



National Environmental
Research Program

TROPICAL ECOSYSTEMS *hub*

Technical Report

The Social and Economic Long Term Monitoring Program (SELTMP) 2014

Drivers of Change in the Great Barrier Reef



Erin Bohensky, Matt Curnock, Sarah Gillet, Jeremy Goldberg,
Margaret Gooch, Ally Lankester, Nadine Marshall, Maxine Newlands,
Petina Pert, Renae Tobin, Lea Scherl and Samantha Stone-Jovicich



GREAT BARRIER REEF
foundation



Centre for
Sustainable
Tropical Fisheries
& Aquaculture



Australian Government
Department of the Environment



JAMES COOK
UNIVERSITY
AUSTRALIA



Australian Government
Great Barrier Reef
Marine Park Authority

Reef &
Rainforest
RESEARCH CENTRE

The Social and Economic Long Term Monitoring Program (SELTMP) 2014 Drivers of Change in the Great Barrier Reef

Erin Bohensky¹, Matt Curnock¹, Sarah Gillet¹, Jeremy Goldberg^{1,2},
Margaret Gooch^{3,4}, Ally Lankester¹, Nadine Marshall¹, Maxine Newlands⁵,
Petina Pert^{1,6}, Renae Tobin⁷, Lea Scherl⁸ and Samantha Stone-Jovicich¹,

¹CSIRO Land and Water Flagship;

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

³Great Barrier Reef Marine Park Authority;

⁴Cairns Institute, James Cook University;

⁵School of Arts and Social Sciences, James Cook University;

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

⁷Centre for Sustainable Tropical Fisheries and Aquaculture, James Cook University;

⁸NQ Dry Tropics NRM



Australian Government

Department of the Environment

Supported by the Australian Government's National Environmental Research Program
Project 10.1: Social and Economic Long Term Monitoring Program (SELTMP)

© CSIRO

This report should be cited as:

Bohensky, E., Curnock, M., Gillet, S., Goldberg, J., Gooch, M., Lankester, A., Marshall, N., Newlands, M., Pert, P., Tobin, R., Scherl, L., Stone-Jovicich, S. (2014) The Social and Economic Long Term Monitoring Program (SELTMP) 2014, Drivers of Change in the Great Barrier Reef. Report to the National Environmental Research Program. Reef and Rainforest Research Centre Limited, Cairns (56pp.).

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 National Environmental Research Program. The NERP TE Hub is administered in North Queensland by the Reef and Rainforest Research Centre Limited (RRRC). The NERP Tropical Ecosystems 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 Photograph: Matt Curnock

This report is available for download from the NERP Tropical Ecosystems Hub website:
<http://www.nerptropical.edu.au/research>

2014

SELTMP 2014: DRIVERS OF CHANGE IN THE GREAT BARRIER REEF

Table of Contents

Overview of the Social and Economic Long Term Monitoring Program	3
Summary of the Drivers of Change report	4
Introduction to Drivers of Change	5
Approach and Methods	8
Driver Categories for Monitoring	14
1. Economic	15
2. Social and Cultural	24
3. Demographic	30
4. Politics, Management & Governance	37
5. Information, Communication and Media	40
6. Science and Technology	45
Examples of Driver Integration through Scenario Analysis in the Region	51
References	55
Appendix: Search Terms Used in Media Analysis	56

SELTMP 2014: OVERVIEW

The Social and Economic Long Term Monitoring Program

The Social and Economic Long Term Monitoring Program (SELTMP) for the Great Barrier Reef is a dataset of national significance. It has been designed to describe conditions and trends of the human dimension of the Great Barrier Reef (GBR) for better decision-making. Through monitoring existing regional datasets and survey work, it presents annual snapshots of coastal communities, national residents, recreational users, the marine tourism industry, the commercial fishing industry, Traditional Owners, ports and shipping, catchment industries and mining. SELTMP monitors human use of and dependency on the GBR, human and community well-being (as they relate to the GBR), as well as a range of socio-cultural drivers such as perceptions, values, attitudes and behaviours. To date, SELTMP has surveyed over 8,000 primary users of the GBR.

One of the main uses of the SELTMP will be to assist reef managers in their quest to manage the Great Barrier Reef. Through web-based facilities researchers will also be able to access data for research purposes, industry and community leaders can support decision-making, and Reef managers can understand the complex social and economic environment within which they operate. For example, as trends in the human dimension are uncovered and understood, Reef managers will be able to recognise 'normal' behaviour (as opposed to 'abnormal'), understand impacts associated with planned or unplanned interventions (using 'before' and 'after' data), gauge public support for proposed environmental management initiatives and seriously consider the social and economic tradeoffs associated with regional decision-making.

Outcomes will be baseline knowledge of social conditions prior to any change event or intervention, and updates on status and temporal trends for the main user groups of the Great Barrier Reef region.

Over 100 people representing government, community and industry act as technical and strategic advisors for the program.

Reference: Marshall, N. 2013. The Social and Economic Long Term Monitoring Program (SELTMP) for the Great Barrier Reef. NERP Tropical Ecosystems Hub – Project 10.1 Factsheet.

SELTMP 2014: DRIVERS OF CHANGE IN THE GREAT BARRIER REEF

Report summary

“SELTMP 2014: Drivers of Change in the Great Barrier Reef” is part of a series of technical reports from the *Social and Economic Long Term Monitoring Program* (SELTMP; NERP Project 10.1) for the GBR region. This report presents drivers identified through a “bottom up” approach involving end user workshops and a “top down” approach based on scientific frameworks and literature. It highlights six categories of drivers of high relevance to the variables being monitored in SELTMP: 1) *Economic* 2) *Social and Cultural* 3) *Demographic* 4) *Politics, Management, and Governance* 5) *Communication and Media* and 6) *Science and Technology*. Indicators in these categories collectively provide a picture of the broad forces shaping the GBR and peoples’ relationships with it.

Key findings

Key findings in this report include:

- Drivers exert their influence in numerous ways; for example, a rise in the value of the Australian dollar may benefit some GBR users but be detrimental to others. Other technical reports in this series detail how drivers play out for the GBR’s diverse end user groups.
- Perceived importance of different drivers tends to change over time. Workshop participants’ views of drivers elicited in workshops in 2011 and 2013 reflect different issues of concern.
- An analysis of news media as part of this research is enabling us to track changing patterns in coverage of high-profile drivers such as climate change, port development and shipping.

SELTMP 2014: DRIVERS OF CHANGE IN THE GREAT BARRIER REEF

Introduction



The Great Barrier Reef region, including the people and industries it supports, is influenced by a range of drivers from global to local scales. We define a driver as any natural or human-induced factor that directly or indirectly causes a change in the GBR system (see SELTMP 2011 for a more in-depth discussion of drivers).

Drivers are important to monitor so that we are able:

- To **understand** mechanisms of change in the variables we monitor
- To **anticipate** and begin to predict outcomes
- To **document the** context or “backdrop” of change – in 25 years’ time, what will we need to know to interpret change?

These drivers themselves change over time (Figure 1) and the direction, magnitude and speed of change can be uncertain; hence monitoring programs need to be adaptive (Lindenmayer and Likens 2009).

In this report we:

1. Present drivers that were identified in eight SELTMP end user meetings in 2011, the first year of SELTMP, and then present comparative data from a workshop in 2013.
2. We then show how we categorised drivers identified in 2011 and from this, define six driver categories to be monitored. We focus on indirect drivers of change (MEA 2003) – underlying causes of pressures on the GBR – which are most relevant to the social and economic dimensions of the reef. Direct drivers such as biophysical processes of climate change and run-off are monitored by other research programs. However, SELTMP is interested in perceptions of climate change and policies to address it, for example.



SELTMP 2014: DRIVERS OF CHANGE IN THE GREAT BARRIER REEF

Introduction, continued



3. Present “wishlist” indicators identified by the Drivers of Change Working Group or in the literature for each of the six key categories of drivers, and some of the data collected. Some categories, such as social and cultural drivers, and politics and management, are not easily generalised, and can be highly specific to the GBR region and the different end user groups.



4. Show examples of how drivers can be integrated to explore alternative future scenarios for the GBR region.


In a nutshell:

- SELTMP is monitoring six inter-connected categories of drivers that influence the Great Barrier Reef and its social dimensions
- Change is often uncertain, increasingly rapid and more global in reach
- Understanding these drivers can help better interventions to be designed that account for uncertainty, rapid change and multiple scales
- Drivers exert their influence in numerous and complex ways; for example, a rise in the value of the Australian dollar may benefit some Great Barrier Reef users but be detrimental to others. Other technical reports in this series will detail how some of these drivers play out for the reef’s diverse end user groups.



SELTMP 2014: DRIVERS OF CHANGE IN THE GREAT BARRIER REEF

Key issues over time



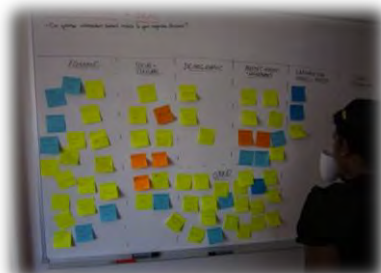
Australian Government
Great Barrier Reef
Marine Park Authority



Figure 1. Concern over issues facing the Great Barrier Reef has shifted over time. Source: Reichelt/GBRMPA, NATSHIP Conference 2012

SELTMP 2014: DRIVERS OF CHANGE IN THE GREAT BARRIER REEF

Approach and Methods



While many studies and management programs have identified drivers, little guidance exists to advise researchers or managers on how drivers might be identified for a monitoring program. In line with the overall SELTMP approach, we employed both “bottom up” and “top down” approaches to driver identification, combining expert elicitation in the first case with an established scientific framework from the Millennium Ecosystem Assessment (MEA 2003; Figure 2), and cross-checking this with other literature in the second (Figure 3). Expert opinion was elicited in eight end user meetings in October-December 2011, (Figure 4). The first of these was a dedicated Drivers of Change workshop to identify broad-brush drivers across the GBR region, followed by meetings for each of the seven end user groups where more sector-specific drivers were identified. Drivers were then categorised into broad themes (Figure 5).

As noted previously, monitoring drivers is a ‘moving feast’. In 2013, we conducted the same exercise in a single workshop of different end user groups and found perceptions of drivers to differ somewhat (Figure 6). For readers interested in comparing this report with earlier SELTMP reports, we note that some datasets reported on in earlier years were not available at the time of this report’s production. In these cases, we report on the most recent data available. Additionally, some data sources used in previous years were no longer accessible and alternative methods were required to obtain the relevant information.

Since 2011 we have been monitoring and analysing print and web-based media – itself a key driver category – to track changing patterns in coverage and narratives used to frame and communicate about key drivers in the GBR. This has included tracking news articles as well as public interest through tools such as Google Trends, Socialbakers.com and other sites. Beginning this year a targeted, in-depth media analysis is being undertaken to supplement survey and interview data related to perceptions. Sample results are shown later in this report (see also Bohensky et al. *in review*; Lankester et al. *in review*).

Drivers methods in summary:

Expert opinion elicited through workshops (broad-brush and sector-specific)

Cross-checking with literature and other secondary data sources (e.g. media)

Comparison, amalgamation, refinement

SELTMP 2014: DRIVERS OF CHANGE IN THE GREAT BARRIER REEF

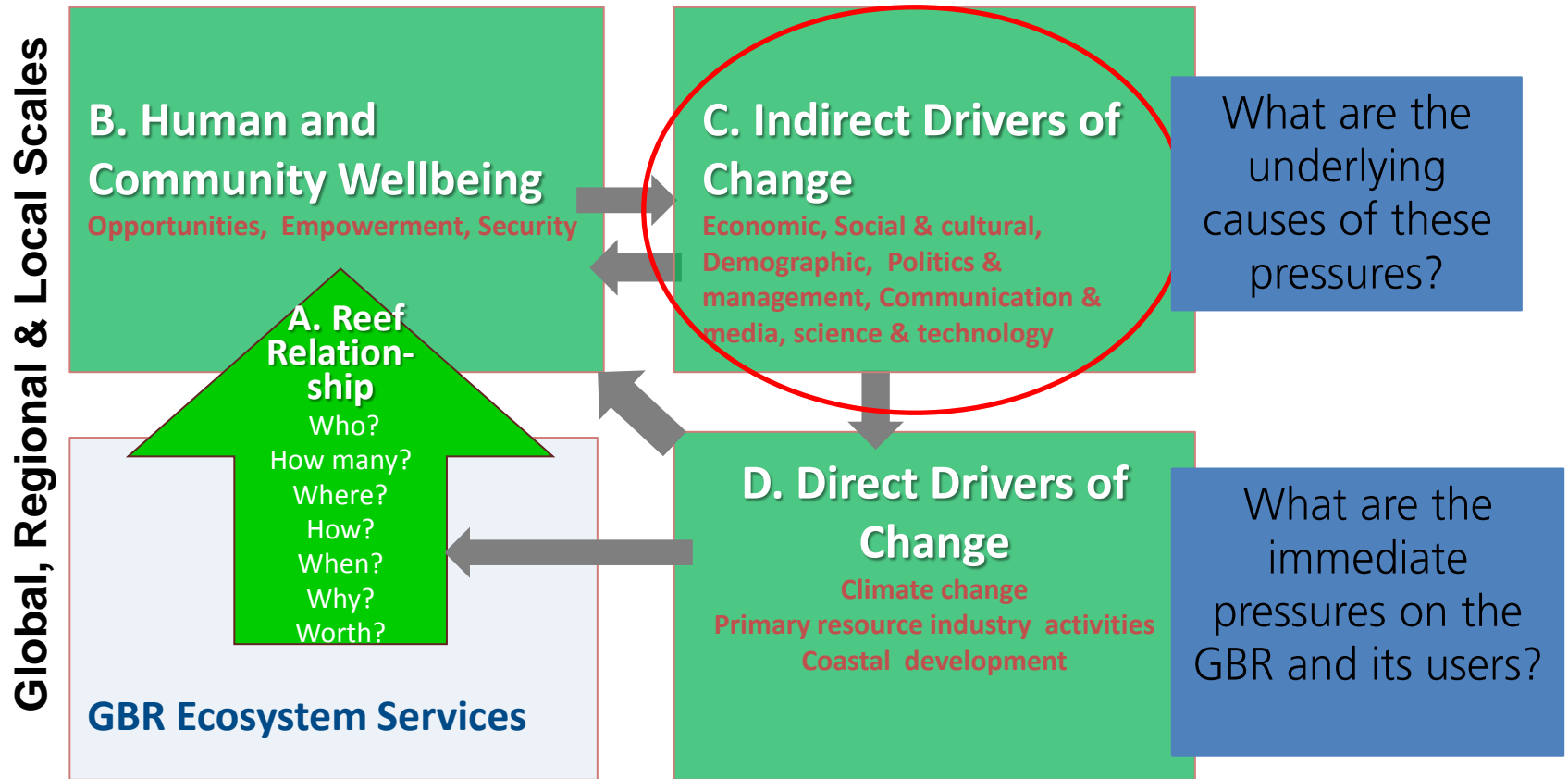


Figure 2. Modified version of the Millennium Ecosystem Assessment framework that describes indirect and direct drivers and their relationships with ecosystems and human well-being (MEA 2003). This report focuses primarily on Indirect Drivers of Change.

