

# Staff Papers

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## **Monitoring activities in the Great Barrier Reef World Heritage Area, challenges and opportunities.**

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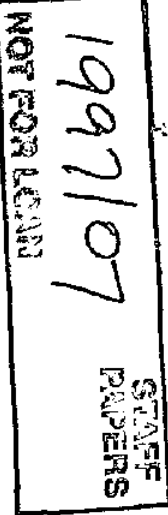


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## Monitoring activities in the Great Barrier Reef World Heritage Area, challenges and opportunities

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### Introduction

To implement the 25 Year Great Barrier Reef World Heritage Area (GBRWHA) Strategic Plan vision of management for ecologically sustainable use, stakeholder agencies need to take a holistic perspective of the Area to include both its physical and human components and their interactions. Managing for ecologically sustainable use is more than managing to minimise ecological impacts of direct uses. It is to minimise social, cultural and economic impacts, ensure equitable opportunities for use and maintain and enhance a socially desirable range of values.

Information on reef use and values not only provide the basis for effective management of direct uses but also allows us to understand direct and indirect causes of observed patterns of use and assist in anticipating undesirable ecological impacts on the Great Barrier Reef (GBR). While the Great Barrier Reef Marine Park Authority (GBRMPA) planning and management activities have concentrated on managing uses, research effort to date has focused on developing an understanding of the GBR ecosystem, and monitoring major ecological impacts of reef related activities. This has not been matched by the development of an information base of the nature of reef activities and reef values. As a result, the available information base is often inadequate to respond to management needs.

This paper describes the status of existing information on reef use, initiatives taken by GBRMPA and other agencies and addresses the need for an integrated approach to the development of long-term reef use datasets. Tourism related projects initiated by the Cooperative Research Centre for Ecologically Sustainable Development of the Great Barrier Reef (CRC Reef Research Centre) are described elsewhere in the proceedings (e.g. Valentine et al. in press; Pearce et al. in progress; Inglis and Shafer in progress).

### Typology of reef related activities

Reef related activities can be broadly classified as those that are GBR dependent and those which are not. In the first category are commercial fishing, tourism, private recreational use, indigenous use, vicarious use, scientific use and management. The second category includes shipping, port development, waste disposal, coastal and catchment development. Further classification include those activities occurring within the GBRWHA boundaries and those occurring in adjacent areas but potentially affecting the GBRWHA (Table 1).

The GBRMPA does not have direct jurisdiction over activities taking place outside the Great Barrier Reef Marine Park (GBRMP), however, it has responsibility for ensuring the protection of the GBR under the *Great Barrier Reef Marine Park Act 1975*. The GBRMPA has management arrangements with relevant stakeholder agencies including a range of government departments and agencies at federal, state and local levels depending on the extent of their jurisdictional boundaries and statutory responsibilities. A consequence of this multiplicity of jurisdictions is that information on patterns of use is held by a range of agencies. Information on ecological impacts of use on the GBR forms most of the GBRMPA research and monitoring effort.

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**Table 1.** Typology of reef related activities

<b>Reef related activities</b>	<b>Within Area</b>	<b>Outside Area</b>
Area dependent	Tourism and private recreation Commercial fishing Indigenous use Scientific use Management Conservation/protection Ecological services Storm protection	Vicarious use
Non-Area dependent	Shipping Waste disposal	Port development Coastal/catchment development

### **Information needs**

The development of a GBRWHA wide integrated information base on reef related activities is at its beginnings. This paper focuses on selected uses (tourism, recreation, coastal demography) for which reef wide datasets are available. Restrictions in the nature of the information only permits an analysis of distributional patterns rather than socio-economic characteristics of uses. Commercial fishing, indigenous use, coastal and catchment land uses are discussed elsewhere in these proceedings.

Gaining information on the range of reef related activities will require further analysis of existing datasets as well as the development of specific data collection (e.g. indigenous use, recreational use, vicarious use) on distributional as well as socio-economic characteristics of those activities and factors affecting them. Cooperative strategies for data collection and information sharing protocols need to be further developed with relevant stakeholder agencies.

Key elements of informed decision making relate to the nature and quality of the information, its relationship to other information sources and its format. To this end, consideration of information needs should take account of:

- Forecasting, based on long-term datasets of uses and users;
- Linking of biophysical and socio-economic datasets;
- Defining appropriate management scale/spatial unit (e.g. bioregion);
- GIS requirements;
- Compatibility with existing datasets at regional and national levels; and
- Access/information sharing/protocols with GBRMP stakeholders and other agencies.

### **Status of information on reef related uses**

Information on reef related activities is found in reports and databases scattered in various government agencies and organisations including GBRMPA. The extent and usefulness of that information varies greatly depending on who collected the data and for what purpose. Most of the GBRMPA reef use information relates to tourism and recreation, a reflection of the focus of planning and management activities and of the interest recreational management has attracted in research institutions and park management agencies in Australia and overseas. The main sources of information on reef use include GBRMPA research reports undertaken since its establishment in the late 1970s, reef specific databases and national and state databases.

### **Overall trends in reef use**

Although its primary function is enforcement, the Aerial Surveillance Databases (Queensland Department of Environment (QDoE) and Coastwatch) provide a GBR wide source of

longitudinal data on reef use. From about 1989 up until November 1994, a stratified random sampling design was used to record vessel sightings in sectors and plots throughout the GBRMP. This data has been used to derive *generalised* spatio-temporal patterns of reef use (see Honchin 1991; Storrie 1993), but rigorous statistical analyses of the data by Pettitt and Haynes (1994a, b) showed that the prescribed sampling design was not strictly adhered to and that the quality of the data was variable between agencies and over years. Therefore, trends and rough estimates rather than actual figures should be inferred from analyses of the aerial surveillance data presented in this paper.

