

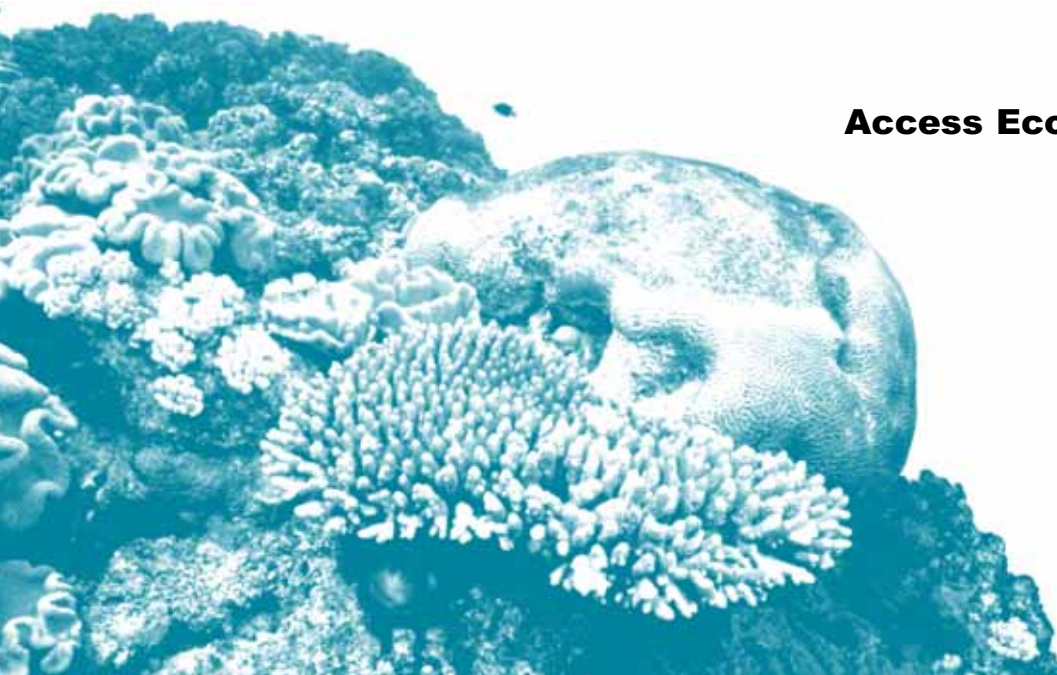


Australian Government
Great Barrier Reef
Marine Park Authority

RESEARCH PUBLICATION NO. 88

Measuring the economic & financial value of the Great Barrier Reef Marine Park, 2005-06

Access Economics Pty Limited



let's keep it great

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**Report by Access Economics Pty Limited
for Great Barrier Reef Marine Park Authority.**



Australian Government

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EXECUTIVE SUMMARY

This report, prepared by Access Economics and commissioned by the Great Barrier Reef Marine Park Authority (GBRMPA), updates quantitative estimates of the economic and financial value of activity undertaken within the Great Barrier Reef Marine Park Catchment Area (GBRCA) for the financial year 2004-05, and presents new estimates for 2005-06.

It should be noted at the outset that the GBRCA is a larger region than the Great Barrier Reef Marine Park (GBRMP), because it is defined to include islands within the GBRMP plus large areas of mainland Australia, mainly east of the ridge defined by the mountain summits of the Great Dividing Range. The use of the GBRCA rather than the more narrowly-defined GBRMP has been dictated by data availability. Adequate, if not ideal, data is available for the GBRCA. Very limited data only is available for the GBRMP, and this is not suitable for a proper national accounts-based analysis. The implications of using the GBRCA rather than the GBRMP include the following:

- *The economic contribution of tourism is over-stated in absolute terms.*
- *The same conclusion applies to recreational activity.*
- *In the case of commercial fishing, the over-statement, if any, is likely to be small.*
- *In relative terms, the report's conclusions about the economic contributions of these three groups of activity will tend to over-state tourism and recreational activity relative to commercial fishing.*
- *Because of data limitations, quantifying the magnitude of these over-statements is not possible.*

This report also presents a brief qualitative assessment of the likely effects of climate change on the Great Barrier Reef Marine Park (GBRMP) and makes recommendations for improving data to allow a quantitative assessment of the economic effects of such climate change.

THIS REPORT IN CONTEXT

There have been several attempts, on varying bases, to measure the economic, financial and social value of the Great Barrier Reef Marine Park. Some of these are quite ambitious, using concepts such as Total Economic Value (TEV). TEV covers:

- 'Use' and 'non-use' values.
- Within the former, direct and indirect values, also broken down into extractive and non-extractive uses and goods and services.

Some of these may or may not line up well with standard national accounting-based stocks and flows concepts, and in many cases, valuations are both difficult and subjective.

This Access Economics report is much less ambitious:

- It only looks at national accounts-based *flows* for which market transactions can readily be estimated and for which input-output tables (Australian, Queensland and regional) can be compiled.

- It concentrates on value added, gross product and employment.
- It does not look at *stocks* because of the fledgling state of the art in relation to environmental accounting using national accounts frameworks.
- And it concentrates mainly on three industries: tourism, commercial fishing and cultural and recreational activity, where the first and third of these include estimates for recreational fishing.

ACCESS ECONOMICS' CONCLUSIONS

As measured using the quantitative data (primarily national accounts-based) available to it, Access Economics concludes that the total (direct plus indirect) economic contribution of tourism, commercial fishing, and cultural and recreational activity to the GBRCA in 2005-06 is as follows:

- For value-added, around \$3.7 billion per annum.
- For gross Area product, (which adds net indirect taxes less subsidies to value-added) around \$4.5 billion per annum.
- For employment (full time equivalent basis), about 44,000 persons.

The corresponding estimates for Queensland are:

- For value-added, about \$4.5 billion per annum.
- For gross product, about \$5.4 billion per annum.
- For employment (full time equivalent basis), about 56,000 persons.

The corresponding estimates for Australia are:

- For value-added, about \$5.7 billion per annum.
- For gross product, about \$6.9 billion per annum.
- For employment (full time equivalent basis), about 66,000 persons.

Tourism dominates these contributions:

- For value-added and gross product, tourism's share is about 84%-87%.
- For employment, tourism's share is about 81%-84%.

Access Economics' results are presented in more detail in tables 1, 2, and 3 below. Note that GAP means Gross Area Product (referring to the GBRCA), and is the GBRCA measure corresponding to GDP. Similarly, GSP means Gross State Product. These terms are not to be confused with the gross value of production (GVP). GAP, GSP and GDP are fractions of the appropriate GVP.

TABLE 1: DIRECT PLUS INDIRECT CONTRIBUTIONS OF SELECTED GBRCA ACTIVITIES TO THE GBRCA, 2004-05 & 2005-06

<i>Total contribution (direct plus indirect)</i>	2004-05	2004-05	2004-05	2005-06	2005-06	2005-06
	<i>Total</i>	<i>Total</i>	<i>Total</i>	<i>Total</i>	<i>Total</i>	<i>Total</i>
	<i>Value Added (\$m)</i>	<i>GAP (\$m)</i>	<i>Employment (FTE 000)</i>	<i>Value Added (\$m)</i>	<i>GAP (\$m)</i>	<i>Employment (FTE 000)</i>
<i>Total tourism within the GBRCA</i>						
Visitors from GBRCA	585	725	8	561	698	7
Visitors from rest of Queensland	460	565	5	442	545	5
Interstate visitors	812	999	10	1,043	1,283	12
by GBRCA residents for travel outside GBRCA	165	198	2	174	211	2
International visitors	827	1,016	11	879	1,080	11
Total tourism	2,849	3,504	36	3,099	3,817	36
Commercial fishing	188	195	1	163	169	1
Recreational activity (net of tourism)	407	482	8	406	482	6
Total contribution to GBRCA	3,444	4,181	45	3,669	4,468	44

Source: Access Economics. Totals may differ from sums of components due to rounding.

TABLE 2: DIRECT PLUS INDIRECT CONTRIBUTIONS OF SELECTED GBRCA ACTIVITIES TO QUEENSLAND, 2004-05 AND 2005-06

<i>Total contribution (direct plus indirect)</i>	2004-05	2004-05	2004-05	2005-06	2005-06	2005-06
	<i>Total</i>	<i>Total</i>	<i>Total</i>	<i>Total</i>	<i>Total</i>	<i>Total</i>
	<i>Value Added (\$m)</i>	<i>GSP (\$m)</i>	<i>Employment (FTE 000)</i>	<i>Value Added (\$m)</i>	<i>GSP (\$m)</i>	<i>Employment (FTE 000)</i>
<i>Total tourism within the GBRCA</i>						
Visitors from GBRCA	682	838	10	658	811	9
Visitors from rest of Queensland	643	779	8	583	711	7
Interstate visitors	956	1,164	12	1,227	1,494	14
by GBRCA residents for travel outside GBRCA	190	227	2	203	244	2
International visitors	1,094	1,328	14	1,101	1,337	13
Total tourism	3,565	4,336	46	3,772	4,597	46
Commercial fishing	236	243	2	205	211	1
Recreational activity (net of tourism)	474	545	10	472	544	9
Total contribution to Queensland	4,274	5,124	57	4,450	5,352	56

Source: Access Economics. Totals may differ from sums of components due to rounding.

TABLE 3: DIRECT PLUS INDIRECT CONTRIBUTIONS OF SELECTED GBRCA ACTIVITIES TO AUSTRALIA, 2004-05 AND 2005-06

<i>Total contribution (direct plus indirect)</i>	2004-05	2004-05	2004-05	2005-06	2005-06	2005-06
	<i>Total</i>	<i>Total</i>	<i>Total</i>	<i>Total</i>	<i>Total</i>	<i>Total</i>
	<i>Value Added (\$m)</i>	<i>GDP (\$m)</i>	<i>Employment (FTE 000)</i>	<i>Value Added (\$m)</i>	<i>GDP (\$m)</i>	<i>Employment (FTE 000)</i>
<i>Total tourism within the GBRCA</i>						
Visitors from GBRCA	773	948	10	750	923	9
Visitors from rest of Queensland	724	879	8	659	803	8
Interstate visitors	1,282	1,559	14	1,661	2,019	18
by GBRCA residents for travel outside GBRCA	211	254	2	228	276	2
International visitors	1,528	1,856	17	1,633	1,982	18
Total tourism	4,518	5,496	52	4,932	6,004	55
Commercial fishing	273	288	2	238	251	2
Recreational activity (net of tourism)	544	624	9	542	623	9
Total contribution to Australia	5,335	6,408	63	5,712	6,877	66

Source: Access Economics. Totals may differ from sums of components due to rounding.

The economic contribution of these selected industry activities to the GBRMP will be a subset of the results just summarised for the wider GBRCA:

- For commercial fishing, the subset results for the GBRMP will presumably be a very high percentage of the GBRCA results.
- For tourism and cultural and recreational activities, the subset results will be smaller proportions of the GBRCA results.

CAVEATS

These estimates are subject to a variety of caveats, as noted throughout this report. For example:

- They cover market-related transactions only: non-market activities, including cultural and indigenous activities, are not covered.
- The analysis relates to annual *flows* re-estimated for 2004-05, and estimated for 2005-06: there is no balance sheet assessment covering stocks of assets, etc.
- The quantification is based on a wide variety of data sources compiled by different Commonwealth and State agencies: there will inevitably be some inconsistencies between these sources.
- Much of the actual data is relatively old and needs to be 'scaled up' to obtain estimates for the reference year (2005-06). The scaling up process undertaken by Access Economics inevitably involves scope for additional errors.
- Externality effects (eg, adverse effects on water quality within the GBRMP associated with other industries (eg, agriculture)) have not been taken into account.
- On externality effects, the economic contributions of the three selected industries also do not cover adverse effects over time from them (eg, from tourism and local resident congestion, at least at some locations within the GBRMP, possible over-fishing, etc.)

FURTHER WORK NEEDED

The main requirement for improved and updated analysis of the type presented in this report is more up-to-date and hopefully more fully consistent data.

Above all, these types of analysis are hampered by delays in the release of the three input-output tables that are a crucial foundation for economic contribution studies such as this. The currently-released data (for 1996-97) is nearly a decade out of date.

Scientific research is an important activity within the GBRCA in general and the GBRMP in particular, but we have not been able to obtain quantitative estimates that we can reformulate in a national accounts-consistent framework at this stage. But a comprehensive summation of the annual gross costs involved in policy development, management, monitoring and research, suggests it might be between \$100 and \$200 million per annum. More work is needed to refine this estimate.

Economic contributions from expenditures on other activities such as scuba diving, snorkelling and boating that are not included in Cultural & Recreational Services are also likely to be significant, but we have no data on these at present.

Any information in these areas would help to make the analysis in this report more comprehensive.

Even if these data gaps can be filled, because of other, insuperable, data gaps relating to the Tourism Satellite Account (TSA) methodology used in this report, the economic contribution of tourism to the GBRCA will be understated by the type of analysis presented in this report.

The main factors working the other way – if not for a particular reference year, at least over time – are the external diseconomies associated with industry activity on the environment of the GBRMP, which is surely a major drawback for tourism, commercial fishing, and other activity.

As and if such diseconomies degrade the GBRMP itself, the ‘pulling power’ of the GBRCA itself may be reduced, and with it the economic contribution of the selected industries examined in this report.

No quantification of these effects has been included in this report. However, a qualitative analysis of likely mechanisms linking climate change and the economic contribution of the Great Barrier Reef has been included (see below).

CLIMATE CHANGE AND THE GREAT BARRIER REEF

The evidence of climate change is strong and growing. Its symptoms include:

- Warming atmosphere and oceans, melting ice, rising (and more acid) sea levels.
- Movement of tropical disease vectors to higher latitudes.
- Increased incidence of extreme weather events, such as cyclones.
- Increased frequency and extent of mass coral bleaching events.

The likely consequences of all of these for the Great Barrier Reef are substantial eco-system change. The only realistic policy response – short of reversing climate change itself – is management to facilitate Reef resilience and recovery.

Reef degradation is likely directly to reduce Reef-related tourism over time. This, plus more extreme weather, plus more tropical disease risks, are likely to deter tourism more generally. Commercial fishing may also be affected to the extent that coral bleaching leads to Reef destruction, less coral cover, less biodiversity and eco-system decline. Recreational activity is likely to be affected as well – the result of the combined effects of the tourism and commercial fishing mechanisms just noted.

But these effects are likely to be at least partly offset by substitution behaviour:

- As a well-managed Reef, the GBRMP might attract increased demand for Reef experiences as a result of demand switching away from less well-managed coral reefs elsewhere in the world. Access Economics judges that, if the GBRMP is relatively well managed in terms of guarding against human activities threatening sustainability – for example due to the 1 July 2004 rezoning of the GBRMP – then the Reef may well be more resilient, and recover more quickly from mass coral bleaching events, than similar coral reefs elsewhere around the world.
- Tourism businesses will presumably switch marketing to cater for other tourism interests as a partial substitute for Reef-related tourism.

- As a region with relatively diverse activities, the GBRCA is relatively well-placed to exploit such substitution opportunities compared with some other coral reef destinations that are more specialised. Substitution effects may well be larger for the GBRCA as a whole than for the GBRMP. But, in the absence of hard data, this is speculation based on the more diverse activity base within the GBRCA than within a subset of that region, the GBRMP.

There is some overseas evidence (of unknown quality) suggesting that these substitution effects can be significant in some cases.

For Australia, Access Economics is not aware of any data on these matters that could be used reliably to assess the direct, or 'impact' economic effects of climate change on the GBRCA. Without that data, general equilibrium modelling of the economic impact of climate change on the GBRCA (which would produce indirect economic effects as part of the model solutions) is not possible.

The recommended response is more and better data, in this case based on appropriate surveys for the tourism, commercial fishing and recreational industries. If the resources were available, the Australian Bureau of Statistics is best equipped to do the job.

PREAMBLE: THIS REPORT IN CONTEXT

There have been several attempts, on varying bases, to measure the economic, financial and social value of the Great Barrier Reef Marine Park (GBRMP).¹

These sometimes entail combining a variety of methodologies and value imputations covering activities and perceived values that are not readily amenable to objective, or market price-based, quantification.

Where these generate quantitative estimates that are then added together to (i) generate a 'total' estimate which, in some cases (ii) is compared with Australia's GDP or Queensland's Gross State Product (GSP), there arises a major risk that 'apples and oranges' are being compared.

This report is much less ambitious:

- It only looks at national accounts-based *flows* for which market transactions can readily be estimated or imputed and for which associated input-output tables (Australian, Queensland and regional) can be compiled.
- It concentrates on value added, gross product and employment.
- It does not look at *stocks* because of the fledgling state of the art in relation to environmental accounting using national accounts frameworks. (Work is being undertaken by the ABS in the area of environmental accounting, and, in terms of methodology, the ABS is pursuing a leading-edge approach. However, in relation to the GBRMP, there is relatively little available at present. Resource constraints faced by the ABS, plus higher priority being given to other matters, such as fresh water, are the main impediments at the present time.)
- And this report concentrates on only three industries: tourism, commercial fishing and cultural and recreational activity, where the first and third of these include estimates for recreational fishing.

Even within a national accounts framework, the focus on the three industries just listed means that about 70%² of the gross value of production in the region within which the GBRMP lies is excluded.

Mineral production (about 50% of the total) and agricultural production (another 20% or so) are not given much attention in this report.

The Total Economic Value (TEV) concept used in the Hand Report is a much more ambitious conceptual framework, covering:

- 'Use' and 'non-use' values, many of which require difficult and/or controversial imputation assumptions to produce quantitative estimates of value.

¹ See, for example, *An Economic and Social Evaluation of Implementing The Representative Areas Program By Rezoning The Great Barrier Reef Marine Park*, Report on the Revised Zoning Plan, Tony Hand, PDP Australia Pty Ltd, November 2003. Hereafter this is referred to as the Hand Report.

² Based on estimates presented in *Land Use and Water Quality in the Great Barrier Reef Catchment* Productivity Commission, Research Report, 2003.

- Within the former, direct and indirect values, also broken down into extractive and non-extractive uses and goods and services.
- Some of these may or may not line up well with standard stocks and flows concepts, and in many cases, as noted, valuations are both difficult and subjective.

An illustrative list of the elements included within the TEV framework makes the point. These elements include (see the Hand report for full definitions):³

- Existence values.
- Bequest values.
- Option values.
- Quasi-option values.
- Religious and/or spiritual (including indigenous community) values.

None of these are easily, or at all, incorporated within a quantitative national accounting framework, whatever their intrinsic importance, whether we are looking at flows and/or stocks.

From a complementary perspective, these values cover, amongst other things:⁴

- Indigenous cultural values.
- National heritage values.
- Environmental and scarcity values (coral reefs, species, bioregions, marine protected areas, direct non-use values, ecosystem services, shoreline coastal protection, medical resources/bioprospecting.
- Other indirect environmental values (visual amenity/aesthetic value, research value, education, etc.)

Some of these are effectively embodied in market transactions, but many are not.

This is not to say that such values are either unimportant or not worth attempting to quantify. On the contrary. But they cover dimensions not easily incorporated into the current national accounting framework.

³ See Hand, op. cit., section 4.

⁴ Hand, op. cit., pages 8-14.

1. FOCUS OF THIS REPORT

This report has been prepared by Access Economics and commissioned by the Great Barrier Reef Marine Park Authority (GBRMPA). It presents quantitative estimates of the economic and financial value of selected types of activity undertaken within the Great Barrier Reef Marine Park Catchment Area (GBRCA) – defined in section 2 below – for the financial year 2005-06. It builds upon the corresponding Access Economics report for 2004-05 and also contains revised estimates for that financial year.

It should be noted at the outset that the GBRCA is a larger region than the Great Barrier Reef Marine Park (GBRMP), because it is defined to include islands within the GBRMP plus large areas of mainland Australia, mainly east of the ridge defined by the mountain summits of the Great Dividing Range. The use of the GBRCA rather than the more narrowly-defined GBRMP has been dictated by data availability. Adequate, if not ideal, data is available for the GBRCA. Very limited data only is available for the GBRMP, and this is not suitable for a proper national accounts-based analysis. The implications of using the GBRCA rather than the GBRMP include the following:

- *The economic contribution of tourism is over-stated in absolute terms.*
- *The same conclusion applies to recreational activity.*
- *In the case of commercial fishing, the over-statement, if any, is likely to be small.*
- *In relative terms, the report's conclusions about the economic contributions of these three groups of activity will tend to over-state tourism and recreational activity relative to commercial fishing.*
- *Because of data limitations, quantifying the magnitude of these over-statements is not possible.*

The rest of this report is organised as follows:

- Section 2 defines the geographic scope of the analysis and sets out the reasons for concentrating on the GBRCA.
- Section 3 summarises the nature of Access Economics' analysis, which is determined by adherence to a national accounting framework, including a 'Tourism Satellite Account' (TSA) treatment of tourism, as used by the Australian Bureau of Statistics (ABS). It also defines the industry activity covered by this report. In addition, it sets out the general limitations of the analysis used.
- Section 4 describes how the data used in the analysis was compiled. It also presents a review of the limitations of the available data.
- Section 5 presents Access Economics' estimates of the direct economic value of the selected activities in the GBRCA.
- Section 6 presents Access Economics' estimates of the indirect economic value of the selected activities in the GBRCA.
- Section 7 presents Access Economics' estimates of the total (ie, direct plus indirect) economic value of the selected activities in the GBRCA.

- Section 8 presents Access Economics' conclusions, relevant caveats, and outlines areas where further work is needed.
- Section 9 covers additional terms of reference for this report requested by GBRMPA. It deals, in a qualitative way, with the effects of climate change on the Great Barrier Reef and possible flow-on economic effects arising from these effects.
- More detailed material, as necessary, is also presented in attachment A to the report. References are listed in attachment B to the report and text references thereto are included throughout the report in parentheses.

2. GEOGRAPHIC SCOPE OF THE ANALYSIS

2.1 DEFINING THE GREAT BARRIER REEF MARINE PARK

The Great Barrier Reef Marine Park (GBRMP) ranges from the tip of Cape York in Queensland in the north extending south past the Tropic of Capricorn almost to Bundaberg.

It covers an area of approximately 345,400 square kilometres and stretches more than 2,300 kilometres along the northeast coast of Queensland. Its width varies from around 90 kilometres to around 300 kilometres.

The Park extends eastwards from the Queensland shoreline (defined as the mean low water mark) and its outer boundaries are defined in terms of coordinates of latitude and longitude. It includes reef and wrecks within these boundaries. However, it excludes islands within its boundaries and some harbour areas around ports.

A revised Zoning Plan for the Park came into effect on 1 July 2004. It established new types of zones and corresponding boundaries. The revised zones and classification of allowable activities in different zones have greatly improved protection of the range of biodiversity within the Park, while preserving public access to much of the Park.

The major change was to increase the proportion of 'no-take area' from around 4.5% to 33.3% of the Park. Anyone can enter a no-take area, and boating, swimming, sailing and snorkelling are allowed. However, extractive activities like fishing or collecting are not allowed unless written permission by the Authority has been obtained.

There are now seven Commonwealth-specified types of zones within the Park, as summarised in Table 2.1 below (although this rises to eight, if we add the estuarine conservation zone, which is a State zoning only).

Table 2.1 presents a very simplified description that conveys a broad picture of activities that are allowed. There are exceptions and additional restrictions for some categories.

The only 'no go area' is the Preservation Zone.

The 'no-take area' corresponds to the Marine National Park Zone plus the Preservation Zone.

In summary, individuals are allowed access to most areas of the Park for boating, diving and photography, but there are varying restrictions on what they can catch or collect.

Commercial operations require permits, and they are not allowed to engage in extractive activities in some zones.

Tourism programs are allowed in all zones except the Preservation Zone, but subject to permits that specify which activities are allowed. Shipping requires permits if operating outside designated shipping lanes General Use Zones.

TABLE 2.1: ALLOWED ACTIVITIES IN GBRMP ZONES, SIMPLIFIED SUMMARY

<i>Activity</i>	<i>General Use Zone</i>	<i>Habitat Protection Zone</i>	<i>Conservation Park Zone</i>	<i>Buffer Zone</i>	<i>Scientific Research Zone</i>	<i>Marine National Park Zone</i>	<i>Preservation Zone</i>
						<i>no take</i>	<i>no go</i>
Trawling	yes						
Netting (other than bait netting)	yes	yes					
Bait netting, crabbing	yes	yes	yes				
Limited spearfishing (snorkel only), line fishing	yes	yes	yes				
Limited collecting	yes	yes	yes				
Trolling	yes	yes	yes	yes			
Boating, diving, photography	yes	yes	yes	yes	yes	yes	
Traditional uses of marine resources	yes	yes	yes	yes	yes	yes	
Limited impact research	yes	yes	yes	yes	yes	yes	permit
Dive-based fishing (sea cucumber, trochus, tropical rock lobster)	permit	permit					
Aquaculture, dive-based fishing (aquarium fish, coral, beachworm)	permit	permit	permit				
Shipping (other than in designated shipping area)	yes	permit	permit	permit	permit	permit	
Tourism program	permit	permit	permit	permit	permit	permit	
Research (other than limited impact)	permit	permit	permit	permit	permit	permit	permit

Source: GBRMPA.