SELTMP 2014: DRIVERS OF CHANGE IN THE GREAT BARRIER REEF

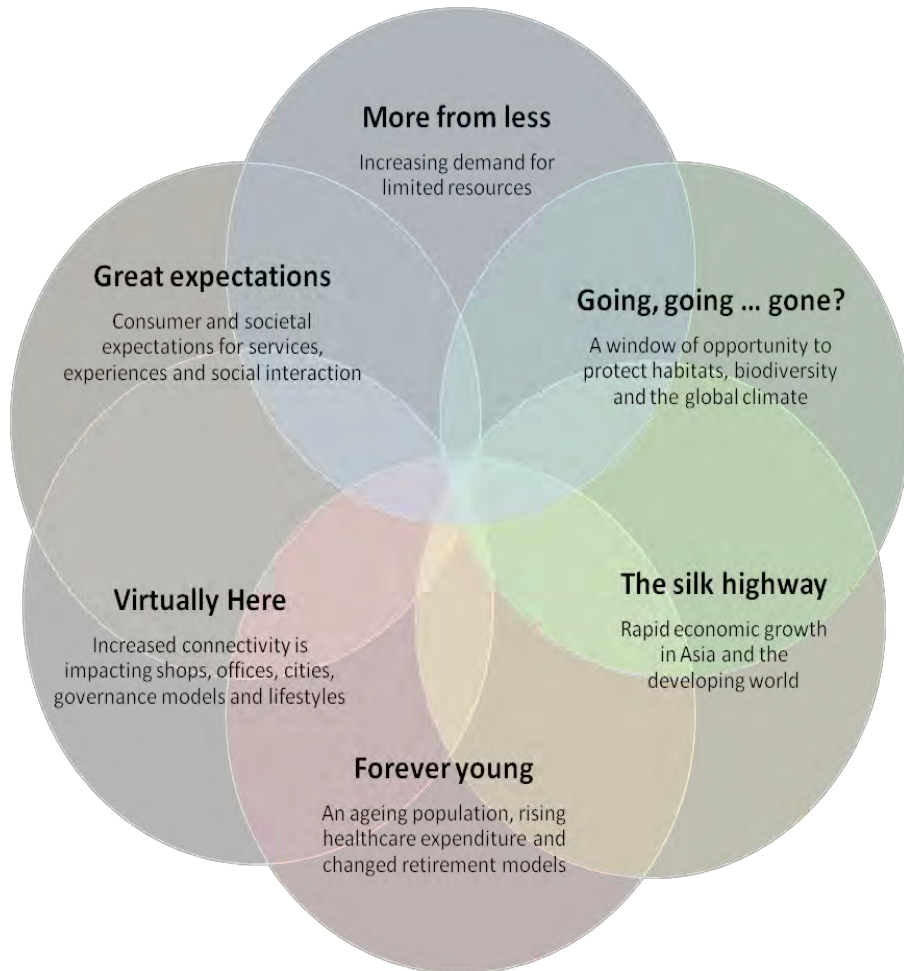


Figure 3. SELTMP driver categories were validated by cross-checking with other literature, such as CSIRO's 'Our Future World' report which describes six megatrends that may change the way people live. CSIRO plans to update the megatrends report biennially, with the next one due in 2014. Source: Hajkowicz et al. 2012.

SELTMP 2014: DRIVERS OF CHANGE IN THE GREAT BARRIER REEF

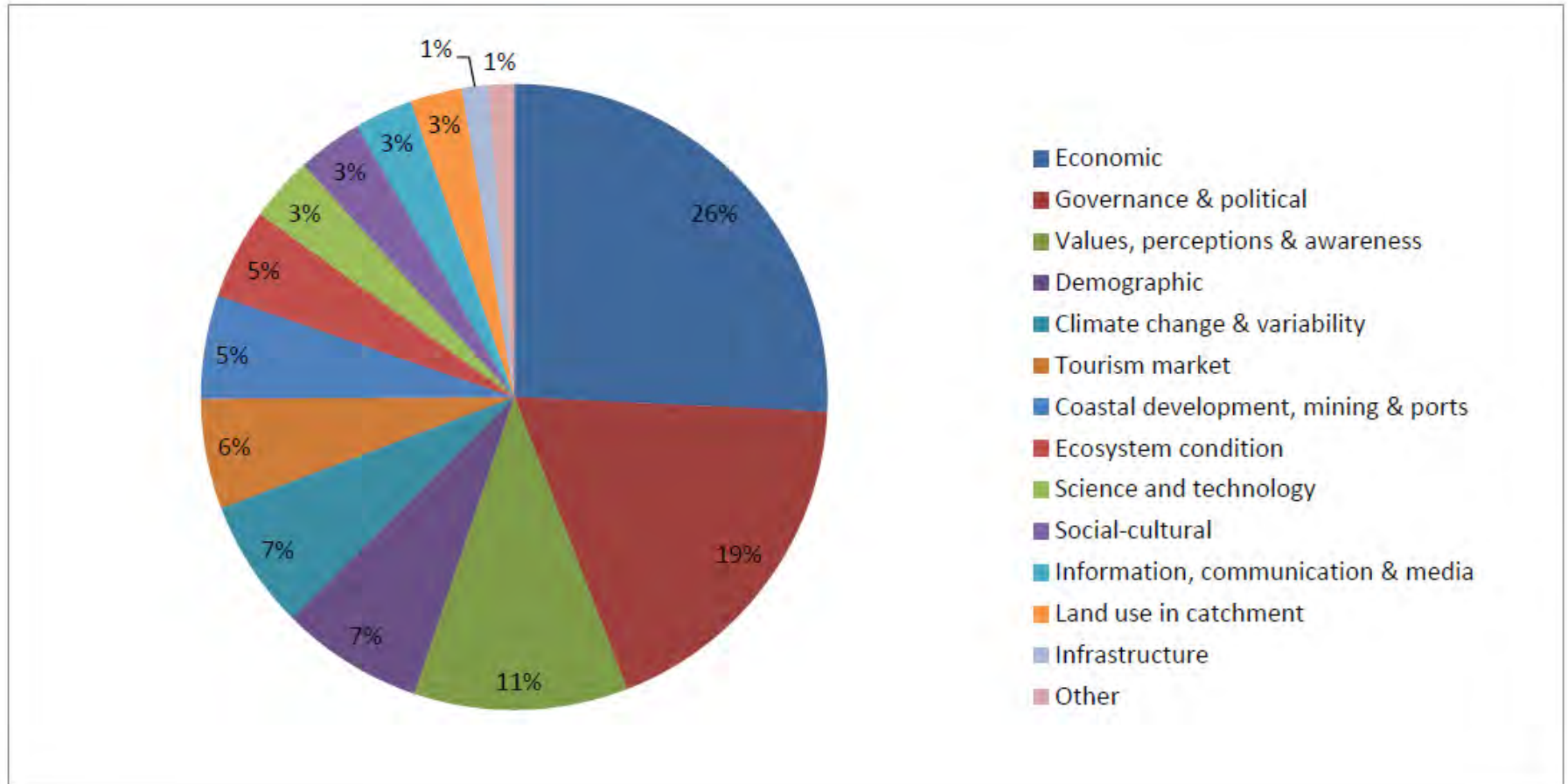


Figure 5. Categorisation of drivers identified in eight end user workshops held in 2011. For this report we focus on six indirect driver categories which are most relevant to the variables being monitored in SELTMP: Economic, Social and cultural, Demographic, Politics and management, Communication and media, and Science and technology.

Driver categories for monitoring

1. Economic
2. Social and cultural
3. Demographic
4. Politics, management and governance
5. Communication and media
6. Science and technology

1. Economic

***Economic** drivers span various issues and scales, from global to local. Global economic growth and its distribution by country, sector, and individual affects relationships between people and the Reef. How growth is distributed determines the character of demand for ecosystem services.*

Represent **26%** of the drivers identified as most important by the working groups (SELTMP 2011).

SELTMP 2014: DRIVERS OF CHANGE IN THE GREAT BARRIER REEF

1. Economic Drivers

User Group	Examples of economic drivers identified
Commercial Fishing	Economic profitability, exchange rate, market access/product form, US\$ and global market problems, world fish prices, input prices, internationalism
Recreation	Cost and perceived benefits of using the GBR, global and regional economic conditions, disposable income
Tourism	Air travel (costs and flight paths), peak oil/fuel costs, cost of product, strength of AUD, relative cost price, interest rates
Ports and Shipping	China and India's economic expansion and resource needs, world economic demand
Traditional Owners	Competing interests (best interests of the nation), economic outcomes
Coastal Communities	Economic reliance on and connection to place, economic situation down south (NSW+ Victoria), international economic situation, job opportunities
Catchment Industries	GDP and exchange rates of importing countries, relative prices of key commodities, production costs, market fluctuation, terms of trade, property prices, employment, services, technology costs, price squeeze, sugar mill viability, international competitiveness, industrialisation of India and China

SELTMP 2014: DRIVERS OF CHANGE IN THE GREAT BARRIER REEF

1. Economic Drivers

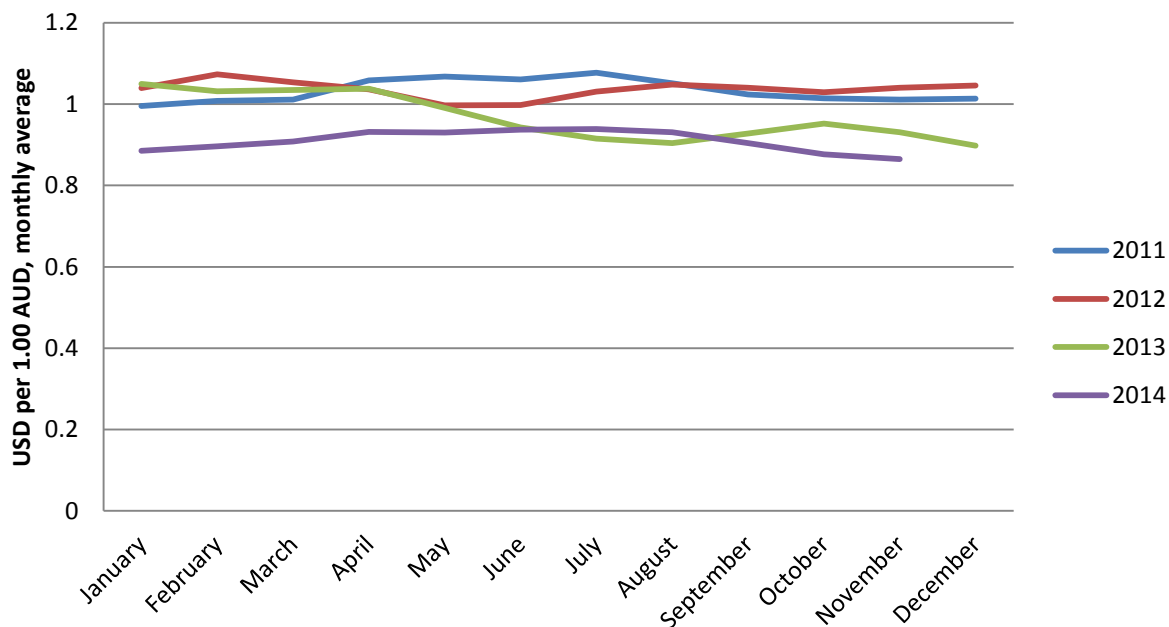
“Wishlist” indicators monitored by SELTMP

- Value of AUD
- Interest rates / inflation
- GDP growth rates
- Centre of world economic “gravity”
- Input, fuel, commodity prices
- House prices
- Equality (Gini index, index of socioeconomic disadvantage)
- Demand (e.g. for fair trade products, experiences)

SELTMP 2014: DRIVERS OF CHANGE IN THE GREAT BARRIER REEF

1. Economic Drivers: Exchange rate

Value of Australian dollar



Average annual values:

