# Zoning Plan for the Great Barrier Reef Marine Park

## Regulatory Impact Statement

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# 1 Introduction

## *1.1 Legislation and zoning*

The *Great Barrier Reef Marine Park Act 1975* ('the Act') provides for the establishment, control, care and development of the Great Barrier Reef Marine Park ('the Marine Park'). The Act confers responsibility for the management of the Marine Park upon the Great Barrier Reef Marine Park Authority ('the GBRMPA'). The GBRMPA also plays a major role in the management of the Great Barrier Reef World Heritage Area ('the GBRWHA'), in accordance with the *Environment Protection and Biodiversity Conservation Act 1999.*

At the broader policy level, the Australian Government has announced that it is committed to the implementation of increased levels of protection for the GBR through a comprehensive rezoning of the Park to implement the Representative Areas Program (Australian Government 2001).

In managing the Marine Park and its responsibilities for the World Heritage Area, the GBRMPA also implements Federal Government policies arising from such international obligations as outlined in Section 3.2.1).

Zoning plans have been developed as the primary planning instrument for the conservation and management of the Marine Park. In accordance with sub-section 32(7) of the Act, the following must be considered in the preparation of Zoning Plans:

- conservation of the GBR;
- regulation of the use of the Marine Park so as to protect the GBR while allowing the reasonable use of the GBR Region;
- regulation of activities that exploit the resources of the GBR Region so as to minimize the effect of those activities on the GBR;
- reservation of some areas of the GBR for its appreciation and enjoyment by the public; and
- preservation of some areas of the GBR in its natural state undisturbed by humanity except for the purposes of scientific research.

As well as zoning plans, a range of other management 'tools', including permits, education and plans of management, used to control and mitigate impacts associated with human use of the Marine Park. The Act requires zoning plans to define the purposes for which areas of the Marine Park may be used or entered. They allow activities, such as tourism, fishing, boating, diving and research to occur in specific areas, but also separate conflicting uses and determine the appropriateness of various extractive activities (refer to the activities matrix in Figure 1).

**Figure 1. Activities matrix**

## ACTIVITIES GUIDE

(see *Zoning Plan* for details)

| | General Use Zone | Habitat Protection Zone | Conservation Park Zone | Buffer Zone | Scientific Research Zone | Marine National Park Zone | Preservation Zone |
|---|---|---|---|---|---|---|---|
| Aquaculture | Permit | Permit | Permit [1] | ✗ | ✗ | ✗ | ✗ |
| Bait netting | ✓ | ✓ | ✓ | ✗ | ✗ | ✗ | ✗ |
| Boating, diving, photography | ✓ | ✓ | ✓ | ✓ | ✓ [2] | ✓ | ✗ |
| Crabbing | ✓ | ✓ | ✓ [3] | ✗ | ✗ | ✗ | ✗ |
| Harvest fishing for aquarium fish, coral and beachworm | Permit | Permit | Permit [1] | ✗ | ✗ | ✗ | ✗ |
| Harvest fishing for sea cucumber, trochus, tropical rock lobster | Permit | Permit | ✗ | ✗ | ✗ | ✗ | ✗ |
| Limited collecting | ✓ [4] | ✓ [4] | ✓ [4] | ✗ | ✗ | ✗ | ✗ |
| Limited impact research | ✓ | ✓ | ✓ | ✓ [5] | ✓ | ✓ [5] | Permit |
| Limited spearfishing (snorkel only) | ✓ | ✓ | ✓ [1] | ✗ | ✗ | ✗ | ✗ |
| Line fishing | ✓ [6] | ✓ [6] | ✓ [7] | ✗ | ✗ | ✗ | ✗ |
| Netting (other than bait netting) | ✓ | ✓ | ✗ | ✗ | ✗ | ✗ | ✗ |
| Research (other than limited impact) | Permit | Permit | Permit | Permit | Permit | Permit | Permit |
| Shipping (other than in a designated shipping area) | ✓ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ |
| Tourism program | Permit | Permit | Permit | Permit | Permit | Permit | ✗ |
| Traditional use of marine resources | ✓ [8] | ✓ [8] | ✓ [8] | ✓ [8] | ✓ [8] | ✓ [8] | ✗ [8] |
| Trawling | ✓ | ✗ | ✗ | ✗ | ✗ | ✗ | ✗ |
| Trolling | ✓ [6] | ✓ [6] | ✓ [6] | ✓ [6,9] | ✗ | ✗ | ✗ |

**PLEASE NOTE:** This guide provides an introduction to Zoning in the Great Barrier Reef Marine Park.

1. Restrictions apply to aquaculture, spearfishing and harvest fishing for aquarium fish and coral in the Conservation Park Zone. Refer to the Regulations for details.
2. Except for One Tree Island and AIMS which are closed to public access.
3. Limited to 4 catch devices (eg. crab pots and dillies) per person.
4. By hand or hand-held implement and generally no more than 5 of a species. Refer to the Regulations for details.
5. Other than limited impact research (extractive) which requires a permit.
6. Maximum of 3 lines/rods per person with a combined total of 6 hooks.
7. Limited to 1 line/rod per person and 1 hook per line.
8. Activities that are not 'as of right' in the zone, or that involve the take of protected species, require either a permit or a Traditional Use of Marine Resources Agreement.
9. Pelagic species only.

Detailed information is contained in the Zoning Plan available from the Great Barrier Reef Marine Park Authority.

A. Permits are required for most other activities not listed above.
B. All Commonwealth owned islands in the Great Barrier Reef Marine Park are zoned "Commonwealth Islands Zone". Refer to the Zoning Plan for details about use and entry of Commonwealth islands.
C. Special Management Areas may provide additional restrictions at some locations.
D. The Zoning Plan does not affect the operation of s.211 the *Native Title Act 1993*.

**ACCESS TO ALL ZONES IS PERMITTED IN AN EMERGENCY.**

### *1.2 New coastal areas*

Between August 2000 and July 2001, 28 coastal areas, totalling 4830 $km^2$, were added to the Marine Park (for more detail see http: www.gbrmpa.gov.au / rap). These inshore habitats, including seagrass beds and mangrove communities, are a crucial part of the GBR ecosystem, and include places that are very important to coastal communities for recreational and traditional use of marine resources. The Act requires a zoning plan to be prepared for new areas 'as soon as practicable' after an area has been included in the Marine Park.

## 2 The problem

### *2.1 What is the problem?*

There has been a dramatic decline in the health of coral reef ecosystems worldwide. In 1998, it was estimated that 16% of the world's reef ecosystems were destroyed and predictions are that this will increase to almost 20% in the next ten years or more (Jackson *et al.* 2001; Wilkinson 2002).

Water pollution, global climate change and overfishing have contributed to the decline of coral reef health. This has led to shifts in ecosystem function, reductions in species diversity and productivity, and a loss of resilience in reef systems (Smith *et al* 1981, Lapointe & O'Connell 1989, Tomascik & Saunders 1989, Rogers 1990, Hodgson 1993, Hughes 1994, Roberts 1995, Hoegh-Guldberg 1999, Watson & Core Writing Team 2001, Bellwood *et al*. in press). Resilience is the ability of the reef to resist impacts or to survive or recover from impacts. Food web dynamics are linked to reef resilience and can be interrupted by the removal of functional groups such as top predators. This has been proven in the Caribbean where the overfishing of many top predators exhausted stocks and redirected fishing pressure down the food chain to herbivorous fish. Removing just one functional group or species from the GBR ecosystem can cause flow-on effects throughout the whole food web. (Graham *et al* 2003). This can lead to a lower resilience and a greater susceptibility to other impacts, including natural events, and potentially ecosystem collapse.

Jackson *et al* (2001) found that, for coral reef ecosystems the threat of overfishing is greater because these systems are relatively 'closed'. Some of the world's fisheries are extremely productive because they have massive nutrient inputs as a consequence of water upwelling from the deep ocean or because large numbers of fish migrate in from elsewhere. Examples of such fisheries can be found off South America, South Africa and New Zealand. By comparison, the fisheries of the GBR are much less productive because it is a relatively closed system, with little nutrient or fish biomass input from elsewhere. This relatively low productivity makes the GBR fisheries more vulnerable to over-fishing. Importantly, overfishing has often been found to be a precondition for other human impacts to have effects, such as eutrophication, outbreaks of disease or species introductions.