Spatial analysis of the dataset from 1990 to 1994, largely based on methods developed by Storrie (1993), showed no significant GBR wide trends in visitation levels (Table 2) and number of reefs visited (Table 3). However, visitation levels have increased in consistently high use areas such as offshore Cairns and in the Whitsundays (over 300 passengers/day on average). Most of the GBR is being used at low intensity (0-30 passengers/day on average) particularly in the more remote parts of the GBR such as the outer reefs and the Far Northern section which are generally areas of commercial fishing activity. About 90% of reefs in the GBR were visited at least once a year.

Pettitt and Haynes (1994b) also analysed the Coastwatch and QDoE aerial surveillance program data. Their analyses indicate that, on the whole, year is not important in explaining the variation in daily vessel sightings on the reef, but that vessel type, day type and reef are important in explaining the variation in vessel sightings. High use sites such as Norman Reef (16030), Green Island Reef (16049), Hardy Reef (19135), Michaelmas Reef (16060) and Moore Reef (16071) were among the top five consistently high use sites from 1989-90, 1990-91 and 1991-92.

For 1994, the distribution of vessel types per flight per section showed that overall, number of vessels sighted was greatest in the Cairns and Mackay/Capricorn sections compared to the Far Northern and Central section (see Table 4). As there are a large number of vessel types which operate in the Marine Park, vessels were recorded into five categories: yachts, commercial fishing (Comfish), large displacement vessels (Displ), miscellaneous vessels (Misc), speed boats (Speed), and aircraft (Acft) based on the vessel types in Table 5.

The distribution of vessel type showed a stable proportion of yachts throughout the GBR (about 15 to 20%) and slightly lower in the Far Northern section (10%). Commercial fishing accounts for 20% of vessel types sighted for most of the GBR except for the Far Northern section where it represented 45% of all vessel types. Private use as indicated by speed boats and yachts varied greatly from section to section with the highest proportion in the Central section and Mackay/Capricorn sections and the lowest in the Far Northern section (see Fig. 1).

#### *Trends in tourism use*

Tourism use of the GBRMP can be derived from permitted commercial use (permits database) and data returns from the Environmental Management Charge (returns tables). The permits database includes details of individual commercial operations, permitted activities, accessible sites and maximum vessel passenger capacity. The database allows differentiation between site dedicated and roving vessel operations.

The permits database can be used to derive potential numbers of visitors per year (Thomas 1993). Potential reef visitation by site specific commercial vessels expressed as potential visitors per year (PVY) exceeded 5 200 000 in 1994 (see Table 6). These same vessels were permitted to access 183 reefs. Most of the permitted use is concentrated in the Cairns and Central sections.

Table 2. Estimated average daily visitation to the top 50 most visited sites in the GBRMP

1990		1991		1992		1993		1994	
Reef id	Ave # daily pax	Reef id	Ave # daily pax	Reef id	Ave # daily pax	Reef id	Ave # daily pax	Reef id	Ave # daily pax
16030	603	16030	466	16030	463	16030	440	16030	422
20041	517	16049	458	16049	420	19135	373	23012	375
16049	415	16071	382	16071	412	23012	354	16071	373
19135	317	16060	264	19135	349	16071	289	16049	370
16060	312	16032	222	20732	337	16049	257	15099	346
15099	231	23012	218	23012	331	16060	233	19135	303
23012	211	19135	204	16751	300	15099	221	15096	275
16032	203	18030	193	16060	221	15096	181	16064	203
16071	191	15096	171	15096	215	19009	173	16060	179
19009	171	23082	164	15099	202	17051	164	23082	151
20732	165	15099	159	23082	180	18030	155	16015	134
20709	159	16028	151	18030	168	23082	142	18030	123
16054	153	19009	151	16032	158	14116	128	16054	116
20058	152	17051	124	16716	132	16064	117	17012	115
20712	150	20028	107	14116	126	16055	114	17053	113
16028	139	16029	107	20028	113	17053	113	17051	111
17053	130	20041	84	16068	109	16032	101	14116	105
14116	129	16057	83	14146	107	16054	95	20287	102
23082	126	14116	78	16054	103	16057	94	16025	90
18030	121	17053	71	16029	102	16709	89	18701	80
20028	109	16068	69	19009	100	15050	81	16020	77
18049	106	14042	66	17051	98	16707	75	23052	75
16716	96	17720	66	16064	89	23009	73	20271	74
14140	89	16054	61	16042	87	20287	71	18702	73
17001	89	14140	61	17053	83	18049	68	19009	66
17051	87	16067	61	16707	82	18701	66	18079	62
16701	87	23052	60	14140	77	17001	65	14146	62
20017	86	16025	55	16020	67	19137	64	16026	62
15096	82	16055	55	19726	67	21701	60	16716	61
16055	82	16026	55	16701	65	19006	59	20733	61
15719	70	14706	55	23052	65	16042	59	16068	60
16709	68	16015	51	18049	61	17012	56	16707	60
20014	68	20067	50	22052	60	16029	54	16032	56
19726	66	16716	49	16067	58	12016	52	19726	51
18702	64	19726	47	17012	58	18079	51	22133	51
20711	61	20287	46	16710	57	19717	51	15094	50
16067	53	23721	45	16025	55	14132	51	19035	50
16710	51	18049	44	18701	54	16026	50	23701	49
18095	51	22147	44	16046	54	23010	50	16057	49
20287	48	14146	42	15736	54	23052	49	18049	48
23049	47	14152	40	20041	54	16073	48	16029	46
19716	47	16065	38	24701	51	16065	44	23031	45
16029	45	17012	36	16709	50	16074	41	16701	44
14152	43	14022	35	23077	50	15091	40	21711	44
16073	41	23049	34	16715	47	14114	39	18080	43
18701	41	17011	34	15025	46	15714	38	16040	42
18086	40	23069	33	23004	44	15072	38	21433	41
17012	40	15719	32	16702	44	15041	38	17720	40
16064	39	23711	32	16028	42	15710	38	15703	38
15065	39	16006	31	23049	42	14140	36	19006	38

Notes:

- Figures are indicative only and should only be interpreted as trends, not actual numbers.
- Figures derived from Coastwatch and QDoE aerial surveillance programs.
- Only includes reefs where vessels have been sighted.
- Includes both reefs and some inter-reefal areas (indicated by xx7xx id codes)

• Pax (i.e. the number of passengers on board) is estimated for each class of vessel type. For example, small pleasure craft is estimated to have an average of three people on board at any one time, while large catamarans would have about 300 passengers on board.

