



National Environmental
Research Program

TROPICAL ECOSYSTEMS *hub*

Final Report

The Social and Economic Long Term Monitoring Program for the Great Barrier Reef (SELTMP) 2014



Nadine A. Marshall, Erin Bohensky, Matt Curnock, Jeremy Goldberg,
Margaret Gooch, Bernadette Nicotra, Petina L. Pert, Lea Scherl,
Samantha Stone-Jovicich and Renae C. Tobin



Australian Government
Department of the Environment

 Reef &
Rainforest
RESEARCH CENTRE

The Social and Economic Long Term Monitoring Program for the Great Barrier Reef (SELTMP) 2014

Final Report

Nadine A. Marshall^{1,6}, Erin Bohensky¹, Matt Curnock¹, Jeremy Goldberg^{1,2}, Margaret Gooch^{3,4},
Bernadette Nicotra^{5,6}, Petina L. Pert^{1,6,4}, Lea Scherl⁶, Samantha Stone-Jovicich¹, Renae C. Tobin^{5,6}

¹ CSIRO Land and Water Flagship and Wealth from Oceans, Townsville

²College of Business, Law and Governance, James Cook University, Townsville

³Great Barrier Reef Marine Park Authority, Townsville

⁴Cairns Institute, James Cook University, Cairns

⁵Centre for Sustainable Tropical Fisheries and Aquaculture, James Cook University, Townsville

⁶College of Marine and Environmental Sciences, James Cook University, Townsville



Australian Government

Department of the Environment

Supported by the Australian Government's
National Environmental Research Program

Project 10.1 The Social and Economic Long Term Monitoring Program for the Great Barrier Reef

© CSIRO

National Library of Australia Cataloguing-in-Publication entry:
978-1-925088-46-5

This report should be cited as:

Marshall, N.A. Bohensky, E., Curnock, M., Goldberg, J., Gooch, M., Nicotra, B., Pert, P.L., Scherl, L., Stone-Jovicich, S., Tobin, R.C. (2014) *The Social and Economic Long Term Monitoring Program for the Great Barrier Reef. Final Report.* Report to the National Environmental Research Program. Reef and Rainforest Research Centre Limited, Cairns (28pp.).

Published by the Reef and Rainforest Research Centre on behalf of the Australian Government's National Environmental Research Program (NERP) Tropical Ecosystems (TE) Hub.

The Tropical Ecosystems Hub is part of the Australian Government's Commonwealth National Environmental Research Program. The NERP Tropical Ecosystem (TE) Hub is administered in North Queensland by the Reef and Rainforest Research Centre Limited (RRRC). The NERP TE Hub addresses issues of concern for the management, conservation and sustainable use of the World Heritage listed Great Barrier Reef (GBR) and its catchments, tropical rainforests including the Wet Tropics World Heritage Area (WTWHA), and the terrestrial and marine assets underpinning resilient communities in the Torres Strait, through the generation and transfer of world-class research and shared knowledge.

This publication is copyright. The Copyright Act 1968 permits fair dealing for study, research, information or educational purposes subject to inclusion of a sufficient acknowledgement of the source.

The views and opinions expressed in this publication are those of the authors and do not necessarily reflect those of the Australian Government or the Minister for the Environment.

While reasonable effort has been made to ensure that the contents of this publication are factually correct, the Commonwealth does not accept responsibility for the accuracy or completeness of the contents, and shall not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance on, the contents of this publication.

Cover photographs: M. Curnock, S. Sobotzick

This report is available for download from the NERP Tropical Ecosystems Hub website:

<http://www.nerptropical.edu.au/research>

December 2014

Contents

List of Figures	ii
Acronyms Used In This Report	ii
Acknowledgements	iii
Introduction	1
Case Study Context	2
Methodology	4
Conceptual Framework.....	4
A. Resource Use and Dependency.....	5
B. Human and Community Well-being.....	6
C. Indirect Drivers within the Great Barrier Reef System	7
Survey Design.....	8
Survey Administration.....	8
Survey demographics.....	9
Data Analysis.....	10
Results	10
i) Use.....	10
ii) Dependency.....	13
iii) Well-being	14
iv) Socio-cultural context.....	15
Perceptions of the Great Barrier Reef.....	15
Level of connection with the Great Barrier Reef	17
Pride in the GBR	17
What people value about the Great Barrier Reef	17
Stewardship	18
Trust in information about the GBR.....	19
Perceptions of management	20
Discussion	21
References	24

List of Figures

Figure 1: Map of GBR Region.....	3
Figure 2: The SELTMP conceptual framework based on the DPSIR framework and Millennium Ecosystem Assessment Framework. The human dimension of the Great Barrier Reef is represented by the four components (in light blue): A. Use and Dependency, B. Human Well-being, C. Capacity and Context, and D. Use and Development.....	5
Figure 3: Measuring Use and Dependency in the Great Barrier Reef: Indicators chosen.....	6
Figure 4: Dimensions of Well-being within the Great Barrier Reef region.	7
Figure 5: The major categories of indirect drivers that are monitored within the SELTMP.....	8
Figure 6: A map showing the responses to the survey question, “Thinking about the entire Great Barrier Reef area, please mark the location of your favourite place on the map below”	11
Figure 7: A map showing the locations of tourist activity (Reproduced from GBRMPA/2014) – Great Barrier Reef Outlook Report 2014. Great Barrier Reef Marine Park Authority.	12
Figure 8: Responses of Australians to the survey question: please list the first words that come to mind when you think of the Great Barrier Reef.....	15
Figure 9: Responses of commercial fishers to the first survey question: please list the first words that come to mind when you think of the Great Barrier Reef.	15
Figure 10: Responses of Australians to the survey question: Below is a list of places in Australia that people have said are inspiring. Please rank the following in terms of how inspiring they are to you (please note that the Great Barrier Term was randomly distributed through the list.	16
Figure 11: Level of agreement with statements relating to how respondents value the Reef....	18
Figure 12: Level of agreement that barriers such as knowledge and skills, time and opportunity, and expense, reduce the ability of respondents to reduce their impacts on the GBR.	19

Acronyms Used In This Report

ABS	Australian Bureau of Statistics
CSIRO	Commonwealth Scientific Industrial Research Organisation
DAE	Deloitte Access Economics
DAFF	Department of Agriculture, Fisheries and Forestry
JCU	James Cook University
GBR	Great Barrier Reef
GBRMPA	Great Barrier Reef Marine Park Authority
GBRWhA	Great Barrier Reef World Heritage Area
GVP	Gross Value of Production
MEA	Millennium Ecosystem Assessment
NERP	National Environmental Research Program
RRRC	Reef and Rainforest Research Centre Limited
SCUBA	Self Contained Underwater Breathing Apparatus
SELTMP	Social and Economic Long Term Monitoring Program

Acknowledgements

The Social and Economic Long Term Monitoring Programme (SELTMP) for the Great Barrier Reef is the result of a large scale regional initiative funded by the National Environment Programme (NERP), CSIRO Wealth from Oceans, James Cook University and the Great Barrier Reef Foundation. We are sincerely grateful for their support. We are also deeply appreciative of the vision and efforts of our steering committee, stakeholder and scientific advisory panel and each of the ten working groups that contribute to the technical aspects of the project. More than one hundred people in total have contributed to the development and implementation of SELTMP. We also acknowledge the very gracious acceptance of 8,300 people to be interviewed as part of this work, and of course to the 35 very talented staff who acted as interviewers. Their efforts, skills and dedication to the cause have been extraordinary. To All: we extend our deepest thanks; the tremendous collaborative effort that has gone into developing this program is a testament to our shared values and sense of stewardship for the Great Barrier Reef World Heritage Area.

Introduction

The need to incorporate people into natural resource management is well established [1; 2; 3; 4; 5]. Improved knowledge of the social components and linkages to a natural resource can help managers to develop strategies that have fewer negative social and economic impacts whilst maximizing conservation benefits. However, incorporating the human dimension into natural resource management can be difficult because natural resource (or socio-ecological) systems are complex in their social, environmental, economic, political and cultural aspects, and this makes them inherently unpredictable and indeterminate [6; 7; 8]. It also makes the implementation of resource-protection policies a political process. On a global scale, increases in the demand for natural resources and the goods and services that they provide have meant that more stringent policies that regulate their use are being implemented more frequently [9; 10; 11; 12]. Limitations on human activities will be essential for the future effective functioning of natural resources and the well-being of people dependent upon them. However, such restraints can impose significant and often immediate levels of stress upon individuals, industries and communities to such an extent that their ability to adapt, tolerate or prosper under the new policy regime is compromised [6; 13; 14; 15] and the resource itself can be left unprotected [16; 17].

In their efforts to implement change for conservation, natural resource managers frequently encounter resistance to their strategies: proposed policies are opposed, goals are contested, public dissatisfaction surmounts, people refuse to participate and comply, animosity and distrust toward the government grows, appeals and litigation increase, and occasionally even threats and violence occur [18; 19; 20; 21]. Flow-on effects of resource management policies can severely impact on the lives and well-being of the people and industries dependent on natural resources, and the resulting conflict, political turmoil and lack of compliance can seriously undermine conservation goals [22; 23; 24; 25; 26; 27]. While the benefits from conservation management may indeed be realized in the long-term, communities and industries have frequently been expected to adapt to the associated reduction in opportunities in the short term. This has often pushed communities and industries to either accept a decline in the resource-based component of their livelihoods and a reduced wellbeing, or to compensate through illegal exploitation of “protected” resources. The net effect is that the livelihoods of resource-dependent people will continue to be under threat for the foreseeable future, partly because some level of ecosystem degradation is inevitable, and also because many conservation measures will in themselves impart substantial stress on social and economic systems [2].

The situation in which the human dimension is not adequately considered within the decision-making process is sub-optimal for resource conservation [28]. Resources that are in good condition are able to offer a wide range of provisioning, regulating, cultural and supporting services to the people and communities dependent upon them [29]. Similarly, well-functioning social systems are able to manage use of their natural resources more effectively and sustainably. Such social systems comprise individuals and institutions with high levels of stewardship, empowerment to deliver on common goals, and a commitment to comply with regulatory provisions [30; 31]. Dysfunctional social systems, however, lead to dysfunctional ecosystems and vice versa where placing increasing stress on natural resources in an attempt to satisfy human demands leads to ecosystems unable to sustain human needs. This critical linkage within socio-ecological systems means that as the condition of one system component degrades (ecological, social or economic), the degradation of others may also be imminent [32]. Like others, we argue that resource management that focuses on managing resources for human benefit where human considerations are central to decision-making are more likely to achieve conservation success [33; 34].

In this report we present a new approach to assist natural resource managers to incorporate the human dimension into decision making processes that is currently being implemented and

trialled within the socio-ecological system of the Great Barrier Reef. The approach is to report on and monitor the status, inter-linkages and trends within the human dimension of natural resource systems through a social and economic long term monitoring program (SELTMP). Whilst the theoretical framework for such monitoring is not novel (our model is derived from the Millennium Ecosystem Assessment, 2005), its implementation at this scale is the first of its kind in considering the inter-linkages between all groups of people. Socio-ecological monitoring can assist managers to understand the competing demands on natural resources and can assist decision-making processes to be evidence-based, transparent, reflect the 'triple bottom line', enabling active adaptive management and learning [35; 36]. The monitoring of social and economic conditions and trends through programs such as SELTMP can alert natural resource managers and other decisions-makers to changes in the socio-ecological system, impacts associated with planned or unplanned interventions, levels of public support and the trade-offs associated with decision-making. We note that natural resource governance structures that enable a linked social-ecological systems approach are effectively still in their infancy, although significant conceptual advances are currently being achieved [33; 37; 38].