GBRMPA receives limited income from the issue of permits to commercial operators. An Environmental Management Charge (EMC) of \$4.50 per person per day is collected via tourism operators, although not all passengers pay the full amount. Revenue generated by the EMC in 2005-06 was \$7.27 million.

GBRMPA receives no income from commercial fishing licences, except for a small amount from permits for dive-based (harvest) fisheries. It receives no income from boat registration fees, or for freight shipping moving through the Park. (There are no Queensland licence fees for ocean recreational fishing.)

Commercial fishing licence fees are paid to the Queensland Fisheries Service and boat registration fees are paid to Queensland Transport Services, while shipping charges including pilot fees are paid to port authorities. Permits are required for freight ships to move through the Park but GBRMPA receives no corresponding income. There are considerable risks of oil spills, but the costs of recovery from damage are seen as an insurance matter.

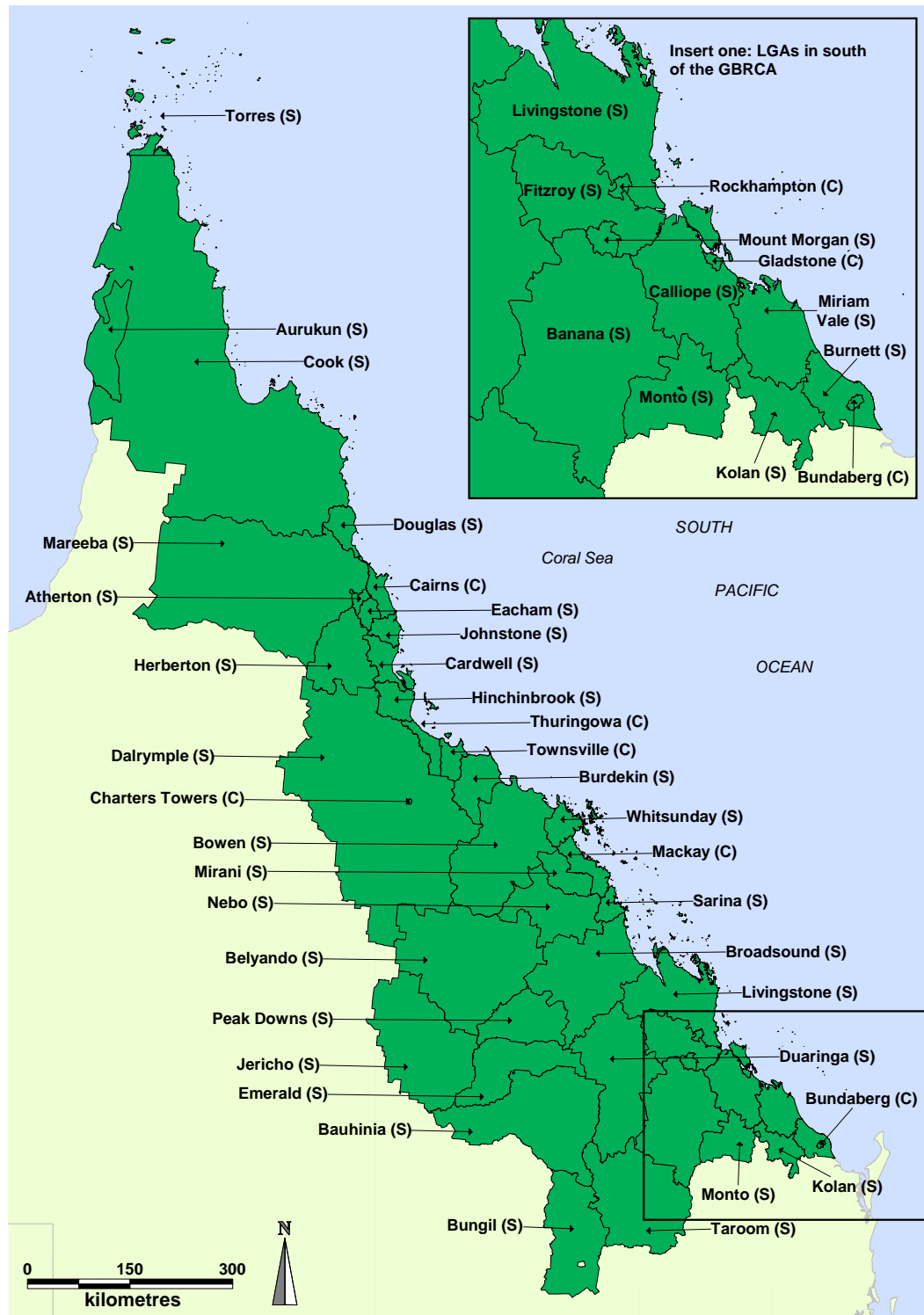
2.2 DEFINING THE GREAT BARRIER REEF CATCHMENT AREA

The boundary of the Great Barrier Reef Catchment Area (GBRCA) is shown in Figure 2.1 below (OESR, 2005).

It is essentially the catchment area for waters that flow from Australia into the Great Barrier Reef Marine Park (GBRMP). It is defined geographically as a set of Local Government Areas (LGAs) where these LGAs have rivers that flow into the GBRMP.

The western boundary more or less follows the Great Dividing Range peaks. At the northern end, the Catchment Area extends further west to the Gulf of Carpentaria because the relevant LGAs cover the whole width of the Cape York Peninsular.

FIGURE 2.1: GREAT BARRIER REEF CATCHMENT AREA AND INCLUDED LGAS



Source: OESR (2005).

The Great Dividing Range becomes more poorly defined moving south. The southern boundary of the Catchment Area extends from north of Roma to the coast south of Bundaberg.

The Catchment Area extends about 100 kilometres further south along the coast than the Marine Park. Water from the Bundaberg River is carried north into the Park by currents. The southern boundary of the Catchment Area excludes some parts of rivers that flow into the Bundaberg River. Major cities and towns within the Catchment Area are Cairns, Townsville, Charters Towers, Bowen, Mackay, Rockhampton, Gladstone and Bundaberg.

The GBRCA corresponds approximately to the ABS Statistical Divisions (SDs) of Far North, Northern, Mackay and Fitzroy.

The Statistical Divisions of Northern, Mackay and Fitzroy are wholly contained within the Catchment Area. Around 85% of the Far North SD is within the Catchment Area; the other 15% in the south west of that SD is sparsely populated.

The GBRCA also includes around 30% of the Wide Bay-Burnett SD (Bundaberg is in the Catchment Area, but Maryborough, Hervey Bay and Gympie are not) and the northern 20% of the Darling Downs SD.

For the purposes of our analysis, which is based on Queensland Regional Input Output Tables for Statistical Divisions, we have approximated the GBRCA as consisting of the Statistical Divisions of Far North, Northern, Mackay and Fitzroy, plus a proportion of the Wide Bay-Burnett SD. For the purposes of this analysis, and in the absence of better data, we have set the proportion equal to the share of the Wide Bay-Burnett population living within the catchment area, which is 29%.

2.3 WHY FOCUS ON THE CATCHMENT AREA?

Most residents in the GBRCA live relatively close to the GBRMP and can use it for recreational purposes.

However, travel distances from the western borders of the Catchment Area to the Marine Park are 400 kilometres in some cases.

The BTR, in its *Assessment of tourism activity in the GBR Marine Park Region* (2003), used a stricter definition of accessibility for recreational purposes that excluded some of the western parts of the Catchment Area.

Use of a water catchment area that includes all rivers that flow into the GBRMP is appropriate for studies of the effects on the Reef of water run-off from the land, and from industrial activity, commercial activity and households.

The rivers collect chemicals and sediments that can affect marine life on the Reef. Sediments may be the result of heavy rain or flood control strategies. Agriculture generates chemicals in the rivers in the form of run-off that includes phosphate fertilisers and residues from treatments for diseases – herbicides, insecticides. There can also be considerable detergents and residues from industrial and household processes.

3. THE NATURE OF ACCESS ECONOMICS' ANALYSIS

The measurement of the economic and financial value of the GBRCA and GBRMP in this report concentrates on:

- an accounting framework that complies with the various rules of the United Nations System of National Accounts (SNA) to avoid problems such as double-counting and resulting charges of over-claiming or exaggeration;
- those activities for which market transactions, or imputations based on related market transactions, are available;
- specifically dealing with three areas of activity: tourism, commercial fishing and 'cultural and recreational services industry' activity;
- for completeness, data relating to other economic activities located within the GBRCA are also presented in this report;
- a *flow*-based analysis, for the financial year 2005-06, together with revised results for 2004-05.

3.1 AGGREGATING ACROSS TOURISM & OTHER ACTIVITY

When seeking a single number to quantify the economic and financial value of the GBRCA and the GBRMP aggregation across the three specific industry activities: tourism, commercial fishing and the 'cultural and recreational services' industry, adjustments must be made to ensure no double counting, as noted above.

Adjustments are needed:

- to reduce the value assigned to the 'cultural and recreational services' industry by the value therein assigned to tourism under the TSA approach;
- to add to the value assigned to the 'cultural and recreational services' industry an estimated amount for recreational fishing by local residents.

Accordingly, tourism, commercial fishing and the 'cultural and recreational services' industry:

- are defined consistent with ABS ANZSIC industry definitions and/or TSA definitions, with three exceptions:
 - Most of recreational fishing (the non-tourism part that consists of local fishers who don't travel far enough to be classified as tourists) has been added to the 'cultural and recreational services' industry rather than being spread across a number of other industries.
 - The remainder of recreational fishing is assumed to be included already in the TSA-based tourism industry measure.
 - The part of the 'cultural and recreational services' industry effectively included in the TSA based measure of tourism has been subtracted from the 'cultural and recreational' industry.

- These adjustments have been made to avoid double counting when aggregating to obtain the economic and financial value of the GBRCA and the GBRMP.

3.2 LIMITATIONS OF THE ANALYSIS

This report does not cover:

- A balance sheet analysis, identifying the value of the *stock* of assets contained within the GBRCA or the GBRMP at any point in time (eg, 30 June 2006).
- Non-market activities for which imputed market values cannot readily be compiled (such as indigenous activities within the GBRCA, and probably substantial externality effects, notably external diseconomies due to water pollution affecting the GBRCA and GBRMP and generated as a by-product of other activity).
- Environmental accounting in the national accounts is still in its infancy, but it is a matter currently under investigation by the ABS (for example, see *Accounting for the environment in the national accounts*, ABS Cat 5206.0, June quarter 2002, pages 13-25).

3.3 ECONOMIC CONTRIBUTION VS ECONOMIC IMPACT STUDIES

This report provides an economic contribution study, not an economic impact study:

- The former is an economic accounting exercise, relating to a specific period (in this case 2005-06), that seeks to capture all of the market-related activity flows for the specified industries or activities. It tells a story about the value of that activity at that time, but does not explain why or how that activity came about.
- The latter is properly tackled as a general equilibrium modelling exercise, where a specified *change* (or 'shock') to the status quo is quantified and run through the model to explore how the model solution changes. If the model is properly structured, this exercise does quantify how the specified shock impacts on the rest of the model of the economy under consideration.

The direct and indirect impacts of tourism (and other industries) are often characterised as multipliers, expressed in statements such as: 'Every 100 visitors generates one job'. (Even at this level, this report is different, because the TSA approach *forces* the analysis to concentrate on *what travellers spend, and its contribution to value added, rather than how many of them visit.*)

But even using the TSA approach, these so-called 'multipliers' must be treated carefully. While expressing the data in this manner may be seen as a convenient rule of thumb, Access Economics cautions against overuse of these 'multipliers'.

The rest of this section of the report briefly explains why.

Tourism and other businesses often have significant scale economies. Airports, airlines, hotels, restaurants and many other tourism businesses could increase output by 10% (that is, serve 10% more tourists) by increasing inputs (such as labour) by, say, only 4%. If they also have spare capacity, they can boost activity without adding to the staff employed, at least to some extent.

Some may argue this is bad news: the employment multiplier is less than expected. Access Economics believes that this is not a sensible way of looking at the issue. Instead, this example suggests that increasing traveller demand *will* increase jobs, albeit perhaps by less than the average 'multiplier' implied, *but it will increase the economic payoffs to the region even more as these scale economies are captured.*

Spending on travel is in significant part a substitute for spending on other items. For example, if there was a short-term downturn in travel, it may well be offset by increases in other types of spending. To be more specific, suppose a few Cairns residents had planned to travel to Mossman for lunch, but it was raining, so they went to a local restaurant instead. Lunch was still eaten and money was still spent, but Mossman would have counted as tourist expenditure, whereas the local restaurant is not counted, because it is a local (non-tourist) meal. In this example, the reduction in tourist expenditure is offset by an increase in non-tourist expenditure, so a simple multiplier would overstate the effect on the GBRCA.

Hence the caveat: over reliance on, or careless interpretation of, multipliers can lead to inaccuracies.

4. COMPILING THE RELEVANT DATA FOR 2005-06

4.1 POSSIBLE DATA SOURCES

As noted above, this report is for the financial year 2005-06, and also contains revised results for 2004-05.

The most recent data in most cases are for financial year 2005-06, although recreational fishing data are available only to around 2002, and Queensland and regional input output data are available only for 1996-97. Estimates in the previous report for 2004-05 (Access Economics 2005) were based on data that had to be extrapolated to June 2005, whereas tourism and commercial fishing data are now available to June 2006.

Data are required for activities in the specified industries located in the GBRCA and GBRMP areas, and also for Queensland and Australia, and for the contributions of individual industries within the GBR Catchment Area.

4.1.1 TOURISM

The sources of tourism data are:

- Tourism Research Australia (TRA) CD-MOTA data for international visitors and domestic visitors, for Australia, Queensland and tourism regions within Queensland provided to Access Economics by GBRMPA. They include numbers of visitors and visitor nights, and also expenditure details, although expenditures are for whole trips and splits between regions have to be estimated. The latest quarterly data used are up to and including the June quarter 2006.
- TRA has estimated expenditures within tourism regions using its Regional Expenditure Model (REM) separately for international, day and domestic overnight visitors. The latest results used are for the year ending June 2006.
- The TRA data have been scaled to be consistent with national Tourism Satellite Accounts (TSA) data which are currently available for 2004-05.

In order to measure GBRCA exports of tourism, total tourists are separated into international, interstate, the rest of Queensland (outside the GBRCA), and those domiciled within the GBRCA.

Many day trips and short distance overnight trips are counted as tourism rather than local recreational trips. While the following definitions are somewhat arbitrary, versions of them have a broad international following. TRA defines overnight travel as involving a stay away from home for at least one night, at a place at least 40 kilometres from home. Day visitor travel requires a round trip distance of at least 50 kilometres and being away from home for at least four hours. It excludes travel as parts of an overnight trip and commuting between work/school and home.

An additional source of tourism data is the number of visitors to the different regions of the GBRMP as recorded by registered tourism operators in the collection of the Environmental Management Charge (EMC). The counts also include those exempted from the charge, such as ferry transfers to and from islands. However, these counts are restricted to visits

associated with registered operators, and do not include visits to the park by individuals on private boats.

4.1.2 COMMERCIAL FISHING

The sources of commercial fishing data are:

- Queensland Department of Primary Industries & Fisheries (QDPI&F) commercial fishing logbook data. These include detailed records of tonnes, number of boats, fishing days, and estimated gross value of product (based on processor prices and described by QDPI&F as 'purely indicative') for grid sizes that vary between 6 and 30 nautical miles on a side]. Data are available for the GBR World Heritage Area (WHA)⁵ and other areas.
- The WHA is slightly larger than the GBRMP but provides a sufficient approximation to the Park for the commercial fishing aspects of this report. The data refer to fish that are caught within the WHA, even though some of the relevant fishing boats come from ports such as Bundaberg that are within the GBRCA but just outside the GBRMP (see the definition of the GBRCA outlined in section 2.2 above).
- Data for commercial fishing for 2004-05 and 2005-06 have been received from QDPI&F.
- Data for payments for commercial fishing licences and boat registration associated with use of the GBRMP, even though these payments are made to state authorities rather than to GBRMPA. They are contributions to the Queensland economy even if not directly to the GBRCA or GBRMP. Nevertheless, given that they are associated with use of the GBRMP, they could be argued to constitute contributions sourced both to the GBRCA and GBRMP as well as to Queensland and Australia. Neither commercial fishing licence fees (\$250 per annum) nor boat registration fees (\$250 per annum) have been included in the analysis. Unpublished data received from QDPI&F indicate that 791 boats were used for commercial fishing in the GBRMP in 2005-06. Even allowing \$1,000 per boat, to allow for additional commercial fishing fees, total fees would be less than \$1 million.
- Data for payments for pilots to navigate through the Reef and for port charges, especially for coal ships. Most of these charges are received by local port authorities and contribute to the economy of the GBRCA, although charges for some small ports are collected by the Queensland Department of Transport. They have not been allowed for in the analysis because it would have been time consuming to assemble data for payments that we assumed would be relatively small.
- ABARE measures of tonnes, export tonnes, value of production, and value of exports for fishing and aquaculture in Queensland for 2004-05 (ABARE 2006).

4.1.3 RECREATIONAL USE

The distinction between tourism and recreational use is explained at the end of section 4.1.1. The distinction depends mainly on the distance travelled from home. A day fishing trip that required travelling 30 kilometres from home (ie a 60 kilometres round trip) would be classified

⁵ The GBR World Heritage Area differs from the GBRMP by including waters above the mean low water mark (the Marine Park boundary) and into the creeks and inter-tidal areas.

as a tourist trip. For a resident of Cairns, fishing locally would be recreational use, but travelling along the coast to a favourite fishing spot – depending upon the distance involved – might be a tourist trip. Somebody living somewhere over 50 kilometres inland and going on a fishing excursion on the coast would be classified as a tourist, regardless of where in the ocean they fished.

Recreation is usually described by reference to the ABS ANZSIC ‘cultural and recreational services’ industry. This covers sport, gambling, libraries, museums, the arts, parks and gardens, and film, video, radio and television services. While these categories may be adequate for some studies, they do not include expenditure on other recreational activities within the GBRMP such as fishing, boating, sailing and snorkelling (some of which is also distributed across industries such as transport equipment, sporting goods, services to transport, and boat rentals). There are no recreational fishing licence fees for ocean fishing in Queensland. Power boat registration fees (of the order of \$100 per annum, depending on boat length) and boat trailer fees are paid to the Department of Transport.

Major expenditures associated with GBRMP activities are on boats, fishing equipment, and scuba and snorkelling equipment. We have considered only recreational fishing directly.

On the basis of Fisheries data (see Attachment A) we have assumed that annual expenditure on recreational fishing in 2004-05 and 2005-06 was about \$100 million in each year. It is assumed, in the absence of other data, that 75% of this relates to local residents. \$75 million has been added to the expenditure on cultural & recreational services. It is assumed that the remaining \$25 million is already included in tourism expenditure.

4.1.4 OTHER ACTIVITIES WITHIN THE GBRMP

International and coastal shipping passes through the GBRMP.

This includes exports of coal from within the GBRCA, movement of iron ore and other metallic ores around the Australian coast, and container ships in transit. To the extent that ships enter ports within the GBRCA they pay fees to the appropriate port authorities, or to Queensland Transport in the case of smaller ports. Ships passing through the GBRMP in most cases must carry a pilot, and the cost of this is paid to the appropriate port authority. Port and pilot fees are included in the regional input-output tables, but we have not identified them separately.

Scientific research, for example, is another significant activity within the Park, but we have not been able to obtain quantitative estimates for it. This activity would be included in ABS ANZSIC industry 7810 (Scientific Research).

4.1.5 OTHER INDUSTRIES WITHIN THE GBR CATCHMENT AREA

While tourism, commercial fishing and cultural and recreational activities (as defined in this report) are significant economic industries within the GBRCA, they are, nevertheless, relatively small compared with total activity as measured by value added or gross product within the GBRCA.

It is instructive to estimate economic contributions of *all* industries within the Catchment Area – see below.

In principle, when attempting to compare tourism with other industries (usually defined on the supply side, by what is produced, rather than on the demand side, by who is consuming the products, as is the case with the TSA) all of the tourism contributions should be subtracted

from the relevant industries, so that total contributions are the sums of the relevant industries and other activities, without any double counting. In practice, given the narrower industry focus of this report, it is easier to omit this step, and simply caution against adding tourism, commercial fishing and recreational contributions to the conventional ABS ANZSIC supply side-defined industry results when discussing the estimates (see section 5.4 below).

The analysis requires descriptions of industries for the GBRCA, Queensland and Australia, and the dependencies of given industries on other industries. These are best described and quantified by using input-output tables.

The Queensland Office of the Government Statistician has prepared 1996-97 input-output tables for Queensland and ten Queensland Regions (Office of the Government Statistician 2004). The regions correspond to the Queensland Statistical Divisions, as at 1996, with the exception of the Brisbane and Moreton Bay Statistical Divisions, which have been combined. As noted in section 2 above, the GBRCA is approximated by the sum of five regions – all of Fitzroy, Mackay, Northern, and Far North, and part of Wide Bay-Burnett. Although the ABS has compiled national input-output tables for 2001-02, the national input-output tables for 1996-97 (ABS 5209.0, 2001) have been used in order to maintain consistency with the Queensland tables.

The broad structures of input-output tables tend to be fairly steady over periods of five to ten years. In the absence of more recent data, the composition – that is, proportions – (but not the absolute levels) of industry costs and sales for 1996-97 are assumed by Access Economics to be reasonable overall approximations for 2004-05 and 2005-06. Value-added, gross GBRCA product and other sales-based estimates are scaled up from 1996-97 to 2004-05 and 2005-06 using the estimated change in Queensland gross value added (or GSP) over that period.

Employment by industry in 1996-97 is provided as part of the 1996-97 input-output data. Employment by industry (ANZSIC-defined) by region for the year to June 2006 is derived by scaling this from 1996-97 to 2005-06 according to ABS employment 'data cube' data (ABS 6291.0.55.001, November 2006).

In all cases employment is expressed in full time equivalents (FTE), calculated as the number of full time persons plus half the number of part time persons.

4.2 DATA LIMITATIONS

The review above shows that the data available is subject to a number of limitations:

- Input output tables and recreational fishing data are dated, necessitating a 'scaling up' process to generate 2004-05 and 2005-06 estimates.
- The data come from a wide variety of sources, and so the underlying methodology used for their compilation may not be fully consistent.
- And, beyond these aspects, the data are subject to the specific narrow focus and the more general limitations briefly covered in section 3 of this report.

5. DIRECT ECONOMIC VALUE OF CATCHMENT AREA

Access Economics has calculated the gross Area value added, gross Area product (GAP), and employment contributions of various activities in the GBRCA using an input-output table for the Area.

The focus is on activities at least partly associated with, or undertaken within, the GBRMP, and specifically defined within: tourism, commercial fishing, and cultural & recreational activity.

As noted in section 3 above, tourism is analysed using a methodology based on the ABS TSA approach. Consistent with this approach, and to avoid double counting, the results for cultural and recreational use are adjusted to remove the tourism component thereof.

5.1 TOURISM DATA FOR THE CATCHMENT AREA

The calculations of value added, gross product and employment for tourism are driven by expenditures on the various tourism products.

Tourism expenditures for the tourism regions within the GBRCA have been measured by the TRA as part of its NVS and IVS surveys. The analysis is based on these measures, but they are adjusted so as to make the corresponding measures for Australia consistent with TSA data for Australia. The GBRMPA provides some additional data for the GBRMP on visitor numbers only.

The tourism contribution to the entire GBRCA is defined in terms of the five Statistical Divisions, plus the associated offshore areas within the GBRMP.