The GBR is a wonderful natural asset for Australia and the world, however the GBR is not immune from these worldwide pressures and has already been found to be degraded (Pandolfi et al 2003). The level of use of the GBR and its various ecosystems has increased steadily over the last 25 years since the Marine Park was established. In particular, fishing activity and effort has expanded throughout the Marine Park and areas once considered remote, and hence protected from high levels of use, are now subject to high levels of exploitation. Active protection is now required to ensure a healthy GBR for the future.

### 2.2 Deficiencies in current GBRMPA zoning

Since the establishment of the Marine Park in 1975, the extent of protective zoning has increased. The first zoning plan was introduced in 1983 and, as new zoning plans have been introduced, the number of no-take areas has increased. Review of the current zoning system has shown that it does not adequately protect the range of biodiversity now known to exist across the Marine Park. Approximately 4.6% of the existing Marine Park is presently protected within Marine National Park Zones (MNPZs, Green Zones or 'no-take' areas) with this higher level of protection being focussed on coral reefs, particular species and remote or 'pristine' areas.

This focus has occurred because coral reefs and some mega fauna were relatively well-understood and were perceived to be particularly fragile or under threat. More information is now available regarding important habitats and functionally important species in the system. All habitats within the Marine Park have intrinsic ecological value and are interlinked with coral reef habitats. The health of each contributes to the overall health of the system. Seagrass beds, algal and sponge gardens, sandy and muddy seabed communities, oceanic trenches and other environments make up 94% of the total area of the Marine Park, yet only about 3% of these habitats are afforded higher level protection within MNPZs. These habitats are important parts of the system and are all interconnected (Kelly and Ryan 1999). Scientific advice is that between 20-50% of coral reef ecosystems should be protected within MNPZs (Townsville Forum 2002). The GBRMPA facilitated a process whereby the biological and physical diversity of the GBRWHA was classified by scientific experts into 70 'bioregions': 30 reef bioregions and 40 non-reef bioregions. To achieve the recommendations made by the RAP Scientific Steering Committee, all 70 bioregions need to have a minimum of 20% protection (refer to Section 3.1.2). Currently, only 14 of these bioregions have adequate protection. A rezoning of the Marine Park is therefore necessary to provide increased protection for the biodiversity of the GBR ecosystem while providing for reasonable use of the Marine Park. Other issues that will be addressed by the revised Zoning Plan include:

- As discussed in Part 1.2, there are 28 new coastal Sections of the Marine Park that must be zoned by the GBRMPA 'as soon as is practicable'.
- Given that the current zoning plans have been progressively developed over the last 15 years, some of the terms, management provisions and zone names differ slightly between various Sections. This current rezoning process will see the development of a single Zoning Plan for the Marine Park and will remove inconsistencies.
- The current zone boundaries are difficult to identify on the water, whereas a coordinate based zoning system will assist compliance and public understanding.

### 2.3 Risk assessment

Risk management is recognised as an integral part of good management practice. It is an iterative process consisting of steps, which, when undertaken in sequence, enable continual improvement in decision-making (AS 4360: 1999).

#### 2.3.1 The context

The maintenance of food webs and ecosystems is extremely important in ensuring the resilience of the GBR to enable it to withstand threats. A network of MNPZs will make the Marine Park less vulnerable to other natural and human disturbances such as over-exploitation of resources, reductions in water quality, sea-surface temperature increases due to global climate change, storms, exotic pests and disease (see Figure 2).

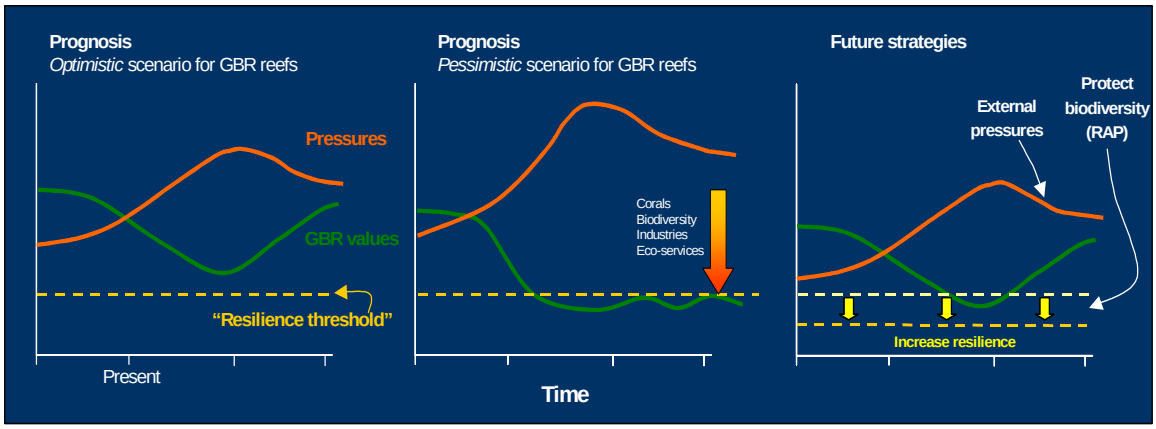




**Figure 2** This figure illustrates the relationship between GBR values and pressures on the Marine Park. Under the optimistic scenario (Panel 1), pressures outside the GBRMPA control (e.g. climate change, population pressures) continue to increase but then stabilise. The increased pressures have a significant impact on GBR values, but the relatively moderate increase in pressure allows the system to stay above the "Resilience threshold". This threshold indicates the point at which the system loses its ability to readily recover, or 'bounce back', from the effects of disturbances or pressures. If the Resilience threshold is crossed due to a greater and unsustainable increase in pressures, as depicted under the pessimistic scenario (Panel 2), serious and protracted impacts can result. Under this scenario, the system has been pushed beyond its resilience, severely compromising recovery potential and depressing key attributes of the system (such as coral diversity and abundance, biodiversity, economic health of dependent industries and ecosystem services) for an extended period. Our strategy is to actively work on two fronts to avoid irreversible losses to GBR values (Panel 3). The first is to raise awareness about the impacts of unsustainable increases in pressures and advocate for their reduction. The second is to support the natural resilience of the reef ecosystem through active management that protects biodiversity, including key functional species, maintaining intact food webs and preserving connectivity among habitats. Supporting the resilience of the ecosystem will serve as a critical insurance policy against unpredictable or unmanageable stresses, such as climate change and coral bleaching.

### *2.3.2 Risk identification*

Over-exploitation of fishery resources is a major pressure on coral reef environments worldwide. The removal of target species because of their economic or social value, generally fails to account for the functional importance of that species to the ecosystem. For example, the giant humphead parrotfish (*Bolbometapon muricatum*) plays an important functional role on the GBR and elsewhere by removing carbonate and transporting this to sediment aprons on the reef (Bellwood *et al.* in press). Each parrotfish ingests over 5 tonnes of structural reef carbonate every year. Exploitation of giant humphead parrotfish weakened not only ecosystem dynamics, but also the resilience of the reef structure itself (Bellwood *et al.* in press). In contrast, areas where this species is protected from fishing possess natural erosion and deposition cycles that contribute to greater resilience of the reef. Graham et al (2003) also showed that predation is an important structuring process in the reef system (e.g. in Palm and Whitsunday reefs) and the role of popular target species, such as coral trout, in predation is impacted by fishing.

Fisheries collapses have occurred all over the world despite, in many cases, high levels of knowledge and management effort. The most prominent of these was the Newfoundland cod fishery (Roughgarden and Smith 1996), which was perceived to be one of the best-studied and well-managed fisheries in the world. If such a 'well-managed' fishery could fail so spectacularly, there is no reason for complacency within Australia or the GBR.