2011 1.032460

2012 1.035767

2013 0.967785

2014 0.909422

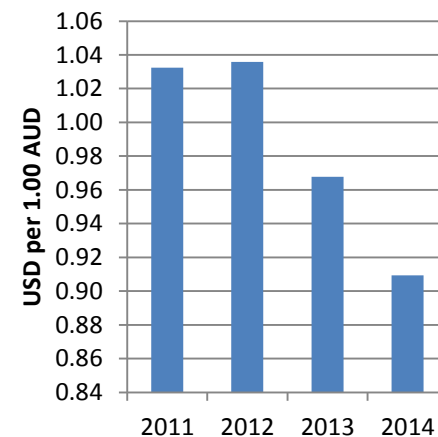


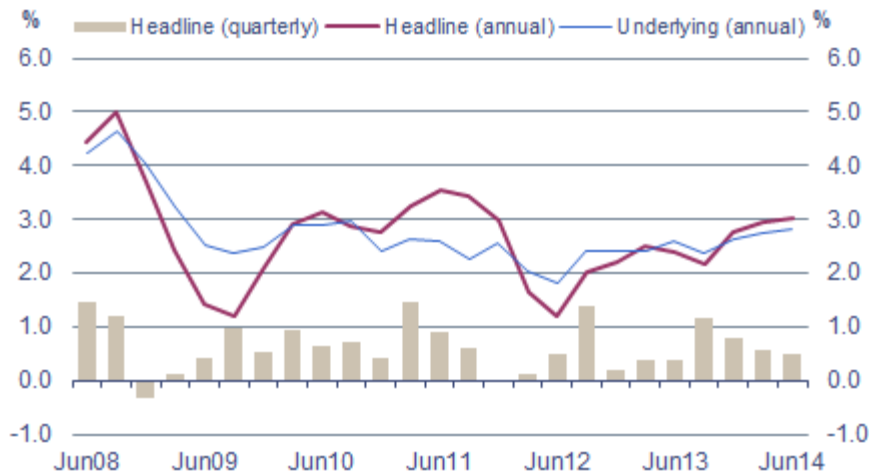
Figure 7. Economics: A key indicator is the value of AUD trading against the USD. The average value in 2014 was at its lowest since SELTMP began monitoring in 2011. 2014 figures current as at 30 November 2014. Source:

<http://www.x-rates.com/average/?from=AUD&to=USD&amount=1.00&year=2014>

SELTMP 2014: DRIVERS OF CHANGE IN THE GREAT BARRIER REEF

1. Economic Drivers: Inflation and interest rates

Inflation rates



Interest rates

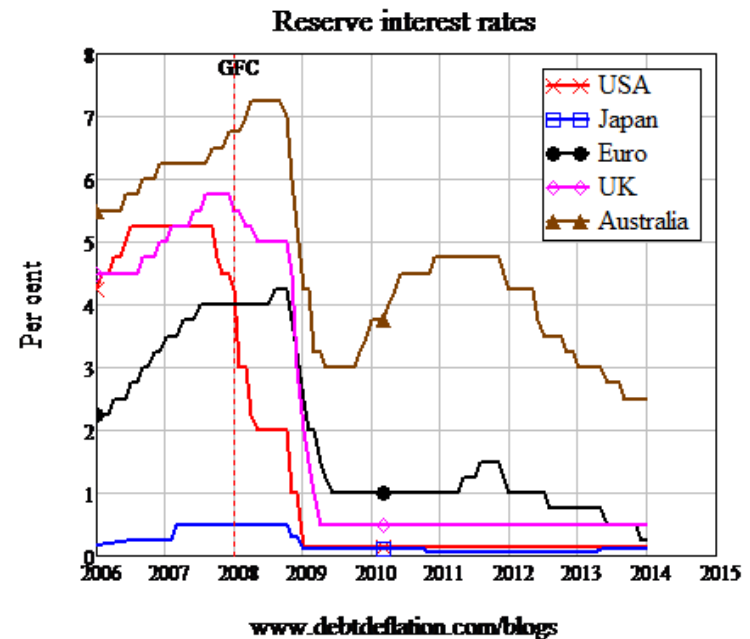


Figure 8. Left: Source: South Australian Centre for Economic Studies. <http://www.adelaide.edu.au/saces/economy/prices/>. Accessed 5 December 2014. Right: Australia's cash rate since 2006 compared to the USA, Japan, Eurozone and UK. Source: <http://www.businessspectator.com.au/article/2014/2/10/economy/why-australias-economic-debate-doesnt-rate>. Accessed 5 December 2014.

SELTMP 2014: DRIVERS OF CHANGE IN THE GREAT BARRIER REEF

1. Economic Drivers: GDP Growth Rates



Figure 9. Annual GDP growth rates (%) for Australia, India, China, and the world. In 2013, Australian growth decreased slightly, and was just slightly higher than the world average. Data not available for 2014 at time of writing. Source: <http://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG/countries/1W-AU-IN-CN?display=graph>.

SELTMP 2014: DRIVERS OF CHANGE IN THE GREAT BARRIER REEF

1. Economic Drivers: Shifting World Economy

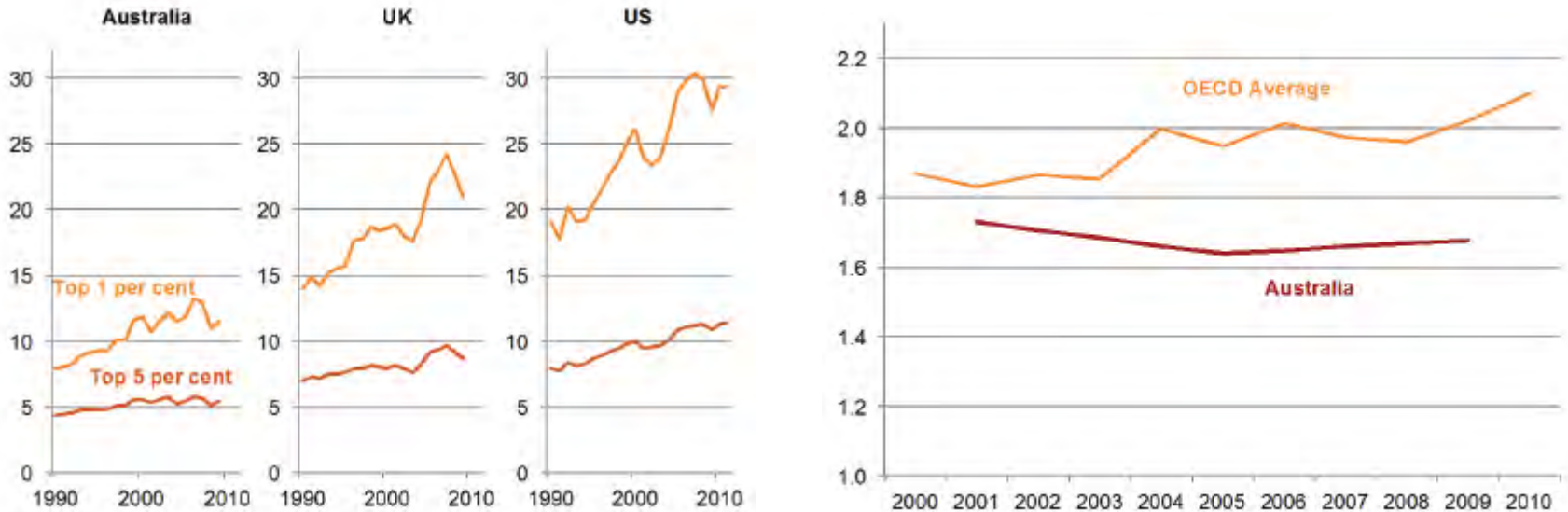


The growth of cities in emerging markets is driving the most significant economic transformation in history. The **Urban World** app tracks movement of economic power as urban expansion takes place.

Figure 10. The centre of gravity of the world economy is the geographic hotspot of income generation based on the distance-weighted gross domestic product of 700 locations. Source: Quah 2011

SELTMP 2014: DRIVERS OF CHANGE IN THE GREAT BARRIER REEF

1. Economic Drivers: Equality



Source: Grattan analysis of Alvaredo et al (2013)

Figure 11. Left: Average incomes of the top 1 and 5 percent; multiple of average income for bottom 90 percent. Right: Earnings premium for higher education. Earnings of workers with bachelor degree as a multiple of earnings of workers with only upper high school education. Inequality may well rise after the mining boom ends, creating pressure to increase welfare payments, a trend evident overseas when inequality has grown. Ref: Daley et al. 2013.

SELTMP 2014: DRIVERS OF CHANGE IN THE GREAT BARRIER REEF

1. Economic Drivers: Australian House Prices

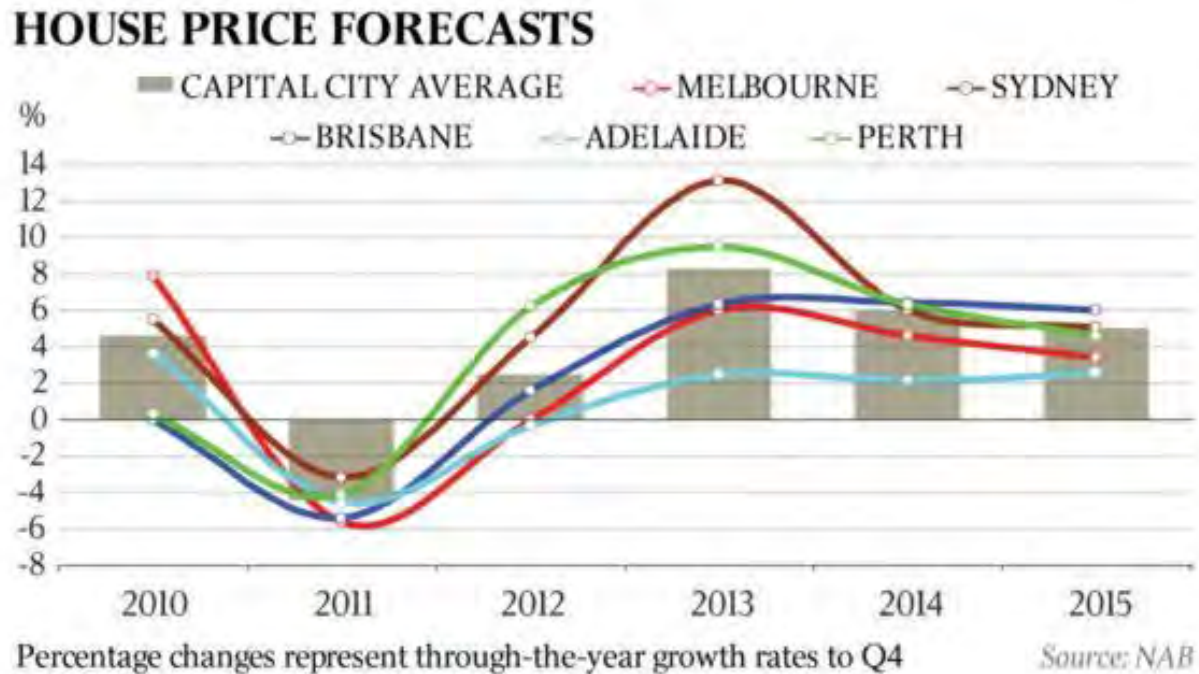


Figure 12. Australian house prices since 2010 and forecast as at 14 Feb 2014. Source: NAB in The Australian. <http://www.theaustralian.com.au/business/property/foreigners-to-keep-pressure-on-capital-city-house-prices/story-fniz9vg9-1226826505278>. Accessed 5 December 2014.

2. Social and Cultural

Social drivers include how society thinks and behaves in relation to the reef. **Culture** refers to the values, beliefs, and norms that a group of people share. Culture conditions individuals' and societies' perceptions of the world, influences what they consider important, and suggests courses of action that are appropriate and inappropriate.

"Wishlist" Indicators

- Environmental awareness & values
- Participation in environmental initiatives
- Perceptions of reef condition and threats

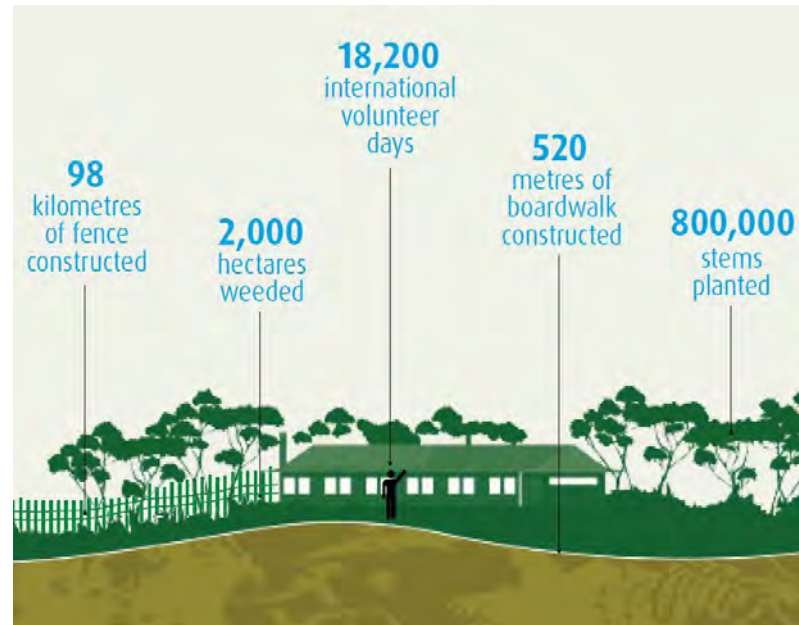
SELTMP 2014: DRIVERS OF CHANGE IN THE GREAT BARRIER REEF

2. Social and Cultural Drivers: Participation in environmental and research initiatives

Conservation & stewardship initiatives

Conservation Volunteers achievements in 2012: (see image, right)
Total volunteer days: 60, 000
Environmental monitoring surveys: 104
Species monitored: 38
Projects undertaken in GBR Region: 3
(Gladstone, Mackay, Townsville and Cairns)

Ref: Conservation Volunteers Annual Report 2012



Citizen science involvement

Great Barrier Reef managers and scientists with past or current involvement in citizen science projects:
Managers: 70%
Scientists: 77%