In response to the growing need for transparency in decision-making, calls were repeatedly made by Great Barrier Reef managers for long term social and economic monitoring. Funding for the design and implementation of a comprehensive social and economic long term monitoring program (SELTMP) for the Great Barrier Reef was secured in mid-2011 for 3.5 years. Phase one was to consider commercial fishing, marine tourism, coastal communities, and national residents (Australians) and phase two was to include Traditional Owners, agricultural industries, mining, and ports and shipping. Here, we report on the results of phase one, which we currently refer to as the '2013 baseline' dataset representing regional, national and international interests and stakeholders, enabling new insights across multiple stakeholder groups. SELTMP offers an opportunity to understand and monitor the impacts of human actions on the Reef and the corresponding capacity of industries and communities to be resilient and face challenges such as climate change, environmental degradation, regulatory change and cultural change. We present the scientific framework behind the SELTMP, the process and indicators undertaken to operationalise it and the governance structure that enables end-user involvement. A summary of key results are presented and discussed for key learnings.

Case Study Context

The Great Barrier Reef World Heritage Area encompasses the largest and most diverse coral reef ecosystem on Earth, spanning 2,300km along the east coast of Queensland, Australia (see Figure 1). In 1981 the Reef was inscribed on the World Heritage List in recognition of its "outstanding universal value". The region was first occupied tens of thousands of years ago by several groups of Indigenous Australians who used marine and coastal resources for food, shelter and sites of cultural significance. Today over 760,000 people live, work and recreate in Great Barrier Reef coastal areas, islands, and waters [39]. The Reef provides local residents, tourists and visitors with a wealth of recreational opportunities including beach combing, snorkelling, diving, whale watching, yachting, fishing, reef-walking and island camping. The coastline currently supports twelve ports that mostly export bulk minerals/ coal and sugar, including one of the largest coal export terminals in the world [40]. A number of activities including oil drilling and mining are strictly prohibited in the Marine Park.

The Marine Park is jointly managed by Commonwealth and Queensland governments as a multiple use park where a wide variety of human activities are allowed to occur including tourism, commercial fishing, recreation, ports and shipping, scientific research and Indigenous traditional use. Three decades of ecological monitoring by the Australian Institute of Marine Science have established substantial decline in the Reef's ecosystem health, resulting in the loss of approximately 50% of coral cover within the World Heritage Area [40]. The most recent,

comprehensive report on the state of the Great Barrier Reef identifies significant threats and pressures to the Reef's natural systems, with the overall outlook for the Reef described as "poor and getting worse" [41]. Current social and economic conditions within the region have not been documented at the regional scale.



Figure 1: Map of GBR Region

Methodology

Our approach to provide end-user-relevant data representing the human dimension of the Great Barrier Reef was to create a strong conceptual structure around the choice of indicators and to ensure that indicators would be well-translated, feed directly into current management processes, and be specific (S), measurable (M), actionable (A), relevant (R) and timely (T) (SMART; [42]). Hence we developed a “bottom-up” and “top-down” approach.

As part of the bottom up approach we established working groups for each stakeholder group comprising technical experts from community, government, research and industry who could advise us on the indicators of choice. We established a high level steering committee comprising leading Reef managers to ensure policy relevance. We also instigated a scientific and stakeholder advisory panel to increase significance, minimise redundancy and maximize end-user engagement. A major output from the bottom-up approach was a “wish list” of indicators that could adequately represent the human dimension from an end-user viewpoint.

The top-down approach that we used referred to a conceptual scientific model to structure indicator choice and define which indicators on the wish list would be part of the data collection process and which would not. The conceptual model focused on drivers, pressures, states, impacts on and responses of systems (DPSIR) modified for the purposes of the project. Importantly, our approach also considered datasets that already existed within the region (such as census data, industry records, government files etc), and attempts were made not to replicate efforts.

Conceptual Framework

Our ‘top down’ conceptual framework for selecting and structuring indices was guided by the Millennium Ecosystem Assessment [43], which established a ‘big picture’ conceptual overview of the relationship between people and natural resources. Its work, involving over 2,000 experts in its authorship and review, posits that people are integral parts of, and have dynamic interactions with, ecosystems and that changing human conditions drive changes in ecosystems which in turn cause changes in human well-being. We modified the MEA framework for SELTMP to focus explicitly on the human dimension of the natural resource system (see Figure 2).

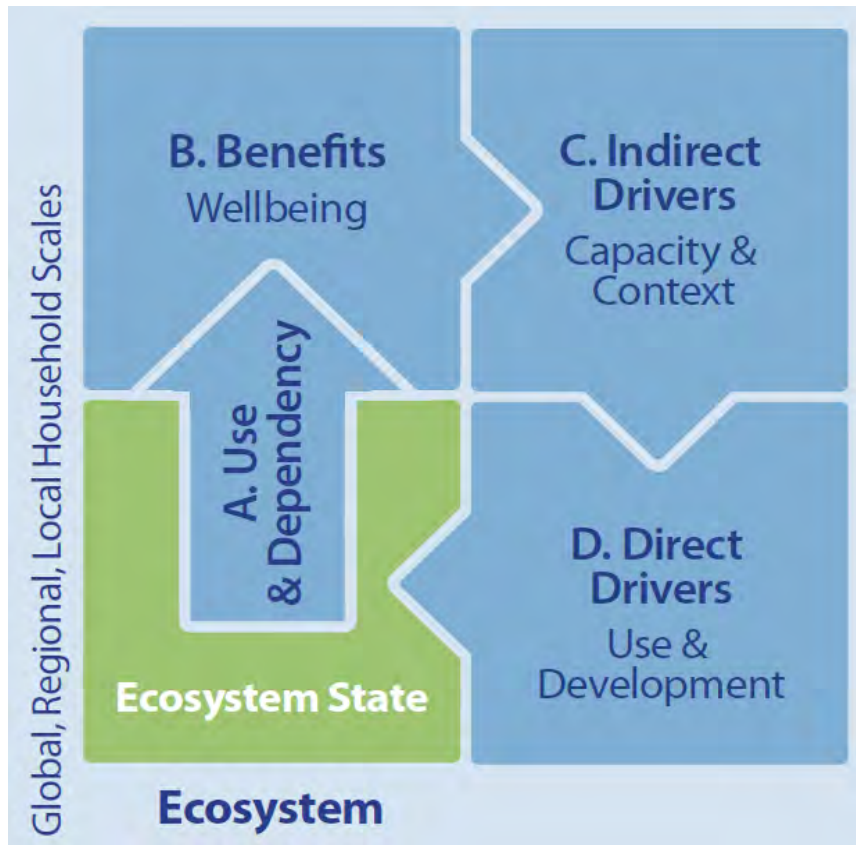


Figure 2: The SELTMP conceptual framework based on the DPSIR framework and Millennium Ecosystem Assessment Framework. The human dimension of the Great Barrier Reef is represented by the four components (in light blue): A. Use and Dependency, B. Human Well-being, C. Capacity and Context, and D. Use and Development.

The SELTMP conceptual framework defines the two-way relationship between the ecosystem (Great Barrier Reef) and human well-being at multiple scales. It states that the level of human and community well-being is determined, in part, by how people use and depend on the Reef (“A” in Figure 2). In turn, human well-being (“B”) is understood to influence the ecosystem by influencing capacity to use ecosystems (“C”), and influences the occurrence and strength of direct drivers which may impact the Reef (“D”). For example, socio-cultural drivers describe the context within which resources are used and managed (e.g. how people value the Reef) and can influence the extent to which direct drivers, such as coastal development, agricultural run-off and fisheries occur. Opportunities for strategies and interventions that can halt, reverse, or change a process exist at several points within the cycle [43]. We describe each of the human dimensions in turn.

A. Resource Use and Dependency

People use and depend on natural resources in many ways. Understanding the nature and magnitude of this relationship is important for anticipating how sensitive people might be to changes in that relationship. Understanding why and how people are dependent on a resource may provide insight into the ability of people to cope and adapt to changes in the user-resource relationship [16; 28; 44; 45]. It may also assist resource-managers, communities and industries to design and implement resource-protection strategies that not only protect ecological values but also the social systems dependent upon them.

We combined the practical needs of stakeholders with scientific learning and refer to ‘resource use’ measures in terms of activities and spatial and temporal patterns: who the Reef-users are, how many there are, where they are, where they go on the Reef, when they go, how they go, how much they use the Reef, what do they do to/at the Reef and why they go. People’s experiences and satisfaction from the GBR were included.

We describe dependency on the Great Barrier Reef in terms of the cultural, spiritual and intellectual benefits from ecosystem services [43] and include inspiration and experiences which includes place-based factors (such as place attachment, sense of place, length of residency, strength of local networks), and identity-based factors (such as occupational attachment, pride in World Heritage status). Networks and the level of employment, value and investment are included (Figure 3).

<p>Activities in the Great Barrier Reef (GBR)</p> <ul style="list-style-type: none"> What are people doing in the GBR? How are people interacting with the GBR (gear etc)? How often are people using the GBR? How much ‘product’ are they taking? <p>Spatial and temporal patterns of use</p> <ul style="list-style-type: none"> Where are people going in the GBR? When are people going to the GBR? <p>Cultural, spiritual and intellectual inspiration and experiences</p> <ul style="list-style-type: none"> Identity in relation to the GBR Place attachment to the GBR Family dependency on the GBR Occupational dependency on the GBR Values of the GBR Experiences of and satisfaction from the GBR Networks <p>Employment, value and investment</p> <ul style="list-style-type: none"> Employment figures Financial investments Income Business versus lifestyle approach
--

Figure 3: Measuring Use and Dependency in the Great Barrier Reef: Indicators chosen.

B. Human and Community Well-being

Although conservation and natural resource management initiatives are not primarily set up to address human and community well-being in Australia, natural resource management is increasingly expected to be accountable for a range of dynamic relationships that individuals and communities have with natural resources. Increasingly natural resource management agencies are aware that what takes place in the natural environment affects the well-being of people and communities. We make a distinction that there are two levels of well-being; one related to individuals and the other that encompasses community at large.

Human and community well-being can be defined in many ways. The Millennium Ecosystem Assessment defined five components of well-being: basic material for a good life, health, good social relations, security, and freedom of choice and action (MA 2003). Well-being may include relationships with others and the environment, a sense of belonging to a place or a group, or spirituality [46; 47; 48]. Human and community well-being is not only about individual or community needs that are being met but also about the freedom to exercise choice and the opportunity to have an influence on factors that affect one’s life conditions [49] [50]. The concept of well-being comprises both notions of feeling good and functioning well.

Equally important for well-being is our functioning in the world. Experiencing positive relationships, having some control over one's life and having a sense of purpose are all important attributes of well-being [51; 52]. In summary, the notion of well-being provides a holistic and positive way to understand the connections between natural resources such as the Great Barrier Reef and individuals and communities dependent on them. We have summarized these concepts into a framework most relevant for the Great Barrier Reef socio-ecological system, and these are summarized in Figure 4. Well-being is defined here as comprising the following dimensions: opportunities, empowerment and security.