TABLE 5.1.1: TRA REM TOURIST EXPENDITURE IN GBRCA TOURISM REGIONS 2004-05 AND 2005-06 (\$MILLION)*

<i>Tourism Region</i>	<i>2004-05 day</i>	<i>2004-05 domestic overnight</i>	<i>2004-05 intl</i>	<i>2004-05 total</i>	<i>2005-06 day</i>	<i>2005-06 domestic overnight</i>	<i>2005-06 intl</i>	<i>2005-06 total</i>	<i>2005-06 overnight share (%)</i>	<i>2005-06 intl share (%)</i>
Tropical North Qld	141	1,377	1,039	2,557	178	1,346	1,111	2,635	39%	82%
Northern	67	477	74	618	121	460	64	645	13%	5%
Whitsundays	19	440	110	569	32	676	121	829	20%	9%
Mackay	56	284	13	353	79	280	14	373	8%	1%
Fitzroy	179	435	30	644	182	502	32	716	14%	2%
Bundaberg	50	195	15	260	85	200	11	296	6%	1%
Total GBRCA	512	3,208	1,281	5,001	677	3,464	1,353	5,494	100%	100%
Australia	11,614	39,380	12,544	63,538	12,611	40,691	13,402	66,704		
GBRCA/Aust	4.4%	8.1%	10.2%	7.9%	5.4%	8.5%	10.1%	8.2%		

Source: TRA unpublished results from the Regional Expenditure Model. Data provided by Tourism Queensland.

* Notes: Expenditures include packages and domestic airfares, but exclude international airfares and all purchases of motor vehicles. The last two columns show shares of specified visitor categories in total GBRCA expenditure by that visitor category in the tourism region in question. Totals may differ from sums of components due to rounding.

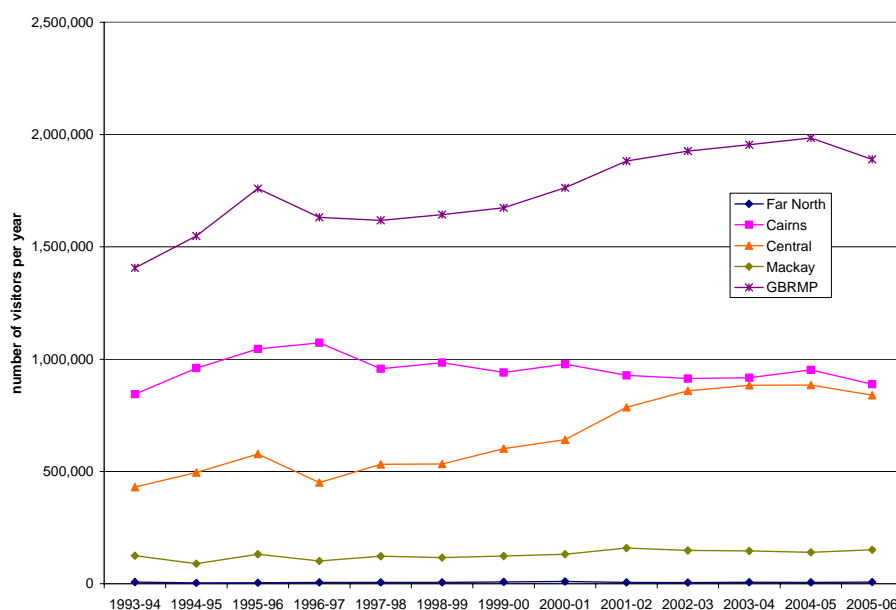
Table 5.1.1 summarises TRA REM expenditures in each of the tourist regions of the GBRCA for 2004-05 and 2005-06. Additional data for numbers of visitors and stopover nights are provided in Attachment A, Table A.2. The expenditures for international visitors shown in Table 5.1.1 exclude allocations of international airfares. The GBRCA accounts for 10% of

expenditure in Australia by international visitors, where the GBRCA visits are predominantly for the purpose of holiday/leisure (see Attachment A for details). The GBRCA also accounts for 8% of total expenditure by Australian overnight visitors. Above average proportions of domestic overnight visits to Tropical North Queensland and the Whitsundays are for the purposes of holiday/leisure. Tropical North Queensland accounts for the largest proportions of visitor expenditure in the GBRCA – 48% of total tourism expenditure in 2005-06, including 82% for international visitors and 39% for domestic overnight visitors.

The GBRMPA measures of numbers of visits to the four GBRMPA management regions over the thirteen years to 2005-06, inclusive are presented in Chart 5.1.1 below, where the within-GBRMPA regional numbers have been scaled so as to sum to the total for the GBRMP. (The GBRMPA management regions of 'Far Northern' and 'Cairns' correspond to the Far North Queensland tourism region. 'Central' corresponds to tourism regions Northern and Whitsundays, and 'Mackay' corresponds to the Mackay, Fitzroy and Bundaberg tourism regions.)

GBRMPA receives from registered operators the numbers of persons on tours within the GBRMP and the numbers of persons being transferred between the mainland and GBRMP islands. An overnight visitor to an island would be counted at least twice, for the trips to and from the island, plus any additional tours taken from the island. The GBRMPA numbers are thus more like a count of the number of visitor days than the number of visitors. GBRMPA does not record numbers of visitors in private boats.

CHART 5.1.1: NUMBER OF VISITS PER YEAR, BY GBRMPA MANAGEMENT REGION



Source: GBRMPA, February 2007, with 2005-06 data understood to be substantially complete.

Total reef visits increased from 1.4 million in 1993-94 to just under 2 million visits in 2004-05. However there was a reduction of around 95,000 in 2005-06, with this fall being experienced in both major tourism regions of Cairns and Central (including Townsville).

There have been changes over time in the composition of visits across regions. The numbers of visits to the Cairns region have been fairly constant, declining slightly over the last decade, but those to the Central region have increased, so that the visit shares in 2005-06 were Cairns 47%, Central 44%, Mackay 8% and Far North 0.4% compared with 60%, 31%, 9% and 0.5% respectively in 1993-94.

The recorded reductions in numbers of visitors to the reef in the Cairns and Central management regions between 2004-05 and 2005-06 are not reflected in the increases in GBRCA tourism expenditure (Table 5.1.1), numbers of visitors (Table A.2) or number of stopover nights (Table A.2), except for reductions in the number of day visitors to the Tropical Far North and the number of international visitor nights for the Central region. There are 20 million tourism visits to the GBRCA each year (Table A.2) but only 2 million visits to the reef. While some correlation between the two measures might be expected, it does not follow that the changes must be fully correlated. Both measures are mixtures of international, interstate, interregional and intraregional visits, but with changes in each driven by different factors to some extent. For example, weather and adverse media reports about coral bleaching and other matters could have different effects on reef visits compared with GBRCA visits.

The economic analysis requires separation of tourism contributions to the GBRCA from international visitors, other states, the rest of Queensland, and residents of the GBRCA. The TRA REM expenditures do not fully provide this split. Its domestic expenditures are totals across all visitors and across all products. Attachment A explains the estimation of expenditures, split across different types of visitors and across products, using TRA CD-MOTA data. A difficulty is that CD-MOTA expenditures are totals for entire trips, so that detailed expenditures are available only for visitors who visit a single destination. Splits of expenditures must be estimated for all other visitors, and this is a potential source of error.

Table 5.1.2 below summarises total GBRCA tourism expenditures in 2004-05 and 2005-06 for different types of visitors. The TRA expenditures have been scaled to be consistent with TSA measures. The final columns correspond to the GBRCA columns in Table A.4.

Domestic overnight visitors accounted for 59% of tourism expenditure in the GBRCA in 2005-06, with international visitors 30% and day visitors 11%. Of the domestic overnight expenditure, 58% was by interstate visitors, 22% by Queenslanders residing outside the GBRCA, and 20% by GBRCA residents. Expressed differently, the largest proportions of GBRCA tourism expenditure in 2005-06 were by interstate overnight visitors (34%) and international visitors (30%).

TABLE 5.1.2: TSA-CONSISTENT TOURISM EXPENDITURE IN THE GBRCA, BY PLACE OF RESIDENCE AND TYPE OF VISITOR, 2004-05 AND 2005-06 (\$MILLION)

<i>Place of residence</i>	<i>2004-05 day visitors</i>	<i>2004-05 domestic overnight visitors</i>	<i>2004-05 international visitors</i>	<i>2004-05 total</i>	<i>2005-06 day visitors</i>	<i>2005-06 domestic overnight visitors</i>	<i>2005-06 international visitors</i>	<i>2005-06 total</i>
GBRCA	465	810		1,275	521	715		1,236
Other parts of Queensland	64	857		921	131	785		916
Other states		1,669		1,669	47	2,104		2,151
Other countries			1,711	1,711			1,814	1,814
Total	529	3,337	1,711	5,577	700	3,603	1,814	6,116

Source: Access Economics, derived using TRA REM, TRA CD-MOTA and TSA.

Note: The totals in Table 5.1.2 differ from those in Table 5.1.1 because Table 5.1.1 uses TRA data whereas in Table 5.1.2 the TRA data have been scaled to be consistent with TSA measures. There are large differences between TRA and TSA for international airfares in particular. See the section on TSA Data in Attachment A for further details. Totals may differ from sums of components due to rounding.

5.2 DIRECT ECONOMIC CONTRIBUTION: TOURISM

The calculations of value added, gross product and employment for tourism are driven by expenditures on the various tourism products. These, in turn, are driven not only by the number of visits and duration thereof, but also by spending per visit per day. The expenditures summarised in Table 5.1.2 are at *purchasers' prices*. They are converted to demands for goods and services at *basic prices* and then applied to input-output tables. (Purchasers' prices and basic prices are explained in footnotes in Attachment A.) The methodology for the calculations is described in Attachment A.

The tourism estimates cover tourist trips to the GBRCA, whether the trips originate from outside the GBRCA or within. They also allow for expenditure within the GBRCA by GBRCA residents on goods and services sold within the GBRCA prior to travelling overseas or to parts of Australia outside the GBRCA.

Direct economic contributions of tourism for 2004-05 and 2005-06 have been estimated separately for:

- travellers from within the GBRCA;
- travellers from the rest of Queensland;
- interstate travellers; and
- international travellers.

Where relevant, each is the sum of contributions from day visitors and overnight visitors (this tends not to apply to the last two groups above, and mostly to the second group, which is predominantly overnight visitors).

The contributions to the GBRCA are presented in Table 5.2.1 below, which also includes estimates for commercial fishing and cultural and recreational activity.

Table 5.2.1 also shows that the contributions of tourism to the GBRCA far exceed those from commercial fishing and (as estimated) cultural and recreational activity.

Note that GAP in Table 5.2.1 means Gross Area Product (referring to the GBRCA), and is the GBRCA measure corresponding to GDP. Similarly, GSP in Table 5.2.3 means Gross State Product. These terms are not to be confused with the gross value of production (GVP). GAP, GSP and GDP are fractions of the appropriate GVP.

TABLE 5.2.1: DIRECT CONTRIBUTIONS OF SELECTED ACTIVITIES TO THE GBRCA, 2004-05 & 2005-06

<i>Direct contribution</i>	<i>2004-05 Direct Value Added (\$m)</i>	<i>2004-05 Direct GAP (\$m)</i>	<i>2004-05 Direct Employment (FTE 000)</i>	<i>2005-06 Direct Value Added (\$m)</i>	<i>2005-06 Direct GAP (\$m)</i>	<i>2005-06 Direct Employment (FTE 000)</i>
<i>Total tourism within the GBRCA</i>						
Visitors from GBRCA	420	524	6	392	493	5
Visitors from rest of Queensland	324	399	4	311	386	4
Interstate visitors	575	709	7	740	912	9
by GBRCA residents for travel outside GBRCA	122	147	1	126	153	1
International visitors	589	726	8	628	773	8
Total tourism	2,030	2,504	26.11	2,197	2,716	27
Commercial fishing	133	137	1	116	119	1
Recreational activity (net of tourism)	301	372	6	301	371	5
Total contribution to GBRCA	2,465	3,012	34	2,614	3,206	33

Source: Access Economics. All magnitudes are to the nearest \$million. Totals may not add due to rounding.

Table 5.2.2 below shows the distribution across industries of value added contributions to tourism, commercial fishing and cultural and recreational activity within the GBRCA for 2005-06.

Table 5.2.3 below presents estimates for the economic contributions of the three selected sectors to the Queensland economy, and Table 5.2.4 presents the same estimates for the Australian economy as a whole.

**TABLE 5.2.2: DIRECT CONTRIBUTIONS OF VALUE ADDED FOR SELECTED INDUSTRIES
WITHIN THE GBRCA, BY INPUT-OUTPUT INDUSTRY, 2005-06, \$MILLION**

<i>Industry</i>	<i>total tourism (\$m)</i>	<i>commercial fishing (\$m)</i>	<i>recreational activity (\$m)</i>	<i>total tourism (%)</i>	<i>commercial fishing (%)</i>	<i>recreational activity (%)</i>
Sheep, grain	0	0	0	0%	0%	0%
Beef cattle	0	0	0	0%	0%	0%
Dairy cattle and pigs	0	0	0	0%	0%	0%
Other agriculture, sugar cane growing	16	0	0	1%	0%	0%
Forestry and fishing	5	116	0	0%	100%	0%
Coal, oil and gas	0	0	0	0%	0%	0%
Non-ferrous metal ores	0	0	0	0%	0%	0%
Other mining	0	0	0	0%	0%	0%
Food manufacturing	70	0	1	3%	0%	0%
Textiles, clothing and footwear	7	0	0	0%	0%	0%
Wood and paper manufacturing	16	0	0	1%	0%	0%
Chemicals, petroleum and coal products	55	0	4	2%	0%	1%
Non-metallic mineral products	1	0	0	0%	0%	0%
Metals, metal products	1	0	0	0%	0%	0%
Machinery, appliances and equipment	46	0	7	2%	0%	2%
Miscellaneous manufacturing	2	0	3	0%	0%	1%
Electricity supply, gas and water	0	0	0	0%	0%	0%
Residential building construction	0	0	0	0%	0%	0%
Other construction	0	0	0	0%	0%	0%
Trade	424	0	0	19%	0%	0%
Accommodation, cafes and restaurants	547	0	0	25%	0%	0%
Road transport	49	0	0	2%	0%	0%
Rail and pipeline transport	43	0	0	2%	0%	0%
Other transport	443	0	2	20%	0%	1%
Communication services	29	0	0	1%	0%	0%
Finance, property and business services	51	0	1	2%	0%	0%
Ownership of dwellings	113	0	0	5%	0%	0%
Government administration and defence	0	0	1	0%	0%	0%
Education	54	0	0	2%	0%	0%
Health and community services	69	0	0	3%	0%	0%
Cultural and recreational services	129	0	283	6%	0%	94%
Personal and other services	27	0	0	1%	0%	0%
Total GBRCA	2,197	116	301	100%	100%	100%

Source: Access Economics. Values are rounded to the nearest \$m so that zero means less than \$0.5m. Totals may not add due to rounding.

The major differences between Table 5.2.1 and both 5.2.3 and 5.2.4 below are that the Queensland and Australian estimates include larger proportions of airfares and other long distance travel expenses than is assumed for the GBRCA. All domestic airfares associated with visits to the GBRCA contribute fully to tourism for Australia. However, only a proportion of these airfares is assumed to generate activity within the GBRCA itself (or to Queensland as a whole).

Similarly, all international airfares for international visitors to Australia (associated with Australian-owned airlines and therefore part of Australia's export income) relating to visits to

the GBRCA by such people contribute fully to tourism for Australia, but only those with a single GBRCA destination contribute fully to export income for the GBRCA. Most international visitors to the GBRCA have multiple destinations in Australia and multiple reasons for their visits to Australia. In the absence of any data, we attribute only one third of their airfares to Australia as being associated with the GBRCA. For multiple stopover visitors, the contributions to the GBRCA region are assumed to be a share of the value for Australia, based on the proportion of arrivals at, and departures from, international airports within the GBRCA (Cairns, Townsville).

For international visits to the GBRCA, only about 23% of the international arrivals and departures for multiple stopover visitors are through Cairns. We assume therefore that only 23% of the associated international airfares contribute to the GBRCA. The remainder are associated with domestic aviation feeder services to GBRCA, and the associated international airfare component is either a contribution to the Queensland economy or more generally Australia as a whole.

TABLE 5.2.3: DIRECT CONTRIBUTIONS OF SELECTED ACTIVITIES WITHIN THE GBRCA TO QUEENSLAND, 2004-05 & 2005-06

<i>Direct contribution</i>	<i>2004-05 Direct Value Added (\$m)</i>	<i>2004-05 Direct GSP (\$m)</i>	<i>2004-05 Direct Employment (FTE 000)</i>	<i>2005-06 Direct Value Added (\$m)</i>	<i>2005-06 Direct GSP (\$m)</i>	<i>2005-06 Direct Employment (FTE 000)</i>
<i>Total tourism within the GBRCA</i>						
Visitors from GBRCA	410	514	6	383	483	5
Visitors from Queensland	386	474	5	347	430	4
Interstate visitors	573	707	7	736	908	9
by GBRCA residents for travel outside GBRCA	123	148	1	126	153	1
International visitors	672	825	9	677	831	9
Total tourism	2,165	2,668	29	2,268	2,805	29
Commercial fishing	145	148	1	126	129	1
Recreational activity (net of tourism)	275	339	6	274	339	6
Total contribution to Queensland	2,585	3,155	36	2,669	3,272	35

Source: Access Economics. Totals may differ from sums of components due to rounding.

TABLE 5.2.4: DIRECT CONTRIBUTIONS OF SELECTED ACTIVITIES WITHIN THE GBRCA TO AUSTRALIA, 2004-05 & 2005-06

<i>Direct contribution</i>	<i>2004-05 Direct Value Added (\$m)</i>	<i>2004-05 Direct GDP (\$m)</i>	<i>2004-05 Direct Employment (FTE 000)</i>	<i>2005-06 Direct Value Added (\$m)</i>	<i>2005-06 Direct GDP (\$m)</i>	<i>2005-06 Direct Employment (FTE 000)</i>
<i>Total tourism within the GBRCA</i>						
Visitors from GBRCA	416	520	6	387	488	5
Visitors from Queensland	396	483	5	356	438	4
Interstate visitors	708	866	8	922	1,127	10
by GBRCA residents for travel outside GBRCA	125	150	1	129	156	1
International visitors	862	1,051	10	926	1,127	10
Total tourism	2,507	3,069	31	2,720	3,336	32
Commercial fishing	131	137	1	114	119	1
Recreational activity (net of tourism)	315	385	6	314	383	5
Total contribution to Australia	2,952	3,591	37	3,148	3,838	38

Source: Access Economics. Totals may differ from sums of components due to rounding.

Economic contributions in Table 5.2.4 for Australia are in general (as would be expected) greater than those in Table 5.2.3 for Queensland which, in turn, are in general greater than

those in Table 5.2.1 for the GBRCA. (However, there are exceptions to this pattern, as discussed below).

This pattern applies especially for tourism as a result of the inclusion of increased proportions of airfares. For tourism value added in 2005-06, the GBRCA contribution is 81% of the Australian contribution and the Queensland contribution is 83% of the Australian contribution.

There are small exceptions to the Australia-Queensland-GBRCA pattern for visitors from GBRCA, visitors from the rest of Queensland, and interstate visitors. There are some corresponding exceptions for commercial fishing and recreational activity, with the exceptions for recreational activity being the largest. All the exceptions are caused by differences in the average value added and employment shares by industry for the different geographical areas, which are calculated from separately-compiled input-output tables.

There are three possible reasons for these differences. First, there may be genuine differences between different geographical areas. Second, there may be estimating errors in the underlying input-output data. The third possibility is that there are deficiencies in the methodology we have used for scaling production data from 1996-97 to 2005-06.

TSA data show that for Australia in 2004-05 tourism value added was \$26,479 million, tourism GDP was \$32,562, tourism employment was 550,100 and tourism expenditure was \$74,682 million (ABS 5259.0, 2006, Tables 1, 10 and 6). These are direct contributions. TSA employment is measured in persons employed and it is estimated that the corresponding employment in full-time equivalent persons, as used throughout this report, is approximately two thirds of this. The total corresponding tourism results in Table 5.2.1 above and in Table A.4 below for visitors to the GBRCA, as proportions of tourism values for Australia, are 7.7% for value added, 7.5% for GDP, 7.1% for employment and 7.9% for expenditure. For comparison, the GBRCA shares of national totals for total economic activity are value added 4.5% (derived from IO tables for 1996-97, using ABS 2001 and Office of the Government Statistician 2004), and employment 4.4% (ABS 6291.0.55.001 2006, Table 16). The GBRCA thus accounts for a much higher proportion of Australian tourism economic activity than its share of economic activity generally. The last row of expenditure data in Table 5.1.1 indicates that this increased proportion is attributable to international and domestic overnight visitors.

5.3 DIRECT ECONOMIC CONTRIBUTION: OTHER INDUSTRIES

The other major activities within the GBRMP are commercial fishing and cultural and recreational activities by local residents. The estimates for these have also been presented in tables 5.2.1 – 5.2.4 above. Some comments on these two activity groupings follow.

5.3.1 COMMERCIAL FISHING

Direct economic contributions for commercial fishing are estimated on the assumptions that the GBRCA-located industry has the same cost structure as the Queensland commercial fishing industry.

The estimated gross value of production (GVP) for 'wild-harvest' commercial fishing within the GBRMP was \$196 million for 2004-05 and \$164 million for 2005-06, compared with an average of \$230 million over the three years to 2003-04 (QDPI&F unpublished data, based on fishing logbooks). The level of activity in the industry is in transition and may not stabilise for several years. See Attachment A for further details.

To this is added \$50 million each year for aquaculture (for the basis for this estimate, see Attachment A). Total value of production for commercial fishing, including aquaculture, is thus \$246 million in 2004-05 and \$214 million in 2005-06.

After deducting input costs, the direct contribution of commercial fishing to value added in the GBRCA is \$81 million in 2005-06 (see Table 5.2.1 above).

We have assumed that the same contribution applies for Queensland and Australia. This is not strictly correct because we have not allowed for fishing licence fees and boat registration fees which should be additional contributions for Queensland and Australia. We have omitted these items because they add to less than \$1 million (see section 4.1.2).

5.3.2 LOCAL RESIDENT CULTURAL & RECREATIONAL ACTIVITY

The contributions of local resident cultural and recreational activity for all of the GBRCA are calculated in two parts:

- The first is the contribution of the industry identified as 'Cultural & Recreational Services' in the input-output tables. Total expenditure on Cultural & recreational services in the GBRCA was \$555 million in 1996-97 which scales to \$1,095 in 2004-05 and \$1,162 million in 2005-06, on the basis of the increase in Queensland value added for cultural & recreational services over these periods (ABS 5220.0, 2006).
- The second is the contribution of recreational fishing by local residents. Little of this activity is included in Cultural & Recreational Services. However, we have not allowed for contributions from expenditures on other (mostly non-commercial) recreational activities such as scuba diving, snorkelling, boating and yachting that are not included in Cultural & Recreational Services (but are distributed across industries such as transport equipment, sporting goods, services to transport, and boat rentals), because we have no data on these.

All of the 'Cultural and Recreational Services' industry is treated as contributing to recreational activity within the GBRCA. However, some of its contributions have already been counted in tourism. To avoid double counting, as noted above, the recreational activity results are presented net of tourism components.

Recreational fishing is not allocated to one specific input-output industry in the ABS ANZSIC coding. Like tourism more generally, it can be defined as a collection of supplies of boats, petrol, tackle, travel, etc.

There have been delays in the release of recreational fishing data for Queensland. It has been assumed that annual expenditure on recreational fishing was \$100 million, and that this was distributed across expenditure items in the same proportions as for Queensland (see Attachment A for details).

5.4 DIRECT ECONOMIC CONTRIBUTION: NON-PARK INDUSTRIES

The direct contributions (value added and employment) of all economic activities in the GBRCA are summarised in Table 5.4.1 below.

The employment entries are based on 1996-97 input output data that have been scaled to 2005-06 according to the changes in GBRCA employment by industry over that period (derived from ABS 6291.0, 2006). The value added entries are based on 1996-97 industry

data that have been scaled to 2005-06 according to changes in Queensland value added by industry over that period (ABS 5220.0, 2006). The values for value added and employment in 2005-06 are thus indicative.

The contributions of tourism, commercial fishing and cultural and recreational activity are shown at the bottom of the table for comparison.

These last three industries should not be simply added to those standard ANZSIC industries shown in the table as adding to 'total GBRCA'. That would result in double counting in the table because the contributions for tourism, commercial fishing and recreational use are already included in the lines above the total. For example, commercial fishing is part of the 'forestry and fishing' industry. The value added for cultural and recreational activity (net of tourism) shown at the bottom of the table equals all of Cultural and Recreational Services, *less* the tourism component thereof, *plus* recreational fishing by local residents that consists of supplies distributed across 'Machinery' (boats) and other industries. Tourism is spread over many industries, with major contributions to 'Other Transport' (air services, tours), 'Accommodation and meals', 'Food', and 'Wholesale & Retail Trade' (retail margin, takeaway meals).