In the last decade, the GBR ecosystem has experienced a marked increase in commercial fishing effort and harvest, including a five-fold increase in catch of sharks and a doubling of effort and catch in the reef line fishery, which predominantly targets coral trout. The population along the Queensland coast is projected to increase by 1.5% per year from about 729 000 in 2001 to almost 1 000 000 in 2021 (Department of Local Government and Planning 2001). Over 35% of Queensland households in areas adjacent to the Marine Park participate in recreational fishing (Higgs & McInnes 2003). The maintenance or even small decline in participation rates in recreational fishing will translate to an ever increasing number of people fishing in the GBR Marine Park.

### 2.3.3 Risk analysis

There is evidence of declines in habitat status, species numbers or risks to sustainability on the GBR for the following species:

- Loggerhead turtle, hawksbill turtle, green turtle;
- Indo-Pacific hump-backed dolphin, Irrawaddy dolphin;
- Dugong;
- Sooty tern, crested tern, common noddy, lesser-crested tern;
- Spotted mackerel, Spanish mackerel;
- Coral trout and other targeted reef fish ;
- Several species of shark;
- Tropical rock lobster and 'bugs';
- Black teat fish, some other commercial sea cucumber species;
- Wild stocks of pearl oysters and giant clams;
- Several species of *Syngnathid* (seahorses and pipefish);
- Half of the Marine Park is available to be trawled. Each pass of a trawl net removes between 5-25% of seabed life; 13 repeated trawls remove 70 - 90%. Some seabed communities could take up to 20 years to recover. (*Queensland's Fisheries Resources – Current condition and recent trends* 1998-2000, Poiner *et al* 1998).

As there is a negative trend in population size of most GBR species, for which information is available, it cannot be assumed that species, for which no information exists, are in good condition.

### 2.3.4 Risk evaluation

It is inevitable that the ecosystem as a whole will be subject to increased pressure over time because of:

- Easier access to increasing areas of the Marine Park;
- Increasing numbers of potential park users due to growth in population and visitor numbers;
- Climate change;
- Increasing range of uses;
- Improved technology, including fishing technology that may amplify fishing impacts;
- Increasing competition for use, including extractive and non-extractive use, of the Marine Park;
- Increased pollution from an expansion of onshore activities; and
- Increased traffic through the Marine Park.

| MANAGEMENT STRATEGY | POSSIBLE OUTCOMES | |
|---|---|---|
| | **No increase in external impacts on GBR system** | **Increase in external impacts on GBR system** |
| **NO REPRESENTATIVE AREAS PROGRAM** | **1. Reef system – status quo**<br>• Reef resilience not increased - *status quo*<br>• Fisheries resources OK<br>• Tourism value - *status quo*<br>• Other social values at risk - *status quo*<br>• No short-term costs | **3. Reef system degraded**<br>• Reef system more susceptible to other impacts<br>• Tourism values decrease<br>• Fisheries values decrease<br>• Fisheries management require more specific intervention<br>• Other social values decrease<br>• No short-term costs<br>• Long-term costs |
| **REPRESENTATIVE AREAS PROGRAM** | **2. Reef system OK**<br>• System more resilient to other impacts<br>• More and bigger fish<br>• More value to tourism<br>• Other social values enhanced<br>• Short-term costs | **4. Reef system protected**<br>• Insurance of fish stocks<br>• Tourism values maintained & increased<br>• System resilient to impacts<br>• Other social values maintained & increased<br>• Short-term costs |

**Table 1. Managing risk in the face of uncertainty.** A significant problem confronting managers is that while everyone believes that 'something must be done' to protect the Reef, management decisions almost always have to be taken in the absence of complete scientific knowledge. In such cases of uncertainty, the risks associated with not acting must be balanced against the risk of taking action with incomplete knowledge. This table presents an analysis of the risks and benefits of leaving things as they are, compared with implementing the Representative Areas Program. There are two ways of potentially 'getting it wrong' in decision-making for natural resource management: taking action to manage an impact that isn't real (2 above) or choosing not to address a problem that does exist (3 above). Both actions aren't necessarily the ideal actions for the situation however the costs of trying to reverse the outcome of 3 would be far greater than those associated with prevention (4 above). The outcome of 2 (above) brings social benefits regardless.

#### *2.3.5 Treatment*

A risk management approach to the threats facing the GBR suggests that regulatory action is warranted to insure the GBR against these impacts. Scientific 'proof' of the negative consequences of such impacts would require unambiguous evidence of degradation of the living GBR. Clearly, such an outcome is to be avoided (McCook, 2002). If not avoided, the cost of trying to restore the system, even if it were possible, would be prohibitive. The treatment is zoning of the Marine Park taking a multiple-use, ecosystem-based approach to managing both extractive and non-extractive activities to provide for biodiversity conservation while allowing reasonable, sustainable use. This includes implementing RAP.

#### *2.3.6 Monitoring and review*

The GBRMPA will continue to monitor the health of the reef including the effects of implementing different management regimes such as the RAP. The Zoning Plan will be reviewed consistent with the GBRMPA policy for regular review of zoning.

#### *2.3.7 Communication and consultation*

Public consultation on the Representative Areas Program has been one of the most extensive ever conducted in Australia, and attracted more than 30,000 public submissions in two phases of consultation. The details are set out in Section 6.

## 3 Objectives

### *3.1 Objectives of GBRMPA action*

The RAP is a major strategy of the GBRMPA for addressing the problems outlined above .The development of a new, comprehensive zoning plan for the entire Marine Park is how this strategy is implemented. The objective of the RAP is to increase the protection of biodiversity within the Marine Park through increasing the extent of Marine National Park Zones (MNPZ) (also called Green Zones, marine sanctuaries or 'no-take' zones) to help:

(a) maintain biological diversity of the ecosystem, habitat, species, population and genes;

(b) allow species to evolve and function undisturbed;
(c) provide an ecological safety margin against human-induced disasters;
(d) provide a solid ecological base from which threatened species or habitats can recover or repair themselves; and
(e) maintain ecological processes and systems.

Equally important is the fact that RAP, in conjunction with other measures, will help to ensure that the marine-based industries that depend on the GBR, such as tourism and commercial fishing, remain both viable and sustainable. The detail of these objectives were further refined from documentation (e.g. Strategic Work Program, the Act), and input from over 200 GBRMPA stakeholders and staff (for more detail see http: www.gbrmpa.gov.au/rap). Zoning the new coastal additions to the Marine Park also meets the requirements of s. 32 (1) of the Act.

### *3.1.1 General principles identified by ANZECC adopted nationally*

The RAP contributes toward the Australian Government's commitment to the development of a National Representative System of Marine Protected Areas (ANZECC/TFMPA 1998)(see Section 3.2.1). The ANZECC Task Force for Marine Protected Areas developed broad principles to guide development of representative protected areas throughout Australia's marine areas. These principles have provided broad guidance to the GBRMPA's RAP. Of the ANZECC principles, the CAR principles (*see below*) are most directly related to the achievement of the primary RAP objectives (Table 3).

**Comprehensiveness (C)** ensures encompassing the biological diversity referred to in objective (a).

- **Adequacy (A)** helps achieve undisturbed species functioning, an ecological safety net, a basis for recovery and maintenance of ecological process (objectives (b) through (e)).
- **Representativeness (R)** helps ensure that the biological diversity is represented and the ecological processes and systems maintained (objectives (a) and (e)).

### *3.1.2 Output of Scientific Steering Committee*

To assist the RAP an independent Scientific Steering Committee (SSC) was formed to provide expert advice to the GBRMPA about the biological and physical aspects of the GBR. The membership of SSC was decided by the GBRMPA after consultation with over 70 of Australia's senior scientists with expertise in the GBR region (for more detail see http://www.gbrmpa.gov.au/rap).