**Table 3.** Number of reefs visited per average daily passenger classes

Passenger Class/year	1990	1991	1992	1993	1994
0-30	903	1022	1080	802	807
30-100	44	38	44	41	56
100-300	16	13	15	14	13
>300	5	3	7	3	6
<b>Total # reefs</b>	<b>968</b>	<b>1076</b>	<b>1146</b>	<b>860</b>	<b>882</b>

**Notes:**

- Figures are indicative only and should only be interpreted as trends, not actual numbers.
- Figures derived from Coastwatch and QDoE aerial surveillance programs.
- Includes reefs and some inter-reefal areas.
- Average daily use is grouped naturally into four average daily PAX classes.

**Table 4.** Reef visitation per vessel type in 1994 expressed as a percentage of total vessel type per flight (adapted from Aerial Surveillance Database)

GBRMP Section	Yacht (% of total sightings)	Comfish	Speed	Misc	Displ.	Acft
Far Northern	10	45	19	14	12	0
Cairns	15	21	27	21	15	1
Central	17	20	43	9	10	1
Mackay/Capricorn	19	22	34	9	14	2

The data returns tables are part of the permits database. The Environmental Management Charge (EMC) was introduced in July 1993 and is calculated on actual daily numbers of passengers carried to a reef site. Commercial operators are required by law to fill in log books with daily information on crew numbers, passenger numbers, vessel name, vessel registration number and sites visited.

Commercial tourism visitation in 1995 based on the EMC data returns was greatest in the Cairns section (911 359) followed by the Central section (555 537) the Mackay/Capricorn (117 800) and the Far Northern section (4410). The top fifteen tourist visited reefs make up 93% of all tourist visited reefs in the GBRMP (see Fig. 2), with 12% of total visitation occurring at Green island in the Cairns section.

*Latent visitor capacity*

Comparing potential visitation with actual visitation gives an indication of the latent tourist visitation capacity (see Honchin 1996). The extent of latent capacity in the GBRMP is a major challenge for GBRMPA and the tourism industry in terms of management of future use. Mechanisms are currently being developed to address this issue.

Table 5. Classification of vessel types

Displ.	Comfish	Yacht	Speed	Acft	Misc
Barge	Barramundi boat	Catamaran	Dinghy	Helicopter	Canoe
Bulk barge	Clam boat	Ketch	Half cabin	Plane	Miscellaneous vessels
Coastal vessel	Fishing vessel	Schooner	Outboard	Seaplane	
Container ship	Foreign fishing vessel		Pleasure craft		
DOT vessel	Game fishing vessel		Runabout		
General barge	Longliner				
General cargo ship	Lugger				
Hydrographic vessel					
Landing barge					
Landing craft heavy					
Launch					
Livestock carrier					
Merchant ship					
Motor sailor					
Naval vessel					
Oil exploration vessel					
Large passenger vessel					
Patrol boat					
Pilot					
Research ship					
Rollon/rolloff ship					
Seismic survey vessel					

Table 6. Potential visitation per year per section for 1994 (adapted from Valentine et al. 1994)

Permit type	Far Northern PVY (# of reefs)	Cairns PVY (# of reefs)	Central PVY (# of reefs)	Mackay/Capricornia PVY (# of reefs)
Site specific only	47 078 (8)	2 434 662 (45)	2 484 479 (105)	142 070 (25)
Mixed	24 592 (6)	986 582 (50)	1 945 723 (69)	209 411 (4)
Roving only	242 376 (735)	354 636 (291)	300 530 (510)	166 192 (1052)

Notes: Information based on existing permits only

*Impact of tourism use on other uses*

A major limitation with the aerial surveillance program is that tourism vessels and private vessels cannot be readily separated for the purposes of data analysis. However, visitation levels at high use sites based on both the EMC data returns and the Aerial Surveillance databases can be used to validate those respective sources and derive an indication of private use (see Table 7). This is based on the assumption that most non-tourism use at high tourism sites is private use, rather than commercial use, for example by commercial fishers.

Impacts of tourism on private use such as displacement of other uses (including indigenous peoples) can be seen in high use destinations such as Green Island and Michaelmas Reef. In other lower use destinations there is a better balance between tourism and non-tourism uses. Patterns of recreational private use needs to be verified by independent assessment of private use at those locations.