For the GBRCA, the direct tourism share of total value added (4.5% - Table 5.4.1 below) is 40% greater than the corresponding national share, which was estimated as 3.2% for 2004-05, (see TSA 2004-05, Table 1).

TABLE 5.4.1: VALUE ADDED AND EMPLOYMENT BY INDUSTRY, GBRCA, 2005-06

<i>Industry</i>	<i>Value added</i>	<i>Employment</i>	<i>Value added</i>	<i>Employment</i>
	<i>(\$m)</i>	<i>FTE 000</i>	<i>Share of total</i>	<i>Share of total</i>
			<i>(%)</i>	<i>(%)</i>
Sheep, grain	182	2	0.4%	0.6%
Beef cattle	458	5	0.9%	1.2%
Dairy cattle and pigs	94	1	0.2%	0.3%
Other agriculture, sugar cane growing	1,697	17	3.5%	4.5%
Forestry and fishing	192	2	0.4%	0.4%
Coal, oil and gas	11,521	20	23.5%	5.3%
Non-ferrous metal ores	2,022	5	4.1%	1.4%
Other mining	1,334	4	2.7%	1.0%
Food manufacturing	992	8	2.0%	2.1%
Textiles, clothing and footwear	19	0	0.0%	0.1%
Wood and paper manufacturing	261	3	0.5%	0.8%
Chemicals, petroleum and coal products	313	1	0.6%	0.3%
Non-metallic mineral products	173	1	0.4%	0.3%
Metals, metal products	874	5	1.8%	1.3%
Machinery, appliances and equipment	283	3	0.6%	0.8%
Miscellaneous manufacturing	63	1	0.1%	0.3%
Electricity supply, gas and water	1,899	5	3.9%	1.3%
Residential building construction	1,015	9	2.1%	2.4%
Other construction	2,173	23	4.4%	6.3%
Wholesale and retail trade	3,941	65	8.1%	17.7%
Accommodation, cafes and restaurants	1,293	21	2.6%	5.8%
Road transport	860	10	1.8%	2.6%
Rail and pipeline transport	897	8	1.8%	2.1%
Other transport	1,381	9	2.8%	2.3%
Communication services	562	5	1.1%	1.4%
Finance, property and business services	3,698	34	7.6%	9.3%
Ownership of dwellings	3,173	0	6.5%	0.0%
Government administration and defence	2,014	27	4.1%	7.4%
Education	1,760	27	3.6%	7.3%
Health and community services	2,303	29	4.7%	7.8%
Cultural and recreational services	558	6	1.1%	1.7%
Personal and other services	947	15	1.9%	3.9%
Total GBRCA	48,951	370	100.0%	100.0%
Tourism	2,197	27	4.5%	7.3%
Commercial fishing	116	1	0.2%	0.3%
Recreational activity (net of tourism)	301	5	0.6%	1.3%

Source: Access Economics. Totals may differ from sums of components due to rounding.

5.5 DIRECT EMPLOYMENT

The employment data (FTE basis) are based on labour force data for 17 industries for the year ending May 2006 (ABS 6291.0, 2006).

These were then mapped into the 32 industries used for this analysis, using 1996-97 employment data for the splits where necessary. The distribution of employment across industries is similar to that for value added but with differences that depend on the labour intensities of industries.

TABLE 5.5.1: DIRECT EMPLOYMENT IN GBRCA INDUSTRIES, BY SELECTED INDUSTRY, 2005-06
(THOUSANDS OR %)

<i>Industry</i>	<i>total tourism FTE 000</i>	<i>commercial fishing FTE 000</i>	<i>recreational activity FTE 000</i>	<i>total tourism (%)</i>	<i>commercial fishing (%)</i>	<i>recreational activity (%)</i>
Sheep, grain	0.0	0.0	0.0	0%	0%	0%
Beef cattle	0.0	0.0	0.0	0%	0%	0%
Dairy cattle and pigs	0.0	0.0	0.0	0%	0%	0%
Other agriculture, sugar cane growing	0.2	0.0	0.0	1%	0%	0%
Forestry and fishing	0.0	0.6	0.0	0%	100%	0%
Coal, oil and gas	0.0	0.0	0.0	0%	0%	0%
Non-ferrous metal ores	0.0	0.0	0.0	0%	0%	0%
Other mining	0.0	0.0	0.0	0%	0%	0%
Food manufacturing	0.6	0.0	0.0	2%	0%	0%
Textiles, clothing and footwear	0.1	0.0	0.0	0%	0%	0%
Wood and paper manufacturing	0.2	0.0	0.0	1%	0%	0%
Chemicals, petroleum and coal products	0.2	0.0	0.0	1%	0%	0%
Non-metallic mineral products	0.0	0.0	0.0	0%	0%	0%
Metals, metal products	0.0	0.0	0.0	0%	0%	0%
Machinery, appliances and equipment	0.5	0.0	0.1	2%	0%	2%
Miscellaneous manufacturing	0.0	0.0	0.1	0%	0%	1%
Electricity supply, gas and water	0.0	0.0	0.0	0%	0%	0%
Residential building construction	0.0	0.0	0.0	0%	0%	0%
Other construction	0.0	0.0	0.0	0%	0%	0%
Wholesale and retail trade	7.4	0.0	0.0	27%	0%	0%
Accommodation, cafes and restaurants	9.5	0.0	0.0	35%	0%	0%
Road transport	0.6	0.0	0.0	2%	0%	0%
Rail and pipeline transport	0.4	0.0	0.0	1%	0%	0%
Other transport	2.9	0.0	0.0	11%	0%	0%
Communication services	0.3	0.0	0.0	1%	0%	0%
Finance, property and business services	0.5	0.0	0.0	2%	0%	0%
Ownership of dwellings	0.0	0.0	0.0	0%	0%	0%
Government administration and defence	0.0	0.0	0.0	0%	0%	1%
Education	0.9	0.0	0.0	3%	0%	0%
Health and community services	0.9	0.0	0.0	3%	0%	0%
Cultural and recreational services	1.5	0.0	4.5	5%	0%	95%
Personal and other services	0.4	0.0	0.0	2%	0%	0%
Total GBRCA	27.0	0.6	4.8	100%	100%	100%

Source: Access Economics. Totals do not always add due to rounding.

5.6 INTER-REGIONAL, INTERSTATE AND INTERNATIONAL TRADE

For Australia as a whole, exports and imports of the ANZSIC industries 'commercial fishing' and 'cultural & recreational services' are available in input-output tables.

Exports of tourism equal expenditure on Australian-produced goods and services by overseas visitors to Australia, including those parts of prepaid airline fares and package tours paid to Australian firms. Imports of tourism are those same payments by Australian residents to foreign firms in relation to overseas visits. In 2004-05 TSA tourism exports for Australia totalled \$18,257 million and TSA tourism imports totalled \$17,869 million (ABS 5249.0, Tables 9 and 8).

For Queensland, in addition to its shares of international tourism exports and imports, there are interstate imports corresponding to spending by Queenslanders visiting other States/Territories, and interstate exports corresponding to spending by persons from other States/Territories visiting Queensland. The Office of the Government Statistician (2002 & 2004) has provided estimates of Queensland's interstate exports and imports by industry in its Queensland and Queensland Regional Input-Output Tables for 1996-97, and these can be used as a starting point for scaled-up estimates for 2005-06. The imports data can then be used to estimate the proportions of industry supplies in each of the industries that constitute tourism, commercial fishing and recreational activity.

For the GBRCA, in addition to international and interstate trade, there are also imports into the GBRCA from the rest of Queensland and exports from GBRCA to the rest of Queensland. The individual regional input-output tables contain estimates of inter-regional flows. The GBRCA input-output table is constructed as the sum of four regional tables, although it does not have the inter-regional trade flows between these four regions netted out. As for Queensland, data by industry can be used to estimate the proportions of industry supplies associated with tourism, commercial fishing and recreational activity.

In the current analysis, all these measures are restricted to the set of visitors who visit the GBRCA and those GBRCA residents who travel outside the GBRCA. Furthermore, the estimates reported in this sub-section are restricted to the direct tourism imports and exports.

5.6.1 EXPORTS

Exports of tourism are given by the expenditures that lie behind the value added results presented in Table 5.2.1. Table 5.1.2 lists expenditures, obtained as the summation of day visitors and overnight visitors where appropriate, separately for visitors from the rest of Queensland, interstate and international. The procedure for splitting total expenditures across residents of the GBRCA, the rest of Queensland and other states contains approximations which introduce uncertainties into the estimates of exports.

We have no direct measure of commercial fishing exports from the GBRCA.

The value of seafood international exports for Queensland in 2004-05 (\$236 million) is 76% of the value of fisheries production caught in Queensland (\$311 million) where both measures include both fish and aquaculture (ABARE 2006). However, the values of exports and production are not directly comparable because production value is measured at the point of landing the catch and exports are measured free on board for export. The export values include additional costs of processing, packaging and transport. However, these additional costs are small for Queensland.

We have assumed that international exports account for 75% of the value of production for Queensland. Applying the same proportion to the GBRCA value of production (\$214 million in 2005-06, see section 5.3.1) means that international exports from the GBRCA are \$161 million. For the purposes of this exercise, and in the absence of any data, we assume that the remaining \$53 million of commercial fishing in the GBRCA is shared equally between consumption within the GBRCA, exports to the rest of Queensland and exports to other states.

Exports of cultural and recreational activity (defined to be spending by non-local residents in the GBRCA) are assumed to be zero because they are almost fully allowed for in tourism.

Access Economics' estimates of exports and imports associated with tourism, commercial fishing and cultural & recreational activity in the GBRCA are presented in Tables 5.6.1 (GBRCA), 5.6.2 (Queensland) and 5.6.3 (Australia) below.

The titles for the final rows differ between the three tables depending on whether the geographical area of interest is the GBRCA, Queensland or Australia. Note that exports and imports, measured as gross expenditures, do not line up with the estimates for value added and gross production in Tables 5.2.1, 5.2.3 and 5.3.4, because the latter net out input costs.

TABLE 5.6.1: GBRCA EXPORTS AND IMPORTS FOR SELECTED GBRCA ACTIVITIES, 2005-06, \$MILLION

<i>Component of trade</i>	<i>Exports: visitors to GBRCA</i>	<i>Imports: trips by GBRCA residents</i>	<i>Imports: inputs of goods and services</i>	<i>Net exports</i>
<i>Tourism</i>				
Visitors to/from GBRCA			255	-255
Visitors to/from rest of Queensland	916	820	189	-92
Visitors to/from interstate	2,151	736	434	981
GBRCA residents travelling outside GBRCA			73	-73
Visitors to/from international	1,814	790	353	671
Total tourism	4,881	2,346	1303	1,231
Commercial fishing	196		81	115
Recreational activity (net of tourism)			240	-240
Total trade contribution to GBRCA	5,077	2,346	1625	1,106

Source: Access Economics. Totals may differ from sums of components due to rounding.

TABLE 5.6.2: QUEENSLAND EXPORTS AND IMPORTS FOR SELECTED GBRCA ACTIVITIES, 2005-06, \$MILLION

<i>Component of trade</i>	<i>Exports: visitors to GBRCA</i>	<i>Imports: trips by GBRCA residents</i>	<i>Imports: inputs of goods and services</i>	<i>Net exports</i>
<i>Tourism</i>				
Visitors to/from GBRCA			163	-163
Visitors to/from rest of Queensland			125	-125
Visitors to/from interstate	2,151	736	248	1,167
GBRCA residents travelling outside GBRCA			43	-43
Visitors to/from international	1,941	790	215	936
Total tourism	4,093	1,527	793	1773
Commercial fishing	178		54	125
Recreational activity (net of tourism)			146	-146
Total trade contribution to Queensland	4,271	1,527	993	1752

Source: Access Economics. Totals may differ from sums of components due to rounding.

TABLE 5.6.3: AUSTRALIAN EXPORTS AND IMPORTS FOR SELECTED GBRCA ACTIVITIES, 2005-06, \$MILLION

<i>Component of trade</i>	<i>Exports: visitors to GBRCA</i>	<i>Imports: trips by GBRCA residents</i>	<i>Imports: inputs of goods and services</i>	<i>Net exports</i>
<i>Tourism</i>				
Visitors to/from GBRCA			68	-68
Visitors to/from rest of Queensland			51	-51
Visitors to/from interstate			119	-119
GBRCA residents travelling outside GBRCA			17	-17
Visitors to/from international	2,584	790	115	1,679
Total tourism	2,584	790	369	1,425
Commercial fishing	161		29	132
Recreational activity (net of tourism)			70	-70
Total trade contribution to Australia	2,745	790	468	1,487

Source: Access Economics. Totals may differ from sums of components due to rounding.

5.6.2 IMPORTS

Imports consist of (a) tourist expenditures by GBRCA residents outside the GBRCA and (b) imports into the GBRCA that are used as inputs into the tourism, commercial fishing and recreational activity industries. The estimates reported in this sub-section are restricted to direct tourism imports.

Firstly, there are expenditures outside the GBRCA by GBRCA residents on trips to the rest of Queensland, and on interstate and international trips. Expenditure within the GBRCA that is associated with these trips is not an import – at least not directly. It has already been included as tourism expenditure within the GBRCA in Table 5.2.1 (although there will be some imported input component meeting this expenditure – see section 6 below). In the absence of other data, we assume that international imports by GBRCA residents associated with an overseas trip are probably in much the same proportions as for Australia.

Second, some of the inputs used to provide tourism and other services are imported into the GBRCA from either overseas, interstate or other parts of Queensland. For example, there is relatively little wine produced in Queensland and even less in the GBRCA, so that most wine is imported from other states and from other countries. Similarly, some food products are supplied from outside the region. Much machinery and many tourist souvenirs are imported into the GBRCA.

The calculations are much less simple in the cases of interstate and inter-regional imports. The Queensland input-output table contains the total value of interstate imports used by each industry, but not the industry composition of these imported inputs. We therefore have to use an alternative approach.

For each industry, the import share of production is multiplied by the tourism demand for that industry, and then summed across industries. The same procedure can be used for commercial fishing and recreational fishing. In the case of the Cultural & Recreational Services part of recreational activity, adjustment must be made for the overlap with tourism. The results are indicative because they rely on 1996-97 import shares.

The same procedure is used for the GBRCA, Queensland and Australia, but using the appropriate (different) input-output tables.

5.6.3 GBRCA EXPORT AND IMPORT ESTIMATES: SOME COMMENTS

Tables 5.6.1, 5.6.2 and 5.6.3 show that the sum of the contributions from the selected GBRCA activities results in a net trade surplus of the order of \$1.1 billion for the GBRCA, \$1.8 billion for Queensland, and \$1.5 billion for Australia.

In contrast with the relationships for value added and employment, exports of tourism increase moving down from Australia as a whole to GBRCA, because expenditures by visitors from interstate and the rest of Queensland count as exports for GBRCA but not for Australia. The same pattern applies for expenditures by GBRCA residents travelling outside the GBRCA. Similarly, imports of goods and services are larger for GBRCA than for Australia because imports for Australia are international imports only, whereas imports for GBRCA also include imports from interstate and other Queensland regions.

Many of the entries in these three tables depend on key assumptions and approximations, necessitated by lack of available data, and the numerical results are sensitive to these.

Imports of goods and services have been calculated by assuming that imports into each industry, for the activities of interest, are in the same proportions as for those industries as represented in the three 1996-97 input-output tables. This leads to two possible sources of error. Firstly, the import shares may have changed since 1996-97. Secondly, the import share for the tourism part of an industry may not be the same as the import share for the industry as a whole.

The TSA for 2002-03 (ABS 2004) provides a partial check on imports of tourism goods and services for Australia. Table 8 in that publication shows that total imports purchased in Australia by tourists in 2000-01 were \$4,092 million. (There is no corresponding information in TSA 2004-05.) The GBRCA accounted for about 7.9% of total expenditure on tourism in Australia in 2005-06 (see the last paragraph of section 5.2).

If we assume that the same share applies to imports, then GBRCA would have accounted for \$323 million of imports into tourism in 2000-01. The corresponding value in 2005-06 is \$441 million if it is assumed that it increased by a factor of 1.364 representing cumulative growth in the nominal value of Australian imports over the period from 2000-01 to 2005-06 (ABS 5204.0, 5204051, November 2006).

The value of \$465 million in Table 5.6.3 is similar. This suggests that the imports of goods and services presented in Table 5.6.3, and also presumably Tables 5.6.1 and 5.6.2, may be reasonable estimates.

6. INDIRECT ECONOMIC VALUE OF CATCHMENT AREA

6.1 INDIRECT ECONOMIC VALUE AS MEASURED

When a tourist buys (say) a meal in a restaurant, the direct economic impact (reported in the tourism part of section 5) is only the value added *directly* at the restaurant. This would include the wages of staff and the gross operating surplus of the restaurant.

For example, if the meal purchased by the tourist cost \$40 and the raw inputs purchased by the restaurant were \$16, only the \$24 value added by the restaurant is included. Similarly, if the restaurant sells a bottle of wine for \$25, worth \$15 wholesale, only the \$10 value added is included. (Note that value added is measured at basic prices, so excludes GST and other indirect taxes.)

If the restaurant used raw ingredients that mostly came from GBRCA abattoirs, fisheries and wholesalers, then much of the \$16 cost of the raw materials in the above example is a further, albeit indirect, contribution made via expenditure by the tourist to the GBRCA economy.

However, if some of the inputs were imported from another region, state, or from overseas, the indirect impact on GBRCA region output and employment would be less.

Therefore, a restaurant that serves GBRCA meat would make a greater indirect economic contribution to the GBRCA than a restaurant that serves South Australian wine and meat from western Queensland, for example.

To measure indirect value added requires the tourism expenditure on each item to be traced to each input used in its production, and the inputs used to create these inputs, and so on.

The mathematical technique used to sum this chain of inputs requires the inversion of a matrix of coefficients derived from the GBRCA input-output table that summarises the relationships between different GBRCA industries (see Attachment A).

Indirect contributions for Queensland and Australia, for visitors to the GBRCA, are calculated in a similar way using input-output tables for Queensland and Australia, respectively.

The indirect contributions for Queensland are expected to be greater than for the GBRCA, and the Australian indirect contributions to be larger again. This is because the larger the area being considered, the larger the proportion of inputs that are supplied from that area.

Table 6.1.1 below summarises the indirect contributions of tourism, commercial fishing and cultural and recreational activity to the GBRCA in 2004-05 and 2005-06. Tables 6.1.3 and 6.1.4 present the corresponding results for Queensland and for Australia.

As is frequently the case for such analyses, the indirect contributions of the three industry groups shown in table 6.1.1, whether to value-added, gross product, or employment, tend to be less than the direct contributions estimated in section 5 above.

The discrepancy is largest for the smallest region (the GBRCA) and smallest for the largest region (Australia as a whole). This reflects the increasing scope for 'upstream' inputs to be sourced to production *outside* the region – and therefore not counting as part of the industry's indirect contribution to the region – the smaller is the region in question.

Comparisons between Tables 6.1, 6.3 and 6.4 show that indirect contributions for the selected activities (tourism, commercial fishing, and recreational activity) are indeed greater for Australia than for Queensland, and least for GBRCA, as expected.

The effect is appreciable in the case of tourism. Expressed another way, the ratio of the indirect value added to the direct value added for tourism (see also Tables 5.2.1, 5.2.3 and 5.2.4) is 0.41 for the GBRCA, 0.66 for Queensland and 0.81 for Australia in 2005-06.

TABLE 6.1.1: INDIRECT CONTRIBUTIONS OF SELECTED ACTIVITIES TO THE GBRCA, 2004-05 & 2005-06

<i>Indirect contribution</i>	<i>2004-05 Indirect Value Added (\$m)</i>	<i>2004-05 Indirect GAP (\$m)</i>	<i>2004-05 Indirect Employment (FTE 000)</i>	<i>2005-06 Indirect Value Added (\$m)</i>	<i>2005-06 Indirect GAP (\$m)</i>	<i>2005-06 Indirect Employment (FTE 000)</i>
<i>Total tourism within the GBRCA</i>						
Visitors from GBRCA	166	202	2	169	206	2
Visitors from rest of Queensland	136	165	2	131	159	1
Interstate visitors	237	291	3	303	371	3
by GBRCA residents for travel outside GBRCA	43	52	0	49	58	0
International visitors	238	291	3	251	307	3
Total tourism	819	1,000	10	903	1,101	9
Commercial fishing	54	58	0	47	51	0
Recreational activity (net of tourism)	105	111	2	105	111	2
Total contribution to GBRCA	979	1,169	12	1,055	1,262	11

Source: Access Economics. Totals may differ from sums of components due to rounding.

Table 6.1.2 below shows the distribution of indirect contributions for the GBRCA across industries for tourism (total), commercial fishing, and cultural and recreational activity.

These distributions are quite different from the direct contributions shown in Table 5.2.2 above, where the largest contributions to tourism are (as would be expected) from Accommodation, Other Transport and Wholesale & Retail Trade, the largest contributions to Commercial fishing are from Wholesale & Retail Trade, Machinery and Chemicals (fuel), and the largest contribution to cultural and recreational activity is from Cultural and Recreational Services.

The largest total indirect contributions, in contrast, are from Finance, Property and Business Services (27%), Wholesale & Retail Trade (16%), Other Transport (11%) and Other Agriculture (10%).

Much the same pattern is repeated for each of tourism, commercial fishing and recreational activity.

TABLE 6.1.2: INDIRECT CONTRIBUTIONS OF VALUE ADDED FOR SELECTED ACTIVITIES WITHIN THE GBRCA, BY INPUT-OUTPUT INDUSTRY, 2005-06, \$MILLION

<i>Industry</i>	<i>total tourism (\$m)</i>	<i>commercial fishing (\$m)</i>	<i>recreational activity (\$m)</i>	<i>total (\$m)</i>	<i>total (%)</i>
Sheep, grain	2	0	0	2	0%
Beef cattle	18	1	0	19	2%
Dairy cattle and pigs	4	0	0	4	0%
Other agriculture, sugar cane growing	95	3	9	107	10%
Forestry and fishing	7	1	0	8	1%
Coal, oil and gas	11	0	1	11	1%
Non-ferrous metal ores	6	0	1	7	1%
Other mining	3	0	1	5	0%
Food manufacturing	26	3	2	31	3%
Textiles, clothing and footwear	0	0	0	1	0%
Wood and paper manufacturing	13	1	2	16	1%
Chemicals, petroleum and coal products	6	0	0	7	1%
Non-metallic mineral products	1	0	0	2	0%
Metals, metal products	5	1	1	6	1%
Machinery, appliances and equipment	9	4	1	13	1%
Miscellaneous manufacturing	1	0	0	2	0%
Electricity supply, gas and water	44	1	4	50	5%
Residential building construction	2	0	0	2	0%
Other construction	5	0	0	5	1%
Wholesale and retail trade	139	17	14	171	16%
Accommodation, cafes and restaurants	16	1	3	19	2%
Road transport	40	2	4	46	4%
Rail and pipeline transport	13	0	1	15	1%
Other transport	105	2	4	111	11%
Communication services	47	1	7	55	5%
Finance, property and business services	248	6	32	287	27%
Ownership of dwellings	0	0	0	0	0%
Government administration and defence	16	1	1	18	2%
Education	3	0	0	4	0%
Health and community services	3	0	1	4	0%
Cultural and recreational services	12	0	12	24	2%
Personal and other services	3	0	1	4	0%
Total GBRCA	903	47	105	1,055	100%

Source: Access Economics. Totals may differ from sums of components due to rounding.

TABLE 6.1.3: INDIRECT CONTRIBUTIONS OF SELECTED ACTIVITIES WITHIN GBRCA TO QUEENSLAND, 2004-05 & 2005-06

<i>Indirect contribution</i>	<i>2004-05 Indirect Value Added (\$m)</i>	<i>2004-05 Indirect GSP (\$m)</i>	<i>2004-05 Indirect Employment (FTE 000)</i>	<i>2005-06 Indirect Value Added (\$m)</i>	<i>2005-06 Indirect GSP (\$m)</i>	<i>2005-06 Indirect Employment (FTE 000)</i>
<i>Total tourism within the GBRCA</i>						
Visitors from GBRCA	272	324	3	276	328	3
Visitors from rest of Queensland	256	305	3	236	281	3
Interstate visitors	383	458	5	491	586	6
by GBRCA residents for travel outside GBRCA	67	79	1	77	91	1
International visitors	422	503	5	424	505	5
Total tourism	1,400	1,668	17	1,503	1,792	17
Commercial fishing	91	95	1	79	83	1
Recreational activity (net of tourism)	198	206	3	198	206	3
Total contribution to Queensland	1,689	1,969	21	1,780	2,080	21

Source: Access Economics. Totals may differ from sums of components due to rounding.