The SSC developed a set of Biophysical Operating Principals (BOPs) to guide the implementation of RAP. The principles derive from multiple sources – ANZECC, consultation with the Representative Areas Independent Reef and Non-Reef Expert Groups, Analytical Working Group, the Representative Areas team and internal review papers addressing reserve design issues (Hill 2000, Sampson 2001) (for more detail see http://www.gbrmpa.gov.au/rap). The principles are numbered sequentially for reference in the subsequent discussion (Table 2). The principles can be referred directly back to RAP objectives (Table 3). For background, origin and justification of the BOPs see GBRMPA's Technical Information Sheet (http://www.gbrmpa.gov.au/corp_site/key_issues/conservation/rep_areas/info_sheets.html)

**Table 2** BOPs recommended by the SSC

| Principle |
|---|
| 1. Have no-take areas each having minimum size of at least 20 kilometres along the smallest dimension (except for coastal bioregions) |
| 2. Have larger (versus smaller) no-take areas |
| 3.Have sufficient no-take areas to insure against negative impacts on some part of a bioregion |
| 4. Where a reef is incorporated into a no-take zone, the whole reef should be included |
| 5. Represent a minimum amount of each reef bioregion in no-take areas |
| 6. Represent a minimum amount of each non-reef bioregion in no-take areas |

| |
|---|
| 7. Represent cross-shelf and latitudinal diversity in the network of no-take areas |
| 8. Represent a minimum amount of each community type and physical environment type in the overall network, taking into account principle 7 |
| 9. Maximise use of environmental information to determine the configuration of no-take areas to form viable networks |
| 10. Include biophysically special/unique places |
| 11. Include consideration of sea and adjacent land uses in determining no-take areas |

If these principles were implemented in full, it was expected that around 25% of the Marine Park would be protected in MNPZs. These BOPs refer to minimum amounts of protection necessary to achieve the RAP objectives. In some cases, to implement the BOPs it was either too expensive or unnecessary to zone an area as MNPZ. For example, in some instances protecting turtle nesting habitat requires the restriction of noise and light. This can best be achieved by using management strategies.

**Table 3** Relationship between RAP objectives, general ANZECC principles and BOPs.

| Objective | ANZECC principle | Operational principle |
|---|---|---|
| a. Biodiversity | iii, v | 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 |
| b. Undisturbed functioning | iv | 1, 2, 5, 6, 10 |
| c. Safety net | iv | 1, 2, 3, 8, 10 |
| d. Recovery | iv | 1, 2, 4, 5, 6, 7, 10 |
| e. Processes | iv | 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 |

### *3.1.3 Social, economic, cultural and management feasibility operational principles*

An independent Social, Economic and Cultural Steering Committee has developed operational principles for assessing social, economic, cultural impacts and management feasibility to complement the BOPs defined above (see relevant GBRMPA Technical Information Sheet: http://www.gbrmpa.gov.au/corp_site/key_issues/conservation/rep_areas/info_sheets.html)

These principles are intended, as far as possible, to locate and configure new Marine National Park Zones (MNPZs) to:

- Maximise complementarity with human values, activities and opportunities;
- Ensure the final selection of MNPZs recognises social costs and benefits;
- Complement existing and proposed management, tenure and Native Title claim areas and issues; and
- Maximise public understanding and acceptance of MNPZs and ease of enforcement of MNPZs.

### *3.2 Regulations and policy currently in place*

Relevant Commonwealth legislation includes:

- *Great Barrier Reef Marine Park Act 1975;*
- *Great Barrier Reef Marine Park Regulations 1983;*
- *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act);*
- *Australian Heritage Commission Act 1975;*
- *Environment Protection (Sea Dumping) Act 1981;*
- *Historic Shipwrecks Act 1976;*
- *Native Title Act 1993;*
- *Protection of the Sea (Prevention of Pollution for Ships) Act 1983;*
- *Sea Installations Act 1987;*
- *Australian Maritime Safety Authority Act 1990*
- *Navigation Act 1912*

Legislation enacted by the State of Queensland that is relevant to the GBR includes:

- *Fisheries Act 1994 (Qld)*
- *Environmental Protection Act 1994 (Qld)*
- *Coastal Protection and Management Act 1995 (Qld)*
- *Nature Conservation Act 1992 (Qld)* (See also Nature Conservation (Whales and Dolphins) Conservation Plan 1997 and the Dugong Conservation Plan 1997)
- *Marine Parks Act 1982* (Qld)
- *Native Title (Queensland) Act 1993*
- *Integrated Planning Act 1997 (Qld)*
- *Transport Operations (Marine Pollution) Act 1995* (Qld)
- *Transport Operations (Marine Safety) Act 1994* (Qld)

### *3.2.1 Australian Government Policy*

#### *Oceans Policy*

- Australia's Oceans Policy includes the Australian Government's commitment to expand Australia's existing marine reserve system through the establishment of a National Representative System of Marine Protected Areas (ANZECC, TFMPA 1998); and
- A commitment to complete a review of existing protection arrangements to ensure appropriate levels of protection for all habitat types within theGBRWHA (Australia's Ocean Policy, 1998).

Twenty-eight new coastal areas have been added to the Marine Park since 2000 (Section 1.2)

#### *International Conventions*

International conventions relevant to the Great Barrier Reef include:

- Convention for the Protection of the World Cultural and Natural Heritage, 1972 (the World Heritage Convention);
- Convention on Biological Diversity, 1992 (the Biodiversity Convention);
- Convention on International Trade in Endangered Species of Wild Fauna and Flora, 1973 (CITES);
- Convention on the Conservation of Migratory Species of Wild Animals, 1979 (the Bonn Convention);
- Convention on Wetlands of International Importance Especially as Waterfowl Habitats, 1971 (the Ramsar Convention);
- International Convention for the Prevention of Pollution from Ships, 1973 (the MARPOL Convention);
- United Nations Convention on the Law of the Sea, 1982 (the Law of the Sea Convention or UNCLOS); and
- United Nations Framework Convention on Climate Change, 1992 (the FCCC).

Implementation of the RAP helps fulfil Australian Government responsibilities associated with each of these conventions.

## 4 Options for management

#### *Option 1 - Retain existing zoning*

Currently 4.6% of the Marine Park is highly protected within MNPZs. As discussed in Section 2 the GBR is under pressure and this level of protection is not adequate to ensure a healthy GBR ecosystem into the future. The GBRMPA collated the very best available data and expertise to describe the variety of life in the GBR system.

**Table 4**. Number of bioregions with MNPZs under existing zoning

| Bioregion type | Zero MNPZ | <1-5% MNPZ | 5-25% MNPZ | >25% MNPZ |
|---|---|---|---|---|
| Reef bioregions | 1 | 8 | 11 | 10 |
| Non-reef bioregions | 11 | 18 | 7 | 4 |
| Total | 12 | 26 | 18 | 14 |

Only one MNPZ in the Marine Park meets the principle recommending a minimum size of 20 kilometres in any dimension and only four are greater than 400km$^2$ overall.

Table 5 shows that thirty bioregions have less than three replicate MNPZ, which provides considerably less insurance against unforeseen natural disturbances and human impacts than recommended in the BOPs (Table 2).

**Table 5.** Number of existing MNPZs per bioregion under existing zoning

| MNPZs per bioregion | 0 | 1 | 2 | 3 | 4 | 5 | >5 |
|---|---|---|---|---|---|---|---|
| Number of bioregions | 13 | 5 | 12 | 8 | 6 | 6 | 22 |

These data clearly indicate that the existing network of highly protected MNPZs within the Marine Park needs to be improved and increased. If not, the biodiversity of the ecosystem will decline as will the values associated with that biodiversity. Section 2 also highlights the problems with the existing zoning.

In summary, retaining the existing zoning would mean:

- The diversity, productivity and resilience of the GBR ecosystem will decline;
- Failure to recognise contemporary values and wishes of Australian (especially Queensland) communities (AEC 2003);
- Values associated with the GBR, will decline;
- Lack of certainty for Marine Park users of the new coastal Sections that are currently unzoned;
- Inconsistency between zoning provisions within different sections is, and remains, a source of confusion; and
- Difficulties with compliance due to poor definition of zone boundaries remain.

In addition maintaining the existing zoning disregards:

- Strong public support for greater protection of the Marine Park;
- Contemporary wishes for extensive community input to revision of zoning in the Marine Park;
- Aboriginal and Torres Strait Islander interests; and
- New scientific data and best scientific advice on management of the Marine Park.