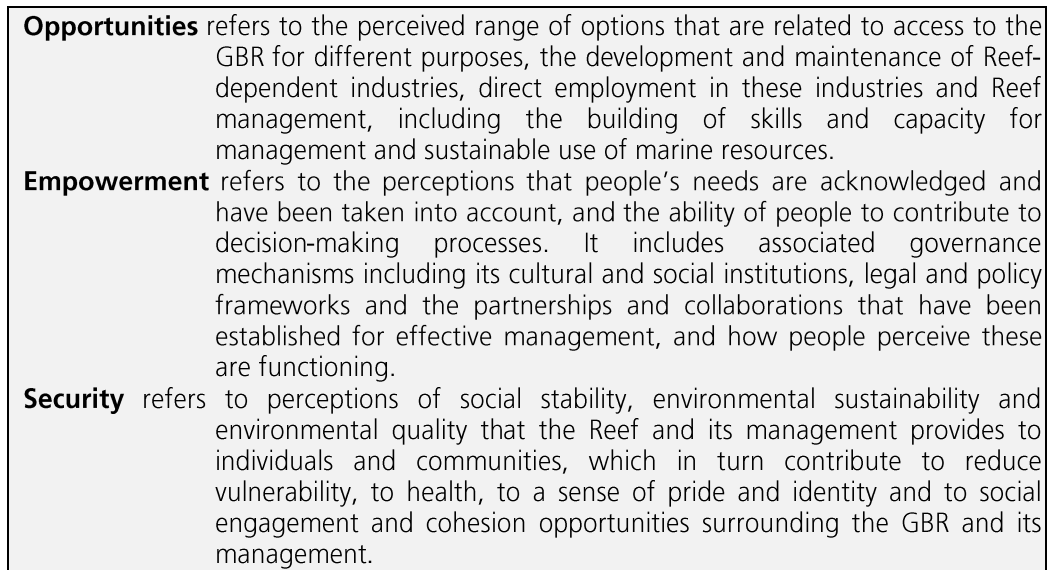


Figure 4: Dimensions of Well-being within the Great Barrier Reef region.

C. Indirect Drivers within the Great Barrier Reef System

Identifying and monitoring drivers within the SELTMP project included both a "bottom up" inductive component, in which we elicited expert opinion through end-user workshops, and a "top down" deductive approach based on a review of existing conceptual frameworks and literature, [29; 53; 54]. The categories of drivers that are monitored within the SELTMP are included in Figure 5.

<p>Economic Drivers, which include value of AUD, interest rates / inflation, GDP growth rates, centre of world economic "gravity", input costs, fuel, commodity prices, house prices, equality (Gini index, index of socioeconomic disadvantage), demand (e.g. for fair trade products, experiences)</p> <p>Social and Cultural Drivers, which include environmental awareness & values, participation in environmental initiatives (stewardship), perceptions of reef condition and threats, normative behaviour</p> <p>Demographic Drivers, which includes population age structure, population growth rate, population movements/mobility, number and source of migrants,</p> <p>Political and Management Drivers, which include financial resources allocated to environment and reef management programs, number of regulations passed, subsidies, compliance with regulations, staff turnover in government agencies, ownership of regional businesses</p> <p>Communication and Media Drivers, which include top news stories, web searches, use of social media, media representations of GBR, % of population using internet for information, sources of and trust in information and networks</p> <p>Science and Technology Drivers, which includes scientific research published, scientific research projects/programs funded, government and private research investment, scientific advances, rates of adoption of new technologies, changes in the productivity and extractive capabilities of new technologies, access to and dissemination of information through new technologies</p>
--

Figure 5: The major categories of indirect drivers that are monitored within the SELTMP.

Survey Design

Once indicators were identified, a master survey, or template, was designed to capture each of the important indicators. The template was used as a guide to develop five separate surveys that targeted each of the main user groups of the Great Barrier Reef; national residents (i.e. Australian residents living outside the GBR region), local residents, tourists, tourism operators and commercial fishers. Indicators that were currently monitored by others (such as census data etc) were removed from each survey where relevant. Most survey questions were presented as a statement designed to elicit an attitude, opinion, or stance. Statements were based on other studies as much as possible [16; 55; 56; 57; 58]. Respondents were asked to rate how strongly they agreed with each statement using a ten-point rating scale. A ten-point rating scale was considered sufficiently sensitive to detect subtle changes through time [59; 60]. The lack of a mid-point meant that data became easier to interpret since it is rarely clear what a mid-point actually infers; undecided, unknown, depends, sometimes, not sure, neutral, cannot be bothered, etc [61]. If respondents were unwilling to commit to 'agree' or 'disagree', they were able to leave an answer blank. Open-ended questions were also included in the survey so as to elicit genuine impressions. For example, the first question in the survey asked participants to list the first words that came to mind when they thought of the Great Barrier Reef. An initial version of the survey was pilot-tested with 5-20 people within each user group to ensure that the questions were readable and unambiguous. The final drafts of the surveys can be found at: www.eatlas.org.au/seltmp.

Survey Administration

National residents were surveyed using an online research panel provided by an external marketing company based in Sydney called Pollinate. This company has access to a relatively random sample of Australians who are prepared to complete surveys in exchange for online credit points that can be converted into gifts or goods. Pollinate have been conducting their

own interviews about environmental perceptions every six months since 2007. We were able to include a small number of additional questions for SELTMP 2013 in both March 2013 and September 2013. Demographic results suggest that the population at both times were representative of the Australian population with regard to location, age and gender. We obtained 1,002 respondents in March, and 1,000 in September.

Local residents and tourists were surveyed using face-to-face methods across 14 main population centres in each of the four sections of the Great Barrier Reef - from Elim beach in the north to Bundaberg in the south. We employed and trained 35 casual staff and deployed them to public places such as parks, shopping centres, market places, airports, marinas, sporting areas, information centres, museums, jetties, caravan parks, lookouts etc. We used a mix of "convenience sampling" and "quota sampling" [62] in which we attempted to produce a population representative of people in categories such as age, gender, interests and occupation. We wanted sufficient individuals within each of the following interest groups to be able to represent them to a satisfactory extent: "grey nomads", backpackers, yachties, boaties, jet-skiers, residents, domestic visitors, snorkelers, divers, and international visitors. A limitation of our sampling was a bias towards English speaking people.

Interviewers were equipped with an Apple mini-iPad loaded with an iSurvey application of both the residents' survey and the tourist survey. At the completion of the sampling period (June-August 2013), we had surveyed 3,181 local residents and 2,877 tourists across the Reef and catchment obtaining a response rate of over 53%. Tourists were defined as people who live outside the Reef catchment (east of Great Dividing Range, from Bundaberg to Cape York).

Marine tourism operators and commercial fishers were interviewed by telephone. Since we were unable to access a contacts database for either industry due to ethical and commercial-in-confidence reasons, we built our own databases using publicly-available data and personal contacts. There are an unknown number of operators within both industries, however, using a comprehensive web-search and snowball method, we identified 213 tourism businesses that appeared to be in current operation within the Marine Park. For commercial fishers, based on licenses issued and information on fishing activity (DAFF, unpublished data, 2013), we estimate that there are around 611 commercial fishers that have at least one license to operate in the Great Barrier Reef Marine Park. Through an intense media campaign, resulting in 44 media stories across the catchment and through targeted mail-outs introducing operators to the project and inviting them to participate, we were able to survey 210 commercial fishers and 119 marine tourism operators, achieving a response rate of 76% each.

Survey demographics

National residents surveyed ranged in age from 14 to 64. The March/April sample was 50:50 male:female and the September survey was 48:52. Most respondents were residents of major cities, consistent with the Australian demographic.

Residents surveyed ranged in age from 15 to 91, and were 44 years of age on average (median 43). The sample was 50:50 male:female, and 78% were born in Australia. Household income was spread from low to high, and reflected population statistics for the region (ABS). These characteristics were compared to statistics for the GBR catchment population available from the Australian Bureau of Statistics, and found to be very similar. All data were post-stratified using the anesrake package in R, based to these variables compared to the known population, as well as the spread of the sample compared to population distribution across relevant Natural Resource Management (NRM) regions.

The sample of 119 tourism operators consisted of 46 Reef tour operations (including live-aboard and day trips visiting reefs and islands in the GBRMP), 28 charter fishing operations, 14 island

resort/accommodation operations, 7 water sports/equipment rental operations, 7 inshore cruise operations, 6 flight/helicopter operations, 6 general charter vessel operations and 5 bareboat charter operations. Respondents included 77 business owner-managers, 39 managers and three other senior staff who could speak on behalf of their company.

The sample of commercial fishers reflected an average age of 55, 93% male, 85% married or with a partner, 56% with high school education or less. 81% had operated in the GBR in the previous 12 months. Surveys included all fishing types, broadly grouped to Line, Trawl, Net, Pot and Harvest fisheries, and 60% accessed only one broad fishery type. Most (92%) respondents were owner-operators, and most (67%) operated one main vessel (and hence one licence).

Data Analysis

Broad level results are presented within each of the following categories: i) use ii) dependency, iii) well-being, and iv) socio-cultural context. We highlight that only a subset of data that we consider 'basic information' are presented here. Detailed results can be found in each of the technical reports within the SELTMP 2014 Technical Report Series that are associated with this report. They can be found on the NERP website and also on the eAtlas website: www.eatlas.org.au/seltmp

Results

i) Use

Coastal residents

Australians across the nation were familiar with the Great Barrier Reef. In the national survey, we found that the vast majority of Australians either want to visit the GBR in the future (48%), or have done so already (37%). Some 9% of Australians have visited the Reef in the last 12 months.

Local residents, living adjacent to the Great Barrier Reef, use the Reef considerably. Around 95% of local residents had visited the Reef in their lifetime, and 86% had visited the Reef in the previous 12 months with 68% venturing 'beyond' the beach (e.g. to a reef or island). Residents participated in a wide range of activities during their Reef visit, including exercising (on the beach), fishing, snorkelling, swimming & relaxing. Around 3% of residents owned a jetski, 5% owned a sailing vessel and 24% owned a motor boat.

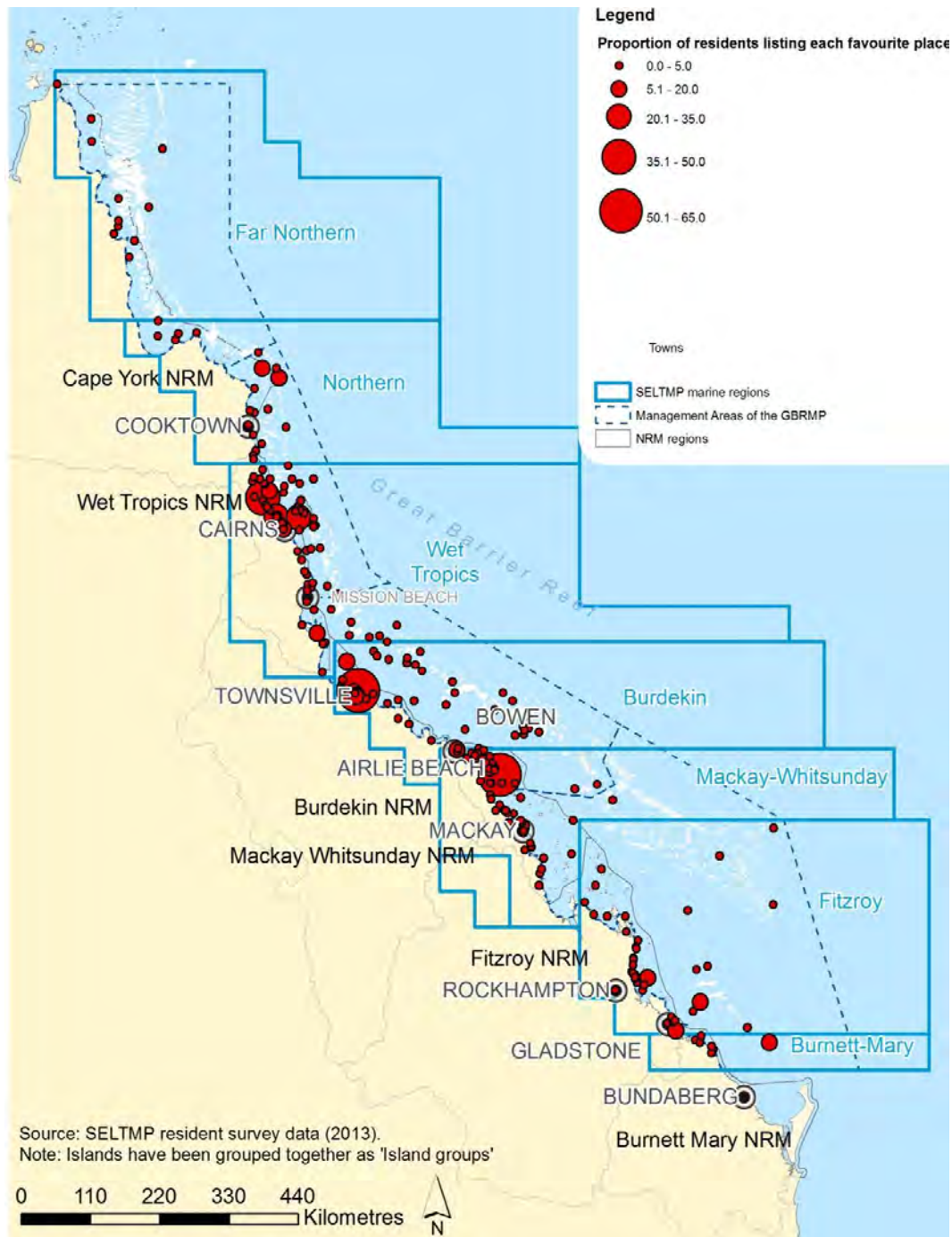


Figure 6: A map showing the responses to the survey question, “Thinking about the entire Great Barrier Reef area, please mark the location of your favourite place on the map below”.