TABLE 6.1.4: INDIRECT CONTRIBUTIONS OF SELECTED ACTIVITIES WITHIN GBRCA TO AUSTRALIA, 2004-05 & 2005-06

<i>Indirect contribution</i>	<i>2004-05 Indirect Value Added (\$m)</i>	<i>2004-05 Indirect GDP (\$m)</i>	<i>2004-05 Indirect Employment (FTE 000)</i>	<i>2005-06 Indirect Value Added (\$m)</i>	<i>2005-06 Indirect GDP (\$m)</i>	<i>2005-06 Indirect Employment (FTE 000)</i>
<i>Total tourism within the GBRCA</i>						
Visitors from GBRCA	357	428	4	362	435	4
Visitors from rest of Queensland	328	396	4	303	365	3
Interstate visitors	573	693	6	739	893	8
by GBRCA residents for travel outside GBRCA	86	103	1	99	120	1
International visitors	666	805	7	707	855	7
Total tourism	2,011	2,426	22	2,211	2,668	23
Commercial fishing	143	152	1	124	132	1
Recreational activity (net of tourism)	229	240	4	229	239	3
Total contribution to Australia	2,383	2,817	26	2,564	3,039	28

Source: Access Economics. Totals may not add due to rounding.

6.2 INDIRECT TOURISM ECONOMIC VALUE IS UNDERSTATED

There is another *indirect* contribution of tourism to the GBRCA. (Similar arguments also apply to the indirect contribution of tourism to, Queensland and to Australia.)

This is the demand for GBRCA production of goods and services that are used as inputs into non-GBRCA businesses directly supplying goods and services to tourism *outside* the GBRCA.

GBRCA tourism value added will be underestimated by the amount associated with production in the GBRCA of goods and services sold directly to tourists outside the GBRCA in Queensland, in other States, or overseas, or used directly or indirectly in the production of tourism goods outside the GBRCA in Queensland, in other States, or overseas.

All State- and region-specific studies undertaken along the lines of this report would underestimate region and state tourism value added, and the sum across all Australian regions or states would be less than Australian tourism value added as a result.

This issue throws up a limitation of the TSA approach as currently applied.

Consider the hypothetical case where there was a TSA for the world economy:

- Globally (assuming no trade with other planets!) there are no imports or exports, only world production of goods and services.
- All goods and services, ideally, will be allocated, via the hypothetical global TSA, either to meeting the needs of travellers or non-travellers.
- An analysis that incorporates the direct plus indirect components as described earlier in this report will capture all production and employment, and allocate it either to tourism-related demand or non-tourism-related demand via the TSA approach.

But national, state, territory and regional TSA analyses generally will *understate* the full direct plus indirect contribution of tourism to the nation, state, territory or region. For example, in the context of Australia:

- The TSA approach does not treat the export of an Australian bottle of wine that is consumed by a French traveller in a Californian restaurant as tourism-related for purposes of the Australian-focussed TSA. However, the Australian TSA would deduct the import value of a French champagne consumed by an American visitor to Australia in calculating the contribution to Australian value added attributable to tourism.
- Similarly, the TSA approach as applied above by Access Economics to GBRCA does not treat the export of a GBRCA beverage that is consumed by a French traveller in a Californian restaurant as tourism-related for purposes of the GBRCA-focussed TSA. However, the GBRCA TSA does deduct the import value of a French champagne consumed by an American visitor to the GBRCA in calculating the contribution to GBRCA value added attributable to tourism.
- Yet, from a GBRCA perspective, the sale of a GBRCA-produced beverage to a French traveller eating a meal in California seems sensibly regarded – in the spirit of the TSA approach – as an indirect, tourism-related, contribution to GBRCA value added and employment.

7. TOTAL ECONOMIC VALUE OF CATCHMENT AREA

The total economic contributions of tourism, commercial fishing and cultural & recreational activity to the GBRCA are the sums of the direct contributions and the indirect contributions that have been presented in sections 5 and 6 above. There are different sets of results depending on whether the calculations are for contributions to the GBRCA, Queensland or Australia.

Contributions of value added, gross regional product and employment for the GBRCA are summarised for 2004-05 and 2005-06 in Table 7.1 below. Tourism is the dominant component, accounting for 83% of both value added and employment in 2005-06. Tourism has very approximately equal contributions from international visitors, interstate visitors and visitors from Queensland, with around 56% of the Queensland contribution being from visitors living within the GBRCA.

The other value added contributions are commercial fishing 3% and recreational activity 14%, after netting out duplication with tourism.

The total economic contributions for Queensland (Table 7.2) and for Australia (Table 7.3) show much the same proportions of tourism, commercial fishing and cultural & recreational activity as for the GBRCA. All the estimates are larger in absolute terms than for GBRCA because the larger geographical areas include inputs additional to those provided within the GBRCA alone.

Total value added for the selected activities in 2005-06 is 21% greater for Queensland than for the GBRCA and 55% greater for Australia than for the GBRCA. The additional contributions include not only direct inputs such as food, petrol, souvenirs and the remaining shares of airfares, but also indirect inputs such as business services and (wholesale) trade.

One of the employment entries in Table 7.2 for Queensland is slightly larger than that in Table 7.3 for Australia, contrary to expectations. Possible reasons for this were addressed at the end of section 5.2. It is probably due to a combination of limitations of the three 1996-97 input-output tables, as applied for our purposes, and deficiencies in our scaling of results from 1996-97 to 2004-05 and 2005-06 as noted in section 5.2 above. The input-output tables may not be consistent with one another in the sense that the same industry may not be represented in the same way in all tables because it consists of a combination of industries which are combined with different weights in different tables.

Table 7.4 shows the value added pattern across direct and indirect contributions and across the GBRCA, Queensland and Australia for total value added for the selected industries. It shows how the direct contributions change relatively little across the geographical areas while the indirect contributions change markedly. The combined result is a mix of the two.

TABLE 7.1: DIRECT PLUS INDIRECT CONTRIBUTIONS OF SELECTED GBRCA ACTIVITIES TO THE GBRCA, 2004-05 & 2005-06

<i>Total contribution (direct plus indirect)</i>	2004-05	2004-05	2004-05	2005-06	2005-06	2005-06
	<i>Total Value Added (\$m)</i>	<i>Total GAP (\$m)</i>	<i>Total Employment (FTE 000)</i>	<i>Total Value Added (\$m)</i>	<i>Total GAP (\$m)</i>	<i>Total Employment (FTE 000)</i>
<i>Total tourism within the GBRCA</i>						
Visitors from GBRCA	585	725	8	561	698	7
Visitors from rest of Queensland	460	565	5	442	545	5
Interstate visitors	812	999	10	1,043	1,283	12
by GBRCA residents for travel outside GBRCA	165	198	2	174	211	2
International visitors	827	1,016	11	879	1,080	11
Total tourism	2,849	3,504	36	3,099	3,817	36
Commercial fishing	188	195	1	163	169	1
Recreational activity (net of tourism)	407	482	8	406	482	6
Total contribution to GBRCA	3,444	4,181	45	3,669	4,468	44

Source: Access Economics. Totals may differ from sums of components due to rounding.

TABLE 7.2: DIRECT PLUS INDIRECT CONTRIBUTIONS OF SELECTED GBRCA ACTIVITIES TO QUEENSLAND, 2004-05 & 2005-06

<i>Total contribution (direct plus indirect)</i>	2004-05	2004-05	2004-05	2005-06	2005-06	2005-06
	<i>Total Value Added (\$m)</i>	<i>Total GSP (\$m)</i>	<i>Total Employment (FTE 000)</i>	<i>Total Value Added (\$m)</i>	<i>Total GSP (\$m)</i>	<i>Total Employment (FTE 000)</i>
<i>Total tourism within the GBRCA</i>						
Visitors from GBRCA	682	838	10	658	811	9
Visitors from rest of Queensland	643	779	8	583	711	7
Interstate visitors	956	1,164	12	1,227	1,494	14
by GBRCA residents for travel outside GBRCA	190	227	2	203	244	2
International visitors	1,094	1,328	14	1,101	1,337	13
Total tourism	3,565	4,336	46	3,772	4,597	46
Commercial fishing	236	243	2	205	211	1
Recreational activity (net of tourism)	474	545	10	472	544	9
Total contribution to Queensland	4,274	5,124	57	4,450	5,352	56

Source: Access Economics. Totals may differ from sums of components due to rounding.

TABLE 7.3: DIRECT PLUS INDIRECT CONTRIBUTIONS OF SELECTED GBRCA ACTIVITIES TO AUSTRALIA, 2004-05 & 2005-06

<i>Total contribution (direct plus indirect)</i>	2004-05	2004-05	2004-05	2005-06	2005-06	2005-06
	<i>Total Value Added (\$m)</i>	<i>Total GDP (\$m)</i>	<i>Total Employment (FTE 000)</i>	<i>Total Value Added (\$m)</i>	<i>Total GDP (\$m)</i>	<i>Total Employment (FTE 000)</i>
<i>Total tourism within the GBRCA</i>						
Visitors from GBRCA	773	948	10	750	923	9
Visitors from rest of Queensland	724	879	8	659	803	8
Interstate visitors	1,282	1,559	14	1,661	2,019	18
by GBRCA residents for travel outside GBRCA	211	254	2	228	276	2
International visitors	1,528	1,856	17	1,633	1,982	18
Total tourism	4,518	5,496	52	4,932	6,004	55
Commercial fishing	273	288	2	238	251	2
Recreational activity (net of tourism)	544	624	9	542	623	9
Total contribution to Australia	5,335	6,408	63	5,712	6,877	66

Source: Access Economics. Totals may differ from sums of components due to rounding.

TABLE 7.4: TOTAL VALUE ADDED FOR SELECTED INDUSTRIES, 2004-05 & 2005-06, \$ MILLION

	<i>2004-05 direct</i>	<i>2004-05 indirect</i>	<i>2004-05 combined</i>	<i>2004-05 indirect/direct</i>	<i>2005-06 direct</i>	<i>2005-06 indirect</i>	<i>2005-06 combined</i>	<i>2005-06 indirect/direct</i>
GBRCA	2,465	979	3,444	0.40	2,614	1,055	3,669	0.40
Queensland	2,585	1,689	4,274	0.65	2,669	1,780	4,450	0.67
Australia	2,952	2,383	5,335	0.81	3,148	2,564	5,712	0.81
GBRCA/Australia	83%	41%	65%		83%	41%	64%	
Queensland/Australia	88%	71%	80%		85%	69%	78%	

Source: Access Economics. Totals may differ from sums of components due to rounding.

8. CONCLUSIONS, CAVEATS & FURTHER WORK NEEDED

8.1 ACCESS ECONOMICS' CONCLUSIONS

As measured using the quantitative data (primarily national accounts-based) available to it, Access Economics concludes that the total (direct plus indirect) economic contribution of tourism, commercial fishing, and cultural and recreational activity to the GBRCA in 2005-06 is as follows:

- For value-added, around \$3.7 billion per annum.
- For gross product, around \$4.5 billion per annum.
- For employment (full time equivalent basis), about 44,000 persons.

The corresponding estimates for Queensland are:

- For value-added, around \$4.5 billion per annum.
- For gross product, around \$5.4 billion per annum.
- For employment (full time equivalent basis), about 56,000 persons.

The corresponding estimates for Australia are:

- For value-added, around \$5.7 billion per annum.
- For gross product, around \$6.9 billion per annum.
- For employment (full time equivalent basis), about 66,000 persons.

Tourism dominates these contributions:

- For value-added and gross product, tourism's share is about 84%-87%.
- For employment, tourism's share is about 81%-84%.

The economic contribution of these selected industry activities to the GBRMP, as opposed to the GBRCA, will be a sub-set of the results just summarised:

- For commercial fishing, the subset results for the GBRMP will be a very high percentage of the GBRCA results.
- For tourism and cultural and recreational activities, the subset results will be smaller proportions of the GBRCA results.

These results are likely to understate the economic contribution of the selected industries to the GBRCA (see section 6.2 above, and sections 8.2 and 8.3 below).

8.2 COMPARISONS WITH THE ACCESS ECONOMICS 2005 REPORT

The results for 2004-05 presented in this report differ a little from those in the Access Economics 2005 report. The 2005 report described the total (direct plus indirect) economic contributions to Australia of tourism, commercial fishing and recreational activities in the GBRCA as: value added over \$5.1 billion per annum; GDP over \$5.8 billion per annum; and employment (measured in full-time equivalents) about 63,000 persons. The corresponding revised 2004-05 results presented in this 2006 report are value added over \$5.3 billion, GDP around \$6.4 billion and employment about 63,000 persons. Table 8.2 summarises the differences in direct value added between the current report and the 2005 report for contributions to the GBRCA and Australia.

TABLE 8.2: ESTIMATES OF THE DIRECT VALUE ADDED CONTRIBUTION OF TOURISM TO THE GBRCA AND AUSTRALIA (\$M), COMPARISON OF CURRENT REPORT WITH 2005 REPORT

	<i>GBRCA 2005 report</i>	<i>GBRCA Table 5.2.1</i>	<i>Australia 2005 report</i>	<i>Australia Table 5.2.4</i>
<i>Total tourism within the GBRCA</i>				
Visitors from GBRCA	456	420	454	416
Visitors from rest of Queensland	246	324	313	396
Interstate visitors	676	575	823	708
by GBRCA residents for travel outside GBRCA	55	122	57	125
International visitors	742	589	825	862
Total tourism	2,175	2,030	2,472	2,507
Commercial fishing	68	133	68	131
Recreational activity (net of tourism)	302	301	315	315
Total contribution	2,545	2,465	2,855	2,952

Source: Access Economics (2005). Totals may differ from sums of components due to rounding.

The changes in the results are driven mainly by differences in the corresponding expenditures. There are several reasons for the differences.

- The earlier report was written before complete data for 2004-05 were available. The TSA data were for 2003-04, the CD-MOTA data were to September 2004, and commercial fishing data were to December 2004. These values were extrapolated to 2004-05. The values presented in this report are based on actual data for 2004-05.
- CD-MOTA tourism expenditures are now adjusted to be consistent with REM total expenditures, whereas those in the previous report were derived directly from CD-MOTA data without use of REM results. We consider the REM totals to be more reliable than our estimates based on CD-MOTA data alone.
- Bundaberg region tourism is now included in the GBRCA analysis and 29% of the Wide Bay-Burnett input-output table is included in the GBRCA input-output table. Both were omitted from the previous analysis. However, they account for relatively small proportions of the GBRCA totals, so that they are not major causes of differences between the new and old results.

- Expenditure by GBRCA residents before and after trips outside the GBRCA has increased considerably because it now includes both domestic and overseas trips, whereas only overseas trips were allowed for in the 2005 report.
- Scaling factors for value added, GAP/GSP/GDP and employment, which were derived by comparing Access Economics national tourism results with TSA results, have been applied to all GBRCA, Queensland and Australian tourism calculations. Corresponding scaling has been applied to commercial fishing and recreational activity on the basis of advice received from the ABS input output section. These scaling procedures were not used in the 2004-05 report.

8.3 QUALIFICATIONS TO RESULTS

While the broad objective is to measure the economic contribution of the GBRMP, it must be emphasised that the economic contributions of tourism, commercial fishing and recreational activities that are presented in this report are for the whole of the GBRCA. They are not for the GBRMP alone. Although the GBRCA and GBRMP commercial fishing contributions are close to being equal, the GBRMP contributions for tourism and for cultural & recreational activities are smaller than the GBRCA contributions. For this reason it is best to consider results separately for tourism, commercial fishing and recreational activities, and to pay less attention to their sum.

Many tourism visits to the GBRCA are unrelated to the GBRMP, and not all visits that include a visit to the GBRMP can be attributed fully to the GBRMP. An appreciable proportion of visits to the GBRCA are for the purposes of business and visiting friends and relatives and have no connection with the GBRMP, although some of these visits will include some use of the GBRMP. Holiday visits to the GBRCA are not driven by the GBRMP alone; there are other attractions such as rain forests and warm weather. In order to assess the economic contribution of the GBRMP, rather than of the GBRCA, it would be helpful to have survey data that could be used to attribute proportions of GBRCA visits, nights and expenditures to the GBRMP. This would have to include all access to the GBRMP, including both commercial and non-commercial uses.

The GBRMP must nevertheless be a significant factor in many decisions to visit the GBRCA. However, without full information about visits by tourists to the GBRMP, including swimming, boating, yachting and fishing, it is not possible to measure the economic contribution to the GBRMP of tourism and recreational activities. In the absence of such measures it is convenient to use the corresponding contributions to the GBRCA as indicators of contributions to the GBRMP. Percentage changes in GBRMP contributions are likely to approximate percentage changes in GBRCA contributions.

Recreational fishing in the GBRMP has been treated as part of cultural and recreational activities, but it accounts for only about 10% of this sector. The sector is dominated by gambling, sport, and radio and TV services, together with movies, theatre, museums and art galleries. Except for the GBRMP exhibits at 'Reef HQ' in Townsville, few of these have much connection with the GBRMP.

Hoegh-Guldberg (2004, especially pages 131 to 166) has investigated various sources of data for estimating the economic contribution of the GBRMP. The emphasis is on tourism. It recognises the value of regional tourism satellite accounts, as developed by Queensland's Office of Economic and Statistical Research. It draws attention to the distinction between international, interstate and intrastate visitors, and there is sympathy with the position that visits to the reef are predominantly by tourists on holidays. It describes differences in tourist expenditure between the different regions. It addresses the problem of separating reef-

interested tourists from other tourists (p.142) by linking regional tourism data to other surveys that inquire about reef visits. This provides information about reef-interested visits, although there is still the problem of which proportion of this to attribute to reef visits. It is reported that three studies that summed expenditures across trips on vessels, mainland accommodation and island resort holidays, found that 15%, 23% and 15% of total tourism expenditure (excluding airfares) was by reef-interested tourists, whether or not they actually visited the reef. The discussion of commercial fishing has been superseded by changes subsequent to the rezoning of the park.

8.4 CAVEATS

These estimates are subject to a variety of caveats, as noted throughout this report. For example:

- They cover market-related transactions only: non-market activities, including cultural and indigenous activities, are not covered.
- The analysis relates to annual flows estimated for 2004-05 and 2005-06 only: there is no balance sheet assessment covering stocks of assets, etc.
- The quantification is based on a wide variety of data sources compiled by different Commonwealth and State agencies: there will inevitably be some inconsistencies between these sources. There are sampling errors in the collection of data.
- Much of the actual data is relatively old and needs to be 'scaled up' to obtain estimates for the reference year (2005-06). The scaling up process undertaken by Access Economics inevitably involves scope for additional errors.
- Externality effects (eg, adverse effects on water quality within the GBRMP associated with other industries (eg, agriculture) have not been taken into account.
- On externality effects, the economic contributions of the three selected industries also do not cover adverse effects over time (eg, from tourism and local resident congestion, at least at some locations within the GBRMP, possible over-fishing, etc.)

8.5 FURTHER WORK NEEDED

The main requirement for improved and updated analysis of the type presented in this report is more up-to-date and hopefully more fully consistent data.

Above all, these types of analysis are hampered by delays in the release of the three input-output tables that are a crucial foundation for economic contribution studies such as this. There are national data for 2001-02 but the currently-released Queensland data (for 1996-97) are nearly a decade out of date. However, against this it should be noted that Queensland is the only state that generates officially-compiled state and regional input output tables.

Scientific research is an important activity within the GBRCA in general and the GBRMP in particular, but we have not been able to obtain quantitative estimates that we can re-formulate in a national accounts-consistent framework at this stage. But a comprehensive summation of the annual gross costs involved in policy development, management, monitoring and research, based on the Hand report, might be between \$100 and \$200 million per annum. More work is needed to refine this estimate.

Economic contributions from expenditures by local residents on other activities such as scuba diving, snorkelling and boating that are not included in Cultural & Recreational Services are also likely to be significant, but we have no data on these at present.

Any information in these areas would help to make the analysis in this report more comprehensive.

Even if these data gaps can be filled, for the reasons set out in section 6.2 above, the economic contribution of tourism to the GBRCA will be understated by the type of analysis presented in this report.

The main factors working the other way – if not for a particular reference year, at least over time – are the external diseconomies associated with industry activity on the environment of the GBRMP, which is surely a major drawback for tourism, commercial fishing, and other activity.

To the extent that such diseconomies degrade the GBRMP itself, the ‘pulling power’ of the GBRCA itself may be reduced, and with it the economic contribution of the selected industries examined in this report.

9. CLIMATE CHANGE AND THE GREAT BARRIER REEF

In the second half of 2006, GBRMPA requested, and accepted Access Economics' proposal for, a variation to the contract for the preparation of this report. This section of the report deals with the additional work required of Access Economics under the contract variation.

9.1 ADDITIONAL TERMS OF REFERENCE

The additional terms of reference are as follows:

Undertake a qualitative assessment of the likely economic implications that climate change might pose for Great Barrier Reef dependent industries and the subsequent flow-on impacts to the Queensland and Australian economies. The assessment should also present options for future economic research that could be used to report the economic impacts of climate change and also assist GBR based industries plan for change based on predicted future climate scenarios.

The key elements in these terms of reference are:

- The assessment is to be qualitative, not quantitative.
- The focus therefore is on identifying likely *mechanisms* linking climate change to conditions of the Reef, and likely *mechanisms* linking Reef conditions to induced economic effects.
- These induced economic effects would comprise *direct* effects (eg, on Reef tourism and fishing activities), and *indirect* effects.
- While general equilibrium modelling, by definition, is not involved (as far as Access Economics is aware, suitable data are not available), Access Economics would *not* be concluding that Reef deterioration would produce large negative effects for Australia, or even, perhaps, Queensland, *because* of significant effects in a direct sense on tourism or fishing. Rather, we would be pointing to *displacement* of activity into other areas. That said, this may have significant regional effects (eg., on coastal development).
- Presentation of options for future research.

9.2 CLIMATE CHANGE: WHAT DOES THE EVIDENCE SHOW?

The science of climate change, and its implications for the physical condition of coral reefs, has been, and is still, the subject of considerable research. This section of the report summarises the *mechanisms* linking climate change phenomena and reef conditions.

9.2.1 CLIMATE CHANGE #1: NATURAL OR ANTHROPOGENIC?

At the outset, is it worth considering whether or not climate change is due to natural causes and/or, instead, is anthropogenic?

This is clearly an important issue when considering what might be done to deal with climate change itself. If climate change is wholly natural in origin, government policy initiatives to curtail human sources of, say, greenhouse gases, may be both costly and have little if any effect. On the other hand, if climate change is significantly caused by human activity, the prospects for greenhouse gas abatement policies (for example) being cost-effective increase significantly as well.

On the basis of Access Economics' limited research into this issue, we conclude that:

- The evidence of global warming, especially since around the mid-1970s, appears strong.
- The evidence that this is anthropogenic (including that contained in the latest IPCC report) is also growing, in the sense that the warming recorded to date appears to be both faster, and, in scale, beyond the bounds of natural variability over the last 1,000 – 2,000 years.⁶ Human-driven emissions of greenhouse gases, mainly carbon dioxide, appear to be the main cause.

However, for the purposes of this report, Access Economics considers that the underlying *causes* of climate change are not the critical issues. The critical issues are whether or not climate change is in fact occurring, regardless of its causes, and what are its symptoms:

- The natural/anthropogenic causes debate *is* crucial for the wider policy debate about what countries should be doing in response to such changes.
- But for this report the focus is more limited: *is* climate change occurring, and *given* that it is, and is likely to continue, what are its likely effects of the physical condition of the Great Barrier Reef?
- As part of this focus, one related question is: how well can the Great Barrier Reef adapt to climate change?

9.2.2 CLIMATE CHANGE #2: ATMOSPHERIC AND CRYOSPHERIC WARMING

The most widely reported evidence of climate change is the estimated increase in global average near-surface atmospheric temperatures between the mid-1800s and 2005, and evidence of ice melting:⁷

- Since the start of the 20th century, the global average surface temperature has risen between 0.6 and 0.7 degrees Celsius. Since 1976, the global average surface temperature has increased by 0.18 degrees Celsius per decade. In the 1990s, the increase in average global surface temperatures was even faster. Australia has experienced similar conditions – indeed, if anything, temperature increases have been larger.
- As to the cryosphere, the area of the Arctic polar floating ice cap has decreased by about 20% compared with the 1978-2000 average. On some projections, the Arctic Ocean could be ice-free, or nearly so, by the end of the 21st century.
- The Greenland ice sheet has a larger area of ice that is melting, especially around its edges (although this is accompanied by greater snowfalls in the interior). In Antarctica, a similar pattern to that recorded in Greenland is evident: loss of ice-shelves and

⁶ Whether or not this time-frame is appropriate is not something Access Economics is competent to judge. That said, Access Economics is aware of evidence suggesting atmospheric carbon concentrations well in excess of current levels (about 385 parts per million) using time-frames going back tens or hundreds of millions of years. These clearly had natural causes. See, for example *Impact from the Deep*, Scientific American, October 2006, page 49.