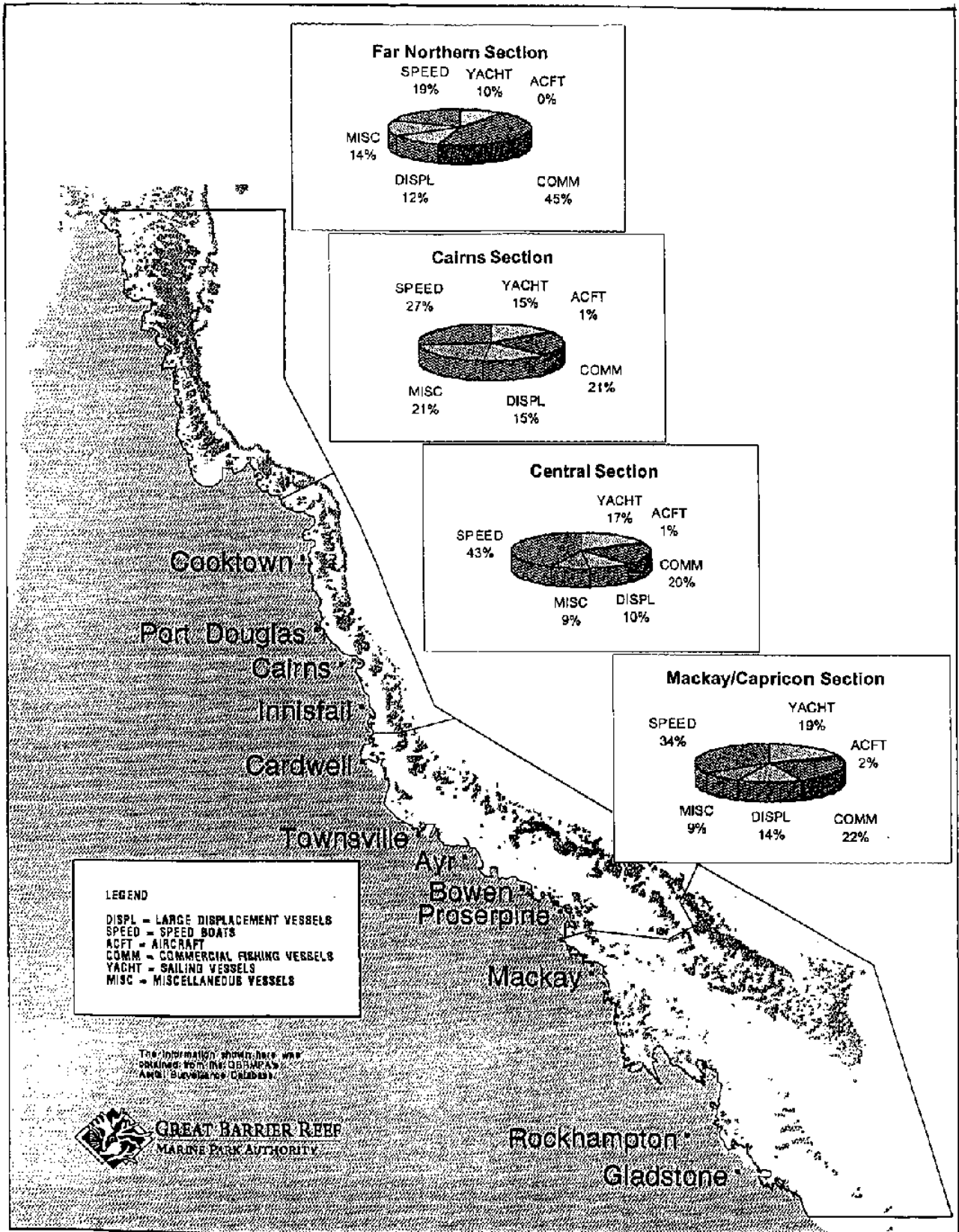


Figure 1. Aerial surveillance - Proportion of vessel types sighted (%) per section in 1994

Table 7. 1994 visitation levels at the 10 high use sites based on the EMC data returns and Aerial Surveillance databases

Reef	Average daily pax	Yearly EMC pax	Daily EMC pax	No. of EMC trips	Daily non-tourism use	% of non-tourism use
Norman	422	124812	342	1758	80	19
Great Keppel	375	23363	64	549	311	83
Moore	373	54853	150	1498	223	60
Green	370	200113	548	1807	-178	0
Agincourt 3	346	95134	261	1132	85	25
Hardy	303	94339	258	1779	44	15
Agincourt-4	275	91093	250	831	26	9
Arlington	203	19771	54	522	149	72
Michaelmas	179	66054	181	1474	-1	0
Lady Musgrave	151	20240	55	699	96	63

Notes:

• Figures are indicative only and should only be interpreted as trends, not actual numbers.

#### *Diving on the Great Barrier Reef*

A recent study of diving activities (Windsor 1995) in the GBR by 532 permit holders (obtained from the Permit database) indicated that 803 000 dives take place in Cairns (see Table 8). This represents 62% of all dives (1 299 500 total), most of those being open water dives (including training dives) rather than open water certifications (18 000) (Windsor 1995).

Table 8. Pattern of diving activities for 1994 ( adapted from Windsor 1995)

Location	Resort dives	Openwater certification	Openwater dives (including training dives)	Overall total dives (% of total)
Coral sea			42 000	42 000 (3.3%)
Cod hole			52 000	52 000 (4.0%)
Yongala			18 500	18 500 (1.4%)
Cairns	83 000	18 000	720 000	803 000 (62.2%)
Townsville	4 500	3 000	17 000	21 500 (1.7%)
Whitsundays	34 000	7 500	214 000	248 000 (19.2%)
Capricorn/Bunker groups	5 500	1 800	59 000	64 500 (5.0%)
SE Qld (non-permit holders)	2 500	2 200	38 500	41 000 (3.2%)

A total value of diving industry in direct expenditure of \$103 240 000 was also estimated based on an average cost of \$80 per dive. Diving activities may result in the degradation of high use sites such as Cairns through diver damage (see Rouphael and Inglis 1995) possibly with wider ecological, social and economic consequences.

#### *Tourism in the Great Barrier Reef region*

National (e.g. Australian Bureau of Statistics, Bureau of Tourism Research) and State (e.g. Queensland Tourism and Travel Corporation) data collection exercises provide contextual information on the characteristics of tourism activities in the GBR region including visitor, trip and industry profiles. Most of those datasets have been in place for a few years and are used for trend identification and forecasting. Information on visitor characteristics (e.g. age, nationality,

expenditure, satisfaction) can be used to target particular market segments for GBR education, predict patterns of use and derive the economic value of tourism.