Tourists

The Great Barrier Reef was an important influence on the decision of visitors to visit the area. Tourists came from 54 countries, with the highest proportion coming from within Australia (55%), followed by the UK (11%), Germany (8%) and France (6%). Some 84% of international tourists that were interviewed were visiting for the first time. We found that 70% of tourists (n=1825) had visited the Reef whilst in the area. Among these, 50% paid to go on an organized tour. Tourists participated in a wide range of activities, most of which were nature-oriented (including snorkelling, SCUBA diving, fishing, swimming, sailing, boating, wildlife watching, scenic flights, camping, water sports, eating Great Barrier Reef seafood, sightseeing

and photography), as well as relaxing and socialising (including partaking in weddings and/or honeymoons).

On average, visitors stayed in the area for 10 days (median). Tourists indicated the places that they had been to on their most recent trip to the Great Barrier Reef, and these are indicated in Figure 7.

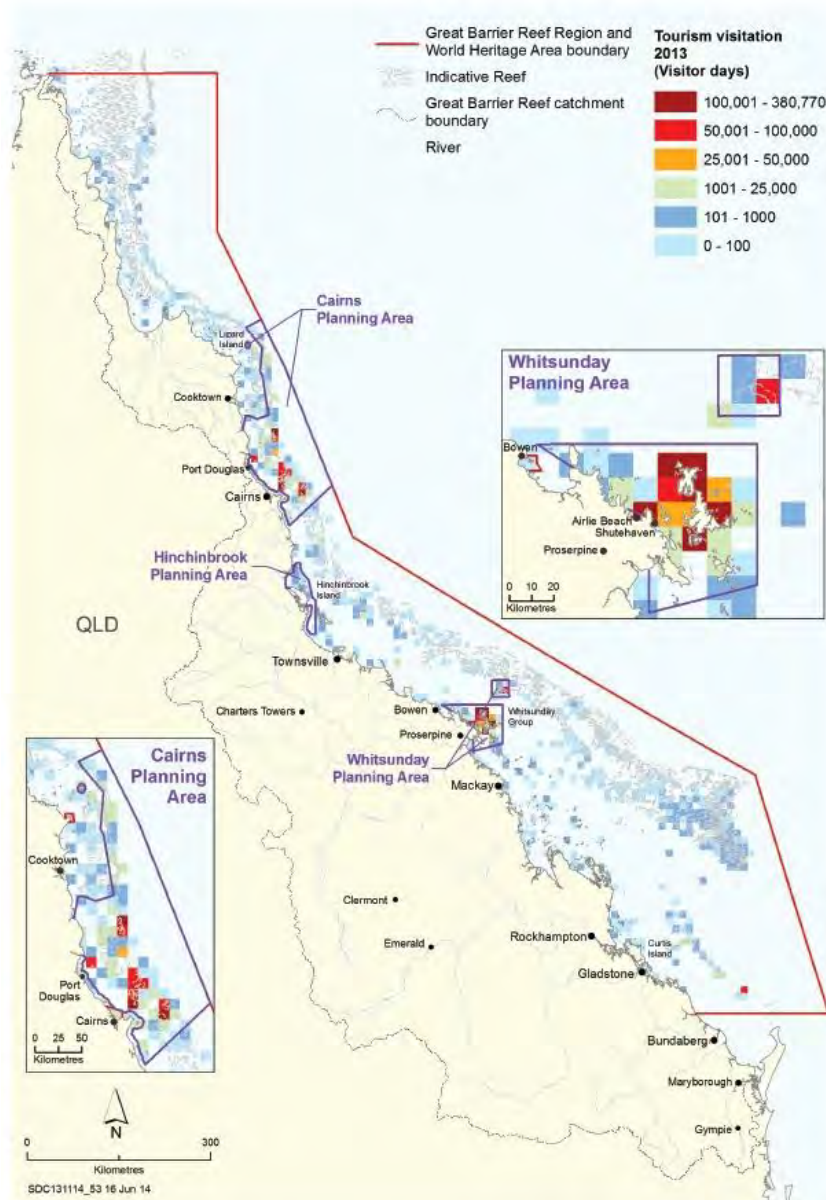


Figure 7: A map showing the locations of tourist activity (Reproduced from GBRMPA/2014) – Great Barrier Reef Outlook Report 2014. Great Barrier Reef Marine Park Authority.

Tourism and Commercial Fishing

Marine park tourism operators had operated in the Great Barrier Reef for a mean of 232 days in the previous 12 months (range 0-365 days). Commercial fishers operated on average for 118 days in the GBR in the previous year. Most commercial fishers used one home port, except for Net fishers (49%) and Trawl fishers (44%). Net and Pot fishers operated very close to their home port, while Trawlers roamed quite some distance away. Commercial fishers' first point of sale

locations was to local markets (mean 61% and median 90%) where an average of 81% of product (median 100%) was sold to wholesalers. Maps describing how tourism operators and commercial fishers use the Great Barrier Reef were sourced using existing datasets and can be accessed via the technical report series on eAtlas.

ii) Dependency

Residents

Coastal residents were financially and socially dependent on the Great Barrier Reef in many ways. We found that 25% of the coastal residents were dependent on the Reef for at least some of their household income. Residents were place and identity dependent within the region. For example, 77% of residents planned to reside in the catchment in five years' time, and 85% planned to stay in the Reef catchment even if cyclones and floods occurred more frequently. The average duration respondents had lived in the Reef catchment was 20.7 years. Some 39% of residents indicated that they lived in the catchment because of the Reef and 63% of residents indicated that "the Great Barrier Reef is part of my identity", where 28% strongly agreed with this statement (rating 9 or 10 on a ten point scale).

Tourism

Tourism operators were also place and identity dependent. Tourism operators had an average of 14 years' experience in the Reef tourism industry (range 1-44 yrs), where the average business age was 18 years (range 1-130 years). Tourism operations had an average of 22 employees (range: 1-400) and most operators (109 out of 119) stated that their company had insurance for its business assets. Some 76% of tourism operators indicated that they live in the catchment because of the Reef. 84% said that the Reef was part of their identity and 61% of respondents indicated that they "wouldn't want to be anything other than a tourism operator". 87% agreed that "the tourism industry is not just a job, it is my lifestyle". 84% indicated that they planned to still be a tourism operator in 5 years' time. Most (82%) indicated that they were likely to remain operating in the Reef and catchment even if events such as cyclones and floods occurred more frequently.

Commercial fishers

Commercial fishers were also place and identity dependent. Commercial fishers had lived in GBR region for 34 years (median 36, max 86 years), and had been fishing in the GBR for 23 years on average. Fishers had an average of 29 years overall fishing experience, and 44% had at least one family member involved in commercial fishing. Most (92%) were owner-operators and about half of the commercial fishers (48%) had no employees. Fishers received an average of 65% of their household income from fishing (median 80%); 41% were 100% dependent on fishing for their household income. Many fishers (71%) stated that the Great Barrier Reef was part of their identity, and 84% disagreed that there were better places than the Reef for fishing. Most (90%) agreed the fishing industry was a lifestyle and not just a job, and 82% still planned to be a commercial fisher in 5 years' time. We found that 97% of fishers planned to be a resident of the Region in the next 5 years, and 95% planned to remain within the Region even if extreme events occur more frequently. Secondary data collated by the SELTMP team revealed that the Gross Value of Production (GVP) for commercial fishing in the Great Barrier Reef was \$105M (excluding most harvest fisheries) (DAFF unpublished data, 2013, for 2012 calendar year). Deloitte Access Economics (DAE) calculated a GVP of \$122.9m in 2011-12, with a value added estimate of \$92.5m (DAE 2013).

iii) Well-being

Opportunities

The Great Barrier Reef is an important contribution to the level of wellbeing in the lives of people of the region. Residents mostly saw the Reef for the opportunities it provided. Around 80% of residents suggested that the Reef, “contributes to [their] quality of life and well-being. Some 95% stated that the GBR is a valuable asset for the economy of the region, and 93% valued the Reef because it supports a desirable and active way of life. Only 34% of people thought that there were many other places for the recreational activities they enjoyed. Tourists (89%) valued the GBR because it supports a desirable and active way of life and for 70% of tourists; the GBR was an important influence on their decision to visit the region. Some 92% of tourists stated that, “it meant a lot to me that I have been to the GBR”. Tourist operators (93%) also derived significant wellbeing from the GBR. Some 76% of operators lived in the region because of the GBR, 97% stating that the GBR is a valuable asset for the region. Similarly, 65% of fishers live in the region because of the GBR, 88% state that the GBR contributes to their quality of life and well-being, and 94% valued the GBR because it supports a desirable and active way of life. Some 95% of fishers acknowledge the GBR as a valuable asset for the economy of the region.

Empowerment

People felt positively empowered within the region. Residents (78%) support the rules and regulations that affect access and use of the GBR, only 22% believed that they did not have fair access compared to other user groups, and 78% stated that they would like to do more to help protect the GBR. Some 26% of residents agreed that they could not make a personal difference in improving the health of the GBR. Tourists also felt empowered about the GBR. Some 78% would like to do more to help protect the GBR. 59% encourage others to reduce their impacts on the GBR, 41% felt that they cannot make a personal difference in improving the health of the GBR and 46% felt that they had the necessary knowledge and skills to reduce any impact that they might have on the GBR. Only 18% of tourist operators felt that they did not have fair access compared to other users, and 69% supported the current rules and regulations however 55% suggested that industry rules and regulations create too great a burden on their time. Commercial fishers felt less empowered than tourism operators. Some 41% of fishers agreed that they did not have fair access to the GBR compared to other groups, and only 39% of fishers supported the current rules and regulations, with 71% saying that the industry rules and regulations create too great burden on their time. However 84% of fishers felt that they did have the knowledge and skills to reduce any impact that they may have, and 76% of fishers valued the Reef because we can learn about the environment through scientific discoveries.