Ref: Chin 2012

“Citizen science (also known as **crowd science, crowd-sourced science, or networked science**) is scientific research conducted, in whole or in part, by amateur or nonprofessional scientists. Also called public participation in scientific research.” (Wikipedia)

SELTMP 2014: DRIVERS OF CHANGE IN THE GREAT BARRIER REEF

2. Social and Cultural Drivers: Fair Trade Logo Sales Revenue

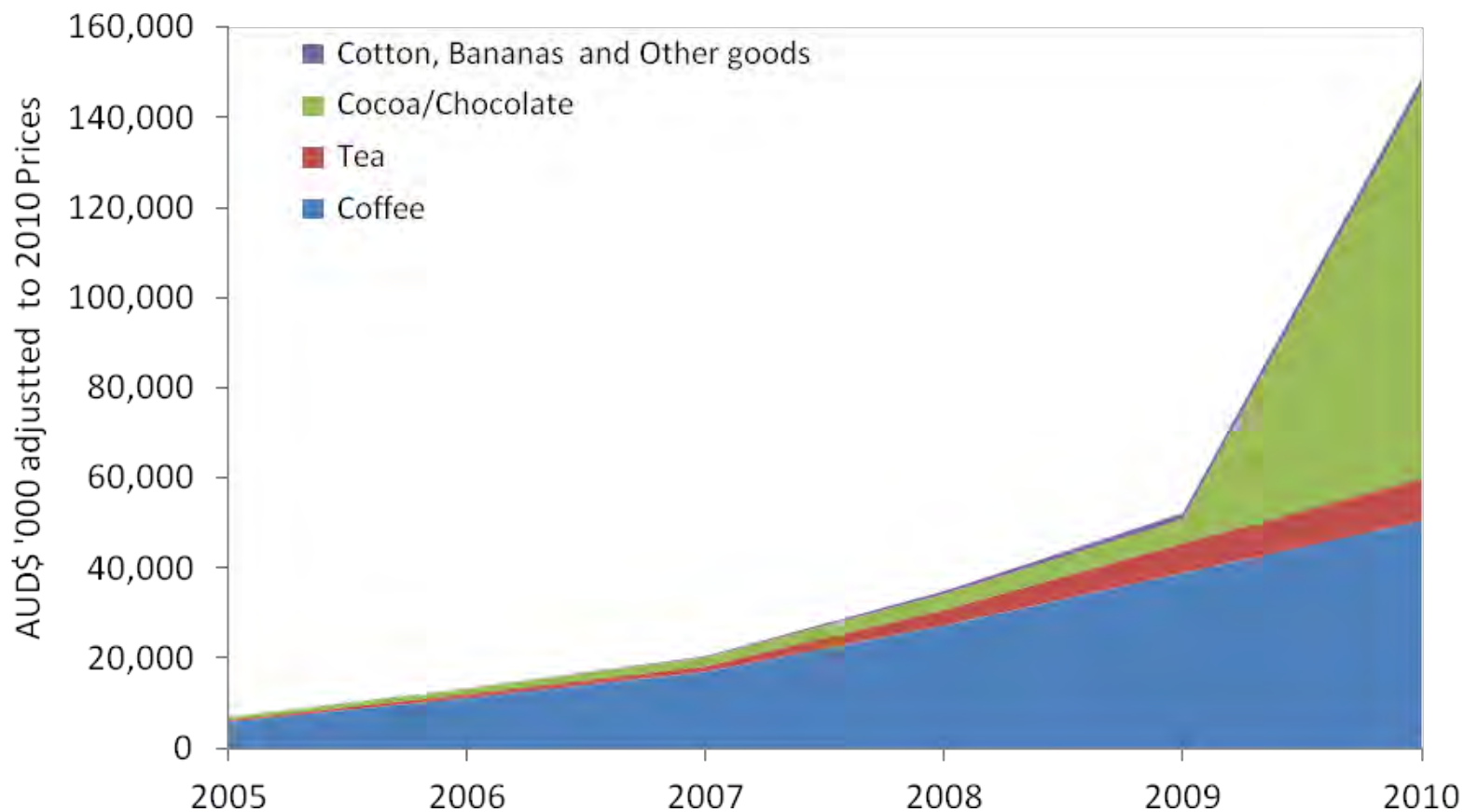
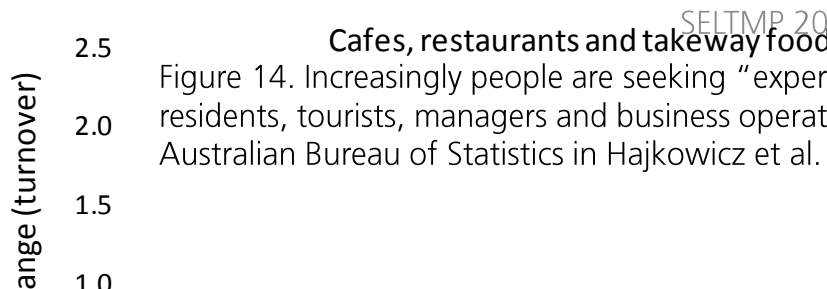
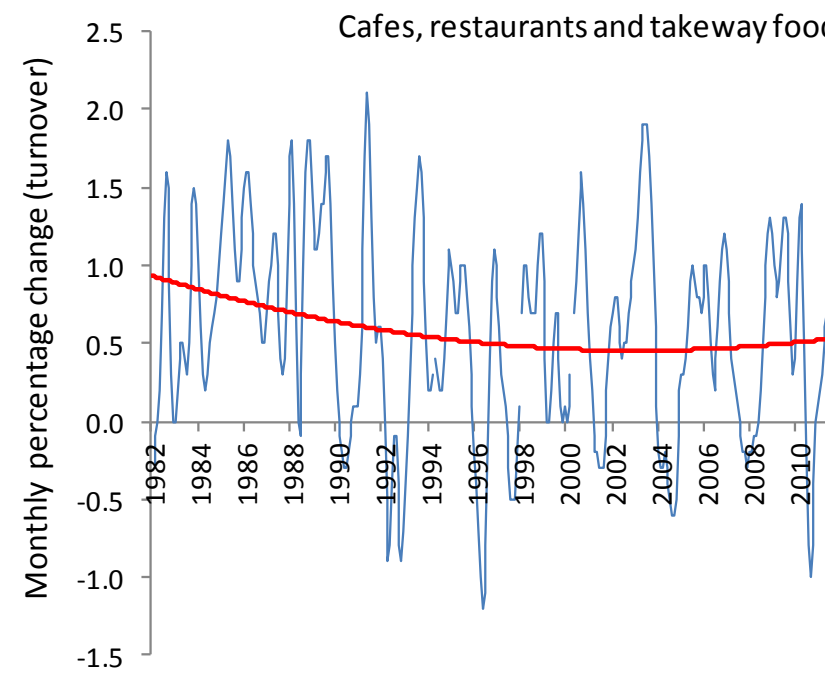
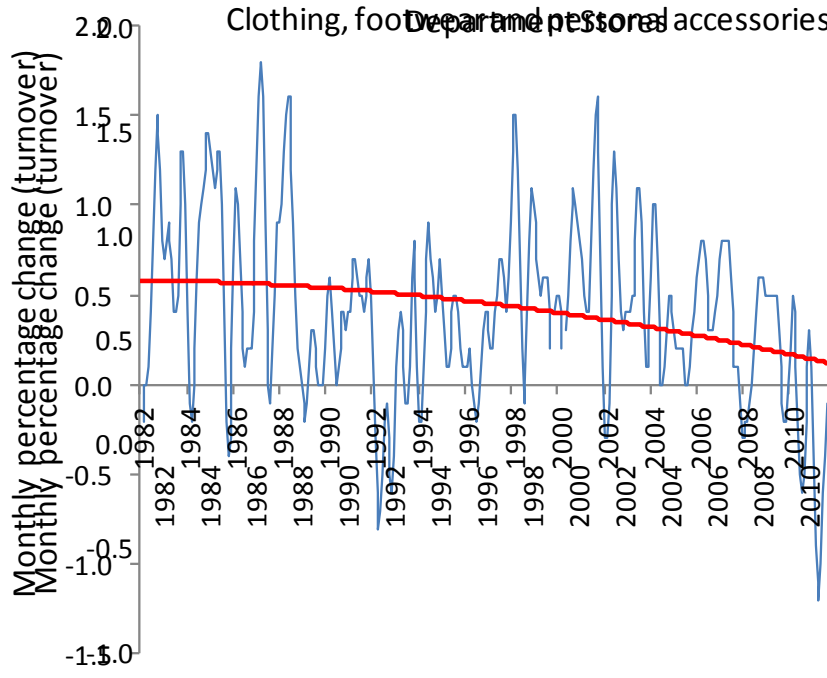
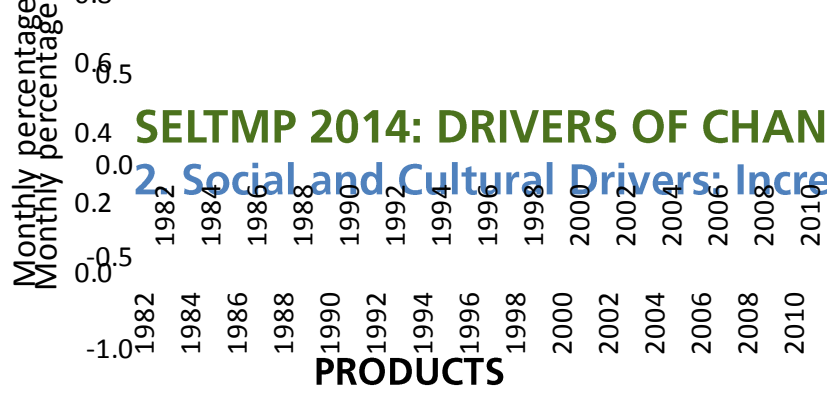


Figure 13. Social and cultural drivers influencing the GBR include an increasing demand for fair trade products. Source: Fair Trade Australia and New Zealand in Hajkowicz et al. 2012.



SELTMP 2014 - DRIVERS OF CHANGE

Figure 14. Increasingly people are seeking “experiences” rather than material goods, which has relevance to residents, tourists, managers and business operators’ values and practices regarding the GBR. Source: Australian Bureau of Statistics in Hajkowicz et al. 2012.

SELTMP 2014: DRIVERS OF CHANGE IN THE GREAT BARRIER REEF

2. Social and Cultural Drivers: Perceived threats to reef

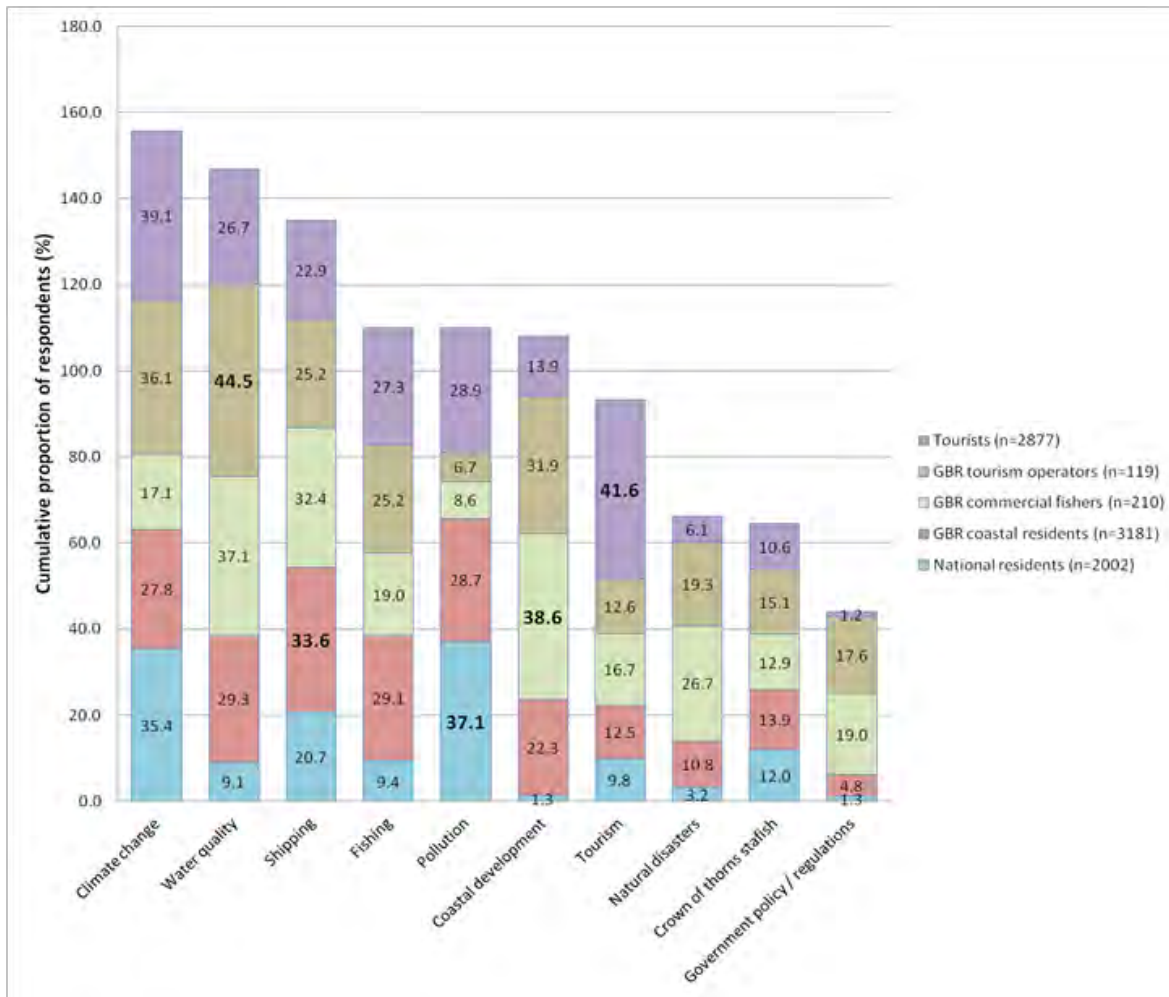


Figure 15. Top ten categories for perceived threats to the Great Barrier Reef (GBR) among tourists, tourism operators, commercial fishers and coastal residents of the GBR region, as well as Australian residents from a national survey (n=8389 for the combined samples). Proportions (%) are shown for respondents who listed specific items when asked "What do you think are the three most serious threats to the Great Barrier Reef?" The most frequently identified threat from each sample is indicated with bold text. SELTMP Survey 2013.