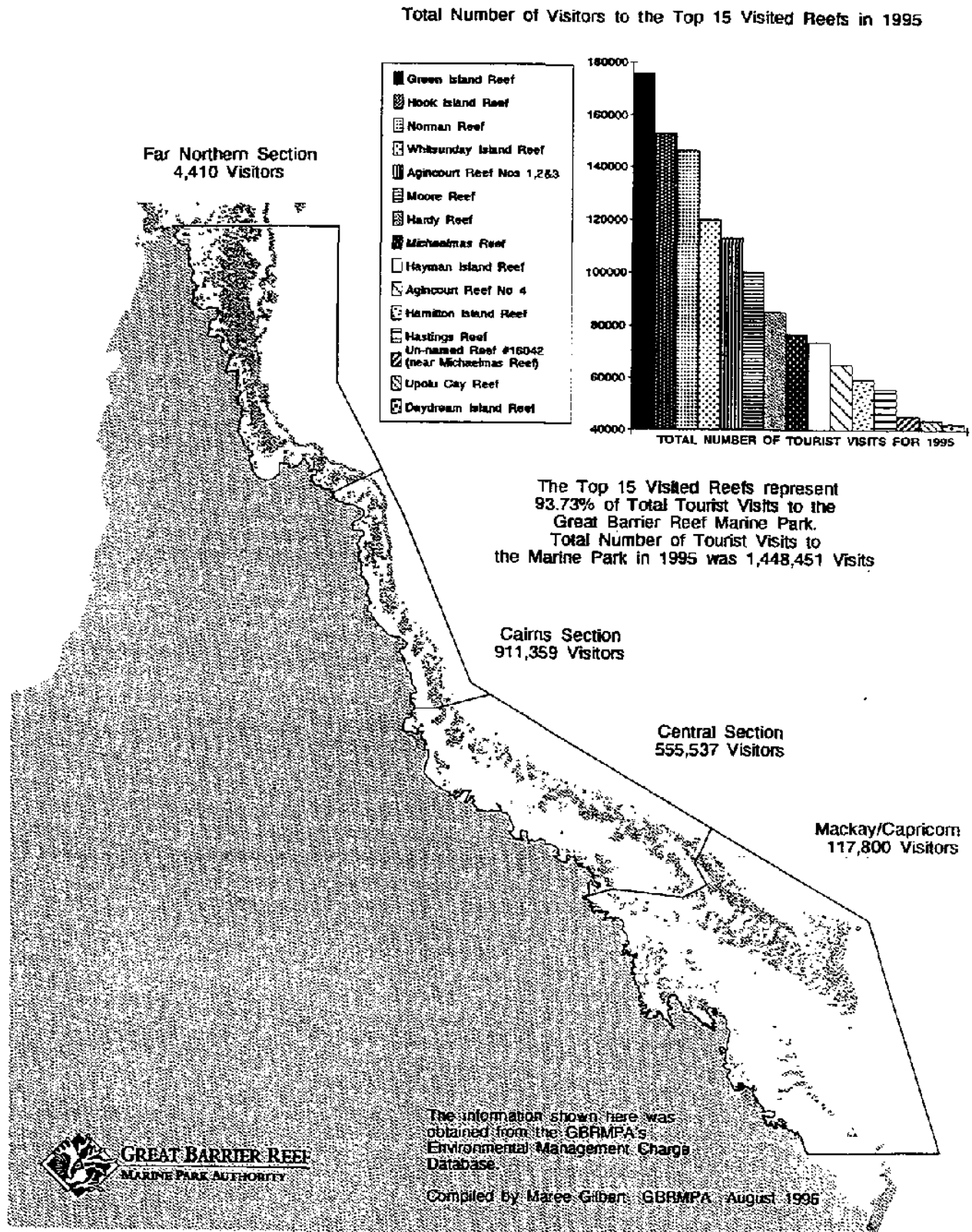


Figure 2. Commercial tourist visitation to reefs in the Great Barrier Reef Marine Park - 1 January 1995 to 31 December 1995

The usefulness of those datasets for management is limited for deriving regional and local estimates for methodological reasons. Other constraints include the absence of a reference to the GBR as a tourism destination, so that area specific visitation cannot be separated from overall tourism visitation to the region. A number of approaches have been proposed to remedy this situation (Benzaken 1995). They include incorporating questions in established data collection, redefining the spatial unit, developing regional data collection which are compatible and comparable with those datasets and ensuring that data collection is appropriately geographically referenced.

The CRC Reef Research Centre's initiative to incorporate a question which describes the GBR as a destination and provide a better taxonomy of reef tourism activities (Pearce et al. pers. comm.) has greatly improved the use of the International Visitor Survey (IVS) undertaken every year by the Bureau of Tourism Research.

#### Trends in private recreational use

The Queensland Private Boat Registration database (held by the Department of Transport) is designed for the administration of boat registration fees. It includes information on boat owners, place and postcode of residence and boat characteristics (e.g. length, power, sails). The data obtained from the Department of Transport for this analysis does not include personal details of boat owners for confidentiality and privacy reasons.

Data for 1995-1996 were spatially analysed using GIS to develop a profile and distribution of private boat ownership adjacent to the GBR region, as a surrogate measure of GBR based recreation (Benzaken et al., in progress). Estimates of GBR water based recreational use (estuarine/inshore, offshore reef) were derived using boat length as an indicator of maximum distance travelled. Boats under five metres were assumed to use primarily rivers, estuarine and inshore marine areas, while boat over five metres were assumed to potentially travel to offshore reefs (see Blamey and Hundloe 1993; Hundloe 1985). A profile of the private boat fleet was derived based on boat length, 'sails' and 'speed'. It showed that in the region adjacent to the GBRMP most boats are under five metres (33 912) and are most are 'speed' boats (39 849) as opposed to 'sail' boats (874) (Table 9).

Table 9. Profile of boats in region adjacent to the Great Barrier Reef Marine Park

Boat class	Region adjacent to Great Barrier Reef Marine Park	Queensland
Under five metres	33 912	
Over five metres	9616	
'Sails'	874	2620
'Speed boat'	39849	
Total sample	43 528	104 657

The spatial analysis of boat per size class per postcodes adjacent to the GBRMP (see Figs. 3 and 4) shows that boats under five metres are found in significant numbers in Bundaberg, Mackay, Cairns, Gladstone, Ingham, Ayr, Rockhampton and Townsville area. The over five-metre fleet is evenly distributed and follows settlement patterns with high numbers registered to the Cairns' postcode area.

By combining number of vessels with population estimates per postcodes (based on Australian Bureau of Statistics CDATA), a density of boat ownership per population can be obtained from which participation in water based recreation and 'recreational use catchments' can be derived. The combination of that information with data from the Aerial Surveillance database provides a

starting point to the development of a picture of recreational use. Further data collection can be developed using the Boat Registration database as a sampling frame.