Security

People felt a sense of security around the Great Barrier Reef, but less so around its management. For instance, 97% of local residents found the aesthetic beauty of the GBR to be outstanding. Some 95% were proud that the GBR is a WHA. Some 86% valued the GBR because it attracts people from all over the world. However only 61% of local residents felt confident that the GBR is well managed and only 62% felt optimistic about the future of the GBR. Tourists (96%) also found the aesthetic beauty of the GBR to be outstanding, and 38% of tourists stated that the GBR is part of their identity. Some 31% of tourists said that they would not be personally affected if the health of the GBR declined, suggesting that the vast majority of tourists would be. Tourists particularly felt a sense of security around the GBR supporting a variety of life such as fish and corals (97%), and 96% of tourists were overall satisfied with their experience of the GBR. Only 6% of Tourist operators said that they would not be personally affected if the health of the GBR declined, where 84% of operators agreed that the GBR was part of their identity. Tourism operators particularly valued the GBR because it attracts people from all over the world (94%), and because it supports a variety of life such as fish and coral (98%). Commercial fishers

also felt that they would be affected if the health of the GBR declined (94%), and 71% suggested that the GBR is part of their identity. Some 96% of commercial fishers valued the GBR because it supports a variety of life including fish and corals.

iv) Socio-cultural context

Perceptions of the Great Barrier Reef

When asked what words come to mind when thinking about the Great Barrier Reef different groups of respondents used similar words. Most respondents in the national survey (82%) used 'positive' words such as beautiful, diversity, fish, and corals (Figure 8). Local residents tourism operators and commercial fishers all used similar words, however fishers also used words about livelihood such as workplace and livelihood.



Figure 8: Responses of Australians to the survey question: please list the first words that come to mind when you think of the Great Barrier Reef.



Figure 9: Responses of commercial fishers to the first survey question: please list the first words that come to mind when you think of the Great Barrier Reef.

The Great Barrier Reef was also considered Australia’s most inspiring landmark by Australian respondents. Figure 10 suggests that when Australians are presented by a list of 12 iconic, well-known Australian landmarks such as the Sydney Opera House, the Australian Outback, Uluru, etc. and asked to list the top three most inspiring iconic places, 76% of Australians listed the Great Barrier Reef. Most Australians (93%) described the Great Barrier Reef as inspiring, and 46% believed it to be the most inspiring natural icon in Australia (the second highest was Uluru at 11%).

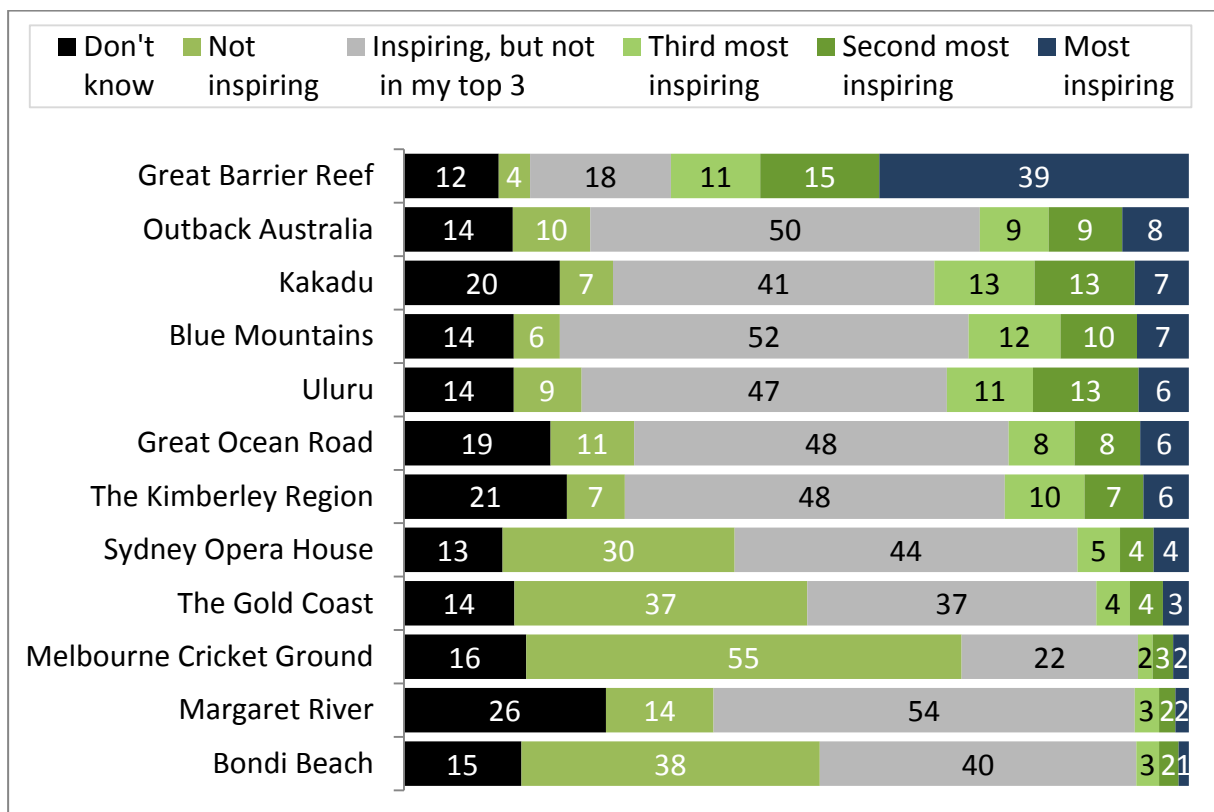


Figure 10: Responses of Australians to the survey question: Below is a list of places in Australia that people have said are inspiring. Please rank the following in terms of how inspiring they are to you (please note that the Great Barrier Reef term was randomly distributed through the list).

Residents

Many residents (63%) indicated that ‘the place they visited most recently in the Reef is in great condition’, and 32% strongly agreed with this statement (rating 9 or 10/10). Most coastal residents (73% and 81%) rated their overall satisfaction with their experience of their recent beach and beyond the beach trip to the Reef (respectively), as very high (i.e. rating of 8 or higher on a scale of 1 to 10; overall mean = 8.3 and 8.6, respectively). Some 66% of residents indicated that there are ‘not many other places better than the Great Barrier Reef for the recreation activities they enjoy’. Residents identified their ‘favourite place’ within the Reef catchment, and results are presented in Figure 6.

Tourists

Of the visitors surveyed, 80% rated their overall satisfaction with their experience of the Reef as very high (i.e. rating of 8 or higher on a scale of 1 to 10; overall mean = 8.5). Highest scores were given for sightseeing and photography (mean = 8.6/10), eating Great Barrier Reef seafood (8.5), wildlife watching (8.5), SCUBA diving (8.4), camping and hiking (8.3) and snorkelling (8.2). Backpackers represented one third of the sample of tourists who were interviewed (33%), who

also stayed in the area for a median of 15 days. The Reef was an important part of their decision to visit the area for 87% of backpackers. Backpackers rated their overall satisfaction with their experience of the Reef very highly (mean = 8.4/10), and 86% indicated that they would consider revisiting the Reef in future. For 74% of international visitors, visiting the Reef was an important part of their decision to visit the area. International visitors rated their overall satisfaction with their experience of the Great Barrier Reef very highly (mean = 8.4/ 10), and 85% indicated that they would consider revisiting the Reef Region in future. For 57% of domestic visitors, visiting the Reef was also an important part of their decision to visit to the area. Domestic visitors rated their overall satisfaction with their experience of the Reef very highly (mean = 8.5/ 10), and 96% indicated that they would consider revisiting the Reef Region in future.

Level of connection with the Great Barrier Reef

Respondents to the surveys indicated that they had a high level of connection with the Great Barrier Reef. For example, 94% of tourism operators indicated that they would be personally affected if the health of the Great Barrier Reef declined. Some 63% said they “regularly get involved in research and/or management activities for the Reef”. Additionally, 98% indicated that they “try to encourage other people to reduce their impacts on the Reef”.

We also found that 81% of commercial fishers indicated that they would be ‘personally affected if the health of the Reef declined’, and 54% strongly agreed with this statement. Some 78% would like to do more to help protect the Great Barrier Reef and 75% indicated that they believed they can make a personal difference in improving Reef health.

Pride in the GBR

All user groups were proud that the Great Barrier Reef was a World Heritage Area. We found that 84% of Australians, 95% of local residents, 92% of tourism operators, 93% of tourists and 68% of commercial fishers felt proud to have the Reef listed as a World Heritage Site. This may be because many Australians regard the Great Barrier Reef as part of their national identity. For example, we found that 64% of respondents to the national survey agreed that the Great Barrier Reef was part of their Australian identity. Similarly we found that 63% of coastal residents identified with the Great Barrier Reef, 84% of tourism operators and 71% of commercial fishers.

What people value about the Great Barrier Reef

Residents

The Great Barrier Reef was most valued for its beauty and biodiversity by local residents. Whilst economic values were important, other factors were more important. For example, the strongest values of the Reef among residents (based on ratings of agreement with a range of statements) were: (1) the Reef’s aesthetic beauty (i.e. “the aesthetic beauty of the GBR is outstanding”; mean rating = 9.1/10), (2) biodiversity values (“the GBR supports a variety of life, such as fish and corals”; 9.1), (3) the Reef’s World Heritage status (“I am proud that the Great Barrier Reef is a World Heritage Area”; 9.0) (4) the economic values of the Reef (“The Great Barrier Reef is a great asset for the economy of this region”; 8.9), (4) the Great Barrier Reef’s scientific and educational values (“I value the Great Barrier Reef because we can learn about the environment through scientific discoveries”; 8.5), and (5) lifestyle values (“I value the Great Barrier Reef because it supports a desirable and active way of life”; 8.5) (Figure 11).

Tourists

The strongest values of the Great Barrier Reef among tourists (based on ratings of agreement with a range of statements) were: (1) biodiversity values (i.e. “the Great Barrier Reef supports a

variety of life, such as fish and corals”; mean rating = 9.0/10), (2) the Great Barrier Reef ‘s aesthetic beauty (“the aesthetic beauty of the Great Barrier Reef is outstanding”; 9.0), (3) the Great Barrier Reef ‘s World Heritage status (“I feel proud that the Great Barrier Reef is a World Heritage Area”; 8.8), (4) the Great Barrier Reef ‘s scientific and educational values (“I value the Great Barrier Reef because we can learn about the environment through scientific discoveries”; 8.3), and (5) lifestyle values (“I value the Great Barrier Reef because it supports a desirable and active way of life”; 8.0) (Figure 11).

Tourism operators

Tourism operators valued the Great Barrier Reef for its biodiversity values (“I value the Great Barrier Reef because it supports a variety of life such as fish and corals”; 98% agree), economic value (“The Great Barrier Reef is a valuable asset for the economy of this region”; 97% agree), scientific/knowledge values (“I value the Great Barrier Reef because we can learn about the environment through scientific discoveries”; 94% agree), international appeal (“I value the Great Barrier Reef because it attracts people from all over the world”; 94% agree), and lifestyle values (“The GBR contributes to my quality of life and wellbeing”; 93% agree, and “I value the Great Barrier Reef because it supports a desirable and active way of life”; 92% agree) (Figure 11).

Commercial fishers

Commercial fishers mostly valued the biodiversity associated with the Great Barrier Reef - an average score of 9.0 was found (where 1 is strongly disagree and 10 is strongly agree) in response to “it supports a variety of life such as fish, corals” and “it is a valuable asset for the economy of this region”. Most fishers (94%) agreed that the aesthetic beauty of the GBR is outstanding (average score of 9.0 / 10) (Figure 11).