SELTMP 2014: DRIVERS OF CHANGE IN THE GREAT BARRIER REEF

5. Information, Communication & Media: Trust in information

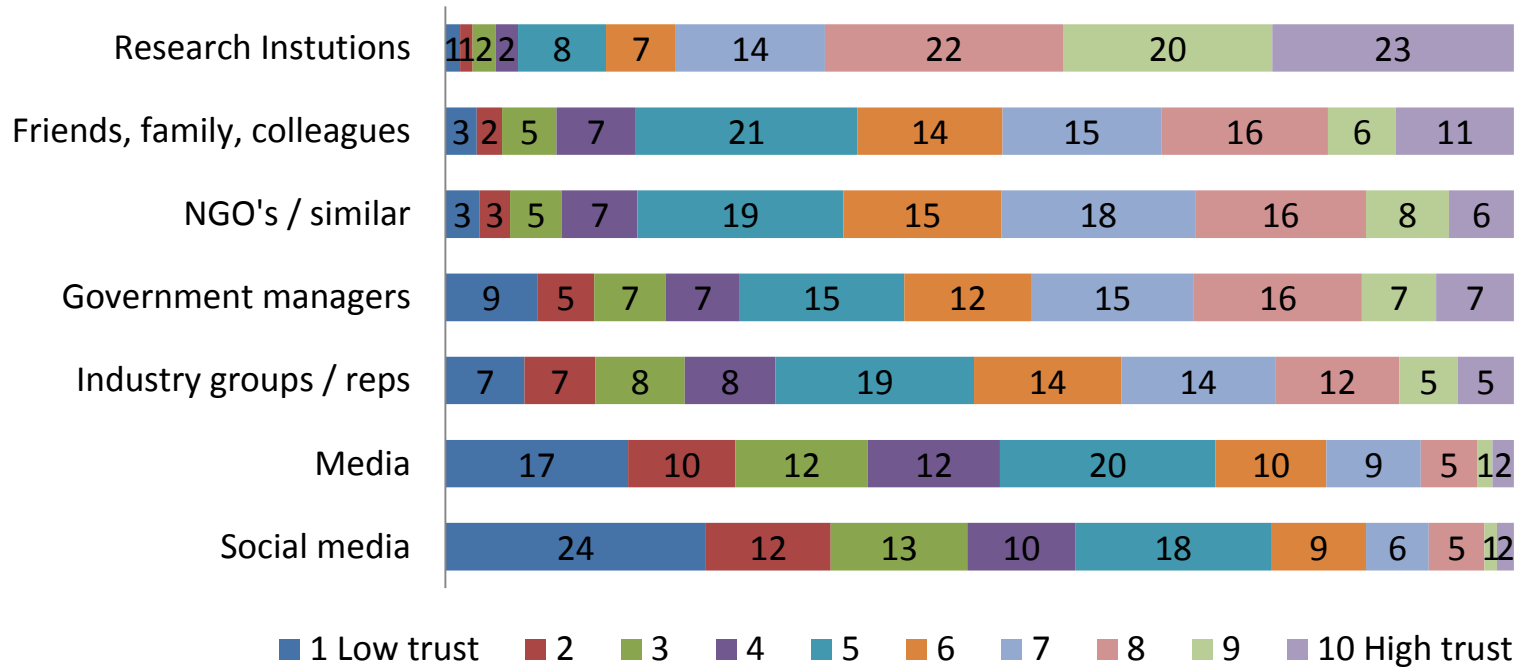


Figure 16. Reported trust in information from institutions. Survey respondents were asked “On a scale of 1 to 5, where 1 means you have no trust, and 5 means you have complete trust, how much trust would you have in each of the following when reporting environmental issues?” Data shows that research institutions are considered the most trusted sources of information. By contrast, there is low reported trust in media and social media. SELTMP Survey 2013.

3. Demographic

*Population size and other **demographic** variables influence the use of the reef and its ecosystem services. Increases in population decrease the per capita availability of resources.*

“Wishlist” Indicators

- Population age structure
- Population growth rate
- Population movements/mobility
- Number and source of migrants

SELTMP 2014: DRIVERS OF CHANGE IN THE GREAT BARRIER REEF

3. Demographic Drivers: Global population distribution

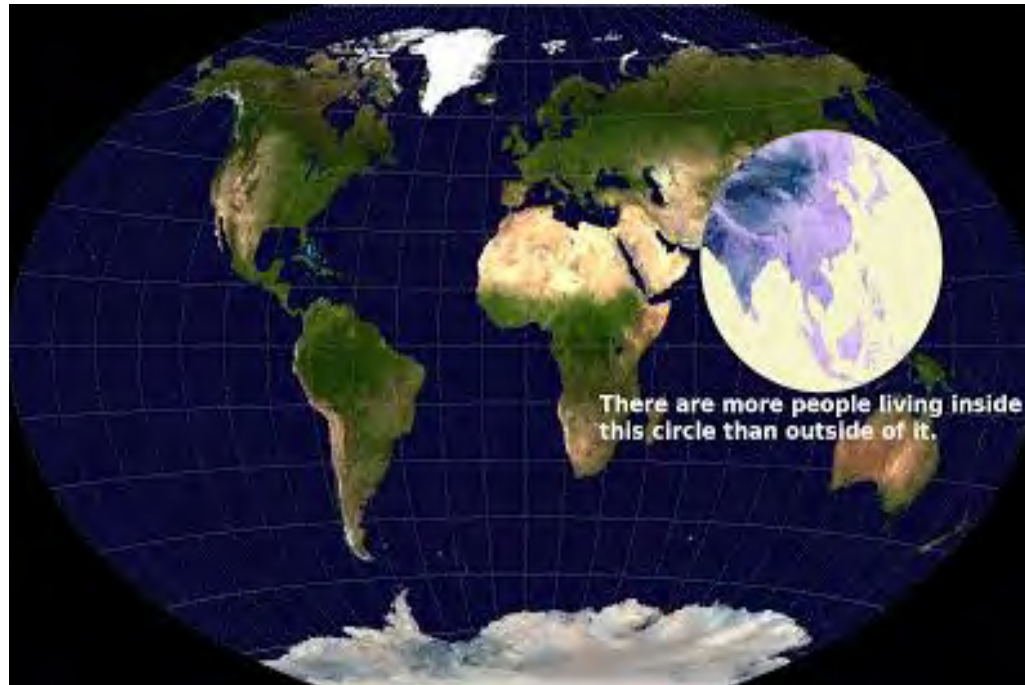


Figure 17. This 4,000km radius around Hainan Island in the South China Sea is only 25 mn sq km, or one-sixth of the world's total land area. Source: Myers 2013. www.globalpolicyjournal.com/blog/05/09/2013/global-hegemony-one-picture and Quah 2013. www.globalpolicyjournal.com/blog/05/09/2013/global-hegemony-one-picture. Accessed 08/10/13.

SELTMP 2014: DRIVERS OF CHANGE IN THE GREAT BARRIER REEF

3. Demographic Drivers: Australian population age structure

2014

Projected Resident Population :

23,524,055

Increase since 2013: 393,124 (1.7%)

Males: 11,709,970

Females: 11,814,085

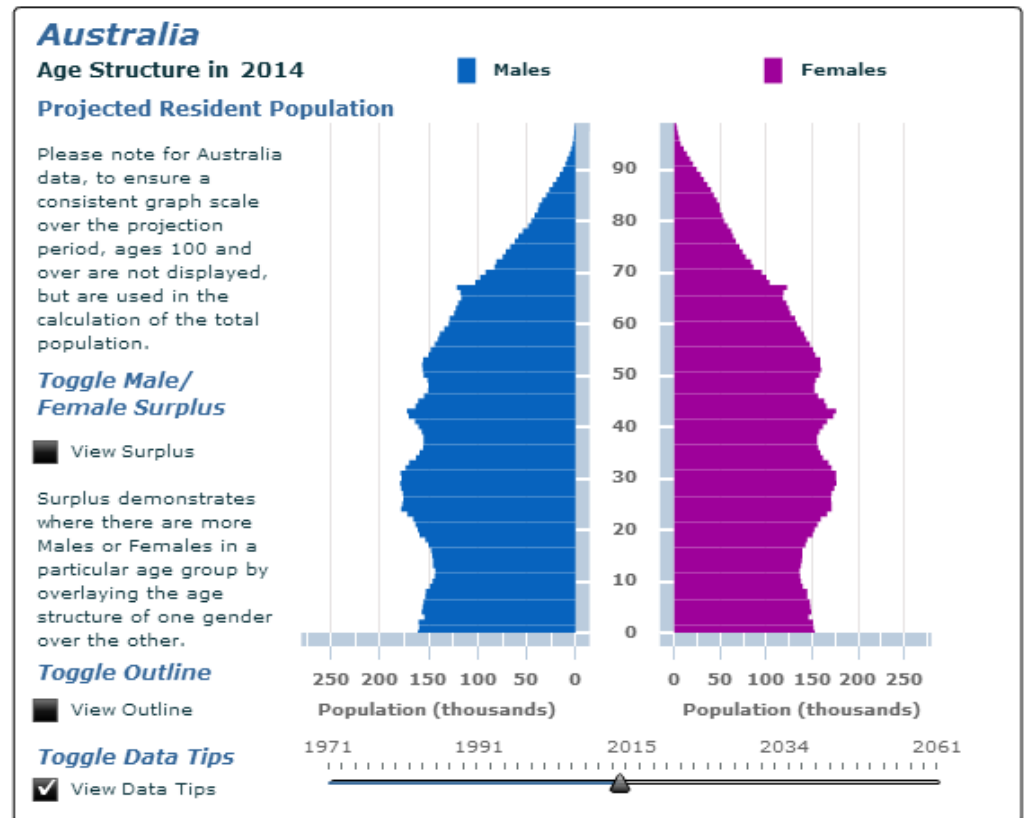


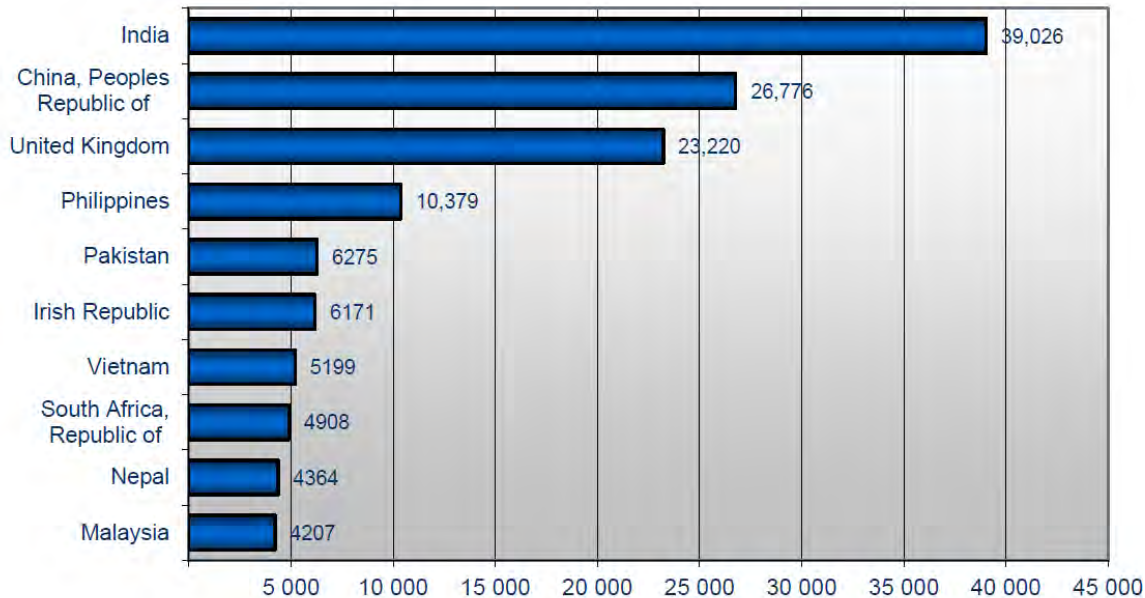
Figure 18. Population age structure by gender for Australia, 2014. Source: ABS

<http://www.abs.gov.au/websitedbs/d3310114.nsf/4a256353001af3ed4b2562bb00121564/ca0b3137794a766bca256f6c0078cb0b> (Accessed 08 Dec 14).

SELTMP 2014: DRIVERS OF CHANGE IN THE GREAT BARRIER REEF

3. Demographic Drivers: Migration

Top ten source countries of migrants 2013-2014, excluding New Zealand



Changes since 2012-2013

- Pakistan ranked in top five
- Nepal ranked in top ten
- Indian sub-continent provides 29.7% of migrants (up 0.5%)
- Migrants from North Asia decreased from 22.1% to 20.7%
- UK migrants increased from 11.4% to 12.2%, still below its 2005-6 peak.

Figure 19. Source: Department of Immigration and Citizenship, 2013-2014 Migration Program Report. The migration programme figures are made up of the total number of visas issued overseas, plus the number of permanent residence approvals for people who have come to Australia as temporary entrants, and then applied to remain permanently.

<http://www.immi.gov.au/media/statistics/statistical-info/visa-grants/> Accessed 8 December 2014.