Site specific studies of reef use

#### *Bramble Reef study*

A study by the CRC Reef Research Centre of the socio-economic impacts of the Reopening of Bramble Reef to line fishing will provide the basis for developing a survey methodology to obtain basic spatio-temporal patterns of recreational use. A technique for integrating the survey data into ARC/INFO is being piloted. The GBRMPA Representations database mapping units are used in conjunction with a coverage of boat ramps for the Queensland coast.

The Representations database includes spatially referenced information from public submissions received by GBRMPA during the zoning and planning reviews of the Central section (1987). Information on patterns of use, motivation, values of the area, expenditure and attitudes towards management collected for the Bramble Reef study can be interpreted with an historical perspective based on the last review of zoning in the area (Benzaken et al. in progress).

A complementary survey of households in the Ingham area provided the necessary background on participation in marine based recreation as well as general information relevant to management.

The Queensland Fisheries Management Authority is currently developing a recreational and boating database and is considering a range of approaches to assess the extent of recreational fishing and its impact on fish stocks.

#### *The human use database*

A review of 89 GBRMPA reports (from 1978 -1992) undertaken in 1992 (Benzaken 1993) showed that most studies had focused on variety of management research issues. These studies provide invaluable insight in the nature of visitor experiences, activities, perceived impacts of tourism on other activities as well as attitudes towards the GBR and its management. They also provide an historical record of the characteristics of tourism and recreation. Compilation of study results for areas of high visitation (where most studies have been undertaken) may be possible. However, they could not be used for trend identification for GBR wide reef use because of the variety of scale (site specific), locations, sampling design (small sample size), variables and analysis used which precludes comparative analyses.

#### *Trends in coastal demography*

##### *Demography of the coastal zone*

The Australian Bureau of Statistics undertakes a population census every five years. Population trends for the region adjacent the GBR are shown in Table 10.

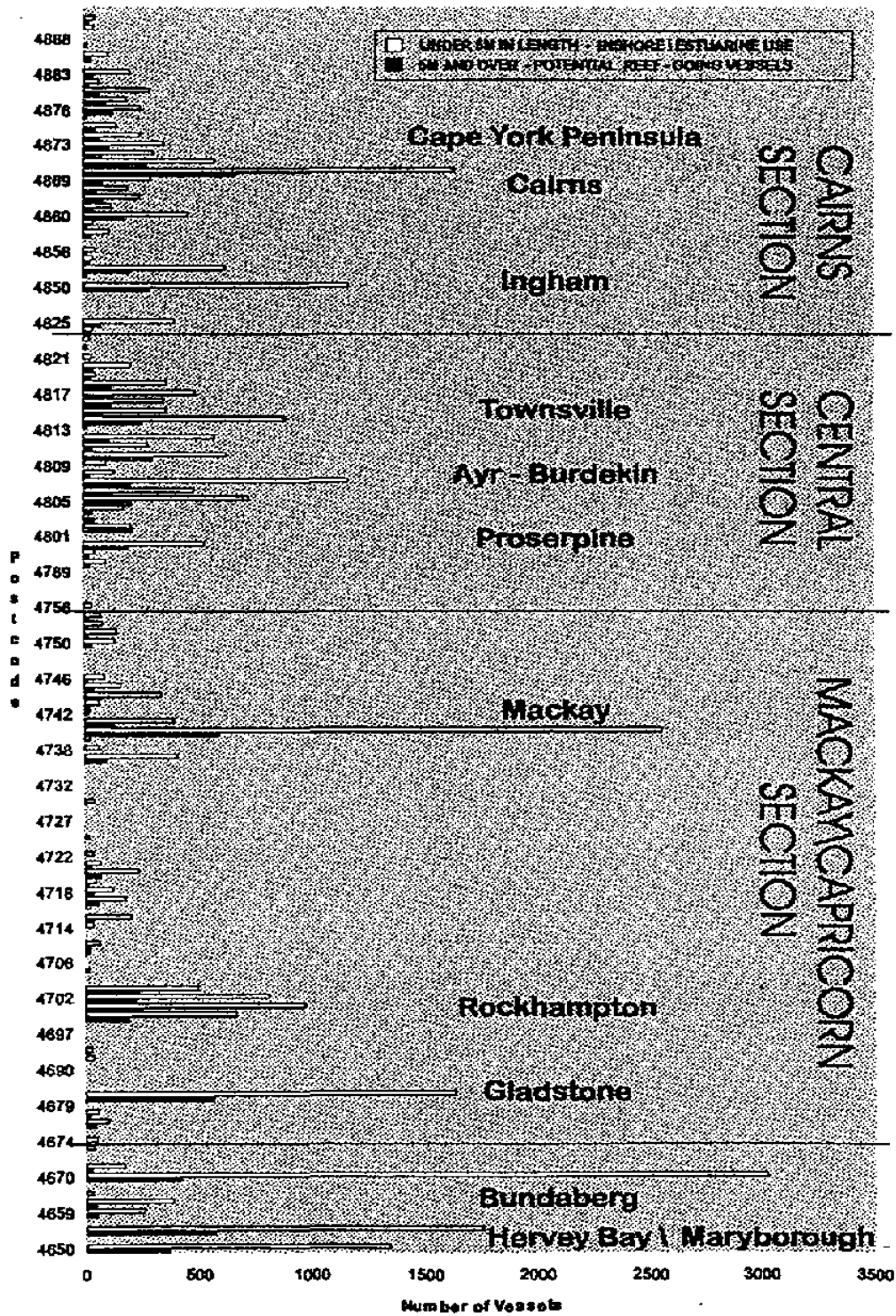
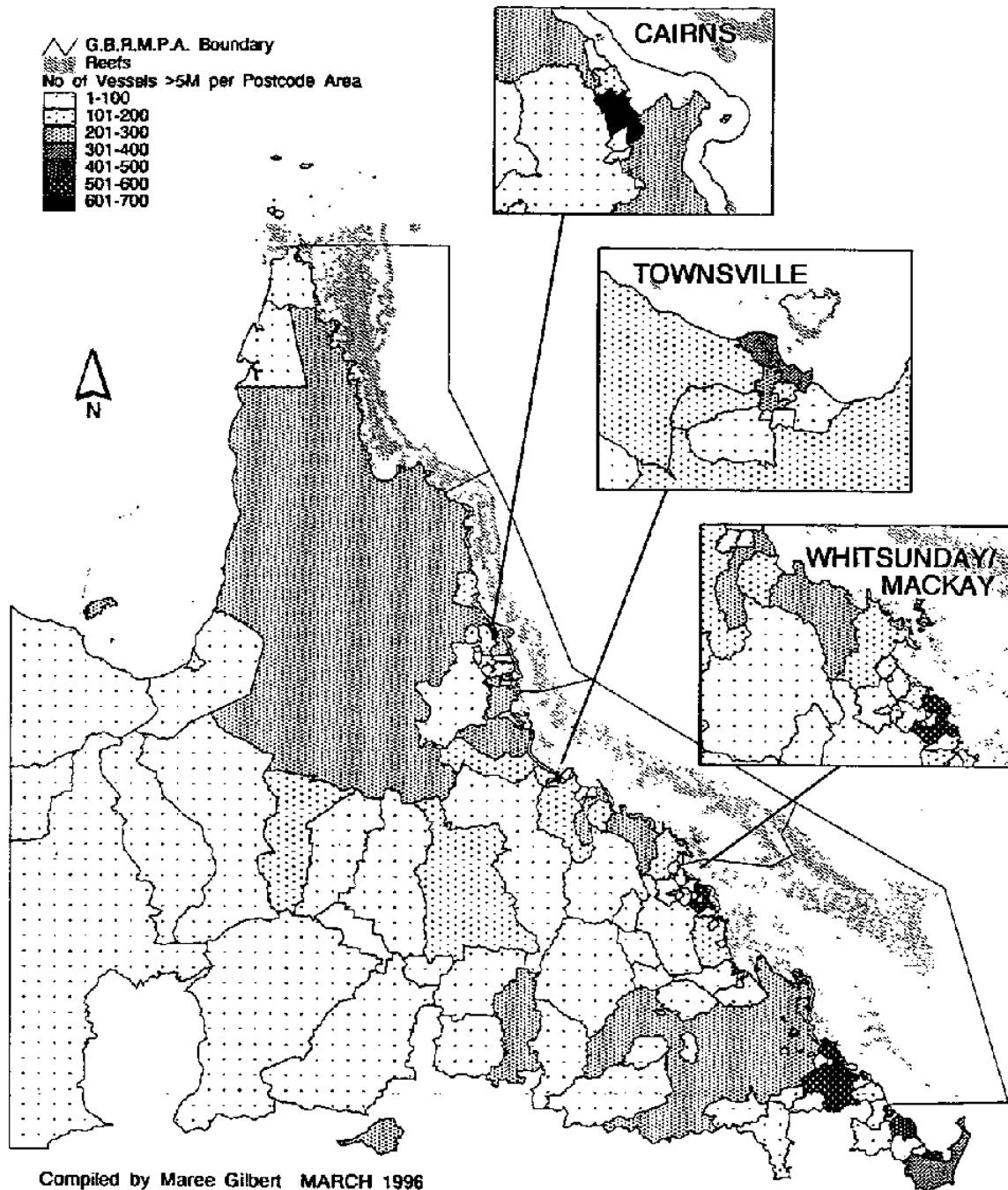