***Option 2 –Implement alternative management techniques***

It has been suggested, for example in submissions, that other conventional fishery management tools, including input and output controls designed to ensure fishery sustainability (e.g. size and bag limits, seasonal closures, gear restrictions, quotas, etc.), could be implemented to protect biodiversity. It was also suggested that tourism activities should be controlled and water quality improved.

The objective of RAP is not to manage any one activity or impact but to protect the biodiversity of the Marine Park. Rezoning the Marine Park in accordance with the revised Zoning Plan offers distinct biodiversity conservation benefits compared with existing conventional fisheries management tools and compared with existing management measures directed at minimising impacts of tourism and directed at improving water quality. Zoning of the Marine Park is a multiple-use, ecosystem-based approach to managing both extractive and non-extractive activities to provide for biodiversity conservation while allowing reasonable, sustainable use. Ultimately, it is not a question of whether zoning is a better approach than other management measures, but a question of how to combine all available management tools to provide maximum aggregate benefit across the entire spectrum of GBR habitats and species. The need for such an ecosystem-based approach is emphasised in the National Strategy for Ecologically Sustainable Development (1992), the National Strategy for the Conservation of Australia's Biological Diversity (1996), Australia's Oceans Policy (1998), and the EPBC Act.

It is not feasible to only implement changes to just some regulations for some activities because:

- Management of, for example, fisheries for stock exploitation alone, tourism or impacts from catchments alone does not ensure maintenance of biodiversity;
- Management of some activities is not the role of GBRMPA, for example, fisheries management is the role of the Queensland Government;
- Management of fishing effort is a highly uncertain activity with sustainable limits from an ecosystem protection perspective being almost impossible to set and enforce;
- Implementing fisheries or other specific management techniques offers no insurance for ecosystem maintenance in the instance of any deficiencies in the management arrangements;
- The health and resilience of the GBR ecosystem will continue to decline or aspects of the system will be at high risk of decline;
- Values associated with the GBR will decline or be at high risk of decline;
- Lack of certainty for Marine Park users of the new coastal Sections that are currently unzoned will not be addressed;
- Inconsistency between zoning provisions within different sections will remain a source of confusion; and
- Difficulties with compliance due to poor definition of zone boundaries will remain.

***Option 3 – Implement the RAP by rezoning the Marine Park***

The GBRMPA has received the best available scientific advice about how to achieve protection of biological diversity within the Marine Park (Section 3.1). Application of this advice requires rezoning the Marine Park to ensure that at least a minimum amount of every bioregion and habitat is included in MNPZs.

This option aims to provide necessary protection to representative examples of all biodiversity in the Marine Park and also enhances the resilience of the system to external pressures not directly controlled by zoning. The GBRMPA has also collated the best available economic, social and cultural advice (Section 3) and information to maximize positive and minimize negative impacts, while still implementing the scientific recommendations to the greatest extent possible. The data used to implement the social, economic and cultural operational principles are listed on the RAP website at http: / / www.gbrmpa.gov.au / rap.

Rezoning the Marine Park also provides an opportunity to meet other GBRMPA obligations under the Act, relevant Government policies and to improve other aspects of zoning. As mentioned above, 28 new coastal Sections have been included in the Marine Park and have yet to be zoned. As these new areas are being zoned for the first time, the entire suite of zoning options available to management, are being considered.

Compliance and enforcement has been complicated by the existing boundary descriptions, particularly in offshore zones (e.g. zone boundaries described as ‘500m from the reef edge’). Unlike inshore areas where coastal geographical features may be used for navigation, there are no landmarks offshore to help Marine Park users locate zone boundaries. The desirability of a coordinate-based approach to zone boundaries in offshore areas has long been recognised. Recent advances in mapping and Global Positioning System (GPS) technology have enabled this approach to be applied in the establishment of offshore zone boundaries in the revised Zoning Plan.

The use and entry provisions for all the zones of the Marine Park should be consistent throughout its whole area. Currently, they are not. As five different Zoning Plans evolved over a fifteen-year period, new and better information changed management practices to improve zone objectives and use-and-entry provisions. As a result, the Zoning Plans for each of the five Sections of the Marine Park are inconsistent and cause confusion. These historical inconsistencies are removed in the revised Zoning Plan.

In summary, rezoning the Marine Park is the only feasible option to protect the biodiversity of the Marine Park because:

- A network of MNPZs will assist to maintain the health and resilience of the GBR ecosystem so that the GBR ecosystem will be maintained as required by the GBRMPA Act 1975;
- Values associated with the GBR, will be maintained;
- MNPZs offer insurance against any deficiencies in fisheries or other management arrangements;
- There is strong public support for (and expectation of) greater protection of the Marine Park;
- It allows widespread and contemporary community input to the zoning of the Marine Park;
- Aboriginal and Torres Strait Islander interests are being addressed;
- Best scientific advice about management of the Marine Park is being used;
- There will be certainty for Marine Park users of the new coastal Sections that are currently unzoned;
- Inconsistency between zoning provisions within different sections will be removed; and
- Introduction of coordinate-based zone boundaries will assist users to locate boundaries and therefore improve compliance.

# 5 Impact analysis

The impact analysis has been conducted with regard to the entire rezoning of the Marine Park, including changes due to implementation of RAP, due to ensuring consistency throughout the Marine Park and including changes due to using coordinate-based boundaries.

## *5.1 Who is affected*

The people most directly affected by the proposed rezoning are present and future generations of Australians. The Act and Regulations provide a framework for the GBRMPA in managing the Marine Park. Australia also has an obligation to protect the GBRWHA (99% of which is in the Marine Park) for the global community. International visitors account for about half of the 1.8 million people who visit the GBR every year (Shafer *et al* 1998, GBRMPA EMC data, 2002, McCoy 2003). Overseas submissions, received during both public submission phases of the RAP, provide evidence of significant global interest in the GBR. As many coral reef ecosystems around the world are in poor or declining condition (Wilkinson 2002), this interest is likely to increase.

Other affected parties include commercial and recreational fishers, government agencies, conservation groups and other NGOs, industry sectors, Traditional Owners and other Indigenous interests, research organisations, members of coastal communities adjacent to the Marine Park, and the national and international community, generally. These parties will be affected in different ways. Recreational users, tour operators and tourists constitute the most numerous and economically significant group of reef users (Productivity Commission 2003).

## *5.2 Allocate expected costs and benefits of feasible option across groups*

Values that people associate with the GBR Marine Park include:

- **Direct values** (tourism, recreational fishing, other recreational activities, Indigenous uses, education, research, coastal and international shipping, ports, medical resources / bio-prospecting, commercial fishing – including charter fishing, game fishing and harvest activities);
- **Indirect use values** (shoreline / coastal protection, maintenance of migratory species and nursery habitats, organic matter and nutrient storage, organic matter and nutrient recycling, waste recycling, waste reception, fixation of solar energy and biomass production, visual amenity, Indigenous cultural values, lifestyle values, spiritual values); and
- **Non-use values** (option values, existence values, bequest values, vicarious use values)(DeGroot 1992, Spurgeon 1992, Brown *et al*. 1993, Holmlund and Hammer 1999, Moberg and Folke 1999, Ronnback 1999, Haycock and Driml 2002).

Given the declining global status and trends in the health of coral reef ecosystems, it can be expected that healthy coral reef systems and their values will be increasingly scarce and that these values will become more important over time. Adoption of increased protection is, therefore, an investment in a scarce resource and will maximise the ongoing utility of the GBR system.

There will be offsets over time due to increased protection for biodiversity providing a baseline of resilience that will allow people and communities to structure their activities in a more sustainable way for their long-term protection. Environmental protection is the cost that has to be borne in order to maintain and protect the values listed in this section. It is also an investment that will increase the yields and values of this asset into the future. In preparing the revised Zoning Plan, all available data, including public submissions and other information were used to maximise positive and minimise negative impacts upon all interested groups, including extractive users of the Marine Park.

### *5.3 Summary of benefits and costs*

Table 10 summarises the main costs and benefits to different groups (Section 5.13).