SELTMP 2014: DRIVERS OF CHANGE IN THE GREAT BARRIER REEF

3. Demographic Drivers: Tourism to QLD



Figure 20. Source: QLD Treasury and Trade 2014 <http://www.budget.qld.gov.au/current-budget/index.php>; accessed 8 Dec 2014

SELTMP 2014: DRIVERS OF CHANGE IN THE GREAT BARRIER REEF

3. Demographic Drivers: Short-term visitation, change since 2003-2004

SHORT-TERM VISITOR ARRIVALS, Australia - Financial Years, Trend Series(a)

Source countries(b)	2003-2004		2013-2014		2003-04 to 2013-14 Trend % change
	Trend '000	Source countries(c)	Trend '000		
New Zealand	932.1	New Zealand	1 223.6		31.3
Japan	718.6	China	769.3		228.4
UK, Cls & IOM(d)	687.1	UK, Cls & IOM(d)	646.7		-5.9
United States of America	428.8	United States of America	528.6		23.3
Singapore	255.0	Singapore	367.1		44.0
China	234.3	Japan	323.7		-54.9
Korea, South	214.8	Malaysia	311.4		75.3
Malaysia	177.6	Hong Kong	202.5		50.1
Germany	140.5	Korea, South	201.1		-6.4
Hong Kong	134.9	India	183.8		246.0
Total	5 106.2	Total	6 657.7		30.4

(a) Data revised from July 2004 to December 2013. For information see [Explanatory Notes](#) 12 & 13.

(b) Top 10 source countries based on trend estimates for 2003-04.

(c) Top 10 source countries based on trend estimates for 2013-14.

(d) United Kingdom, Channel Islands and Isle of Man.

Figure 21. Short-term visitation. New Zealand numbers have increased by over 30%, while Japanese visits decreased 55%. Chinese visits have increased by nearly 230% and Indian visits by nearly 250%. Source: <http://tomjconley.blogspot.com.au/2014/08/importing-chinese-tourists-as-exports.html> accessed 8 December 2014. Data from ABS, 3401.0 - Overseas Arrivals and Departures, Australia, June 2014.

SELTMP 2014: DRIVERS OF CHANGE IN THE GREAT BARRIER REEF

3. Demographic Drivers: Short-term visitation, January 2014

Short-term Visitor Arrivals, Australia - January 2014

Source countries(a)	Trend '000	Seasonally Adjusted '000	Original '000	Dec13 to Jan 14(b) Trend % change	Jan 13 to Jan 14(b) Trend % change
China	61.5	68.8	95.4	0.7	9.6
New Zealand	102.9	101.0	78.7	0.7	2.2
UK, CIs & IOM(c)	53.7	54.1	64.7	0.1	6.4
United States of America	44.7	43.4	41.6	0.8	7.8
Korea, South	17.0	17.2	22.1	0.3	3.2
Japan	26.5	25.5	19.3	-0.8	-4.5
Singapore	31.7	32.8	18.4	2.1	25.6
Hong Kong	17.5	17.1	16.1	1.7	25.9
Malaysia	28.5	29.0	15.6	2.6	40.5
Germany	15.1	14.7	15.6	1.7	9.2

Figure 22. Source: ABS, 3401.0 - Overseas Arrivals and Departures, Australia, Jan 2014.

<http://www.abs.gov.au/ausstats/abs@.nsf/Previousproducts/3401.0Main%20Features3Jan%202014?opendocument&tabname=Summary&prodno=3401.0&issue=Jan%202014&num=&view=>

4. Politics, Management & Governance

Political and management drivers – governance – affect the use of and access to reef resources. Includes management structures, frameworks, institutions and processes; legislation and regulation; decision-making and the role of the public in decision-making processes.

“Wishlist” Indicators

- 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

SELTMP 2014: DRIVERS OF CHANGE IN THE GREAT BARRIER REEF

4. Political Drivers: State and federal government allocation of resources

Environment-related measures in QLD 2014-15 budget:

State government support and resources for Reef Water Quality Program: **\$55 million** over five years

Support for Great Barrier Reef MPA for the Marine Parks Field Management Program: **\$8.4 million**

Activities under the Reef Water Quality Protection Plan: **\$934,000**

Sustainable agriculture and water quality: **\$1 million** in the Burdekin region, **\$1.8 million** in Cape York and Wet Tropics region, and **\$900,000** to target pests and weeds, improve reef water quality and promote and enhance sustainable agriculture in Mackay region.

Drought relief: **\$62 million**

Rebuilding after natural disasters: **\$5.63 billion** over the 2013-14 to 2015-16 period

Source: QLD Treasury and Trade 2014
<http://www.budget.qld.gov.au/current-budget/index.php>; accessed 8 Dec 2014

Reef 2050 Plan:

\$40 million to establish a Reef Trust to support support the improvement of coastal habitat, water quality and enhancing species protection along the Great Barrier Reef.

Source: Department of Environment
<http://www.environment.gov.au/minister/hunt/2014/mr20140513c.html>; accessed 8 Dec 2014

Federal budget cuts:

\$2.8 million less for GBRMPA
\$7.8 million less for AIMS over next four years
\$27 million less for CSIRO in the 2014-15 financial year, and \$114 million over the next five years.

Sources:
<http://www.abc.net.au/news/2014-05-14/greenpeace-attacks-federal-budgets-reef-authority-funding-cuts/5451800>; accessed 8 Dec 2014

<http://www.news.com.au/finance/economy/million-government-funding-cuts-to-the-csiro-will-have-huge-impacts-on-scientific-research-in-australia/story-fn84fgcm-1226937209145>; accessed 9 Dec 2014

SELTMP 2014: DRIVERS OF CHANGE IN THE GREAT BARRIER REEF

4. Political Drivers: Legislation and regulation

Regulations 2014

Legislation, regulation or plan	Implementing agency and level
Reef 2050 Long-Term Sustainability Plan (draft)	Department of Environment (Federal)
The Marine Tourism Contingency Plan for the Great Barrier Reef Marine Park	GBRMPA (Federal)
Dredging and Spoil Disposal Policy (due for review October 2014)	GBRMPA (Federal)
Environmental Impact Management Policy (due for review October 2014)	GBRMPA (Federal)
QLD Ports Strategy and Ports Bill	Department of State Development, Infrastructure and Planning (State)

Table 1. Legislation, regulation or management plans commencing in 2014 relevant to GBR region stakeholders. GBRMPA and Department websites, accessed 8 December 2014.

5. Information, communication and media

*Information is at the core of decision-making, and **communication and media** provide mechanisms for information flows among and between managers, resource users and the public. Media outlets regulate visibility of information, and are instrumental in reflecting and shaping public perceptions about the reef.*

“Wishlist” Indicators

- 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



SELTMP 2014: DRIVERS OF CHANGE IN THE GREAT BARRIER REEF

5. Information, Communication & Media: Google searches

The news Australians searched for most in 2014 on Yahoo7

1. Malaysian Airlines
2. Minecraft
3. Frozen
4. FIFA World Cup
5. Australian Open
6. Peppa Pig
7. Robin Williams
8. Commonwealth Games
9. Ebola
10. INXS












Source: <https://au.news.yahoo.com/year-in-review/a/25630333/the-news-australians-searched-for-most-in-2014/>. Accessed 8 December 2014.

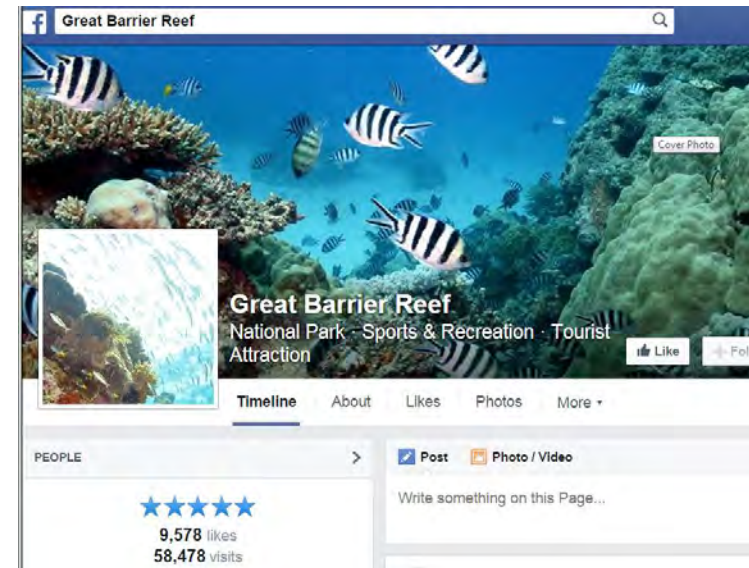
SELTMP 2014: DRIVERS OF CHANGE IN THE GREAT BARRIER REEF

5. Information, Communication & Media: Social media trends

What Australian 'places' were visited on Facebook on 2014?

Facebook Pages Stats in Australia

		Local Fans	Total Fans
1	 Australia.com	1 404 578	6 248 450
2	 Sydney.com	256 933	1 638 683
3	 Visit Queensland, Australia	454 740	1 169 459
4	 Visit Gold Coast, Queensland, Australia	256 654	754 184
5	 Australian Working Holiday	38 159	619 403
6	 Scenic World Blue Mountains	45 699	578 538
7	 Sydney Opera House	185 901	547 240
8	 Visit NSW	85 547	542 439
9	 Visit Melbourne	58 598	503 120
10	 I Love Melbourne	254 347	320 260



Facebook data: Socialbakers.com.
<http://www.socialbakers.com/facebook-statistics/australia> 8 December 2014.

SELTMP 2014: DRIVERS OF CHANGE IN THE GREAT BARRIER REEF

5. Information, Communication & Media: GBR media coverage

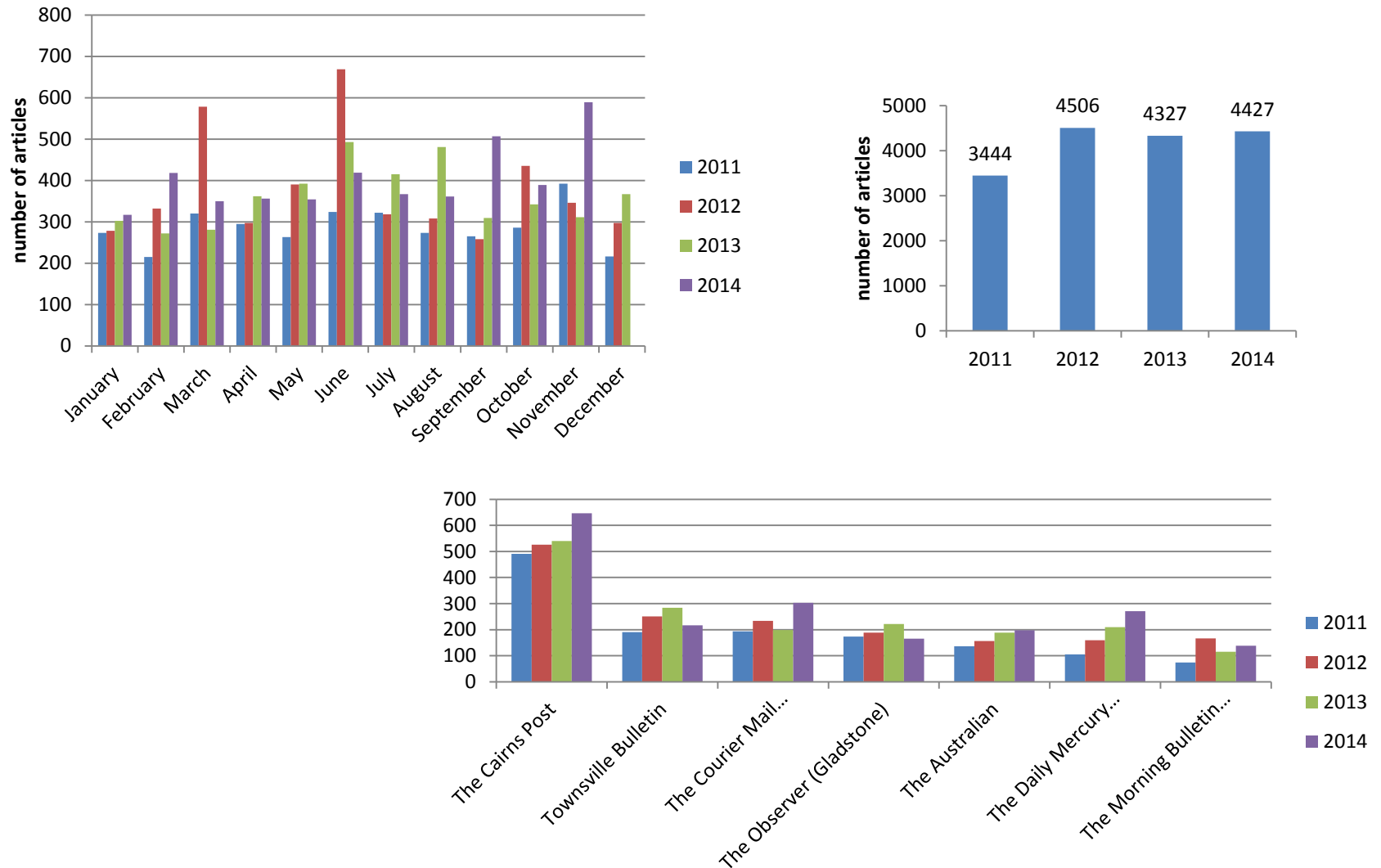


Figure 23. News articles containing "Great Barrier Reef" in text, as at 30 November 2014. Top left: Articles by month. Top right: Articles by year. Bottom: Articles by publication (top 7 only). Source: Proquest Australia & New Zealand Newsstand.