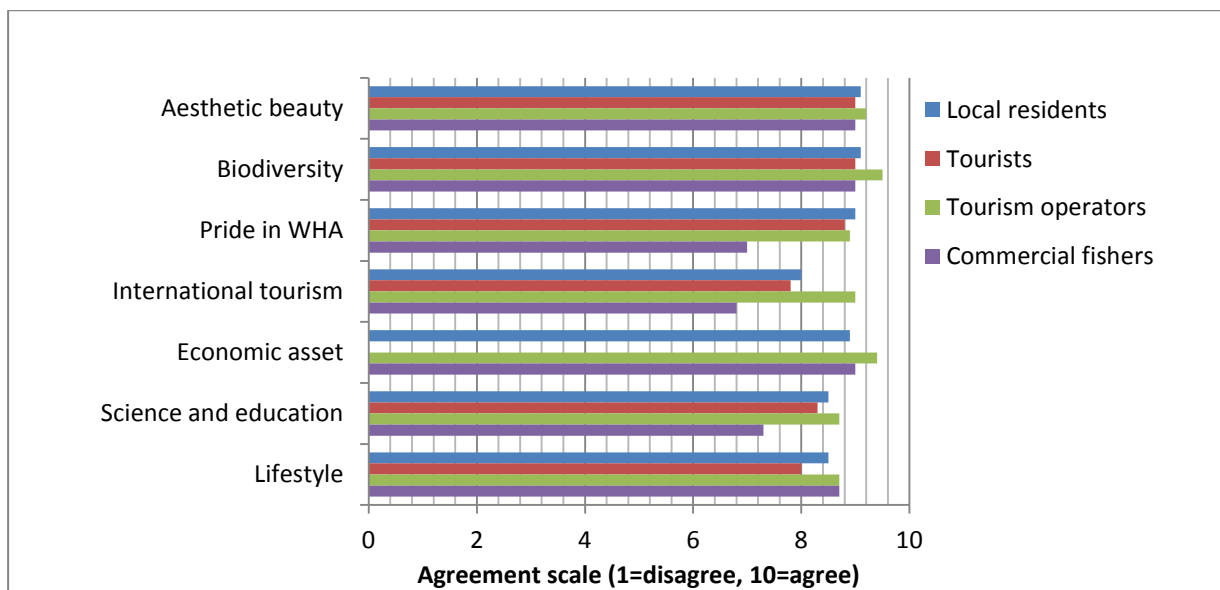


Figure 11: Level of agreement with statements relating to how respondents value the Reef.

Stewardship

Survey respondents felt a responsibility to protect the Great Barrier Reef. We found that 81% of national survey respondents agreed that it was the responsibility of all Australians to protect the Reef and 63% believed it was their responsibility to protect the Reef. Similarly 95% of coastal

residents, 86% of tourism operators and 86% of commercial fishers felt that it was the responsibility of all Australians, and 87% of coastal residents, 97% of tourism operators and 90% of commercial fishers felt it was their responsibility to protect the Reef.

Some 87% of tourism operators indicated that they “would like to do more to help protect the Great Barrier Reef”. 85% of tourism operators believed that they can make a personal difference in improving Reef health. 90% indicated that they “have the knowledge and skills to reduce any impact that [their] business might have on the Reef”. 14% “do not have the time and opportunity to reduce any impact that my business might have on the Reef”. 76% indicated that it is not “too expensive for me to reduce any impact I might have on the Reef” (Figure 12).

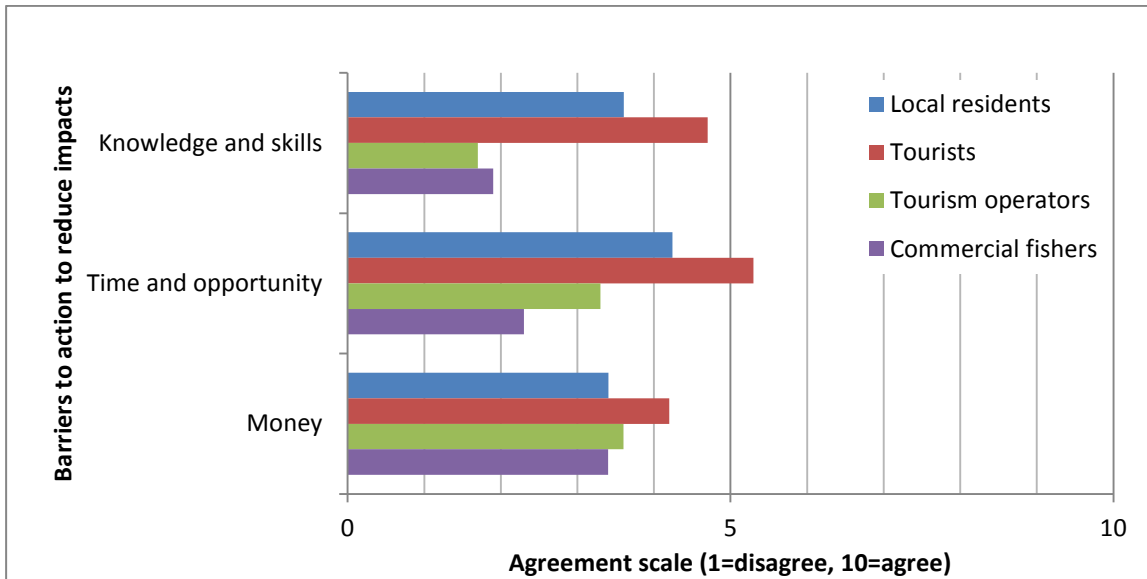


Figure 12: Level of agreement that barriers such as knowledge and skills, time and opportunity, and expense, reduce the ability of respondents to reduce their impacts on the GBR.

Trust in information about the GBR

Residents

Residents most trusted source of information about the Reef ranged across research institutions (mean rating = 7.8 out of ten; where 10 = high trust), friends, family and colleagues (6.3), Non-Government Organisations (6.2), and government managers (5.8). There was low trust for industry groups (5.5), media (i.e. radio, newspapers, TV) (4.2), and social media (e.g. Facebook, Twitter) (3.8).

Tourists

Tourists placed the most trust regarding information about the Great Barrier Reef, from friends, family and colleagues (mean rating = 6.7 out of ten), tourist information centres (6.7), clubs, societies and other interest groups (6.1), tourism operators (5.8), media (i.e. radio, newspapers, TV) (5.6), with low trust for, travel agents (5.4), and social media (e.g. Facebook, Twitter) (4.8).

Tourism operators

Tourism operators indicated their level of trust in the following groups for information about the Great Barrier Reef; research institutions (e.g. CSIRO, universities) (7.6), Great Barrier Reef Marine Park Authority (7.1), other tourism operators (6.4), industry groups/representative bodies (e.g. AMPTO, WCBIA, Dive QLD) (6.2), Non-Government Organisations and other community groups (e.g. Natural Resource Management organisations) (5.7), friends, family and work colleagues

(5.9). Social media (e.g. Facebook, Twitter) (18%), and media (e.g. radio, newspapers, TV); (13%) received low scores for trust.

Commercial fishers

Commercial fishers had the greatest amount of trust in other commercial fishers (6.6), followed by friends, family and colleagues (6.0) and research institutions (5.6). The remaining sources received low scores for trust, including Industry groups and representatives (5.2), Fisheries Queensland (4.5), GBRMPA (3.9), Non-Government Organisations (3.6), the media (2.3) and social media (1.9)

Perceptions of management

A large proportion of national survey respondents are not confident that the Reef is well managed and do not feel optimistic about the future of the Reef. Some 76% of respondents to the national survey were concerned about the impacts of climate change on the Reef; only 54% were optimistic about the Reef's future; 54% would be personally affected if Reef health declined, and only 52% were confident that the Reef is well managed.

In contrast, 61% of the residents surveyed indicated that they felt confident the Reef is well managed, and 62% feel optimistic about the future of the Reef. Most (78%) supported the current rules and regulations that affect access and use of the Reef, and 78% indicated that they believe they have 'fair access to the Reef compared to other user groups'.

Similar to residents, 65% of tourism operators indicated that they feel confident that the Reef is well managed and 62% are optimistic about its future. Most (69%) said they "support the current rules and regulations that affect access and use of the Reef", and only 18% felt that they did not have fair access to the Reef compared to other user groups. A light majority (55%) indicated that "industry rules and regulations create too great a burden on [their] time".

Less than half (46%) of the commercial fishers are confident the Reef is well managed, although 75% are optimistic about the future of the Reef (note only 46% are optimistic about the future of their business). Less than half (39%) support the current rules and regulations, and 71% agree the "industry rules and regulations create too great a burden on [their] time". Most (59%) do believe they have fair access compared to others.

Discussion

Results from the 2013 baseline for local coastal residents, Australians, tourists, tourism operators and commercial fishers reveal the strong relationships between these user-groups and the Reef, as well as considerable heterogeneity in values, perceptions, attitudes, knowledge, behaviours and well-being. Data will eventually be included from all groups including Traditional Owners, Coastal industries (agriculture) and ports and shipping. Meanwhile results can be used to provide Reef managers with contextual information about the environment within which the Reef is embedded and management decisions are made. This information can be used to improve the assessment of the likely outcomes associated with specific management strategies and tools. We envisage that the results from the 2013 baseline will be most useful in testing management and future scenarios within the Great Barrier Reef region. We discuss five points from the data for this report.

Firstly, we highlight that there are no clear indications about the priorities for management of the Great Barrier Reef. A significant proportion of each stakeholder group felt strongly aligned with the biodiversity values of the Great Barrier Reef and also highly valued the economic aspects of the Reef. These results suggest a level of internal conflict occurring within user groups and probably within individuals and at other levels (e.g. regional level, national level, global level). Ecological values were, however, rated higher than economic values. These results suggest that there is support for Reef managers to more strongly promote protection and conservation of the Reef but such an interpretation would require strong leadership. Given the high value placed on biodiversity above all other values, the general low confidence in current management, and the strong level of connection between all respondents and the Reef on very many aspects (pride, identity, stewardship, perceptions), we suggest that longer term initiatives for sustainability through unambiguous and transparent management, and promoting wise use for current and future generations are likely to be publically supported.

Secondly, we highlight that knowledge of how people use, depend on and perceive the Great Barrier Reef is important for a range of management decisions, yet such knowledge is so sparingly documented. Spatial and temporal patterns such as where people go, when and how often, key ports and boat ramps, distances travelled, highly valued places, the proximity of Reef areas to people's homes and businesses are important for spatial and temporal planning and identifying conservation options with lesser/least social impact. Indicators of dependency (such as attachment to place, length of residency in a particular region and other data such as strength of local networks), levels of visitor satisfaction (associated with Reef experiences at specific Reef locations), levels of understanding and appreciation (of the natural, social, cultural and economic dimensions of the GBRWHA and specific locations within it) held by Reef users and other stakeholders are critically important for spatial planning, and for understanding the extent to which spatial closures may affect people's sense of place. Our results also highlight the very many ways in which people in the Great Barrier Region are dependent on the Reef. For example, identity-based factors such as occupational attachment or "activity attachment" (e.g. to spear fishing or boating) were high in commercial fishing, marine-based tourism and recreation. People can become especially dependent on a resource because of their level of attachment to their resource-based occupation or activity. People can be affected by their activities in such a way that their activity-based relationships, interests and values permeate their non-working lives [28; 63]. An attachment to an activity is usually developed and reinforced by interacting with others within the profession or activity both during working hours and outside of working hours [63; 64; 65]. The more firmly attached a person becomes to his/her occupation or activity, the more traumatic and disorienting a change in occupation or activity is likely to be [44]. Identity-based factors are important for understanding the likely success of buy-back schemes, and the impacts of closing down sectors, of introducing regulations, for designing social incentives, as well as for understanding likely impacts associated with extreme events, and people's capacity to work elsewhere.