Figure 3. Distribution of privately-registered vessels in the postcode areas adjacent to the GBRMP. Data was obtained from Queensland Transport Boat Registration records as at 19 January 1996.



Compiled by Maree Gilbert MARCH 1996  
 Boat Registration data from Queensland Transport as at 19 January 1996  
 Postcode Boundary Coverage compiled by ERSIS AUST P/L - CDATE



**GREAT BARRIER REEF**  
 MARINE PARK AUTHORITY

**Figure 4.** Vessels five metres and over in length privately-registered to the postcode areas adjacent to the Great Barrier Reef Marine Park

Notes:

- not all postcodes have a unique identifier. For example, Cape York Peninsula shares its postcode within a small area near Cairns which makes it difficult to estimate numbers of registered boats in Cape York Peninsula
- the allocation of post codes to large populations centres is variable and not related to population size.



**Table 10.** Resident population changes in centres adjacent to the GBR (p: x preliminary estimates) adapted from Queensland Department of Housing and Local Government 1995)

<b>Statistical division</b>	<b>1986</b>	<b>1991</b>	<b>1994 (p)</b>
<b>Local Government area</b>			
<b>Mackay</b>	<b>103 499</b>	<b>110 301</b>	<b>116 317</b>
Whitsunday	9 676	11 429	12 252
Mackay	58 828	63 557	68 607
<b>Northern</b>	<b>171 744</b>	<b>182 581</b>	<b>192 432</b>
Townsville	82 064	86 245	88 855
Thuringowa	28 415	35 331	42 510
Hinchinbrook	15 536	15 501	15 365
<b>Far Northern</b>	<b>161 042</b>	<b>181 399</b>	<b>195 763</b>
Cape York Peninsula (Aurukun, Cook, Weipa)	7 840	8 289	8 413
<b>Cairns/Mulgrave</b>	<b>79 567</b>	<b>92 563</b>	<b>103 410</b>

Significant areas of population growth include the major urban and tourism centres (Fig. 5). Growth can be attributed to migration gain as a result of economic activity and urban overspill (Ward 1995). Areas like Cape York Peninsula and Torres however can be attributed to natural increase rather than migration (Ward 1995). An important trend is migration away from urban centres to non-metropolitan areas (Bell 1992 in Ward 1995, p. 9).

The Australian Bureau of Statistics census uses full enumeration and data can be aggregated at a range of spatial units, the smallest unit of data collection being the Collection District (200 households). Work is in progress to aggregate the data for catchments boundaries. This information can be used to estimate potential ecological impacts on the GBR (e.g. sewage effluent).