SELTMP 2014: DRIVERS OF CHANGE IN THE GREAT BARRIER REEF

5. Information, Communication & Media: Outlook threats

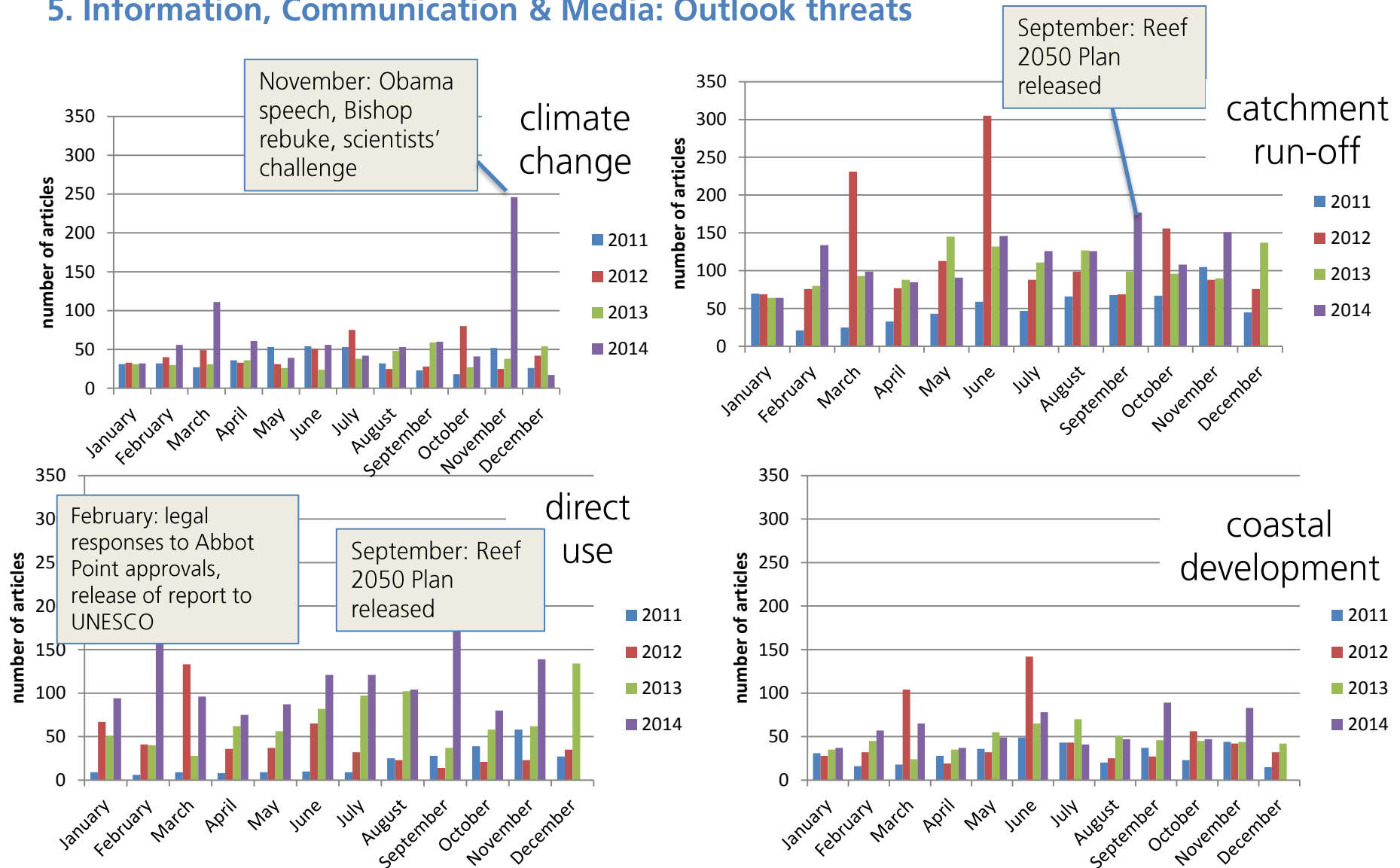


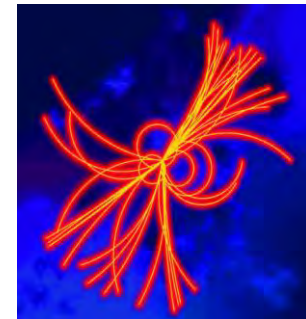
Figure 24. Proquest Australia & New Zealand Newsstand Search of 2011-2014 news articles as at 30 November 2014. Threats from GBRMPA Outlook Report (2009). Details of search terms in Appendix. Additional analysis from Bohensky et al. *in review*, Lankester et al. *in review*.

6. Science and Technology

*The development and diffusion of **scientific knowledge** and **technologies** can have significant implications for ecological systems and human well-being. Rates of investment in research and development, rates of adoption of new technologies, changes in the productivity and extractive capabilities of new technologies, and the access to and dissemination of information through new technologies all have profound implications.*

“Wishlist” Indicators

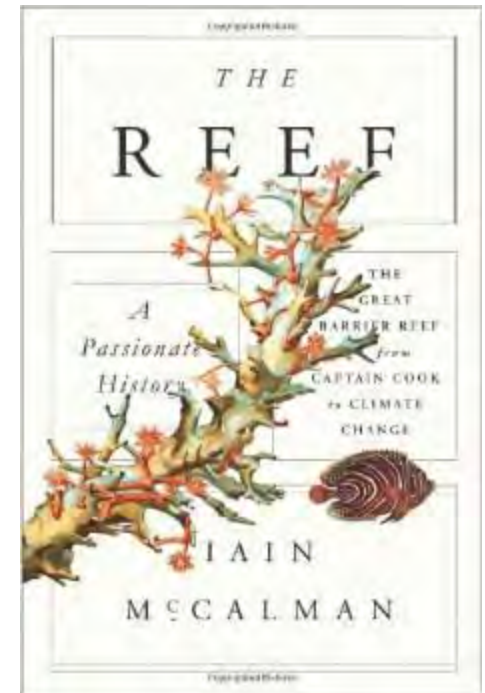
- Scientific research published
- Scientific research projects/programs funded
- Government and private research investment
- Scientific advances
- Rates of adoption of new technologies
- Changes in the productivity and extractive capabilities of new technologies
- Access to and dissemination of information through new technologies



SELTMP 2014: DRIVERS OF CHANGE IN THE GREAT BARRIER REEF

6. Science and Technology: GBR research

1. Number of 2014 Web of Knowledge publications with "Great Barrier Reef" in title: **78 (512 on topic)**
2. Most cited GBR-related 2014 publication on Google Scholar: **Rigsby, Bruce and Chase, Athol. The Sandbeach People and dugong hunters of Eastern Cape York Peninsula: property in land and sea country in *Customary Marine Tenure in Australia* (26 citations)**
3. On *The Economist's* 'Best Books of 2014' List: **Iain McCalman. *The Reef: A Passionate History: The Great Barrier Reef from Captain Cook to Climate Change*.**



SELTMP 2014: DRIVERS OF CHANGE IN THE GREAT BARRIER REEF

6. Science and Technology: Scientific achievements

Wikipedia's 'science events for 2014':

- 31 Jan:** Despite warnings from scientists about the ecological impact, Australia's government has approved plans to dump three million cubic metres of sediment near the Great Barrier Reef, as part of the world's largest coal port [1]
- 4 March:** A new study concludes that nearly one-fifth of the 720 UNESCO World Heritage Sites will be affected by rising sea levels this century if global temperatures rise by 3 °C [2]
- 6 March:** The discovery of a new living coral reef with an area of 28 km² in the territorial waters of Iraq is announced in Scientific Reports [3]
- 2 July:** Coral reefs in the Caribbean will disappear within 20 years, according to a new report from the IUCN [4]; Fabien Cousteau and two crew members resurface after 31 days living underwater and collecting scientific data [5]
- 8 October:** Ocean acidification is causing nearly \$1 trillion of damage to coral reefs each year, threatening the livelihoods of 400 million people, according to a report based on the work of 30 experts [6]



Source: http://en.wikipedia.org/wiki/2014_in_science. Accessed 8 December 2014.

SELTMP 2014: DRIVERS OF CHANGE IN THE GREAT BARRIER REEF

6. Science and Technology: Telecommuting

In Queensland 58% of employees (1.1 million people) have a flexible work arrangement of some type. This includes 13.3% (253,000 people) working from home.



The Australian Government aims to increase teleworking to 12% of the workforce (DCDBE).

Currently 6% of Australian workers telecommute, 11% in the US and 10% in Europe (Access Economics).

Source: Hajkowicz et al. 2012

SELTMP 2014: DRIVERS OF CHANGE IN THE GREAT BARRIER REEF

6. Science and Technology: New retail models

Tescos Virtual Grocery Walls

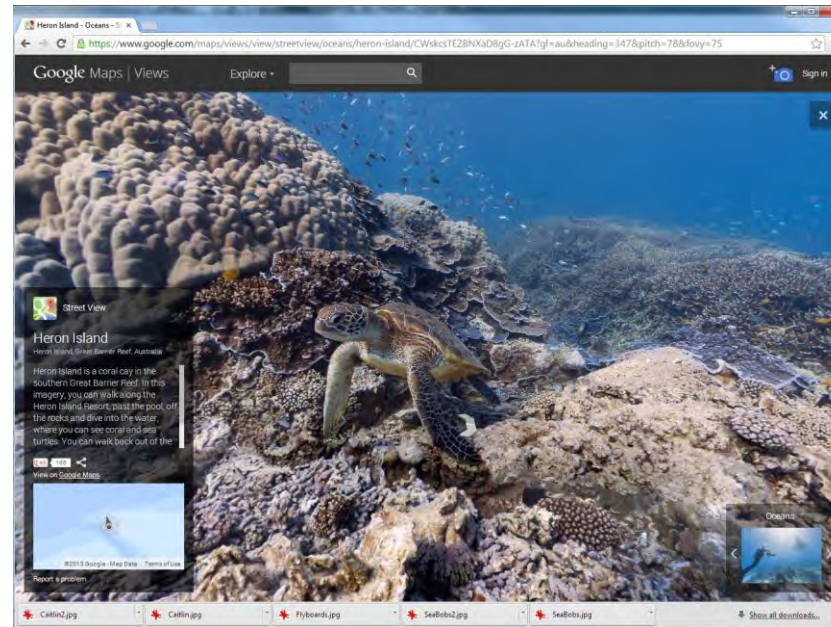


Source: Hajkowicz et al. 2012

Images: www.terminalu.com; www.designboom.com; shoppingcartandshopper.blogspot.com

SELTMP 2014: DRIVERS OF CHANGE IN THE GREAT BARRIER REEF

6. Science and Technology: Reef exploration and enjoyment



Images (clockwise from top L): © Christian Miller; © Matt Curnock;; <http://www.smh.com.au/technology/sci-tech/googles-360degree-tour-of-the-deep-blue-sea-20120926-26101.html>; © Jayne Jenkins

SELTMP 2014: DRIVERS OF CHANGE IN THE GREAT BARRIER REEF

What next? Examples of Driver Integration through Scenario Analysis in the Region

SELTMP identified six major categories of drivers and has collected data on selected indicators on an annual basis, or as frequently as data become available. The logical progression from driver identification is a consideration of how these drivers interact. Such an integrated analysis of drivers is an essential part of managing future change.

Scenario analysis is a structured process of generating imaginative future possibilities which have implications for ecosystems and human well-being. Scenarios consist of narratives that consider how alternative futures, typically related to a particular focal issue (O'Brien, 2000), may unfold from combinations of highly influential and uncertain drivers, and their interaction with more certain driving forces (Figure 25).

In the GBR, scenario planning has been used to explore how climate change is likely to interact with other drivers to produce different future trajectories for the reef. In one exercise undertaken in 2009, scenarios were developed to explore how the future might unfold for the GBR and catchments, given climate change projections (Bohensky et al. 2011). Two main drivers were identified that were considered central to determining regional change: 1) whether global development would follow a 'business and usual' or 'green economy' pathway, and 2) whether Australian development would follow one or the other of these pathways. From these drivers, four scenarios were formed, each expressing a different narrative for the GBR region (Figure 26). Indicators of ecosystem health and human well-being were compared under the scenarios, revealing that while proactive regional management could offset some negative global impacts, without stronger global commitments on climate change the GBR will eventually undergo irreversible changes.

In another scenario study, a participatory process was used to explore potential futures for the GBR's fishing and tourism industries given varying capacities for adaptation to climate change (Evans et al. 2013), resulting in the four scenarios illustrated in Figure 27. This study found that drivers such as economic volatility, natural disasters, and policy and management decisions are more immediate concerns for the GBR' industries than climate change. However, the project concluded that policies on economic development, environmental management and adaptation to climate change should be integrated.