Thirdly, we highlight the high level of financial dependency on the Great Barrier Reef aside from those with direct commercial interest (such as fishers or tourism operators). Clearly, providing people with the continued ability to earn an income from the Great Barrier Reef will be important for their social and economic well-being. Our results show that 25% of coastal residents in the region are dependent to some extent on the Reef for at least part of their income. This knowledge is particularly important for designing incentives, compensation packages and buy-back schemes. We were also able to elicit other information about the nature of financial dependency into the future. Information about the extent to which business people are lifestyle-oriented, the approach that people take in their business, whether they have insurance, how they access markets, whether they understand consumer choices, have access finance, the extent to which they have a financial buffer, and use technology (data that are collected by the SELTMP but not presented here) are all important related pieces of information to describe the level of financial dependency on the Great Barrier Reef. They are important for understanding the extent that businesses will see opportunity in change, have the capacity to respond and the extent to which people are likely to resist conservation strategies. For example, within the commercial fishing industry we found that 69% of fishers had prepared themselves for a financial crisis. Understanding how people (and whether people can) access finance is important since it can significantly influence the extent to which people can effectively respond to, and absorb the costs of, change [66; 67]. People with a lower ability to access finance often lack the flexibility to absorb the costs of change and are often reluctant to take on further risks. Having access to credit, especially during times of crises, can significantly increase adaptive capacity [45; 68]. Similarly, the size of a resource-dependent enterprise can influence their level of dependency on the resource in complex ways. Business size is a potential indicator of the business skills that people possess, of their competitive advantage within the resource industry and their level of transferable skills outside of the resource industry [68; 69]. Larger businesses can buffer themselves from unpredictable problems such as mechanical breakdowns and fluctuations in the weather. They can take bigger risks and experiment with their options for the future. In addition, owners of larger companies are more likely to have the ability to motivate, plan, organize and act and are more likely to be driven by economic incentives to harvest the resource. Lifestyle operators on the other hand are less likely to be competitive in a business-sense. On the other hand, larger businesses have invested more in their industry and stand to lose more in the event of a crisis. Recent research on the impacts of a very large cyclone in the region (Tropical Cyclone Yasi) highlighted that larger businesses were more severely impacted [44].

Fourthly, our results pertaining to the wellbeing of local people in terms of the benefits that they derive from the Great Barrier Reef are frontier at a global level and need to be fully developed to establish a new international benchmark in this area. Whilst the topic of human well-being of residents of coastal communities adjacent to the Reef has received attention previously (e.g. Silva 2010), the extent that well-being is related to or dependent upon the environmental goods and services provided by the Reef is still largely unexplored. We grant that there is ample acknowledgment that the Great Barrier Reef has a value that goes beyond any market or economic values [70; 71]. Some studies have addressed selective facets of such values, such as the opportunities for recreation and tourism experiences [72; 73]. There is also a growing movement linked to promoting the notion of 'Healthy Parks, Healthy People' that is exploring the many ways in which nature and parks significantly contribute to our health and wellbeing [73; 74; 75]. The enhancement of health and human well-being is becoming established as an important pillar of effective coral reef governance [50]. Our results present a baseline from which more meaningful insights will be gained as longitudinal data are collected. Meanwhile, results can contribute to assist the Australian Government and management agencies to meet their obligations to the World Heritage Convention that the GBRWHA is providing a 'function in the life of the community'. World Heritage Convention obliges State Parties to the convention to identify, protect, conserve, rehabilitate, present and transmit to future generations the natural

and cultural heritage of the World Heritage properties within its territory (Article 4). The convention also obliges State Parties to ‘adopt general policies which [aim] to give the cultural and natural heritage a function in the life of the community and to integrate the protection of that heritage into comprehensive planning programs’ (Article 5 (a)).

Fifthly, there is much that can be gained from a better understanding the context within which management decisions are made. Like census data, contextual knowledge of the human dimension of natural resource systems is fundamental to responsible governance. Most simply, the provision of contextual information enables managers to maintain a strategic “keeping a finger on the pulse” approach. Contextual indicators include attitudes, values, perceptions, experiences, knowledge, support for management, the extent to which people (at local, regional, national and international levels) are aware of the Great Barrier Reef; appreciate its natural, historic and cultural values; and understand issues relating to it, local knowledge of Reef Region by resource-users, environmental awareness of ‘social norms’, compliance rates, subscription to voluntary schemes, stewardship program membership, adoption of best practices, and effectiveness of community engagement programs. However, there is a strong push within natural resource management funding contexts to invest in research that can directly influence a decision or policy. Contextual datasets are often dismissed as too difficult to incorporate into decision-making processes. Indeed, the provision of data that contributes to contextual knowledge suggests that attributing singular policy or decision-making outcomes to social science input becomes challenging. Yet, the results from the 2013 baseline have already contributed substantially to GBR management appraisals (e.g. the 2014 Outlook and Strategic Assessment Reports), and we anticipate they will become even more useful in testing management and future scenarios within the Great Barrier Reef region. A growing focus on people and their relationship with the resource condition will increase the need for contextual social and economic data in future.

Finally, this report is intended as an update for Reef managers, decision-makers, academics, and industry and community leaders. The strategy to use a bottom-up and top-down approach enabled us to maximise relevance to end-users and is likely to be replicated given future funding opportunities. Science credibility is important for Reef managers [76; 77; 78], and engagement with end users is important for relevance [79; 80]. We now have a complete baseline data for several of the large user groups of the Great Barrier Reef for inclusion in Great Barrier Reef management. We see that the richness of the SELTMP reporting framework will grow through time as other users and industries are incorporated (e.g. Traditional Owners, shipping, mining) and longitudinal trends and relationships are identified. Readers interested in viewing the baseline data can visit the NERP web page (www.nerp.gov.au/seltmp) or eAtlas site (seltmp.eatlas.org.au) where data representing each user group can be seen in the series of technical reports representing “SELTMP 2014” and where the database is made publically available.

References

- [1] W.N. Adger, K. Brown, and D. Conway, Progress in global environmental change. *Global Environmental Change* 20 (2010) 547-549.
- [2] N.A. Marshall, P.A. Marshall, J. Tanelander, D. Obura, D. Mallaret King, and J. Cinner, M. , *Sustaining Tropical Coastal Communities & Industries: A Framework for Social Adaptation to Climate Change*, Gland, Switzerland, 2010.
- [3] D.R. Bellwood, T.P. Hughes, C. Folke , and M. Nystrom, Confronting the Coral Reef Crisis. *Nature* 429 (2004) 827-833.
- [4] N.C. Ban, M. Mills, J. Tam, C.C. Hicks, S. Klain, N. Stoeckl, M.C. Bottrill, J. Levine, R.L. Pressey, T. Satterfield, and K.M.A. Chan, A social-ecological approach to conservation planning: embedding social considerations. *Frontiers in Ecology and the Environment* 11 (2013) 194-202.
- [5] S.L. Collins, S.R. Carpenter, S.M. Swinton, D.E. Orenstein, D.L. Childers, T.L. Gragson, N.B. Grimm, M. Grove, S.L. Harlan, J.P. Kaye, A.K. Knapp, G.P. Kofinas, J.J. Magnuson, W.H. McDowell, J.M. Melack, L.A. Ogden, G.P. Robertson, M.D. Smith, and A.C. Whitmer, An integrated conceptual framework for long-term social-ecological research. *Frontiers in Ecology and the Environment* 9 (2011) 351-357.
- [6] S. Levin, S. Barrett, S. Aniyar, W. Baumol, C. Bliss, B. Bolin, P. Dasgupta, P.R. Ehrich, C. Folke, I. Gren, C.S. Holling, A. Jansson, B. Jansson, K. Maler, D. Martin, C. Perrings, and E. Sheshinski, Resilience in Natural and Socioeconomic Systems. *Environment and Development Economics* 3 (1998) 222-235.
- [7] I.J. Davidson-Hunt, and F. Berkes, Nature and Society Through the Lens of Resilience: Toward a Human-in-Ecosystem Perspective. in: F. Berkes, J. Colding, and C. Folke, (Eds.), *Navigating Social-Ecological Systems. Building Resilience for Complexity and Change*, Cambridge University Press, Cambridge, 2004, pp. 53-81.
- [8] I. Scoones, New Ecology and the Social Sciences: What Prospects for a Fruitful Engagement? *Annual Review of Anthropology* 28 (1999) 479-507.
- [9] E. Ostrom, J. Burger, C.B. Field, R.B. Norgaard, and D. Policansky, Revisiting the Commons: Local Lessons, Global Challenges. *Science* 284 (1999) 278-282.
- [10] M.B. Lane, and G.T. McDonald, Crisis, Change and Institutions in Forest Management. *Journal of Rural Studies* 18 (2002) 245-256.
- [11] C.S. Holling, and G.K. Meffe, Command and Control and the Pathology of Natural Resource Management. *Conservation Biology* 10 (1996) 328-337.
- [12] J.F. Caddy, Fisheries Management in the Twenty-First Century: Will New Paradigms Apply? *Reviews in Fish Biology and Fisheries* 9 (1999) 1-43.
- [13] G.E. Machlis, and J.E. Force, Community Stability and Timber-Dependent Communities. *Rural Sociology* 53 (1988) 220-234.
- [14] R.C. Stedman, Sense of Place as an Indicator of Community Sustainability. *The Forestry Chronicle* 75 (1999) 765-770.
- [15] J.D. Wingard, Community Transferable Quotas: Internalizing Externalities and Minimizing Social Impacts of Fisheries Management. *Human Organization* 59 (2000) 48-57.
- [16] N. Marshall, P. Marshall, and A. Abdulla, Using social resilience and resource dependency to increase the effectiveness of marine conservation initiatives in Salum, Egypt. *Journal of Environmental Planning and Management* 52 (2009) 901-918.
- [17] J. Clifton, and C. Majors, Culture, Conservation, and Conflict: Perspectives on Marine Protection Among the Bajau of Southeast Asia. *Society & Natural Resources* 25 (2012) 716-725.
- [18] C. Sneddon, L. Harris, R. Dimitrov, and U. Ozesmi, Contested Waters: Conflict, Scale, and Sustainability in Aquatic Socioecological Systems. *Society and Natural Resources* 15 (2002) 663-675.
- [19] P. LeBillon, The Political Ecology of War: Natural Resources and Armed Conflicts. *Political Geography* 20 (2001) 561-584.