### *5.4 Indigenous people including Traditional Owners*

The Indigenous population on the GBR coast in 2001 was 36 821 or 5% of the total coastal population. The majority of the Indigenous coastal population is located in the Cairns, Townsville, Rockhampton, Mackay, Hinchinbrook, Cook and Thuringowa Local Government Areas. Traditional Owner groups and Native Title Representative Bodies are concerned about possible impairment of their Native Title rights by the possible imposition of Regulations or changes to existing Regulations. The revised Zoning Plan is not intended to impair native title. For example, the revised Zoning Plan provides for traditional hunting, fishing and cultural practices to continue.

### *5.5 Australian public*

Independent studies show that the Australian public values the GBR ecosystem and wants it protected (AEC 2001, Moscardo 2001, AEC 2002, AEC 2003). The most recent study showed that over three-quarters of Australians think that the reef is under threat. About 70 per cent of Australians think that more than 30 per cent of the GBR should be in MNPZs. About 82 per cent think it is acceptable to lose some use of the reef to secure increased protection for it.

Hundloe *et al.* (1987) estimated the partial option and existence values of the GBR to Australians. The estimated value was about $45 million. Taking inflation into account, this would be about $98 million today. Even in 1987, this was an underestimate of the value, as it excluded Australians who did not visit the reef, and excluded the range of values they may be assumed to hold.

### *5.6 Coastal Queensland communities*

The coastal Queensland communities adjacent to the GBR are the twenty-six Local Government Areas from Bundaberg City in the south to the Cook Shire that takes in the majority of Cape York Peninsula. The population along the GBR coast at the 2001 census was 729 237 persons, representing 20 per cent of Queensland's population of 3,627,816. The majority of the population is located in Townsville-Thuringowa, Cairns, Mackay, Gladstone and Bundaberg (ABS 2001). Eleven of Queensland's fifteen ports are in the GBR coastal region and in 2000/01 they accounted for $14.5 billion worth of exports, predominately metal ores and mineral products (OESR 2001). GBR coastal communities have a combined labour force of 341,042 people with an unemployment rate of 8.3 per cent[1] (ABS 2001). It is estimated that:

- 10.5 per cent (47,600 people) of the overall GBR coastal workforce is employed in tourism related industries[2];
- 8 per cent (27,880) Manufacturing;
- 6.8 per cent (23,934) Health and Community Services;
- 4.9 per cent (17,400) Agricultural production; and
- <1 per cent (641) of the GBR coastal workforce is employed in the commercial fishing industry.

GBR tourism is the third most significant industry after mining and metal processing (Productivity Commission 2003)(Table 6).

[1] Source: ABS, 2001 Census of Population and Housing, Basic Community Profile (BCP) - Second Release, 2001 Geographical Boundaries

[2] Note that this covers all the GBR catchment tourism and not just GBR-related tourism

**Table 6** Economic and social values of main industries in the GBR Catchment or Lagoon (**Source:** Productivity Commission 2003)

| Industry | Definition of industry | Year | Gross Value of Production of Industry |
|---|---|---|---|
| GBR Fisheries | Gross financial value commercial fishing for the GBR | 1999-00 | $119,000,000 |
| GBR Recreational Activities | Value of the total expenditure by the recreational fishing and boating sector | 1999-01 | $240,000,000 |
| GBR Tourism | Estimate of amount all visitors (both land and marine based) | 1999 | $4, 269,000,000 |
| | Estimate of Gross Financial Value for just marine based tourism in the GBR region[3]. | 2000-01 | $589,000,000 |
| Beef and Veal | In GBR catchment as defined in the Productivity Commission report on the GBR 2003 | 1999-00 | $1,017,000,000 |
| Sugar | In the GBR catchment as defined in the Productivity Commission report on the GBR 2003 | 1999-00 | $803,000,000 |
| Horticulture | In GBR catchment as defined in the Productivity Commission report on the GBR 2003 | 1999-00 | $708,000,000 |
| Mining | In GBR catchment as defined in the Productivity Commission report on the GBR 2003 | 2000-01 | $7,052,000,000 |

[3] Source: GBRMPA (in prep)

Studies (Section 5.5) showed that Queensland coastal communities also value the GBR ecosystem and want it protected (AEC 2001, Moscardo 2001, AEC 2002, AEC 2003). The most recent study showed that about three-quarters of people in coastal GBR communities think the reef is under threat, which is similar to the Australian public generally, and more than 90 per cent want greater protection for the GBR. This is consistent with the views of other Australians. About 64 per cent of people along the GBR coast think that over 30 per cent of the GBR should be in MNPZs; 80 per cent people were prepared to accept some loss of use to achieve increased protection for the Reef. These data indicate that people living on the GBR coast have very similar views to other Australians with respect to improving protection for the GBR.

These are the communities most likely to suffer short-term costs (due to changes to access in the Marine Park), and are also those most likely to enjoy the medium and long-term direct and indirect benefits arising from the implementation of the RAP.

### *5.7 Tourism sector*

Human impacts need to be managed to keep the GBR in good condition for the entire range of human values, including tourism. To minimise their impacts on the Marine Park, tour operator best practice guidelines call for:

- Protect coral reefs and other habitats such as seagrass from anchor damage, poor diving practices, waste disposal, reef walking and collecting;
- Protect turtles and sea birds from disturbance, especially during nesting seasons;
- Respect the cultural importance of the GBR to Aboriginal and Torres Strait Islanders;
- Minimise conflicts of use, particularly at high use sites; and
- Inform the wider community about the GBR and its World Heritage values.

Tourism is one of the largest commercial activities in the Marine Park and adjacent catchments, generating over $4.2 billion per annum and employing about 47600 people (Productivity Commission 2003). The direct marine-based tourism industry is a major contributor to the local and Australian economy contributing over $580 million in Gross Value of Production (GVP) per year. Tourism attracts approximately 1.8 million visitors into the Marine Park each year (excluding ferry passengers, approximately 2.37 million transfers in 2002 by EMC). Service industries (such as accommodation, catering, cafes/restaurants, vessel maintenance slipping, electrical, and mechanical) are also critically important and support tourist boats and facilities on the water. 'Not everyone understands the important flow on effects from Marine Tourism and the benefits. Small percentage changes in this league have significant effects' (KPMG Consulting, 2000, *Economic and Financial Values of the Great Barrier Reef Marine Park*, GBRMPA Research Publication No.63. GBRMPA Townsville available at http://www.gbrmpa.gov.au/corp_site/info_services/publications/research_publications/rp63/index.html).

In 2002, there were approximately 730 permitted tourism operators and 1500 vessels and aircraft permitted to operate in the Marine Park. For more details on these operations see http://www.gbrmpa.gov.au/corp_site/key_issues/tourism/tourism_on_gbr.html

The Productivity Commission (2003) forecasts that GBR catchment tourism will grow by 15.4% over the period 2001-10 and 30.5% over the period 2010-20, giving total forecast growth for 2001-20 of over 50.6%. Bailey et al (2003) find that the forecast predictions for growth in tourism are spread throughout the different statistical divisions within the GBR region. The outcome of a forum on *Protecting the Great Barrier Reef's Tourism Future* held by CRC Reef in July of this year stated that '…it is imperative to implement the Commonwealth's RAP ... to ensure the long term viability of the … billion dollar tourism industry.' Hence, the values of marine-based tourism in the Marine Park will be maintained and enhanced by implementation of the revised Zoning Plan.

Sensitivity analysis of forecast analysis suggests that changes to the risk attached to future earnings has a significant influence on the expected tourism expenditure in the Marine Park

region over the next 20 years. For example, if there is no change in the annual number of visitors, but the perceived risk is lower this could raise the expected cumulative expenditure by $13 billion (Bailey et al 2003). The kinds of risks referred to include the risk of a decline in the health of the reef and implementing RAP would lower the risk.