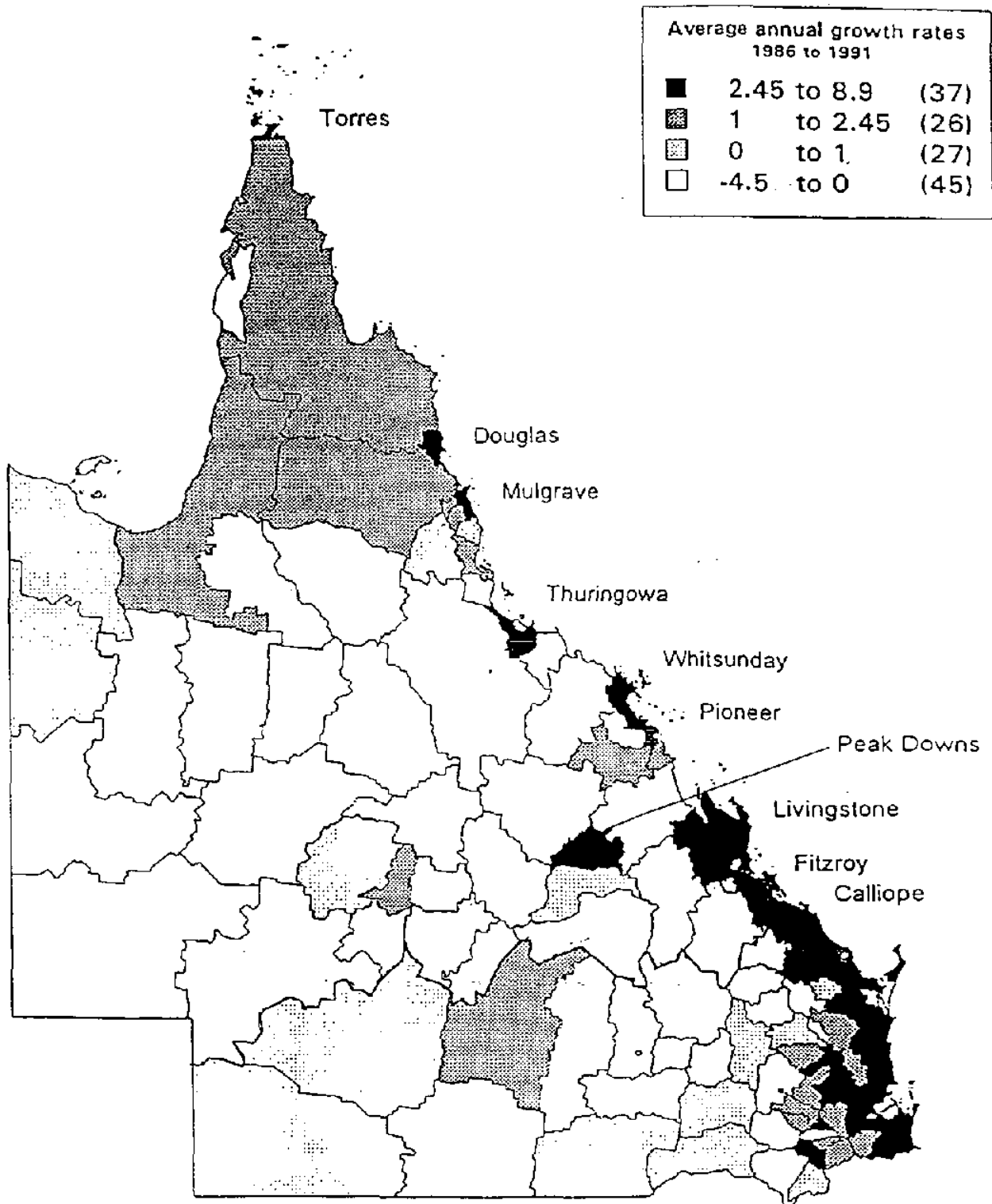
Australian Bureau of Statistics census data are also routinely used to derive regional socio-economic profiles (e.g. the Centre for Applied Economic Research and Analysis quarterly reports on regional economies for Cairns, Townsville and Mackay). Australian Bureau of Statistics census data have also been traditionally used to derive representative sample populations (based on demographic characteristics) for site specific studies on a range of topics.

### **Conclusion and future directions**

From the data available, overall trends in reef use and coastal resident populations have not changed dramatically at a GBR wide scale. Localised 'hot spots', where tourism is the dominant economic activity (Cairns and Whitsundays) have experienced growth both in the resident population and reef tourism visitation. However, current tourism use is well below permitted capacity in most areas of the GBR except in a few localised areas offshore Cairns.

Snap shots of recreational boat ownership in high use areas show a large fleet of private vessels over five metres with the potential to use the GBR. Some displacement of private use is evident at these reefs. Private boat ownership along the Queensland coast show nodes around the main urban centres with most of the fleet under five metres in length. These vessels are also most likely to use estuarine and inshore waters.





**Figure 5.** Average annual growth rates 1986 to 1991 per statistical Local Government Area based on Australian Bureau of Statistics CDATE (source Ward 1995)

Notes

- Census data are not useful for deriving remote areas population estimates (e.g. CYP) because data cannot be disaggregated below the Collection District for confidentiality reasons.
- CYPLUS recent study of CYP population indicates the difficulty of deriving accurate figures for remote areas (King 1994)

Trends and statistics derived from the sources of data have to be read with caution. In most cases, several datasets should be used in concert to get reliable information as any one dataset is likely to be deficient in some way. Initiatives both at GBRMPA and other stakeholder agencies are underway to develop a GBR wide information base. Cooperation and information sharing are essential elements of this process.

Steps for the future include:

- Improving the quality of existing long term datasets;
- Linking GBRMP datasets with datasets on catchment and coastal uses datasets;
- Developing appropriate reporting mechanisms which allow the translation of data into useable information by managers and other stakeholders; and
- Developing new data collection strategies to address information gaps.

### **Acknowledgments**

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