	1	2	3	4	5
The GBR is the region's most important tourism asset	1	2	3	4	5

17. In your opinion, what are the five most concerning threats to the GBR?

1. _____
2. _____
3. _____
4. _____
5. _____

18. Are you concerned about the recent reports of coral bleaching on the GBR?

Not at all concerned	Not very concerned	Somewhat concerned	Very concerned	Extremely concerned
1	2	3	4	5

19. My knowledge about the causes of coral bleaching is:

- ○ **Low** (I am unsure why coral bleaching occurs)
- ○ **Medium** (I know a little about the causes)
- ○ **High** (I understand the science)

20. Do you think coral bleaching of the GBR can affect you personally?

o Yes (go to Q21) o No (go to Q22) o Maybe (go to Q22)

21. If yes, how could it affect you?

_____

22. Should we stop trying to fix the reef and direct funding into the protection of other natural attractions instead?

o Yes o No o Maybe

23. Please circle your level of agreement with the following statements:

	Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly agree
I feel confident that the GBR is well managed	1	2	3	4	5
I support the current rules and regulations that affect access and use of the GBR	1	2	3	4	5
Current management zones should be revised to protect several bleached parts of the reef	1	2	3	4	5
The local tourism industry will decline if coral bleaching becomes a regular event	1	2	3	4	5
If coral bleaching becomes a regular event I will need to find a new job	1	2	3	4	5
If coral bleaching becomes a regular event I will need to move away from Cairns	1	2	3	4	5
I believe more money needs to be spent by the government to save the reef	1	2	3	4	5
I CANNOT make a personal difference to improving the health of the GBR	1	2	3	4	5
I would like to do more to help protect the GBR	1	2	3	4	5
I try to encourage other people to reduce their impacts on the GBR	1	2	3	4	5
It is NOT my responsibility to protect the GBR	1	2	3	4	5
Coastal residents should take steps to reduce their impacts on the GBR	1	2	3	4	5
It is the responsibility of all Australians to protect the GBR	1	2	3	4	5
I have the necessary knowledge and skills to reduce any impact I might have on the GBR	1	2	3	4	5
I do NOT have the time and opportunity required to reduce any impact that I might have on the GBR	1	2	3	4	5
I would NOT be personally affected if the health of the GBR declined through coral bleaching	1	2	3	4	5
It is too expensive for me to reduce any impact I might have on the GBR	1	2	3	4	5

24. Which of these statements best describes your beliefs about climate change? (Choose one)

- o I think it is A NATURAL SEASONAL CHANGE and the reef will adapt to climate change.
- o Climate change is an IMMEDIATE THREAT requiring action.
- o I NEED MORE EVIDENCE to be convinced of the climate change problem.
- o I believe that climate change is NOT A THREAT at all.
- o I DO NOT HAVE A VIEW on climate change.

Any final comments:

_____

THANK YOU FOR YOUR TIME!

T: +61 (0) 4050 7400

www.rrrc.org.au