⁷ See, for example, *Stronger Evidence but New Challenges: Climate Change Science, 2001-2005* Professor Will Steffen, published by the Australian Greenhouse Office in the Department of the Environment and Heritage, March 2006, pages 5-7.

coastal ice, and associated acceleration of glacial movement, but increased ice accretion in the interior.

- Most land-based glaciers are in retreat (out of 88 glaciers surveyed recently by the World Glacier Monitoring Service, apparently 79 were receding, and only 4 were growing in mass and extent). This process appears to be accelerating.
- Model-based estimates of the extent of further global atmospheric warming by the end of the 21st century lie within the range +1.4 to +5.8 degrees Celsius.

9.3 CLIMATE CHANGE: WHAT ARE ITS EFFECTS?

This section of the report summarises the effects expected to be associated with climate change phenomena.

9.3.1 CLIMATE CHANGE EFFECTS #1: OCEAN WARMING/SEA LEVEL RISE

The effects of global warming include warmer oceans:⁸

- There is evidence of an increase in temperature between the mid-1950s and 1998 that amounts to the equivalent of 0.037 degrees Celsius across the entire ocean, with most of this in the upper levels.
- Both because of thermal expansion and increased ice run-off from land, there is evidence of rising sea levels:
 - From 1950 to 2000 global-averaged sea levels rose by 1.8mm (plus or minus 0.3mm) per year.
 - During the 1970s and more recently, this has increased to about 3mm per year.
 - This compares with evidence that the sea level was relatively stable or falling slightly over the last 6000 to 7000 years.
 - The estimated contribution of thermal expansion in the period after 1993 is about 1.8mm per year, with the remainder (1.2mm per year) due to increased run-off from melting ice sheets and glaciers.

9.3.2 CLIMATE CHANGE EFFECTS #2: BIOSPHERIC CHANGES

Further evidence of the effects of global warming can be found in the behaviour of plants, insects, and animals:⁹

- There is evidence of plants and animals moving towards the poles and towards higher altitudes, changing their previous ranges, as they respond to global warming.
- There is also evidence that diseases (eg, associated with the anopheles mosquito, such as malaria) that are endemic in tropical regions are moving away from the equator towards more temperate latitudes in recent decades.

⁸ See *Stronger Evidence but New Challenges: Climate Change Science, 2001-2005* op. cit., page 8.

⁹ See *Stronger Evidence but New Challenges: Climate Change Science, 2001-2005* op. cit., page 9.

- Migratory timing, and shooting and flowering of plants, are occurring earlier in the spring.

9.3.3 CLIMATE CHANGE EFFECTS #3: MORE EXTREME WEATHER EVENTS

There is evidence that the number of extreme (by historical standards) weather events is increasing, and this is consistent with what would be expected as a result of global warming. These include:¹⁰

- More frequent heatwaves.
- More severe storms and floods.
- More destructive cyclones (the power of which depends importantly on the warmth of the ocean surface waters over which they form).

9.3.4 CLIMATE CHANGE EFFECTS #4: OCEAN COMPOSITION/CIRCULATION

Rising atmospheric concentration of carbon dioxide increases upper ocean uptake of this greenhouse gas.¹¹

This increases ocean acidity (reduces the pH) of the ocean, and there is evidence of this change occurring. In turn, this decreases the concentration of carbonate ions in the oceans. These are important for the formation of calcium carbonate.

Melting ice and increased water run-off into the ocean appears to have reduced ocean density and salinity in the North Atlantic Ocean.¹² While the science is less certain, one possibility is that this process might weaken or even stop the North Atlantic thermohaline circulation. Such changes have occurred in the past and have been associated with severe cooling in Northwestern Europe, even as the globe as a whole warms. There is some evidence of a slight weakening of the North Atlantic thermohaline circulation.

In the Southern Ocean, there is some evidence of cooler and less salty deep waters than was evident 10 years ago, believed to be caused by fresh water associated with Antarctic glacial melt.

In both of these areas, at least two possibilities arise:

- There may be less circulation of water between the tropics and the poles, as well as less circulation between warmer surface layers and cooler deeper layers, or at least changes in where that occurs.
- As a result, global warming may be concentrated more in the equatorial tropical regions and near the ocean surface, with, if anything, the re-emergence of cooling in the higher latitudes as ocean currents weaken.

The science in these areas appears to be less clear-cut, and more research is needed.

¹⁰ See *Stronger Evidence but New Challenges: Climate Change Science, 2001-2005* op. cit., pages 12 – 14.

¹¹ See *Stronger Evidence but New Challenges: Climate Change Science, 2001-2005* op. cit., pages 15 - 16.

¹² See *Stronger Evidence but New Challenges: Climate Change Science, 2001-2005* op. cit., page 17.

9.3.5 CLIMATE CHANGE EFFECTS #5: RUNAWAY GREENHOUSE?

There has been a substantial amount of popular media coverage of ‘tipping points’ and so-called ‘runaway greenhouse effects’.

These appear to be based on the general proposition that the Earth’s atmosphere, land masses and oceans are likely to respond to initial global warming with ‘positive feedback’ effects that increase and accelerate the process (eg, the so-called aerosol cooling effect, that may be masking global warming now, but which will, when aerosol emissions are reduced, allow a faster warming process to occur).

An alternative view is that responses from the Earth’s atmosphere, land masses and oceans may also include significant ‘negative feedback’ effects that, ultimately, will limit the extent of, and then reverse, the warming process. Unfortunately, at least one of these hypotheses seems to involve the emergence of general conditions unsuitable for most life, and mass extinctions.¹³

For the purposes of this report, the likely time periods for either of these alternatives to emerge is probably too long to be of immediate practical concern – or to be sufficiently limited to allow practical responses. Runaway global warming, or reversal via the aftermath of mass extinctions are not considered further in this report.

9.4 CLIMATE CHANGE EFFECTS ON THE GREAT BARRIER REEF

This section of the report summarises the *mechanisms* linking climate change phenomena and conditions on the Great Barrier Reef.

9.4.1 EXPECTED PHYSICAL REEF EFFECTS #1: CORAL BLEACHING

The Great Barrier Reef is a relatively shallow, tropical warm water, coral reef system. (There are other corals reefs found in deep cold water. These are not addressed in this report.)

Unlike other animals, the polyps comprising coral reefs such as the Great Barrier Reef may not be able to migrate fast enough to higher latitudes to offset the effects of rapid climate change on atmospheric and tropical upper ocean temperatures (although presumably limited responses of that kind are occurring).

The symptoms and effects of climate change briefly reviewed in sections 9.2 and 9.3 above point to higher temperatures in the upper layers of ocean water around the world, and possibly especially so (see section 9.3.4 above) in tropical regions.

There is evidence that higher sea surface temperatures are a key cause of coral stress, and coral bleaching. Indeed, this is the key cause of mass, or regional, coral bleaching. Increases in sea temperatures of 1 to 2 degrees Celsius above long term average maximum temperatures are all that is needed.¹⁴ Projected increases in carbon dioxide and global

¹³ See, for example, *Impact from the Deep*, op. cit.

¹⁴ See *A Reef Manager’s Guide to Coral Bleaching* Paul Marshall and Heidi Schuttenberg, GBRMPA/IUCN. 2006, page 6.

temperatures exceed the conditions under which coral reefs have flourished for the past half million years.¹⁵

The impact of warming may be exacerbated by the extent of light penetration into the water because UV radiation exacerbates the effect of higher temperatures.¹⁶ In addition, over time, increased ocean acidity (and reduced presence of carbonate ions) may affect marine life's ability to produce calcium carbonate shells, with obvious longer term implications for coral reefs due to reduced calcification growth rates and reduced structural strength.^{17 18}

Mass, or regional, coral bleaching therefore is one of the first effects that we might expect to observe as a result of global warming.

Bleaching can also be induced by other sources of stress, such as pollution, including high nutrient levels in the surrounding ocean due to run-off from human activity on adjacent land. These factors can reinforce each other, intensifying the severity and frequency of bleaching episodes.

Such episodes may increase the susceptibility of affected coral reefs to infestations by invasive species, or algae growth.

There is some evidence (based on data from the Seychelles) that the capacity of coral reefs to survive in a warming world, and to recover from past bleaching episodes, may also depend on the levels of pollution to which they are exposed.¹⁹

In Australia, mass coral bleaching was virtually unknown in the Great Barrier Reef region before 1979. Such bleaching episodes now occur more frequently. In 2002, GBRMPA estimated that 60% to 95% of the Great Barrier Reef was affected by bleaching to some extent. In 2005-06, warmer waters around the Keppel Islands caused as much as 98% of the corals to bleach (although subsequent cooler weather allowed more than half to survive).²⁰

9.4.2 EXPECTED PHYSICAL REEF EFFECTS #2: ECO-SYSTEM IMPACTS

Bleaching occurs when zooxanthellae, the microscopic plants that nourish the corals and give them colour, are expelled, leaving the corals white. This may reduce the attractiveness of the corals as perceived by some tourists.

If the warming that induced this effect is sustained for long enough, or repeated frequently enough, the zooxanthellae do not return, either enough or at all, to recolonise the corals. In turn, the corals cannot recover quickly enough or sufficiently, and they die.

¹⁵ See, for example, *Our Precious Coasts: Marine Pollution, Climate Change and the Resilience of Coastal Ecosystems* Christian Nellemann and Emily Corcoran (Editors), United Nations Environment Programme, 2006, pages 12 and 14.

¹⁶ See, for example, *Coral Reef Resilience and Resistance to Bleaching* GD Grimsditch and RV Salm, IUCN Resilience Science Group Working Paper Series – No. 1, 2006, page 8.

¹⁷ See *Stronger Evidence but New Challenges: Climate Change Science, 2001-2005* op. cit., pages 15 – 16.

¹⁸ See *Coral Reef Resilience and Resistance to Bleaching* op. cit., page 8.

¹⁹ *Our Precious Coasts: Marine Pollution, Climate Change and the Resilience of Coastal Ecosystems* op. cit., pages 26 – 35.

²⁰ See *Don't let our corals lose their colour* Article by John Schubert, chairman, Great Barrier Reef Foundation, chairman, Commonwealth Bank, and a former chairman of Esso Australia, The Australian newspaper, 2 January 2007.

This, in turn, has food chain repercussions. The fish and other organisms dependent on the living coral also die (if they cannot move elsewhere). In turn, the fish and other animals higher up the food chain (including the top predators) also either die or move elsewhere.

In this situation, the whole reef eco-system may change. While the reef may not be completely destroyed, its nature will change:

- towards lower species diversity and numbers;
- towards less coral cover;
- towards more specialisation on more hardy coral species;
- and including higher algae concentrations.

9.5 PHYSICAL REEF EFFECTS: ECONOMIC FLOW-ON EFFECTS

The economic flow-on effects from climate change involve changes in economic activity within the GBRCA that are *directly* attributable to the effects of climate change, plus induced changes in economic activity that flow from these direct effects, and that are therefore *indirectly* attributable to climate change.

The drivers of these economic effects, summarising sections 9.2 and 9.3 above, are:

- Atmospheric and cryospheric warming, with the former possibly concentrated in tropical regions.
- Ocean warming, sea level increases and changes in ocean composition, possibly especially in tropical regions.
- More extreme weather events, including cyclones (which will be concentrated in tropical regions).
- Increased incidence of tropical diseases within the GBRCA, and migration of disease vectors away from the equator and towards the poles.
- Specific to the GBRMP, increased frequency of mass coral bleaching events, threatening reef diversity, coral cover and ultimately reef eco-systems.

For the purposes of this report, the economic activities of most interest are tourism, commercial fishing, and recreational activities. That said, other industries, such as primary industries, within the GBRCA can also be affected by, for example, extreme weather events (eg, cyclone Larry and banana production).

The effects listed above presumably will have their effects over different time frames:

- *Average* atmospheric warming and cryospheric changes, and sea level rises and changes in composition, will presumably occur relatively slowly (albeit possibly on an accelerating path).
- The same conclusion presumably applies to the movement of disease vectors.

- But *extreme* warming events could occur more rapidly as one-off occurrences, even though their average incidence might grow more slowly. These could begin doing considerable damage sooner. Recovery speed and resilience then become the immediate policy concerns.
- Therefore the incidence of mass coral bleaching – already a significant problem for the GBRMP – is likely to become an even more serious problem much more quickly than implied by *average* rates of global warming, especially given the small increases in maximum temperatures needed to induce it. For the Reef, recovery speed and resilience *are* the immediate policy concerns.

These considerations suggest that:

- Reef-related tourism activities may be amongst the first to be affected by climate change.
- Commercial fishing might be next.
- Recreational activities might also be affected: (i) quite quickly, especially if *perceptions* relating to adverse weather and disease vectors run ahead of reality; or (ii) more slowly if recovery from adverse weather is rapid, and marketing of the GBRCA is successful in encouraging return business.

Ideally, we would like to be able to quantify all of these effects, and their timing. If this were possible, we could estimate an economic ‘shock’, defined as climate change-induced reductions of \$X million for tourism, \$Y million for commercial fishing, and \$Z million for recreational activity.

This ‘shock’ could then be used to run a general equilibrium model of the GBRCA. The model solution, inclusive of the effects of this ‘shock’ could then be compared with the baseline model solution (ie, exclusive of the ‘shock’). The difference – which would include effects on gross area product, consumption, investment and employment for each of tourism, commercial fishing and recreational activity – would then be the net, Catchment Area-wide, effect of the specified climate change as embodied in the ‘shock’ used to run the model.

Assuming that this analysis is feasible, extending the analysis to show net effects for Queensland as a whole, and then for Australia as a whole, would be relatively straightforward.

But this is not straightforward, as sections 9.5.1 and 9.5.2 below explain.

Access Economics notes that estimates of the economic cost of damage to the Great Barrier Reef have already been made. One of these puts the cost of bleaching-related damage to the Great Barrier Reef for the tourism industry alone at between US\$95.5 million and US\$293.5 million (ie, between about A\$120 million and A\$375 million) by 2020.²¹ Given Access Economics’ estimates for the 2005-06 *direct* economic contribution of tourism to the GBRCA as a whole, which include value-added based measures of between \$2,500 million and \$3,000 million, these sorts of impacts may not be out of the question, even allowing for the qualification that the estimates in this report are for the GBRCA as a whole, while the WWF estimates are for the GBRMP.

²¹ See *A Reef Manager’s Guide to Coral Bleaching* op. cit., page 9, which refers to *Implications of Climate Change for Australia’s Great Barrier Reef* WWF, Sydney, 2004.

But estimating the *net* adverse effects of just one manifestation of climate change (mass coral bleaching) on just one type of activity (tourism) is not at all straightforward.

A key feature of economic behaviour – and of general equilibrium models – is the existence of substitution effects. These are major determinants of both demand and supply responses to various economic shocks. Allowance needs to be made for these substitution effects – quantitatively – if quantification of the net economic effects of climate change on the GBRCA is to be credible.

9.5.1 PHYSICAL REEF EFFECTS: DIRECT ECONOMIC FLOW-ON EFFECTS

In order to obtain quantitative estimates of the effects of climate change on tourism, commercial fishing, and recreational activity within the GBRCA we need to estimate a first-round ‘impact’ effect. For the purposes of this report, this first round effect is defined to include substitution effects. These are the focus of section 9.5.1. Induced effects flowing from these impact effects are the focus of section 9.5.2 below.

9.5.1.1 TOURISM

The climate change mechanisms directly affecting tourism are:

- Atmospheric and cryospheric warming, and changes in ocean composition (increased acidification, both of which may lead to mass coral bleaching).
- Increased extreme weather frequency
- Disease vector movements.

These effects influence (i) the attractiveness of the Great Barrier Reef as a destination *per se*; (ii) the attractiveness and risks of visiting the GBRCA more generally.

Scientific research can presumably be used to obtain current assessments and forecasts of the physical manifestations of climate change under the headings listed above. But translating these into impacts on tourism-related visitation to, and spending within, the GBRCA is much more difficult.

There are several reasons for this, including those relating to substitution effects. For example:

- There is no reliable data on the proximate effects of coral bleaching on tourism relating to Reef diving, snorkelling and charter boat visitation activities. These *are* likely to be adverse *assuming other things are equal*.
- However, if the GBRMP is relatively well managed in terms of guarding against human activities threatening sustainability – for example due to the 1 July 2004 rezoning of the GBRMP – then the Reef may well be more resilient, and recover more quickly from mass coral bleaching events, than similar coral reefs elsewhere around the world. To the extent that mass coral bleaching is a response to global warming, and to the extent that the GBRMP is both relatively well preserved and more resilient than other competing reefs, there may well be a global diversion of reef-specific tourism demand away from poorly-managed reefs and towards better-managed reefs such as the Great Barrier Reef. This substitution effect may well be large for Australia (which has a relatively small share of world tourism), and may well largely offset, and even outweigh,

adverse direct effects on Reef-specific tourism demand. But we have no data on this for Australia.

- There will also be a substitution effect away from Reef-specific tourism to other tourism markets appealing to 'the tropical experience'. To be sure, this market is one within which GBRCA will be competing against many more alternative destinations not offering the Reef experience. Nevertheless, it is another source of demand/supply substitution that can reduce the direct adverse effect on tourism of Reef degradation. We have no data on this for Australia.

As far as Access Economics is aware, there is no reliable data available for Australia about:

- The direct adverse (quantitative) effects of mass coral bleaching, increasing extreme weather events, or increased risk of disease, on tourism visitation and expenditure within the GBRCA (or indeed other regions within Australia).
- The likely (multiple) substitution effect possibilities, and especially a quantification of these effects.

There is some international evidence, of probably very mixed quality, suggesting that these substitution effects are real. For example:²²

- A study in the Philippines suggested tourist visitors had a low awareness of the effects of mass coral bleaching (implying a low direct impact on general tourism visitation there).
- Another study in Palau suggested some visitors actually liked the appearance of bleached coral (a temporary effect, presumably).
- Nevertheless, dive-oriented tourism can be adversely affected: the 1997-98 bleaching event appears to have adversely affected dive tourism in Tanzania, the Maldives, Sri Lanka and the Philippines.
- Some evidence from the Philippines supports the view that substitution effects (eg, away from reef-related tourism to the 'honeymooners' market) can at least partially offset adverse effects of reef degradation.
- Nevertheless, overseas analysis for Kenya, Tanzania and the Seychelles suggests that the largest adverse impacts from coral bleaching will fall on the tourism sector. Given the relative magnitudes of tourism, commercial fishing and recreational activities estimated by Access Economics in this report, this conclusion seems plausible.
- In general, overseas studies suggest adverse tourism effects from mass coral bleaching will be larger in regions with lower diversification of tourism attractions, and conversely. If true, this implies possibly smaller net adverse effects for the GBRCA.

But quantification of these effects for Australia requires reliable data that is currently not available.

²² See *A Reef Manager's Guide to Coral Bleaching* op. cit., pages 44 – 48.

9.5.1.2 COMMERCIAL FISHING

Possible links between climate change and commercial fishing within the GBRMP may include the effects of the former on the incidence of mass coral bleaching and the influence of bleaching on the food chain within the GBRMP.

Again, substitution effects may be important. To the extent that commercial fishing businesses can substitute away from commercial fish species more immediately affected by mass coral bleaching to other species that are less affected, the slower (and for a time at least) smaller the adverse effects of climate change on commercial fishing within the GBRMP.

There are studies assessing the effects of mass coral bleaching in Tanzania and the Seychelles,²³ but these are not as useful in assessing subsequent effects on fishing yields or net incomes because of the influence of substitution effects and other factors.

In the case of the GBRMP, there is the possibility of obtaining a 'cleaner' assessment of the effects of mass coral bleaching by concentrating the quantitative analysis within the 'no take' zones established as part of the 1 July 2004.

While this, in principle, is possible, Access Economics is not aware of any environmental accounting-based analysis of commercial fish stocks within the current GBRMP 'no take' zones. These are needed:

- To provide 'baseline' data against which to evaluate the effects of mass coral bleaching on commercial fish species, relatively free of the effects of commercial fishing and changes in access arrangements for such activity.
- To allow time series monitoring of how climate change affects the GBRMP food chain within 'no take' zones. This assessment of physical fish stocks is an essential starting point from which to derive estimates of fishing income flows and effects of mass coral bleaching as a separate cause of commercial fishing economic impacts.

9.5.1.3 RECREATIONAL ACTIVITY

The sorts of considerations relevant here are very similar to those raised in relation to tourism and commercial fishing (in the case of recreational fishing).

The data requirements are similar. The target individuals are local residents rather than tourists, and activities other than commercial fishing. Substitution effects, if anything, might be more significant. Direct adverse effects, if anything, might be smaller.

But again, Access Economics is unaware of reliable, national account-consistent, data that might be used to quantify these direct economic effects of climate change within the GBRCA.

9.5.2 PHYSICAL REEF EFFECTS: INDIRECT ECONOMIC FLOW-ON EFFECTS

Once the direct (net) impact effects of climate change on tourism, commercial fishing and recreational activity have been quantified, the indirect effects can be determined endogenously – that is, within the general equilibrium model framework. They will be incorporated in the difference between the 'baseline' and 'climate change' model solutions.

²³ See *A Reef Manager's Guide to Coral Bleaching* op. cit., pages 48, 133.

In general, these will tend to be larger as one moves from the GBRCA, to Queensland, and to Australia as a whole (because, by definition, these spill-over effects from climate change impacts within the GBRCA will have a relatively small effect on the GBRCA, a larger effect on the state of Queensland, and an even larger effect on Australia).

9.6 FUTURE RESEARCH OPTIONS: MORE DATA NEEDED

Quantifying the impact of climate change on the economic value of the GBRMP and, more broadly, the GBRCA, requires more **data** on (i) the science of climate change and its physical manifestations, and (ii) the direct economic impacts of such change on activity within the GBRCA and especially within the GBRMP.

Research relating to the former is already substantial, ongoing, and expanding. The challenge is to marshall the data in ways amenable to general equilibrium modelling.

Quantifying the direct economic impacts of climate change is the real challenge.

Data requirements for tourism

- Climate change is (probably) just beginning to have effects on the GBRMP and the wider GBRCA.
- Behavioural responses to these changes, and expectations that they will continue and even intensify, are, at best, only now beginning to emerge. They are also, at present at least, largely masked by broader economic drivers such as real income growth, the value of the Australian dollar, oil prices and associated effects on airfares, geopolitical uncertainty and conflict, and the like.
- Substitution effects are even harder to discern. In part, they depend literally on what climate change is doing to competing reef destinations world-wide. While this cannot be quantified at this stage, Australia's *relatively* cautious and pre-emptive approach to Reef preservation (including the 1 July 2004 rezoning) may be setting up the conditions for a substantial demand switch away from less cautiously-managed reef destinations towards Australia. If this effect *is* significant it may mask, for the GBRMP, underlying adverse effects of climate change on reef visitation demand around the world. As a relatively diversified region, GBRCA may also be relatively well insulated from adverse reef-related tourism effects because of substitution into other tourism activities within the Area.
- There is some overseas evidence that all of these sorts of effects may operate in the real world.
- But Access Economics is not aware of reliable evidence of them that could be used specifically for the GBRCA.

The challenge is to develop such evidence. In the first instance, because the focus is economic behaviour, and in particular tourism demand behaviour, the evidence probably requires properly-designed tourism surveys.

Tourism Research Australia (TRA) is one possible candidate for undertaking such research, provided it can be resourced to do so. GBRMPA is another. However, in both cases, there is a potential independence problem. Whatever their official charters specify, the independence of TRA from the marketing thrust that is the rationale for Tourism Australia as a whole is crucial.

As a basic governance issue, there is the potential for there to be a conflict of interest between the (pro-optimism) marketing functions of Tourism Australia and the (impartial, more objective) research imperatives of TRA.

Similar sorts of issues may apply if GBRMPA were to undertake the surveys.

This conflict of interest would not apply at all to specialised statistical organisations such as the Australian Bureau of Statistics. The ABS, properly resourced, would be Access Economics' preferred organisation for this type of survey work.

Data requirements for commercial fishing

Access Economics has prepared an extensive report for the (then) CRC Reef on the environmental accounting requirements for commercial fishing. Implementing the recommendations in that report would be the logical starting point, because it would provide a monitoring data base for evaluating changes in commercial fish stocks, and their value, over time.