Using the Environmental Management Charge data (GBRMPA 2002), in the current Zoning Plan, there were approximately 635, 000 location visits (or 31 % of total location visits) to MNPZs (i.e. Marine National Park B and National Parks zones in 2002). In the proposed Zoning Plan, on present usage, this figure would approximately double to 1,231,000 (or 60% of total location visits) within MNPZs (i.e. Marine National Parks) (See Table 7).

| Plan | Location Visits | % Of total location visits |
|---|---|---|
| Current Zoning Plan | 634 723 | 31 |
| Proposed Zoning Plan | 1 231 491 | 60 |

**Table 7 Location visits to green zones for both the current and Proposed Zoning Plans.**

The above analysis demonstrates that in developing the revised Zoning Plan, the GBRMPA has tried to complement human uses such as tourism (i.e. diving, snorkelling) so that the values associated with these uses are substantially enhanced.

Given the increased attractiveness of a well-maintained reef ecosystem when many other reefs around the world are suffering from degradation, visitor numbers to the GBR are likely to increase. Even a minor increase in visitor numbers due to implementation of RAP, such as five per cent, would represent a considerable boost to the Australian economy.

### *5.7.1 Tourism industry representatives*

Tourist industry representatives include the Association of Marine Park Tourism Operators, Queensland Tourism Industry Council and Tourism Queensland. These groups have recognised that they will benefit from the new zoning plan because it offers greater security for their members, expands the potential for sustainable tourism and will enable them to offer higher quality destinations into the future. The new zoning will also mean a greater range of GBR 'products' to promote.

### *5.7.2 Tourism operators*

Given more MNPZs means more and bigger fish (Mapstone *et al* (2003), Russ (2002), Roberts & Hawkins (2000)) and the continuing expansion of recreational diving activity around the world in an environment where many reefs are declining in health, the RAP process is extremely likely to lead to an increase in visitor numbers. Even a small increase in visitors to the GBR would bring significant benefits to local tourism and, therefore, local communities' economies and employment levels (Bailey et al 2003).

The revised Zoning Plan also offers protection of prime tourist destinations, greater incentives for site stewardship and, potentially, reduced incidence of conflicts of use. Tour operators will also benefit from a greater range of protected areas to choose from for operations and an expansion of potential for sustainable tourism and eco-tourism. It is anticipated that the simpler boundaries will make it easier for visitors to comply, and for authorities to enforce.

### *5.7.3 Tourists*

Tourists may be locals from GBR communities, domestic visitors from other parts of Australia, or international visitors. Healthy ecosystems with increased fish biomass and diversity mean a higher value experience for tourists with greater flow-on effects in terms of revisits, word-of-mouth and greater appreciation of the marine environment. For example, most visiting tourists are not aware that fishing can happen in the Marine Park and consider their reef experience diminished if they interact with fishers while on the reef. Marine

sanctuaries in a greater variety of locations also mean a wider range of products from which to choose and that add to their value of a 'reef experience'. Given the predicted continuing decline of coral reef ecosystems around the world the attractiveness of a well- managed GBR to an expanding number of visitors will increase.

#### *5.7.4 Non-extractive recreational users*

People use the Marine Park for activities such as snorkelling, diving, kayaking, sailing, boating, shell collecting and more. Fishing may conflict with or diminish the 'Reef experience' for these users. The interaction may be direct (someone diving in the same location as someone fishing) or indirect, as in the decreased value of a snorkelling experience due to the absence of big fish. Marine sanctuaries in a greater variety of locations also mean a wider range of high quality experiences from which to choose and that adds to their value of a 'reef experience' This should have a positive impact on the local economies that supply goods and services to these people.

### *5.8 Fishing*

The RAP is focused on increasing protection of biodiversity. The implementation of a system of MNPZs is likely to benefit fisheries through improved recruitment and 'spillover' effects. These benefits will vary from species to species and increase over time. With growing concerns about fish stocks worldwide, the permanent closure of a part of available fishing grounds is seen as an essential component of management strategies aiming to deliver ecologically sustainable fisheries. The rezoning is expected to bring other benefits including:

- Protection of important habitat, spawning areas, aggregation sites and nursery grounds;
- Increased stock abundance and spawning biomass;
- Increased mean age and size of fish;
- Improved reproductive output;
- Enhanced settlement and recruitment of juveniles;
- Protection of genetic diversity;
- Maintenance or enhancement of yields in adjacent fished areas;
- Reduced variability and uncertainty in fisheries yields; and
- Increased likelihood of sustainable exploitation (Mapstone et al 2003, Ward et al 2001).

It is important to note that while zoning may prohibit particular fishing methods in some areas, other nearby areas will be available where the fishing method is allowed.

#### *5.8.1 Recreational fishing and collecting sector*

Recreational fishers participate in the reef line and pelagic finfish fisheries, the east coast inshore line and bait net fisheries, recreational collecting (including oyster and bait gathering, shells and other animals), the blue swimmer and mud crab fisheries and, to a small degree, in the spanner crab and tropical rock lobster fisheries in the Marine Park. The value of the total expenditure by the recreational sector in the GBR catchment, including recreational fishing, is about $240 million (Productivity Commission 2003). This does not include the non-economic importance and value to communities of recreation in the Marine Park. The GBRMPA considered the ability of recreational fishers to adapt when assessing options for the placement of MNPZs.

Overlay of recreational fishing data and the GBRMPA zoning datasets was used to explore the relationship between recreational fishing and the proposed Zoning Plan. Patterns of recreational fishing effort can be estimated from Queensland Fisheries Service Recreational Fishing Diaries (RFISH, 1997 and 1999), from Suntag[4] catch and release records, and from the distribution of boat-ramps (which are recorded by Queensland Transport and by the Surf-life-saving clubs).

[4] SUNTAG is part of AUSTAG, an umbrella program that coordinates the collection of tagging and catch and effort by the Australian National Sportfishing Association members throughout Australia. SUNTAG was established in QLD in the late 1970's and is funded by the Queensland Fisheries Service and managed by Infofish Services.

Approximately 8-10% of the recreational fishing days reported in RFISH diaries are from within the Marine Park; of these 1-2% of fishing days are spent within areas that would be closed to fishing under the Zoning Plan. Zoning prohibits fishing in Marine National Park, Preservation and Scientific Research Zones. Of the 36,600 Sunfish tagger-days from 1995 to 2000, 485 (approximately 1%) would be closed under the Zoning Plan.

| Zone. | Tagger-days | % of all tagger-days | Zone available for recreational Fishing (Y/N) |
|---|---|---|---|
| Preservation | 1 | 0 | N |
| Marine National Park | 485 | 1 | N |
| Scientific Research | 1 | 0 | N |
| Buffer Zone | 0 | 0 | Y |
| Conservation Park | 1317 | 4 | Y |
| Habitat Protection | 1444 | 4 | Y |
| General Use | 1552 | 4 | Y |
| Outside GBR | 31800 | 87 | Y |

**Table 8**: **Suntag recreational fishing locations in the Proposed Zoning Plan zone. (Suntag data 1985-2002)**

Using the boat-ramp data, in the proposed Zoning Plan 169 $km^2$ (4%) of the area most likely to be recreationally fished (i.e. within 5km of a Queensland Transport boat-ramp) would be within Zones closed to fishing (See Table 9).

| Recreational Fishing (Y/N) | Area $km^2$ | Percentage |
|---|---|---|
| Not available to fishing within 5km of boatramp | 169 | 4 |
| Yes – available to fishing within 5km of boatramp | 3943 | 96 |
| Grand Total | 4112 | 100 |

**Table 9**: **Percentage of the area within 5km of Queensland Transport boat ramps that is and is not available to fishers under the revised Zoning Plan.**

All indications are that the revised Zoning Plan will have minimal impact on recreational fishers even if anecdotal information suggests that these data are slight underestimates. Most will benefit directly or indirectly as many important inshore fishing areas have been zoned to accommodate fishing in various forms, including limited fishing. The frequency and / or cost of fishing trips are unlikely to be affected by the increased area of MNPZs throughout the Marine Park. The purchase of capital items such as boats and motors for recreational fishing, or support industries based on recreational fishing expenditure, will be unaffected by the new Plan. Indeed, it is likely that, in the medium to longer term, more MNPZs as proposed in the revised Zoning Plan will enhance the GBR's reputation as a fishing destination.