SELTMP 2014: DRIVERS OF CHANGE IN THE GREAT BARRIER REEF

Driver Integration through Scenario Analysis

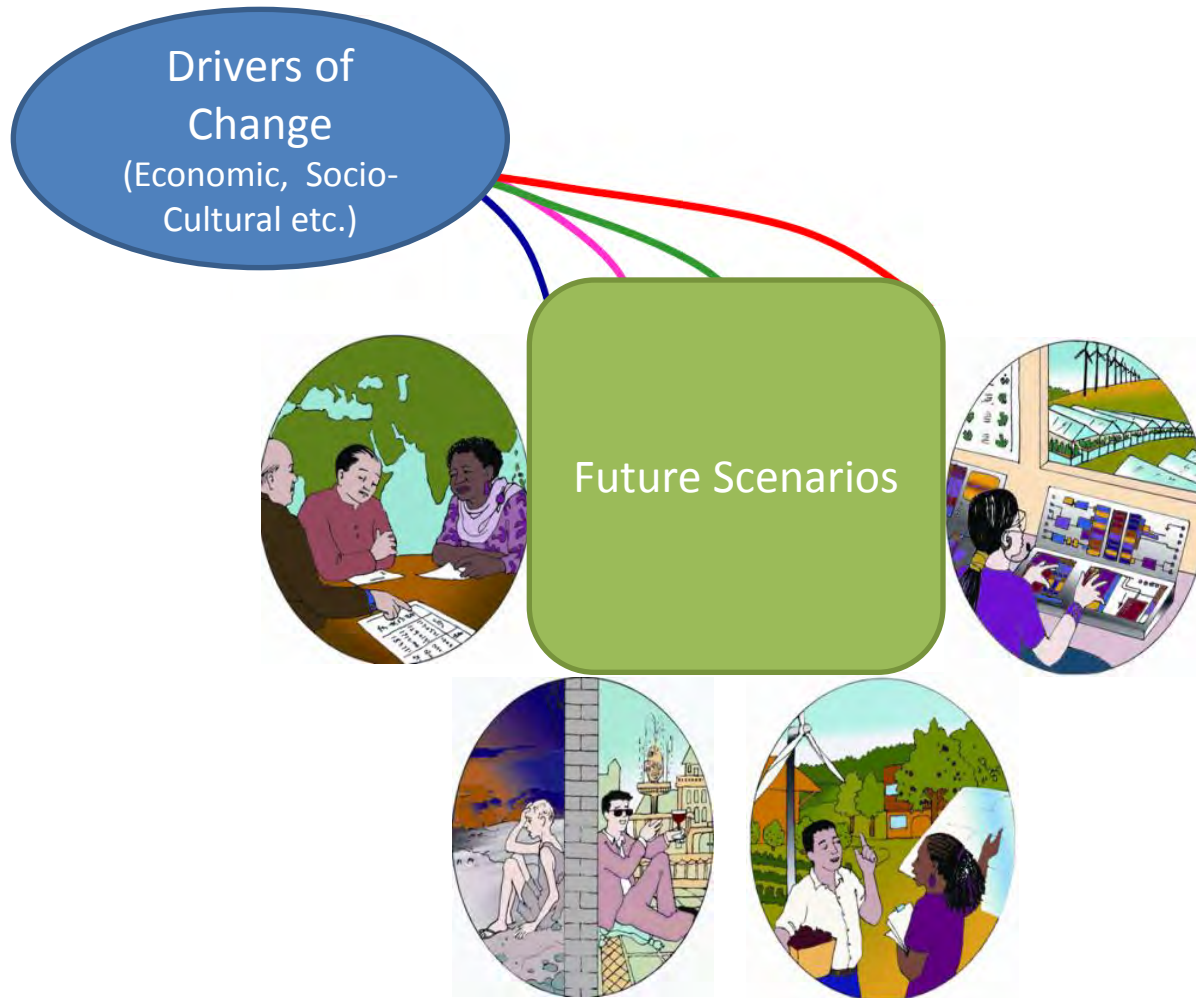


Figure 25. Future scenarios unfold from combinations of different categories of drivers, which may vary in their certainty and expected influence. Scenario pictures from MEA 2005.

SELTMP 2014: DRIVERS OF CHANGE IN THE GREAT BARRIER REEF

Four Future Scenarios for the Great Barrier Reef

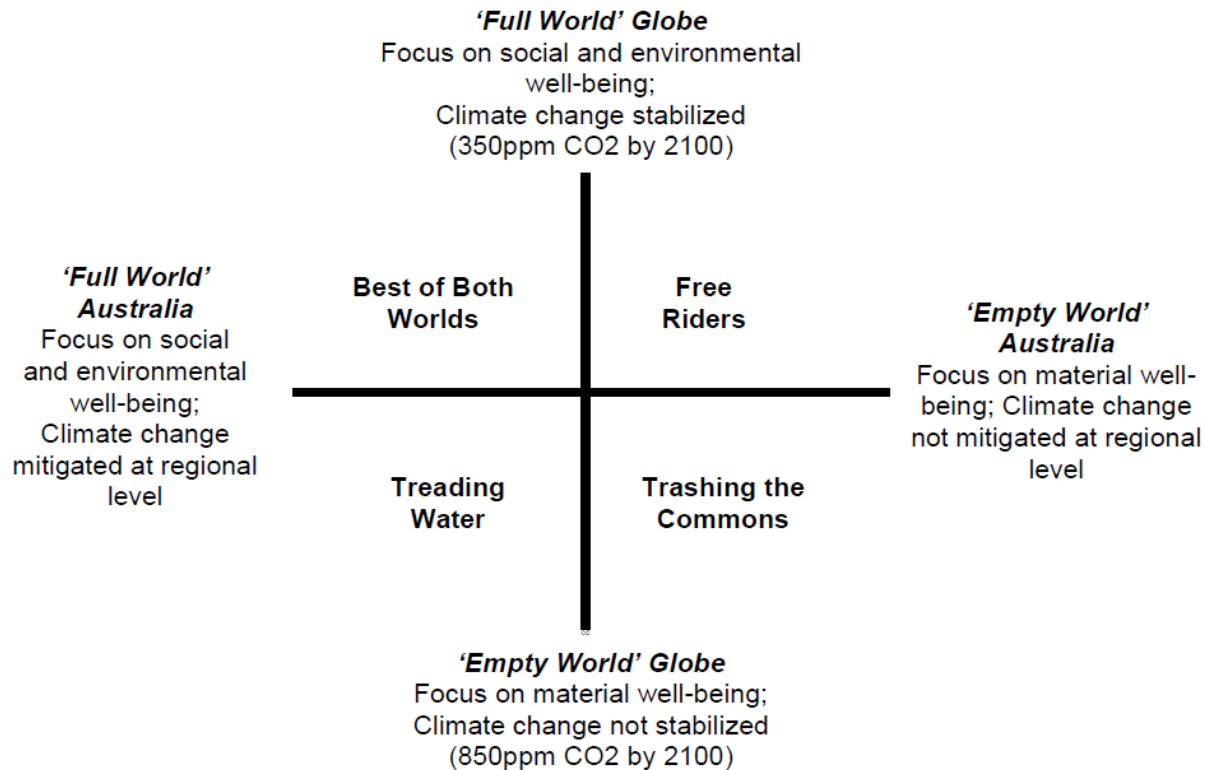


Figure 26. In one scenario analysis, four scenarios for the GBR were developed from combinations of two key drivers of change: 1) the global pathway for development and 2) the Australian pathway for development. These pathways set the boundary conditions for other types of drivers, including those described in this report. Source: Bohensky et al. 2011.

SELTMP 2014: DRIVERS OF CHANGE IN THE GREAT BARRIER REEF

Visualising Scenarios for the Great Barrier Reef

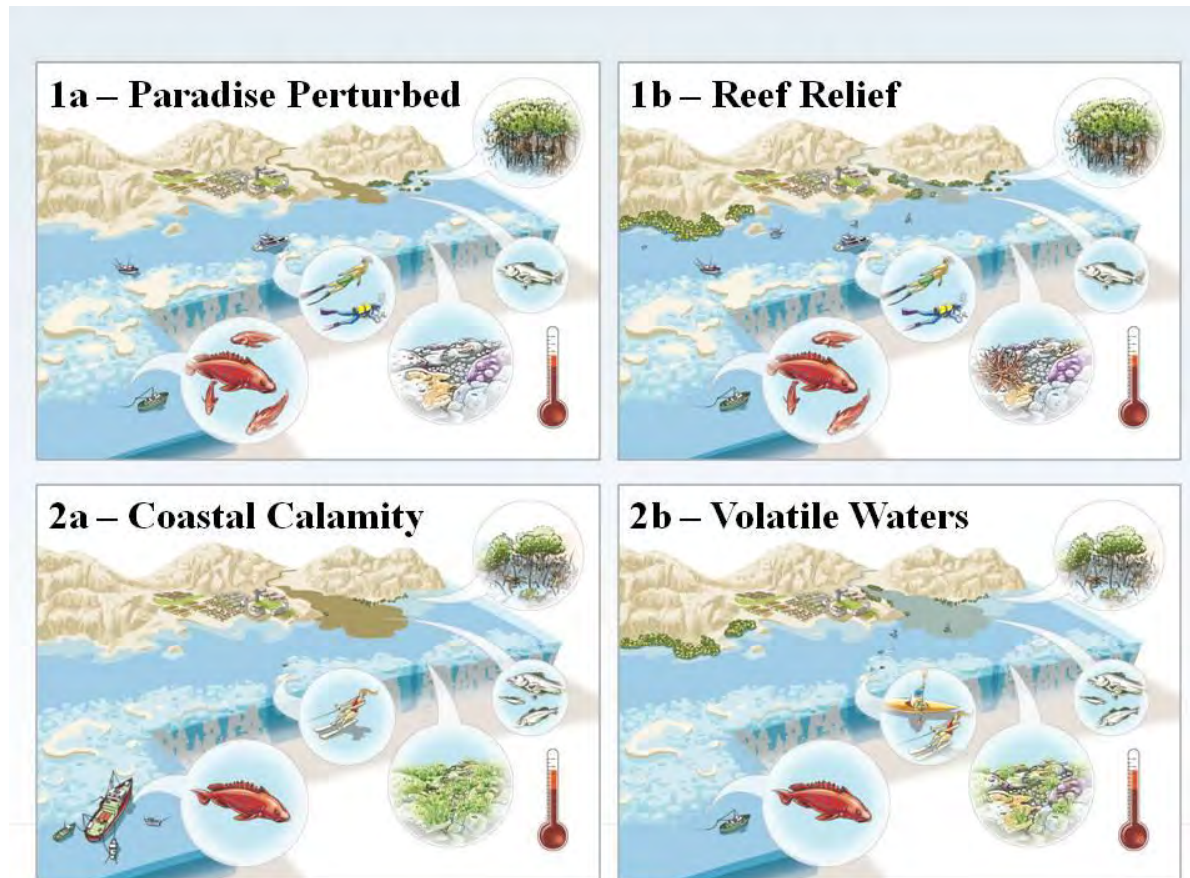


Figure 27. Illustrations of alternative future scenarios defining different limits to climate change adaptation for the Great Barrier Reef. Source: Evans et al. 2013.

SELTMP 2014: DRIVERS OF CHANGE IN THE GREAT BARRIER REEF

References

1. Bohensky, E., Butler, J., Costanza, R., et al. 2011. Future makers or future takers? A scenario analysis of climate change and the Great Barrier Reef. *Global Environmental Change*, 21 (3), 876-893.
2. Bohensky, E.L., Lankester, A.L., Newlands, M., et al. *In review*. Still real, still a problem?: Public and media concern with climate change in the Great Barrier Reef.
3. Daley, J., McGannon, C., and Savage J., 2013, *Budget pressures on Australian governments*, Grattan Institute
4. Evans, L. S., Hicks, C. C., Fidelman, P., Tobin, R, C., Perry, A. L. 2013. Future Scenarios as a Research Tool: Investigating Climate Change Impacts, Adaptation Options and Outcomes for the Great Barrier Reef, Australia. *Human Ecology*, 41 (6), 841-857.
5. Hajkovicz, S., Cook, H., and Littleboy, A. 2012. *Our Future World*. Canberra, CSIRO.
6. Lankester, A., Bohensky, E., Newlands, M. *In review*. Media representations of risk to the Great Barrier Reef from dredge spoil disposal for port expansion at Abbot Point.
7. Lindenmayer, D.B. and G.E. Likens. 2009. Adaptive monitoring: a new paradigm for long-term research and monitoring. *Trends in Ecology and Evolution* 24(9), 482-486.
8. Millennium Ecosystem Assessment 2003. *Ecosystems and Well-being: A Framework for Assessment*. Island Press, Washington D.C
9. Millennium Ecosystem Assessment 2005. *Ecosystems and Human Well-Being: Synthesis*. Island Press, Washington, DC.
10. O'Brien, P., 2000. *Scenario Planning: A Strategic Tool*. Bureau of Rural Sciences, Canberra.
11. Quah, D. 2011. The Global Economy's Shifting Centre of Gravity. *Global Policy* 2(1): 3-9.

All other references used in this report, including websites, are given with respective data.

SELTMP 2014: DRIVERS OF CHANGE IN THE GREAT BARRIER REEF

Appendix: Search terms used in media analysis

General: "Great Barrier Reef" AND stype.exact("Newspapers" OR "Magazines" OR "Wire Feeds") AND at.exact("Front Page/Cover Story" OR "Correspondence" OR "Article" OR "Feature" OR "Editorial" OR "News" OR "Letter To The Editor" OR "Commentary")

Climate change: ("climate change" OR "global warming" OR "ocean acidification" OR "greenhouse gas" OR "carbon dioxide" OR "sea level rise" OR "sea surface temperature" OR "bleach*")

Coastal development: ("coastal development" OR "wetland destruction" OR "marine debris" OR "industrial development" OR "litter" OR "plastic bag" OR "rubbish" OR "urban development" OR "urbanization" OR "urbanisation" OR "urban pressure" OR "urban growth" OR "port development" OR "pollut*")

Catchment runoff: ("water quality" OR "pesticide*" OR "sediment*" OR "nutrient*" OR "fertiliser*" OR "fertilizer" OR "soil erosion" OR "mine*" OR "mining")

Direct use: ("fishing pressure*" OR "illegal fishing" OR "overfish*" OR "tourism impact*" OR "recreation use impact*" OR "defence training impact*" OR "underwater blasting" OR "scientific research impact*" OR "shipping incidents" OR "boat strike*" OR "dredg*" OR "traditional use impact*" OR "anchoring" OR "mooring" OR "diving impact*" OR "chemical spill*" OR "oil spill*")

Additional details of analysis available upon request from author.



National Environmental
Research Program

CONTACT

Name: Dr. Erin Bohensky
Organisation: CSIRO Land and Water
Phone: 07 4753 8569
Email: erin.bohensky@csiro.au