However, in addition, there is a good case for conducting surveys of commercial fish stocks within GBRMP 'no take' zones, as discussed in section 9.5.1.2, in an attempt to isolate the effects of mass coral extinctions on commercial fish stocks.

Data requirements for recreational activity

GBRCA local resident surveys are required. See comments above in relation to tourism and commercial fishing surveys.

ATTACHMENT A: METHODOLOGY

The economic analysis in this report relies heavily on the Tourism Satellite Account (TSA) methodology, which is applied primarily to tourism. Data for commercial fishing and cultural & recreational activity are largely based on the conventional supply-side analysis typical of industry studies.

Tourism is not an identifiable supply industry in the national accounts. It is defined instead on the demand side as a combination of products that are purchased by tourists. The TSA methodology is a means for relating these demands, as measured by expenditure incurred by travellers, to proportions of outputs of conventionally defined supply industries, and in that way calculating economic contributions of tourism in terms of gross value added, gross product and employment.

OVERVIEW OF THE TSA METHODOLOGY

Access Economics has had a long involvement in various panels and forums promoting the development of a TSA since 1992. Based on our long experience with the concept of a TSA, we judge that the approach adopted by the ABS is the most consistent and elegant approach of those currently proposed by various international agencies (WTO, OECD, WTTC).

The ABS Tourism Satellite Account 2004-05 (ABS 2006) has calculated the direct effects of tourism in Australia using Tourism Research Australia (TRA) tourism survey data, but adjusted to be consistent with ABS national accounts and balance of payments data. Building upon the TSA analysis for 2001-02, the Bureau of Tourism Research calculated the indirect effects of tourism in Australia for 2001-02 (BTR 2004) but the TRA has not yet produced corresponding results for later years. TRA plans to release in February 2007 the indirect effects of tourism in Australia for 2004-05.

Direct contributions of tourism to value added, Gross Area Product (GAP), employment and exports for the GBRCA can be calculated using tourism shares of expenditure, and hence economic activity, in each industry in the GBRCA. In order to determine the indirect contributions, as well as the direct contributions for imports, it is necessary to create an input-output (IO) table for the GBRCA. Once created, the IO table can then be used to compute *both* the direct and indirect contributions. An important aspect of the IO table is that it takes account of inter-regional and interstate imports as well as international imports (to the extent allowed by the data).

The process can be repeated to calculate the contributions of tourism expenditures in the GBRCA to the Queensland and Australian economies by using IO tables for Queensland and Australia.

TOURISM DATA

The data and analysis in this report are for the years ending June 2005 and June 2006 – that is, the financial years 2004-05 and 2005-06.

The major sources of tourism data are the TSA national results for 2004-05 (ABS 5249.0, 2006), and the TRA CD-MOTA (Compact Disc – *Monitor of Tourist Activity*) and Regional Expenditure Model (REM) (TRA 2006a) state and regional results to June 2005 (Collins and Carter 2005) and June 2006 (TRA 2006b, TRA 2006c) that are based on the National Visitor

Survey (NVS) of domestic visitors (both overnight and day trips) and International Visitor Survey (IVS).

An objective is to determine results for visitors to the GBRCA for four visitor residence classifications – within GBRCA, the rest of Queensland, interstate, and international. This separation is important for calculating regional trade.

TRA tourism data are available for regions as small as Local Government Areas, but we have used only more broadly-defined tourism regions. The GBR Catchment Area (GBRCA) corresponds closely to the sum of six Queensland tourism regions, namely Tropical North Queensland, Northern, Whitsunday, Mackay, Fitzroy and Bundaberg²⁴.

In assembling the data, the approach used in this report is to use of the TSA data wherever possible for Australia-wide tourism contributions, and then make use of the TRA data to estimate GBRCA and Queensland shares thereof. Furthermore, within the TRA data, the emphasis is on REM data for total expenditures by region. We then use CD-MOTA results to estimate the splits of total REM expenditures into total expenditures for residents of the GBRCA, residents of the rest of Queensland and residents of other states. Finally, total expenditures are allocated across expenditure items in proportion to CD-MOTA data.

TSA DATA

The TSA presents tourism outputs, expenditures and employment nationally for 2004-05, classified to products according to ABS concepts of 'tourism characteristic' products and 'tourism connected' products, and similarly for industries. The TSA makes use of TRA data, but maps the data into supply-use classifications and scales the data to conform to national accounts totals and balance of payments aggregates. In particular, it adjusts the TRA survey data for airline fares and pre-paid packages that contain substantial proportions of airline fares paid by non-residents to foreign airlines, which are by definition not part of the Australian national accounts. The TSA allocates pre-paid package expenditure to accommodation, airfares and tours. Consistent with the treatment in the national accounts, the TSA contains an imputed value of rent for holiday houses, and includes expenditure on motor vehicles and other capital items.

The TSA provides consumption by expenditure item (expressed at purchasers' prices²⁵) for each of: day (domestic) visitors, overnight (domestic) visitors and international visitors. Aggregated across expenditure items, the TSA estimates that total tourism expenditure in Australia in 2004-05 was \$74,682 million, consisting of day visits \$12,004 million (16.1%), overnight visitors \$40,960 million (54.8%), outbound Australian residents \$3,461 million (4.6%) and international visitors \$18,257 million (24.4%).

It should be noted that tourism gross value added (GVA) and gross domestic product (GDP) in TSA 2004-05 (published in April 2006) are not consistent with updated national accounts for 2004-05 published in November 2005. While the national aggregates and industry division values in TSA 2004-05 reflect the (mostly) upward revisions in the national accounts,

²⁴ While five of the six tourism regions correspond closely to GBRCA boundaries, only part of the Bundaberg tourism region is within the GBRCA. However, around 80% of the Bundaberg tourism activity occurs in that part of the tourism region that is within the GBRCA. Given that the Bundaberg region accounts for a small proportion of total GBRCA tourism expenditure (1% for international, 6% for domestic overnight and 13% for day visitors), the calculations have been simplified by including all Bundaberg region tourism in total GBRCA tourism.

²⁵ The purchasers' price (also known as market price) is the amount paid by the purchaser in order to take delivery of goods or services. It includes any taxes payable (less subsidies receivable) on production and imports, and any transport charges paid separately by the purchaser to take delivery of goods.

the tourism results do not. It follows that tourism proportions of GVA and GDP are now lower than reported in earlier TSA publications. This inconsistency is expected to be corrected in TSA 2005-06, which is expected to be released later in 2007.

The TRA dollar values as *levels* differ from the TSA values, but we can use the TRA-REM data to calculate the GBRCA *share* of Australia for each expenditure item and for each type of visitor and apply these shares to TSA-based Australian magnitudes to obtain consistent GBRCA *levels* as presented in Table A.1. (While the TRA data may be deficient in some ways, it is assumed that they are deficient in a consistent manner so that any systematic errors in *ratios* derived from REM data are consistently in error by about the same factor from year to year.) We refer to these values as TSA-REM values. In the case of international visitors, results are presented separately for international airfares and the sum of all other items

TABLE A.1: EXPENDITURE BY TYPE OF VISITOR TO THE GBRCA, \$ MILLION, 2004-05 & 2005-06

<i>type of visitor</i>	<i>2004-05 Australia TSA</i>	<i>2004-05 GBRCA/Aus REM</i>	<i>2004-05 GBRCA "TSA"</i>	<i>ratio 2005-06 to 2004-05 TRA, Australia</i>	<i>2005-06 Australia TSA</i>	<i>2005-06 GBRCA/Aus REM</i>	<i>2005-06 GBRCA "TSA"</i>	<i>ratio 2005-06 to 2004-05 GBRCA "TSA"</i>
day	12,004	4.4%	529	1.086	13,034	5.4%	700	1.322
domestic overnight	40,960	8.1%	3,337	1.033	42,324	8.5%	3,603	1.080
international								
excl intl airfares	13,742	10.2%	1,403	1.068	14,682	10.1%	1,482	1.057
intl airfares	4,515	6.8%	309	1.143	5,160	6.4%	332	1.074
incl intl airfares	18,257	9.4%	1,711	1.087	19,842	9.1%	1,814	1.060
total incl intl airfares	71,221	7.8%	5,577	1.056	75,200	8.1%	6,116	1.097

Source: Access Economics, using TSA (2006), TRA REM and TRA CD-MOTA. Totals may differ from sums of components due to rounding.

The TSA data include Australian expenditures by outbound Australian residents before and after international trips (for example, on airline fares, luggage, vaccinations, film processing), but such data are not included in the TRA data. This is a domestic tourism contribution, because it involves travel-related domestic spending by Australian residents on goods and services sold within Australia (and within the GBRCA). In the absence of other information, it is assumed that expenditure on overseas trips is in proportion to population which for the GBRCA is about 4.2% of Australia (estimated using ABS 3218.0, February 2006).

TSA values for 2005-06 were not available when this report was written. Values for 2005-06 were generated by scaling the TSA values for 2004-05 up by the ratio of total TRA expenditure in 2005-06 to total TRA expenditure in 2004-05, where purchases of motor vehicles were omitted from the calculations – see below. The ratios were 1.086 for day visitors, 1.033 for domestic overnight visitors and 1.087 for international visitors (1.143 for international airfares and 1.068 for the sum of all other items). In the calculation of ratios for international visitors, expenditures on domestic goods and services were approximated by giving weight 0.5 to TRA prepaid airfares (because TSA values tend to be around half of TRA values) and a weight of 0.3 to total pre-paid package expenditure (as used by TRA in its REM calculations). Expenditures in 2005-06 for different types of visitors to the GBRCA were then calculated in the same way as for 2004-05 (see Table A.1 above).

TRA REGIONAL EXPENDITURE MODEL

The expenditures obtained from TRA's CD-MOTA are for entire trips and are thus unsuitable by themselves for allocating expenditures to regions, except for trips with a single destination. The TRA's Regional Expenditure Model (REM) allocates total trip expenditures

to regions visited in an iterative process that takes account of (single destination) information about daily and nightly expenditures in towns and cities visited and according to the purpose of the visit. Results for the most visited tourist destinations, together with corresponding values for numbers of visitors and visitor nights, were previously published in *Travel expenditure by domestic and international visitors in Australia's regions* (e.g., Collins & Carter, 2005) but are now incorporated into TRA quarterly publications for domestic and international visitors.

TRA has used REM to calculate total expenditure in each region for day, domestic overnight and international visitors separately. Table A.2 summarises these expenditures for GBRCA regions together with numbers of visitors, visitor nights, expenditure per night, and nights per visit. The expenditures include apportionment of package expenditures for both international and domestic visitors to airfares and other items. REM also provides separately the total expenditures by domestic visitors on airfares and other public long distance travel, including apportionment of the airfare component of package expenditure.

TABLE A.2: TOURISM DATA, BY GBRCA TOURISM REGION, 2004-05 AND 2005-06

	<i>Tropical Far North</i>	<i>Northern</i>	<i>Whitsundays</i>	<i>Mackay</i>	<i>Fitzroy</i>	<i>Bundaberg</i>	<i>Total</i>
domestic day visitors							
number of visits (000)							
2004-05	1645	905	226	667	1440	777	5660
2005-06	1512	1095	182	584	1153	648	5174
REM expenditure (\$m)							
2004-05	141	67	19	56	179	50	512
2005-06	178	121	32	79	182	85	677
expenditure per day (\$)							
2004-05	86	74	84	84	124	64	90
2005-06	118	111	176	135	158	131	131
domestic overnight visitors							
number of visits (000)							
2004-05	1375	970	436	613	1183	548	4499
2005-06	1471	857	537	630	1036	535	4518
visitor nights (000)							
2004-05	7300	3515	2018	2942	4298	2230	22303
2005-06	7304	3217	3623	2506	3532	1952	22134
REM excluding long distance travel (\$m)							
2004-05	1,182	378	392	236	384	188	2,760
2005-06	1,128	358	573	220	446	182	2,907
REM long distance travel (\$m)							
2004-05	195	99	48	48	51	7	448
2005-06	218	102	103	60	56	18	557
nights per visit							
2004-05	5.3	3.6	4.6	4.8	3.6	4.1	5.0
2005-06	5.0	3.8	6.7	4.0	3.4	3.6	4.9
expend per night, excl long distance travel (\$)							
2004-05	162	108	194	80	89	84	124
2005-06	154	111	158	88	126	93	131
expenditure per visit on long distance travel (\$)							
2004-05	142	102	110	78	43	13	100
2005-06	148	119	192	95	54	34	123
international visitors							
number of visits (000)							
2004-05	822	140	212	47	98	59	930
2005-06	868	140	218	46	94	51	986
visitor nights (000)							
2004-05	6,093	1,217	1,203	185	341	330	9,368
2005-06	6,511	1,077	1,216	201	735	381	10,122
REM incl package, excl intl airfares (\$m)							
2004-05	1,039	74	110	13	30	15	1,281
2005-06	1,111	64	121	14	32	11	1,353
nights per visit							
2004-05	7.4	8.7	5.7	4.0	3.5	5.6	10.1
2005-06	7.5	7.7	5.6	4.4	7.8	7.5	10.3
expenditure per night (\$)							
2004-05	170	61	92	68	88	46	137
2005-06	171	60	99	70	44	29	134

Source: Unpublished TRA REM data, supplied by Tourism Queensland.

Note: The shaded cells relate to total visits to the GBRCA that include some visits to multiple regions. Totals may differ from sums of components due to rounding.

The values in Table A.2 are based on samples and hence contain sampling errors, with the smaller samples having larger percentage errors. Nevertheless, the data are of sufficient accuracy to show some significant differences in measures between regions, as well as changes from 2004-05 to 2005-06. Tropical North Queensland dominates the results for visitors from outside Queensland. It accounts for 64% of visitor nights for international

visitors and 45% for interstate visitors in 2005-06. For international visitors, whose visits are predominantly to the Tropical North Queensland, there were increases in numbers of visits (6%), visitor nights (8%) and expenditure in nominal terms (6%). For domestic overnight visitors, there was no significant change in numbers of visits and visitor nights. Expenditure increased by 5% in nominal terms or 3% in real terms (using the percentage change in the private consumption deflator). Domestic overnight visits to the Whitsundays increased by 23% with the number of nights increasing by 80% and expenditure (excluding airfares) by 46%. While the number of day visits decreased by 9%, expenditure increased by 32%.

The REM totals are provided as sums across all visitors, but there is no separation of values according to numbers of stopovers or the region or state of residence. For the purposes of estimating regional trade, our analysis requires separation of expenditures for domestic visitors according to place of residence (GBRCA, rest of Queensland, and interstate).

Day visits consist predominantly of single stopovers. The TSA-REM totals are allocated to visitors from GBRCA, the rest of Queensland and interstate in proportion to CD-MOTA expenditures, where the expenditures for individual items have been multiplied by the ratios of TSA values for Australia to CD-MOTA values for Australia.

For domestic overnight visitors, REM provides expenditure for airfares and other long distance travel separately from other items. Airfares and long distance travel account for around 16% of total overnight expenditure. While expenditures on most items can be expected to be proportional to the number of nights, travel expenditures relate to the number of trips. We treat travel separately from other items in making use of the REM data.

The separation of TSA-REM totals for domestic overnight visitors into total expenditures by visitors from GBRCA, the rest of Queensland and interstate is necessarily based primarily on single stopover CD-MOTA data. Single stopover data are used to calculate costs per trip for airfares and other long distance transport (with only half of these costs allocated to the GBRCA for visits by non-GBRCA residents), and costs per night for all other expenditure items. These results are then scaled up to all visits by multiplying by the numbers of visits in the case of airfares and other long distance transport, and by number of nights for all other items. The airfares, etc. results for GBRCA, rest of Queensland and interstate are then prorated so that their sum equals the TSA-REM value for airfares, etc. The sums for the other items are pro-rated similarly to agree with the TSA-REM values for other items. Totals for these results are presented in Table A.3 below.

The scaling of single stopover results to represent all visits is obviously an approximation and a likely source of error. However, given the relatively large proportion of single stopover nights (see Table A.3), the error may not be large. Because the proportion of single stopover visits is lowest for interstate visitors and highest for GBRCA residents, and multiple stopover visitors are likely to have lower costs per night (especially for those camping or in caravans), it is recognised that applying single stopover results to all stopovers may overestimate expenditure shares for interstate visitors.

TABLE A.3: ESTIMATION OF TSA-REM TOTAL EXPENDITURES FOR DAY AND DOMESTIC OVERNIGHT VISITORS TO THE GBRCA, 2004-05 AND 2005-06

	2004-05 GBRCA	2004-05 rest of Qld	2004-05 interstate	2004-05 total	2005-06 GBRCA	2005-06 rest of Qld	2005-06 interstate	2005-06 total
Day visitors to GBRCA								
number of visitors (000)	5,215	445		5,660	4,495	679	194	5,368
CD-MOTA expenditure (\$m)	454	61	0	515	529	118	41	688
TSA-REM expenditure (\$m)	465	64	0	529	521	131	47	700
Domestic overnight visitors to GBRCA								
number of visitors (000)	2,197	1,349	954	4,500	2,073	1,235	1,209	4,517
number of nights (000)	6,137	6,875	9,291	22,303	6,112	6,720	9,301	22,133
share of 1 stopover nights (%)	81%	70%	53%	66%	86%	54%	59%	65%
CD-MOTA \$/visit airfares+, 1 stop	15	83	251		29	57	267	
CD-MOTA \$/night other, 1 stop	142	117	165		119	117	205	
TSA-REM airfares+ (\$m) total	45	151	323	520	80	96	439	615
TSA-REM other expend (\$m) total	765	706	1,346	2,817	634	689	1,665	2,988
TSA-REM total expend (\$m)	810	857	1,669	3,337	715	785	2,104	3,603

Source: Access Economics, based on TSA (2006), TRA REM and TRA CD-MOTA. Totals may differ from sums of components due to rounding.

There are changes in the composition of total expenditures between 2004-05 and 2005-06. The increase in total day expenditure corresponds to an increase in expenditure on 'shopping'. For domestic overnight visitors, there is a large increase in expenditure by interstate visitors which is related to an increased number of visits, although with little change in total nights, so that there is an increase in expenditure per night. There are also decreases in expenditures by residents of the GBRCA and the rest of Queensland corresponding to reductions in the numbers of visitors and visitor nights.

The analysis would be improved by the use of CD-MOTA expenditures that had been obtained by the REM procedure. TRA has a very long term aim of releasing such data.

CD-MOTA

Detailed tourism data for the GBRCA were assembled from TRA electronic CD-MOTA data separately for (domestic) day visitors, (domestic) overnight visitors and international visitors. We have used data for the June 2006 quarter, together with data from earlier quarters, to construct values for the years ending June 2005 and June 2006. From the wealth of sample information provided in CD-MOTA, we make use of numbers of visitors, number of nights, expenditure across about 20 items, destinations visited, state/region of residence, and itemised expenditure before and after the trip. We also distinguish between visitors to a single destination and those who visit multiple destinations.

As already noted, Tropical North Queensland accounts for the largest proportions of visitor data for international visitors and interstate visitors (see Table A.2 above). Tourism patterns for GBRCA residents are different. For them, 46% of visitor nights and 82% of day visits are within the tourism region of residence. Visits within regions account for 93% of total day visits in Tropical North Queensland.

Our analysis of the TRA data excludes expenditures on capital items and the purchase of motor vehicles, as used by the TRA in many of its presentations of data. The CD-MOTA data show that these expenditures fluctuate greatly from year to year. We have doubts about the allocation of these costs between tourism and other purposes, and there is no allowance for sales of items after the trip.

Our objective is to determine all travel-related expenditure that can be attributed to the GBRCA. In the case of visits to the GBRCA by residents from outside the GBRCA we include all expenditure during the trip plus selected payments made before and after the trip, but clearly attributable to the GBRCA, such as accommodation, entertainment and conference fees.

Our methodology for calculating value added, GAP/GSP/GDP, employment and regional trade requires expenditures by expenditure item. A major difficulty with CD-MOTA data is that expenditures are provided for complete trips only, without any separation into values for the various stopovers. This makes it impossible to determine expenditures in individual regions, except where there are single stopovers.

Aggregate day and domestic overnight expenditures by visitors to the GBRCA from the GBRCA, the rest of Queensland and interstate have already been presented in Table A.3 above. Our methodology for determining expenditure by item is to first determine expenditures by item for single stopovers and multiple stopovers for visitors from the CGRCA, rest of Queensland and interstate, knowing that the multiple stopover results are unreliable because of multiple counting. Values for airfares plus other long distance transport are copied from Table A.3. For all other items, expenditure equals the CD-MOTA single stopover result plus a fixed proportion of the CD-MOTA multiple stopover result. The fixed proportions are derived by assuming that total multiple stopover expenditure, equal to REM expenditure less single stopover expenditure, is spread across visitors from GBRCA, rest of Queensland and interstate in proportion to visitor nights.

Results for each item are converted from CD-MOTA values to TSA values by multiplication by the ratio of the total TSA value for Australia to the total CD-MOTA value for Australia. Finally, all values (except for airfares etc.) for visitors from each of GBRCA, rest of Queensland and interstate are scaled by a common factor so as to equal the values in Table A.3. The methodology provides approximate results only because of the use of multiple stopover data.

International visitors tend to have far more stopovers than Australians on domestic overnight trips. Indeed, only 12% of international visitor nights within the GBRCA are accounted for by single stopovers. Nevertheless, in the absence of any other information, the same scaling process is used for multiple stopovers as is used for domestic visitors. This means that the proportions of expenditure across products for the GBRCA are almost the same as for total expenditure in Australia by those who visit the GBRCA.

Tourism expenditure within the GBRCA also includes pre-departure and post-return expenditure by GBRCA residents within the GBRCA related to overseas trips and domestic overnight trips that is attributable to the region (luggage, film processing), but excludes payments for accommodation, etc. that are not attributable to the GBRCA. Domestic airfares are shared using the same principles as for visitors to the GBRCA.

We extract CD-MOTA expenditure vectors for type of visitor (day, overnight, international) and for four origin categories (within GBRCA, rest of Queensland, interstate, international). Each of the overnight and international entries is the sum of expenditures for single destination visits and multiple destination visits.

Pre-paid package expenditures are allocated to airfares, accommodation, meals and organised tours in the same proportions as used by TRA in its REM calculations.

Purpose of visit

It is to be expected that tourism visits to the GBRMP, as opposed to the GBRCA, are almost exclusively for the purposes of holiday and leisure, although there will be some for scientific research, monitoring of conditions and to investigate business possibilities. Within the GBRCA, visits for the purposes of holiday and leisure account for 63% of international visitor nights, compared with 38% for all international visits to Australia. The proportions are even higher for Tropical North Queensland (70%) and the Whitsundays (77%). For day visitors, the GBRCA proportion of holiday/leisure visits, which includes shopping, is 57% which is similar to 53% for Australia as a whole. For domestic overnight visitors, the GBRCA share of visitor nights is 48% compared with Australia 47%, although the proportions for Tropical North Queensland and the Whitsundays are around 60% (averaged over two years).

Domestic long distance travel costs

The allocation of domestic airfares and other 'public' long distance costs (i.e., trains and buses, but not cars) between the GBRCA and other regions is more complicated. The general principle is that domestic airfares are shared equally between the GBRCA and the region of residence for single destination trips, but a smaller proportion is allocated to the GBRCA for multiple destination trips. However, some of these travel costs are put back into the calculations when estimating the contributions of GBRCA tourism to Queensland and Australia.

For single destination trips by Australians, contributions for Australia include all airfares associated with visits from interstate, the rest of Queensland and the GBRCA. Contributions for Queensland include all airfares associated with visits from the GBRCA and the rest of Queensland, and 50% of those associated with visits from interstate. Contributions for the GBRCA include all airfares associated with visits within the GBRCA and 50% of airfares associated with visits from interstate and the rest of Queensland. The equal allocation of airfares to origin and destination regions follows TRA REM procedures.

For multiple destination visits by Australians, when calculating the Queensland and Australian contributions it is a matter of deciding which proportion of the airfares outside the GBRCA should be attributed to the GBRCA visit. For example, what proportion of travel costs for a trip Sydney-Brisbane-Townsville-Sydney, with several nights in both Brisbane and Townsville, should be allocated to the GBRCA? Inspection of the stopover data indicates that many of the additional stopovers associated with visits to the GBRCA are within the GBRCA, and that the visit to the GBRCA is often the main event. However, these considerations were bypassed by using an alternative approach. Total expenditure on airfares and other long distance transport by multiple stopover visitors is equal to REM expenditure on airfares etc., less the expenditure on airfares etc. by single stopover visitors. This was then allocated across visitors from the GBRCA, the rest of Queensland and interstate in proportion to CD-MOTA total expenditures by these visitors on airfares etc.