- [20] P.R. Lachapelle, S.F. McCool, and M.E. Patterson, Barriers to Effective Natural Resource Planning in a "Messy" World. *Society and Natural Resources* 16 (2003) 473-490.
- [21] Y. Jabareen, A Knowledge Map for Describing Variegated and Conflict Domains of Sustainable Development. *Journal of Environmental Planning and Management* 47 (2004) 623-642.
- [22] J.R. Maiolo, J. Johnson, and D. Griffith, Applications of Social Science Theory to Fisheries Management: Three Examples. *Society and Natural Resources* 5 (1992) 391-407.
- [23] K. Hampshire, S. Bell, and G. Wallace, "Real" Poachers and Predators: Shades of Meaning in Local Understanding of Threats to Fisheries. *Society and Natural Resources* 17 (2004) 305-318.
- [24] E. Roe, Why Ecosystem Management Can't Work Without Social Science: An Example from the California Northern Spotted Owl Controversy. *Environmental Management* 20 (1996) 667-674.
- [25] J.G. Sutinen, and K. Kuperan, A Socio-Economic Theory of Regulatory Compliance. *International Journal of Social Economics* 26 (1999) 174-193.
- [26] P.J. May, Compliance Motivations: Affirmative and Negative Bases. *Law and Society Review* 38 (2004) 41-45.
- [27] J.G. Sutinen, Blue Water Crime: Deterrence, Legitimacy, and Compliance in Fisheries. *Law and Society Review* 32 (1998) 309-313.
- [28] N.A. Marshall, D.M. Fenton, P.A. Marshall, and S.G. Sutton, How resource dependency can influence social resilience within a primary resource industry. *Rural Sociology* 72 (2007) 359-390.
- [29] M.E.A. (MA), Ecosystems and human well-being: a framework for assessment. A report of the Conceptual Framework Working Group of the Millennium Ecosystem Assessment. , Island Press, Washington, D.C., USA., 2003.
- [30] K. Brown, W.N. Adger, E. Tompkins, P. Bacon, D. Shim, and K. Young, Trade-off analysis for marine protected area management. *Ecological Economics* 37 (2001) 417-434.
- [31] N.H. Tri, W.N. Adger, and P.M. Kelly, Natural resource management in mitigating climate impacts: the example of mangrove restoration in Vietnam. *Global Environmental Change-Human and Policy Dimensions* 8 (1998) 49-61.
- [32] H.S. Koren, and C.D. Butler, The interconnection between the built environment ecology and health. *Environmental Security and Environmental Management: The Role of Risk Assessment* 5 (2006) 111-125.
- [33] B.S. Halpern, C.J. Klein, C.J. Brown, M. Beger, H.S. Grantham, S. Mangubhai, M. Ruckelshaus, V.J. Tulloch, M. Watts, C. White, and H.P. Possingham, Achieving the triple bottom line in the face of inherent trade-offs among social equity, economic return, and conservation. *Proceedings of the National Academy of Sciences of the United States of America* 110 (2013) 6229-6234.
- [34] T.R. McClanahan, M.J. Marnane, J.E. Cinner, and W.E. Kiene, A comparison of marine protected areas and alternative approaches to coral-reef management. *Current Biology* 16 (2006) 1408-1413.
- [35] H.S. Grantham, M. Bode, E. McDonald-Madden, E.T. Game, A.T. Knight, and H.P. Possingham, Effective conservation planning requires learning and adaptation. *Frontiers in Ecology and the Environment* 8 (2010) 431-437.
- [36] J.D. Rothlisberger, D.M. Lodge, R.M. Cooke, and D.C. Finnoff, Future declines of the binational Laurentian Great Lakes fisheries: the importance of environmental and cultural change. *Frontiers in Ecology and the Environment* 8 (2010) 239-244.
- [37] M.H. Friedel, A.C. Grice, N.A. Marshall, and R.D. van Klinken, Reducing contention amongst organisations dealing with commercially valuable but invasive plants: The case of buffel grass. *Environmental Science & Policy* 14 (2011) 1205-1218.
- [38] B.J. Downes, F. Miller, J. Barnett, A. Glaister, and H. Ellemor, How do we know about resilience? An analysis of empirical research on resilience, and implications for interdisciplinary praxis. *Environmental Research Letters* 8 (2013).

- [39] GBRMPA, Great Barrier Reef outlook report 2009, Great Barrier Reef Marine Park Authority., Townsville, Australia., 2009.
- [40] G. De'ath, K.E. Fabricius, H. Sweatman, and M. Puotinen, The 27-year decline of coral cover on the Great Barrier Reef and its causes. *Proceedings of the National Academy of Sciences of the United States of America* 109 (2012) 17995-17999.
- [41] A. Great Barrier Reef Marine Park, Great Barrier Reef Outlook Report 2014, Great Barrier Reef Marine Park Authority, Townsville, 2014.
- [42] M. Schomaker, Development of environmental indicators in UNEP, Paper Presented at the Land Quality Indicators and their Use in Sustainable Agriculture and Rural Development, January 25–26 1996, FAO, Rome, 1997, pp. 35-36.
- [43] M.E. Assessment, *Ecosystems and Human Well-Being: Synthesis.*, Island Press, Washington D.C., 2005.
- [44] N. Marshall, R. Tobin, P. Marshall, M. Gooch, and A. Hobday, Social Vulnerability of Marine Resource Users to Extreme Weather Events. *Ecosystems* 16 (2013) 797-809.
- [45] N.A. Marshall, P.A. Marshall, A. Abdulla, and T. Roupheal, The Links Between Resource Dependency and Attitude of Commercial Fishers to Coral Reef Conservation in the Red Sea. *Ambio* 39 (2010) 305-313.
- [46] S. Larson, D.M. De Freitas, and C.C. Hicks, Sense of place as a determinant of people's attitudes towards the environment: Implications for natural resources management and planning in the Great Barrier Reef, Australia. *Journal of Environmental Management* 117 (2013) 226-234.
- [47] H. Adams, and W.N. Adger, The contribution of ecosystem services to place utility as a determinant of migration decision-making. *Environmental Research Letters* 8 (2013).
- [48] S. Jackson, N. Stoeckl, A. Straton, and O. Stanley, The changing value of Australian tropical rivers. *Geographical Research* 46 (2008) 275-290.
- [49] WBAA, A Methodology for Assessing and Accounting for Water Benefits in the Water for a Healthy Country National Research Flagship. A paper prepared for the WfHC Management Committee meeting, Canberra 24-26 June 2004 (2004).
- [50] L.M. Scherl, and L. Emerton, Protected Areas and Poverty Reduction. in: S.o.t.C.o.B. Diversity, (Ed.), *Protected Areas in Today's World: Their Values and Benefits for the Welfare of the Planet*, Montreal, 2008, pp. 4-17.
- [51] E. Pereira, C. Queiroz, H.M. Pereira, and L. Vicente, Ecosystem services and human well-being: a participatory study in a mountain community in Portugal. *Ecology and Society* 10 (2005).
- [52] M. Berbes-Blazquez, A Participatory Assessment of Ecosystem Services and Human Wellbeing in Rural Costa Rica Using Photo-Voice. *Environmental Management* 49 (2012) 862-875.
- [53] S. Hajkowicz, H. Cook, and A. Littleboy, *Our Future World*, CSIRO, Canberra, 2012.
- [54] E. Bohensky, J.R.A. Butler, R. Costanza, I. Bohnet, A. Delisle, K. Fabricius, M. Gooch, I. Kubiszewski, G. Lukacs, P. Pert, and E. Wolanski, Future makers or future takers? A scenario analysis of climate change and the Great Barrier Reef. *Global Environmental Change-Human and Policy Dimensions* 21 (2011) 876-893.
- [55] G. Moscardo, Exploring public awareness of threats to the Great Barrier Reef environment. *Interdisciplinary Environmental Review* X (2008) 45-64.
- [56] C.J. Van Riper, G.T. Kyle, S.G. Sutton, J.L. Yoon, and R.C. Tobin, Australian residents' attitudes toward pro-environmental behaviour and climate change impacts on the Great Barrier Reef. *Journal of Environmental Planning and Management* 56 (2013) 494-511.
- [57] J. Young, and R. Mar, Community perceptions of climate change and the effects on the Great Barrier Reef, Colmar Brunton, 2010, pp. 165.
- [58] N.A. Marshall, Understanding social resilience to climate variability in primary enterprises and industries. *Global Environmental Change-Human and Policy Dimensions* 20 (2010) 36-43.
- [59] P.B. Horton, and C.L. Hunt, *Sociology. Sixth Edition*, McGraw-Hill Book Company, New York, 1984.

- [60] J.C. Nunnally, *Psychometric Theory* (2nd ed.), McGraw-Hill, New York, 1978.
- [61] N.A. Marshall, *A Conceptual and Operational Understanding of Social Resilience in a Primary Resource Industry*, School of Tropical Studies and Geography, James Cook University, Townsville, Australia, 2006.
- [62] A. Bryman, *Social Research Methods*, Oxford University Press, Oxford, 2012.
- [63] J. Tunstall, *The fishermen: the sociology of an extreme occupation*, MacGibbon and Kee, London, 1969.
- [64] M. Minnegal, T.F. King, R. Just, and P.D. Dwyer, Deep identity, shallow time: sustaining a future in Victorian fishing communities. *The Australian Journal of Anthropology* 14 (2004) 53-71.
- [65] K. Brookfield, T. Gray, and J. Hatchard, The concept of fisheries-dependent communities. A comparative analysis of four UK case studies: Shetland, Peterhead, North Shields and Lowestoft. *Fisheries* 72 (2005) 55-79.
- [66] J. Cinner, M., T.M. Daw, and T. McClanahan, Socioeconomic factors that affect artisanal fishers' readiness to exit a declining fishery. *Conservation Biology* 23 (2009) 124-130.
- [67] J. Cinner, M.M.P.B. Fuentes, and H. Randriamahazo, Exploring Social Resilience in Madagascar's Marine Protected Areas. *Ecology and Society* 14 (2009).
- [68] N.A. Marshall, and P.A. Marshall, Conceptualizing and operationalizing social resilience within commercial fisheries in northern Australia. *Ecology and Society* 12 (2007).
- [69] N.A. Marshall, I. Bastawisi, and P.A. Marshall, Toward Marine Protected Area Success: The Human Dimensions of a Prospective MPA in Salum, Egypt. . in: S.E. CSIRO, (Ed.), IUCN, Townsville, 2007, pp. 1-81
- [70] N. Stoeckl, C.C. Hicks, M. Mills, K. Fabricius, M. Esparon, F. Kroon, K. Kaur, and R. Costanza, The economic value of ecosystem services in the Great Barrier Reef: our state of knowledge. *Ecological Economics Reviews* 1219 (2011) 113-133.
- [71] P. Prayaga, J. Rolfe, and N. Stoeckl, The value of recreational fishing in the Great Barrier Reef, Australia: A pooled revealed preference and contingent behaviour model. *Marine Policy* 34 (2010) 244-251.
- [72] N. Stoeckl, R. Greiner, and C. Mayocchi, The community impacts of different types of visitors: an empirical investigation of tourism in North-west Queensland. *Tourism Management* 27 (2006) 97-112.
- [73] R.S. Koss, and J. Kingsley, Volunteer health and emotional wellbeing in marine protected areas. *Ocean & Coastal Management* 53 (2010) 447-453.
- [74] C. Maller, M. Townsend, A. Pryor, P. Brown, and L. St Leger, Healthy nature healthy people: 'contact with nature' as an upstream health promotion intervention for populations. *Health Promotion International* 21 (2006) 45-54.
- [75] N.J. Bennett, and R.H. Lemelin, Situating the eco-social economy: conservation initiatives and environmental organizations as catalysts for social and economic development. *Community Development Journal* 49 (2014) 69-84.
- [76] A.S. Pullin, and T.M. Knight, Doing more good than harm - Building an evidence-base for conservation and environmental management. *Biological Conservation* 142 (2009) 931-934.
- [77] C. Cvitanovic, N.A. Marshall, S.K. Wilson, K. Dobbs, and A.J. Hobday, Perceptions of Australian marine protected area managers regarding the role, importance and achievability of adaptation for managing the risks of climate change. *Ecology and Society* accepted 28 August 2014 (in press).
- [78] C. C., H. A.J., v.K. L., and M. N.A., Overcoming barriers to knowledge exchange for adaptive resource management; the perspectives of Australian marine scientists. *Marine Policy* (in press accepted 29 Oct 2014).
- [79] E.F. Granek, E.M.P. Madin, M.A. Brown, W. Figueira, D.S. Cameron, Z. Hogan, G. Kristianson, P. De Villiers, J.E. Williams, J. Post, S. Zahn, and R. Arlinghaus, Engaging Recreational Fishers in Management and Conservation: Global Case Studies. *Conservation Biology* 22 (2008) 1125-1134.

- [80] G.R. Almany, R.J. Hamilton, D.H. Williamson, R.D. Evans, G.P. Jones, M. Matawai, T. Potuku, K.L. Rhodes, G.R. Russ, and B. Sawynok, Research partnerships with local communities: two case studies from Papua New Guinea and Australia. *Coral Reefs* 29 (2010) 567-576.