For international visitors, domestic travel costs are again treated differently for single stopover and multiple stopovers. The contributions to the GBRCA and Queensland depend on where the other destinations are, which is not known. Based on analysis of international ports of arrival and departure for visitors to the GBRCA, and estimated proportions of multiple stopovers that might be attributed to the GBRCA and Queensland, it is estimated that around 8% of total domestic travel costs can be allocated the GBRCA and around 18% to Queensland.

International airfares

Most international visits consist of visits to multiple destinations which should all be given weightings in the attribution of airfare expenditure, unless it can be demonstrated that one stopover was of much greater importance than all the others. Of course, in the case of single stopover visits, all expenditure is allocated to the GBRCA, except for some leakage to transits through other airports. In all other cases, only a proportion of international airfares should be attributed to GBRCA visits, even if arrival or departure is through a GBRCA airport.

In the absence of information about the priorities for visits to the GBRCA and other parts of Australia, we have made the simplifying assumption that one third of international airfares for multiple stopover visitors who include the GBRCA in their itinerary can be allocated to visits to the GBRCA. Proportions of the total value allocated to visits to the GBRCA that contribute to Queensland and the GBRCA are calculated on the basis of the ports of arrival and departure.

CD-MOTA data show that in 2005-06 single stopovers accounted for 8% of international airfares for those who visited the GBRCA. Based on numbers of visits, international arrivals and departures through GBRCA airports accounted for 21% of international movements for multiple stopover visitors, while the corresponding figure for Queensland airports (including GBRCA airports) was 40%. Assuming equal airfares per visit, this corresponds to multiplication of the Australian multiple stopover expenditure by 0.27 for the GBRCA and 0.44 for Queensland. Combining single stopover and multiple stopover results, 39% of total international airfares for visitors to the GBRCA are attributable to Australia, 20% to Queensland and 15% to the GBRCA.

In calculating expenditures in Australia by GBRCA residents before and after trips outside the GBRCA, it has been assumed that all GBRCA residents travelled overseas from and to Cairns.

Other data issues with state and regional results

There are some difficulties in moving from national results to regional and State results – for example, the head office and maintenance base of Qantas is in Sydney, while Virgin Blue is headquartered in Brisbane. Hence NSW and Queensland would be expected to have more-than-proportional employment in the aviation industry relative to WA, SA or Tasmania.

In most cases tourism-related jobs tend to be where the tourists are, particularly for very localised activities like hotels, restaurants and taxis. For these jobs the economic contribution and jobs effects closely follow the data on expenditure. However, some of the larger tourism enterprises like Qantas will tend to have employment and economic impacts that diverge more from the point where the expenditure is made.

TOURISM EXPENDITURE BY INDUSTRY

While the CD-MOTA data contain great detail, the expenditure data are not fully consistent with national accounts. The ABS publishes national expenditure on tourism in the TSA. The latest data are for 2004-05 (ABS 2006). We have scaled these to 2005-06 as described above in the section on 'TSA data'. We apply the 2004-05 and 2005-06 ratios of TSA expenditures to CD-MOTA expenditures, for individual expenditure items, to the CD-MOTA results for the years ending June 2005 and June 2006. Because TSA, NVS and IVS use different expenditure classifications, this requires establishing mappings between some CD-MOTA and TSA expenditure items, such as from packages to accommodation, meals, tours

and airfares. In the absence of other information, we assume that the same ratios apply throughout Australia.

The CD-MOTA vectors of expenditure are then scaled to be consistent with the TSA data. This is done separately for day, domestic overnight and international visitors. This process generates tourism expenditures expressed in TSA expenditure categories at purchasers' prices. Corresponding day and domestic overnight expenditures are added together, such as for tourism expenditures by GBRCA residents within the GBRCA.

The data are then mapped into the 32 industries used in the IO tables (see below).

In order to analyse the economic effects on industries within GBRCA, Queensland and Australia, it is necessary to split values of tourism consumption at purchasers' prices into domestic supplies at basic prices²⁶, imports at basic prices, commodity taxes and margins for components of wholesale & retail trade and transport. The TSA for 2002-03 (ABS 2004) contains the 2000-01 splits, by product type, of tourism supplies valued at purchasers' prices into domestic supplies at basic prices, imports at basic prices, taxes on tourist products and total margins on tourist products (Table 8). There is no corresponding table for TSA 2004-05. We use the data for 2000-01 together with additional information from national input output tables to split the margins into their components. The margins are added back into the appropriate domestic trade and transport industries.

COMMERCIAL FISHING

Commercial fishing consists mainly of 'wild-harvest' fishery production, although there is also some aquaculture, which is addressed at the end of this section. Most of the expenditures on GBRMP commercial fishing occur within the GBRCA, with little additional expenditure in the rest of Queensland. Commercial fishing licence fees are paid directly to State Government authorities rather than to local authorities, and hence contribute to Queensland and Australian value added but not to GBRCA value added. (We have not allowed for this.)

The Queensland Department of Primary Industries & Fisheries (QDPI&F) assessed prospects for the Queensland fishing industry in September 2006.

Forecasts for 2006-07 suggest that the decline in the value of wild-harvest fisheries will continue to around \$180 million. This is due to the declining terms of trade for fishing businesses, difficulties in obtaining and retaining skilled labour and changes in management arrangements impacting on access arrangements in a range of fisheries.

The Queensland managed commercial fishing industry remains in a transition phase because of major changes to management practice, implemented to ensure the sustainability of the fishery and to meet other ecological goals related to the fishery environment. (QDPI&F, September 2006, p. 45)

QDPI&F explains that the reasons for the decline include lower priced seafood imports, the strong Australian dollar, higher fuel prices, the effects of drought and cyclones, a lack of available and willing labour, the introduction of tighter restrictions on catches, numbers of boats and fishing effort, and restrictions on fishing areas introduced by rezoning of the GBRMP on 1 July 2004. These have resulted in reduced fishing effort in most sectors of the commercial fishing industry.

²⁶ The basic price is the amount receivable by the producer for the sale of a unit of a good or service. It excludes any taxes or subsidies associated with the sale, any transport charges invoiced separately by the producer, and any (wholesale and retail) trade margins on the resale of goods.

QDPI&F has provided estimates of value of product, tonnes caught, number of boats and fishing effort (measured in boat days) for commercial fishing within the GBRMP for 2004-05 and 2005-06. All of these measures of the industry declined in 2004-05 relative to the average of the three preceding years, and declined further in 2005-06. In broad terms, declines relative to 2001-02 to 2003-04 were larger for line fishing (-32% in 2004-05 and -48% in 2005-06) than for trawl fishing (-11% in 2004-05 and -23% in 2005-06) so that trawl fishing has now increased its share of gross value of product from 45% to 54%. Trawl fishing is dominated by prawns, and other fishing is dominated by reef line fishing, especially for coral trout. While many of the reasons for the decline apply to both sectors, the trawl industry has declined less in 2004-05 and 2005-06 because its reforms occurred between 1999 and 2001 whereas the reef line fishing reforms commenced on 1 July 2004. Across the industry, catches have fallen short of the tonnage quotas, after adjustment for Department of the Environment and Heritage (DEH) buy-backs of commercial fishing licences under the GBRMP Structural Adjustment Package (QDPI&F, *Annual status reports*, 2006), and because of reduced effort brought about by reduced opportunities to make profits.

The gross value of production for aquaculture within the GBRMP averaged around \$50 million from 2000-01 to 2002-03 (see production by Queensland Statistical Division in *Report to farmers – aquaculture production survey – Queensland 2002-03*) while the total for Queensland averaged around \$65 million from 2002-03 to 2004-05 (*Australian Fisheries Statistics 2005*, p. 30). *Prospects for Queensland's Primary Industries 2006-07*, p. 48) implies that Queensland production was \$70 million in 2005-06. We have assumed that GBRMP aquaculture production was \$50 million in 2004-05 and 2005-06.

RECREATIONAL USE

The distinction between tourism and recreational activity depends on the distance travelled. Tourism relates to one-way overnight travel of more than 40 kilometres from home or one-way day travel of more than 25 kilometres from home, excluding for the purposes of work or school. Many recreational activities by local residents are thus classified as recreational use.

The contribution of recreational activity to the GBRCA is calculated as the sum of (a) contributions from the Cultural & recreational services industry (sport, gambling, movies, theatre, art galleries) and (b) contributions associated with recreational fishing by local residents. Cultural & recreational services include tours to look at the reef and watch whales but do not include recreational fishing. On the other hand, many activities included in cultural and recreational activities are not related to the GBRMP.

Total expenditure on Cultural & recreational services in the GBRCA was \$555 million in 1996-97 which scales to \$1,095 in 2004-05 and \$1,162 million in 2005-06, on the basis of Queensland value added for cultural and recreational services (ABS 5220.0, 2006). There is some overlap between Cultural & recreational services and tourism, and we report results for recreational activity net of contributions already estimated for tourism.

The economic contribution of recreational fishing is not measured by the equivalent value of production of the fish caught and kept. Rather, it is driven by the expenditure by fishers. To this might be added some measure of enjoyment and relaxation, but such an approach is outside current economic frameworks. Recreational fishing is not an activity that is allocated to an input output industry. It is like tourism in that it is the sum of contributions for boats (and associated costs such as petrol and insurance), boat hire, tackle, private car travel, food, drink and accommodation.

Total expenditure on recreational fishing in Queensland in 2000-01 was \$320 million (Henry and Lyle, 2003), and it is estimated that around \$100 million of this could be attributed to the

GBRMP (Lew Williams, QDPI&F Fisheries, private communication). Henry and Lyle also provide shares of total costs that are attributable individually to boats, etc. Results of Queensland recreational fishing surveys in 2001-02 and 2004-05 have not yet been released, although results from a November 2004 telephone survey have (QDPI&F 2006). It shows declines throughout Queensland and also in the GBRCA in the numbers of fishers and fishing effort compared with telephone surveys in 1996, 1998 and 2001. It estimated that 148,170 Queensland households owned at least one boat used for recreational fishing. If most boats are powered and around one third are used in the GBRMP, then an average annual boat registration fee of about \$100 corresponds to a total of around \$5 million a year. On top of this there is a small driver licence fee for life, and annual registration fees for boat trailers.

QDPI&F staff have the impression that recreational fishing in the GBRMP is continuing to decline. It appears to have been affected relatively little by reduced bag limits introduced on 1 July 2004 because most recreational fishers were not previously reaching the limits. The rezoning introduced on 1 July 2004 was designed to minimise effects on previous users, but it has prohibited fishing in some areas previously accessed by recreational fishers. This has increased travel times and fuel costs for some fishers, including the use of charter boats, and has discouraged others from fishing.

In the absence of further information we have assumed that annual expenditure on recreational fishing in 2004-05 and 2005-06 was \$100 million. We assume that 75% of this relates to local residents and is thus to be added to cultural & recreational services. It is assumed that the remaining 25% is already included in tourism expenditure.

SUMMARY OF EXPENDITURES

Table A.4 summarises total expenditures in 2004-05 and 2005-06, measured at purchasers' prices, that are associated with tourism, commercial fishing and recreational activities in the GBRCA. The expenditures have been scaled to be consistent with TSA data, and are presented for the GBRCA, Queensland and Australia. Results for tourism are split into separate contributions for international visitors, domestic visitors from the GBRCA, the rest of Queensland, and interstate, and expenditure by GBRCA residents within the GBRCA before and after trips.

TABLE A.4: TSA-CONSISTENT TOTAL EXPENDITURES (PURCHASERS' PRICES) FOR GBRCA, QUEENSLAND AND AUSTRALIA THAT ARE ASSOCIATED WITH TOURISM, COMMERCIAL FISHING AND RECREATIONAL USE IN THE GBRCA, \$ MILLION, 2004-05 & 2005-06

	<i>2004-05</i>	<i>2004-05</i>	<i>2004-05</i>	<i>2005-06</i>	<i>2005-06</i>	<i>2005-06</i>
	<i>GBRCA</i>	<i>Queensland</i>	<i>Australia</i>	<i>GBRCA</i>	<i>Queensland</i>	<i>Australia</i>
Visitors from GBRCA	1,275	1,275	1,275	1,236	1,236	1,236
Visitors from rest of Qld	921	1,073	1,073	916	1,011	1,011
Interstate visitors	1,669	1,669	1,993	2,151	2,151	2,590
GBRCA before/after	303	303	303	331	331	331
International visitors	1,711	1,935	2,420	1,814	1,941	2,584
Total tourism	5,880	6,255	7,064	6,447	6,671	7,752
Commercial fishing	246	246	246	214	214	214
Recreation and culture	1,170	1,170	1,170	1,237	1,237	1,237

Source: Access Economics. Totals may differ from sums of components due to rounding.

Table A.5 shows estimated expenditures in 2005-06 for the GBRCA, measured at basic prices and classified by input output industry, for the same activities. The expenditures have been scaled to be consistent with TSA data.

TABLE A.5: GBRCA EXPENDITURES BY INDUSTRY (BASIC PRICES) THAT ARE ASSOCIATED WITH TOURISM, COMMERCIAL FISHING AND RECREATIONAL USE IN THE GBRCA, \$ MILLION, 2005-06

<i>Industry</i>	<i>Visitors from GBRCA</i>	<i>Visitors from rest of Qld</i>	<i>Interstate visitors</i>	<i>GBRCA residents to non-GBRCA</i>	<i>International visitors</i>	<i>Total visitors</i>	<i>Commercial fishing</i>	<i>Recreational use</i>
Sheep, grain	0	0	0	0	0	0	0	0
Beef cattle	0	0	0	0	0	0	0	0
Dairy cattle and pigs	0	0	0	0	0	0	0	0
Other agriculture, sugar cane growing	10	6	10	1	13	40	0	0
Forestry and fishing	4	3	4	0	5	17	0	0
Coal, oil and gas	0	0	0	0	0	0	0	0
Non-ferrous metal ores	0	0	0	0	0	0	0	0
Other mining	0	0	0	0	0	0	0	0
Food manufacturing	88	61	100	13	104	367	34	4
Textiles, clothing and footwear	10	4	7	0	8	30	1	0
Wood and paper manufacturing	14	6	9	0	12	41	4	0
Chemicals, petroleum and coal products	68	34	44	12	23	182	26	17
Non-metallic mineral products	1	0	1	0	1	3	1	0
Metals, metal products	2	1	1	0	2	6	12	0
Machinery, appliances and equipment	53	22	37	1	38	151	41	28
Miscellaneous manufacturing	2	1	1	0	2	6	2	11
Electricity supply, gas and water	0	0	0	0	0	0	2	0
Residential building construction	0	0	0	0	0	0	0	0
Other construction	0	0	0	0	0	0	0	0
Wholesale and retail trade	309	165	280	29	235	1,019	64	0
Accommodation, cafes and restaurants	229	209	555	31	437	1,461	2	2
Road transport	42	24	43	15	46	169	3	0
Rail and pipeline transport	16	20	20	24	10	90	0	0
Other transport	75	100	408	142	343	1,068	4	5
Communication services	8	5	9	5	24	52	2	0
Finance, property and business services	10	20	75	3	40	148	13	2
Ownership of dwellings	31	33	92	0	4	161	0	0
Government administration and defence	0	0	0	0	0	0	3	3
Education	1	1	1	0	69	72	0	0
Health and community services	18	12	19	11	53	112	0	0
Cultural and recreational services	33	63	136	15	58	306	0	1,164
Personal and other services	7	4	7	4	20	43	1	0
Total GBRCA	1,032	795	1,859	308	1,549	5,543	214	1,237

Source: Access Economics. Totals may differ from sums of components due to rounding.

INPUT OUTPUT TABLES

The economic analysis is driven by access to input output (IO) tables that describe the economies of the GBRCA, Queensland and Australia. IO tables for 1996-97 are available electronically for Queensland and for all regions of Queensland, where the regions correspond to the Statistical Divisions in Queensland for 1996-97 (Queensland Office of the Government Statistician, 2002 & 2004). ABS has published national IO tables with 106 industries for 1996-97 (ABS 5209.0, 2001). (ABS has also published national IO tables for 2001-02 (ABS 5209.0, 2006), but we use the 1996-97 tables to maintain consistency with the Queensland tables.) GBRCA corresponds fairly closely to the sum of four Statistical Divisions that border the north east coast of Queensland, namely Fitzroy, Mackay, Northern, and Far North, together with about 29% (based on population) of the Wide Bay-Burnett Statistical Division. The GBRCA IO table has been formed as the sum of the IO tables for the four regions plus 29% of the fifth region.

The Queensland regional IO tables are for 34 industries. We aggregate these to 32 industries by combining sheep (which has negligible production within the GBRCA) with grain, and sugar cane with other agriculture because sugar cane is not a separate industry in the national IO table. The Queensland and Australian IO tables are aggregated to the same 32 industries.

We use industry-by-industry IO tables with direct allocation of imports. The use of an industry-by-industry table means that there is a 1-to-1 correspondence between industry production or supply, as described by a column of the table, and industry sales or demand, as described by a row of the table.) This generates a table that is square, which is essential for the matrix inversion used in the calculation of indirect contributions. The need to use an IO table with direct allocation of imports is explained in the following paragraph.

Only GBRCA-produced supplies of goods and services should be included in the GBRCA calculation, only Queensland produced supplies should be used in the Queensland calculation, and only Australian-produced supplies should be included in the national calculation. Consider the sale of an imported toy koala made in China. The production of this toy koala does not contribute to Australia's GDP, although the margins associated with its distribution and sale within Australia do contribute to Australia's GDP. For this reason it is appropriate to use an input-output table with 'direct allocation of imports', i.e., in which imports are directly allocated to the sectors in which they are used, *but as a separate line item*. In this treatment, each cell in the intermediate use matrix of the input-output table contains only the domestically-produced inputs into an industry column, while total imported inputs into that industry are contained in a single cell at the bottom of each 'use' column of the table, just above the line for GBRCA, Queensland or Australian production. In the more usual 'indirect allocation of imports' input-output table, each input cell is the sum of the corresponding domestic and imported inputs. Value added, taxes and Australian production have the same values in both tables, but the industry inputs are presented differently. This results in different I-O coefficient matrices (A) and thus different inverse matrices $(I-A)^{-1}$ that are used to form the derived coefficients for calculating the indirect effects.

Tourism expenditure is dominated by transport (especially air and road), accommodation, food and drink, entertainment (cultural and recreational services), petrol and shopping, and we use separate industries for each of these as far as possible. The IO data for the industry 'Accommodation, restaurants and cafes' provides no information for separating it into components of accommodation, pubs & bars, cafes & restaurants, and clubs that would be more convenient for tourism studies.

USING A 1996-97 INPUT OUTPUT TABLE FOR A 2005-06 APPLICATION

The relationships between different industries change relatively slowly so that the 1996-97 IO table is a reasonable approximation to the structure of the economy today. There are of course changes in the relative importance of industries and the distribution of consumption across products, as described in the State Accounts (ABS 5220.0, 2006).

While national IO tables for 2001-02 are available, Queensland state and regional IO tables are available only for 1996-97. The cost structures of IO tables do not change greatly over five or ten years, so that the coefficients derived from 1996-97 IO tables, such as value added per \$1 million of output, for each industry, are assumed to be approximately constant over such time scales. For the employment coefficients (persons per \$1 million of output) it is necessary to adjust for changes in prices and productivity between 1996-97, 2004-05 and 2005-06 (see below).

CALCULATION OF DIRECT CONTRIBUTIONS OF TOURISM

Each industry column of the input output table provides the direct value added and direct employment per unit production for that industry. Application of the tourism vector of domestic production to these coefficients thus gives tourism direct value added and tourism direct employment. This process is applied to the GBRCA, Queensland and Australian input output tables. The vectors of production used in the three cases are much the same except that expenditure on airfares is larger for Queensland than for the GBRCA, and larger again for Australia.

The value added coefficients, which are ratios of value added to value of production, are calculated for 1996-97, and we assume that they are the same in 2004-05 and 2005-06. However, the employment results need to be adjusted to allow for the changes over time in the number of persons per dollar of output (i.e., gross value of production). For each industry, the employment coefficient for 2005-06 is calculated according to

$$\text{employment coefficient '05-06} = \text{employment coefficient '96-97} \times \\ (\text{FTE '05-06/FTE '96-97}) / (\text{output '05-06/output '96-97})$$

where it is assumed that output is proportional to value added. The increases in FTE were derived from the average annual increases in employment by industry in Australia, Queensland and Queensland regions over the period August 1998 to May 2006 (ABS 6291.0, 2006). The increases in value added were derived from average annual increases in factor income by industry for Australian and Queensland over the period 1996-97 to 2005-06 (Access Economics, October 2006).

The use of 1996-97 IO tables does not take account of changes in the patterns of consumption of products or output by industries from 1996-97 to 2005-06, as measured by State Accounts (ABS 5220.0, 2006). This would require creation of a more up to date IO table. However, this omission has only a second order effect on the tourism results. The activities of tourism industries are represented adequately by the 2005-06 tourism demands generated from TSA and TRA data. It is changes over time in the ratios of value added and employment to output, and the interactions between sectors, that are the largest sources of uncertainty.

Direct tourism value added for each industry is calculated as the sum of the direct tourism contributions associated with wages, gross operating surplus (GOS) and net taxes on production. Direct tourism GDP/GSP/GAP is then calculated as tourism value added plus taxes on products sold directly to tourists, but not including the net product taxes on inputs into production. Taxes for Australia, by product, are allocated across regions and types of visitor in proportion to expenditures.

CALCULATION OF INDIRECT CONTRIBUTIONS OF TOURISM

Each of the Australian inputs of goods and services into tourism activities generates additional value added and employment.

It can be shown (ABS 5246.0, 1996) that the total value added, including both first round and flow-on effects, that is generated by a column vector of demands d is $v.(I-A)^{-1}.d$, where v is a row vector of value added shares in production.

The corresponding employment result is $e.(I-A)^{-1}.d$ where e is a row vector of employment per unit production. A is a square matrix where the values in each column are the shares of

intermediate inputs in total production for that industry. In this case, d is the vector of domestically-supplied intermediate inputs used in tourism production. The formulae describe the total effects of the demands including both the first round (or direct) contributions from the supplying industries and the flow-on (or indirect) contributions from industries further along the supply chain.

The industry composition of the value added indirect contributions is given by the sum over columns j of $v_i.(I-A)^{-1}_{ij}.d_j$ where i denotes the row industry and j the column industry. The corresponding result for employment is obtained by using e in place of v .

The value added shares (v) and employment shares (e) are the same as for the direct contributions calculations.

We calculate indirect GDP, GSP and GAP as indirect value added plus both the direct and indirect net product taxes (commodity taxes less subsidies) on production. The direct net product taxes have been included because they were not included in direct tourism GDP, GSP and GAP. The ABS includes total indirect taxes on production when calculating GDP, but omits them when calculating contributions from individual industries. We believe that direct net product taxes should be included in direct tourism GDP, GSP and GAP. However, we have followed the TSA in omitting them from the direct results; hence we include them in the indirect results.

SCALING RESULTS TO BE CONSISTENT WITH TSA AND NATIONAL ACCOUNTS

Although the tourism expenditures have been scaled so that totals for Australia are consistent with TSA totals, tourism value added, GDP and employment differ from TSA values. The differences are attributed to our use of 1996-97 input-output tables for ratios such as value added to production, whereas TSA has access to more up to date supply-use tables. We have, accordingly, multiplied all our value added results for Australia in 2004-05 by a factor of 0.879 to bring the total into line with the TSA value. The calculations also ensure agreement with the TSA GDP. A scaling factor of 0.92 has been used for employment, based on extrapolation of earlier 'persons' results for 2002-03.

The same scaling factors are applied to our tourism calculations for Queensland and the GBRCA. In the absence of additional information for 2005-06, the same scaling factors are used for 2005-06.

The adjustments for tourism prompted consideration of similar treatments for commercial fishing and recreational activities. Inspection of the ratio of value added to production in the input-output tables for 1996-97 and 2001-02 revealed larger differences for these industries than for nearly all others. The matter was discussed with the input-output section of ABS, which is responsible for generating the national IO tables. This revealed that the IO tables for 2001-02 were constructed using supply-use data for 2004-05 which in turn was assembled using a new register of firms. Re-construction of supply-use data for 1996-97, revised according to the new register, generates ratios of value added to production for commercial fishing and recreational activities that are close to the 2001-02 values. On advice from the ABS IO section, the 1996-97 ratio of value added to production has been multiplied by 1.492 for 'forestry and commercial fishing' and 0.670 for recreation activities. Forestry and commercial fishing exhibit similar problems so that the correction for 'forestry and fishing' can be applied to commercial fishing alone.

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