### *5.8.2 Commercial fishers*

Commercial fisheries in the Marine Park include the trawl, coral reef and pelagic finfish, net and inshore finfish, pot (crab) fisheries, and a suite of dive-based fisheries (sea cucumber, trochus, tropical rock lobster, marine aquarium fish and coral). Commercial fisheries effort and catch data provided to the GBRMPA by the QFS do not enable distinctions to be made between fishing within the Marine Park and fishing in adjacent estuarine and intertidal foreshore waters (Williams 2002). Despite this, it is well understood that substantial parts of some fisheries occur outside the Marine Park.

The estimated mean annual Gross Value of Production (GVP) of all commercial fisheries managed by the QFS and operating in the Marine Park is approximately $130 million (QFS data). This assessment includes 2002 logbook data and excludes those parts of fisheries outside the Marine Park. Over half of GVP is attributable to the East Coast Otter Trawl Fishery ($72 million including $4 million from the banana prawn fishery). Line fishing accounts for almost another third of GVP ($34 million). Most of the other fisheries are estimated to each comprise 5% or less of the total value of the commercial fisheries. Although most GVP is attributed to fishing within the Marine Park, it has been estimated that up to half of the inshore net and mud crab effort and harvest occurring in coastal areas in the GBR Region actually occurs in the Marine Park. Where there was some uncertainty, the GBRMPA tended to overestimate the proportion of effort and harvest attributable to Marine Park (versus GBR Region) activities. Hundloe *et al* (2003) consider that no mud crab fishing occurs in the Marine Park. Other fisheries, spanner crab, blue swimmer crab and beam trawl, have significant effort outside the Marine Park. Overall, the revised Zoning Plan prevents fishing in areas where the GVP is currently equal to 10.51% of total fisheries GVP or $13.68 million.

Benefits to commercial fisheries of the proposed zoning include:

- Contributing to ecologically sustainable fisheries in the medium- to long-term;
- Increased numbers and larger individuals of target species than would be otherwise available in the medium- to long-term due to 'spill-over effects';
- Improved recruitment from increased reproductive output (more larvae) in the medium- to long-term; and
- improved resilience and maintenance of the ecological sustainability of the GBR ecosystem.

Any estimates of potential short-term impacts on effort, are approximations due to data limitations discussed above and in Section 5.16. Based on discussions with QFS and Queensland Seafood Industry Association, the Productivity Commission (2003) estimated that the GBR Region's fisheries GVP was forecast to decline 6% by 2010 and 21% by 2020 period, regardless of the review of the zoning plan for the Marine Park. The short-term impact of the rezoning should be viewed in this context.

The capacity to adapt to change will vary from fishery to fishery, and from fisher to fisher. Factors which will impact on the adaptability of fisheries include:

- The percentage of the fishery being located in the proposed protected zones;
- The sustainability of fisheries under existing management arrangements and practices;
- The availability of alternative fishing grounds;
- Search costs associated with locating suitable new fishing grounds;
- Changes in patterns of fishing effort in those areas where fishing activity may be displaced following implementation of the new zoning plan;
- Spillover and recruitment benefits from protected areas, that could potentially arise in some fisheries as a result of the number, size and fecundity [fecundity is higher for older fish and there are more older fish in protected areas] of stocks increasing in protected areas. Realisation of spillover and recruitment benefits would be dependent on movement of larvae, and juvenile and adult fish from protected into non-protected areas;
- The dependence of fishers on GBR fisheries income compared with other sources of income;
- The recent [trawl] and soon-to-be-introduced [eg reef line] fleet rationalisation and impending inshore finfish management review offsetting the effects of reduced fishing area and / or catch reduction;
- Age of fishers;
- Education of fishers;
- Number of dependents relying on fishers for income;
- Diversity and robustness of the local economy.

Given this range of factors, the amount of GVP or value-added (VA)[5] derived from areas that will no longer be available to fishing in the Marine Park due to the rezoning (and reported below) is likely to be greater than the actual impacts that will be realised.

#### *5.8.2.1 East Coast (Otter) Trawl Fishery*

The Queensland Government introduced a revised East Coast (otter) Trawl Fishery Management Plan in January 2001. The fishery has consequently undergone major structural adjustment in the last three years, with the number of otter trawlers operating in the fishery being reduced from 750 to about 500 and fishing effort being reduced across the fleet by approximately 15%. This occurred following extensive negotiations between the industry and the Australian and Queensland Governments with an awareness of the upcoming rezoning of the Marine Park. The revised management arrangements made significant improvements to the management of the fishery. The Queensland east coast otter trawl fleet is highly mobile. Most trawlers involved in the fishery operate in several areas and travel large distances. Progression of the revised Zoning Plan will have minimal impact on the fishery.

*In summary:*

- Total GVP **$72.3 million**
- Historical GVP in proposed no-take areas in the GBR Marine Park: **$4.81 million**
- Value added component: **$900,000**
- Expected degree of adaptability to Zoning Plan: **High** except for some small inshore banana trawl fishers

#### *5.8.2.2 Line Fishery*

The coral reef finfish fishery is second only to the trawl fishery in terms of its economic value (commercial and recreational fishing, including charter), and its potential to affect the Marine Park ecosystems. The main issues in the coral reef finfish fishery are the increasing commercial effort (largely driven by the high prices in the live fish trade), local depletion of targeted reef fish (particularly on inshore reefs), and latent effort (there are a substantial number of previously unused commercial fishing licences).

The Queensland Government introduced a management plan for the fishery in mid-2003 that was developed in the knowledge that the RAP was being implemented. The commercial line fleet is mostly mobile and able to transport live fish over long periods. The vessels will be able to target alternate reefs, if necessary, in response to the Draft Zoning Plan. Nonetheless, the RAP has endeavoured to minimize the impact of zoning on the commercial reef line fleet wherever possible.

Given the impending management interventions proposed by the QFS in pursuit of an ecologically sustainable fishery, the progression of the revised Zoning Plan is unlikely to have a significant negative impact on the fishery. Approximately 16% of GVP is currently derived from areas proposed to be closed to fishing. On the other hand, in the medium- to long-term, more highly protected MNPZs are likely to benefit this fishery.

*In summary:*

- Total GVP **$33.9 million**
- Historical GVP in proposed no-take areas in the GBR Marine Park: **$5.42 million**
- Value added component: **$1.03 million**
- Expected degree of adaptability to Zoning Plan: **High**

[5] Value-added (VA) refers to the value of outputs produced by an industry less the value of its inputs. In essence, this surplus equates to the sum of incomes earned directly from an industry's production process, including returns to labour and capital.

#### 5.8.2.3 Charter Fishery

Several types of charter fishing operations take paying customers on trips to recreationally fish in the Marine Park. They include game boats that target pelagic species including marlin, sailfish (often catch and release fishing) and tuna; charters that target coral reef fish and Spanish mackerel; and inshore/fishing guide charters, targeting species such as barramundi. The GVP of the charter and game fishers that operate in the Marine Park is approximately $50 million, based on estimates by Fenton [2002] and the GBRMPA [2003].

Game boats and most reef fishing charter boats have the mobility to move over a wide area and can use alternative areas if areas they now fish are zoned 'green'. Approximately 13% of days fished of these fishers is located in areas proposed as MNPZs. On the benefit side, some important game fishing areas in the Cairns/Lizard Island area have been zoned as Buffer (light green) zones, which specifically allows trolling for pelagic species, while excluding other forms of fishing. Other important inshore fishing areas have been zoned to allow for fishing or limited fishing activities such as undertaken by many charter boats. Given the extensive areas of the Marine Park that will remain open to charter fishing, it is unlikely that the revised Zoning Plan will have any significant negative impact on this sector.

*In summary:*

- Total GVP **$50 million**
- Historical fishing activity in proposed no-take areas in the GBR Marine Park: **13% days fished**
- Expected degree of adaptability to Zoning Plan: **High**

#### 5.8.2.4 Inshore Net and Line Fishery

Commercial fishers involved in the inshore net fishery (apart from those targeting shark) usually are small-scale operators whose operating costs and incomes are more modest than those in the otter trawl or coral reef finfish fisheries.

A Management Plan for the fishery has been proposed for release by Queensland fisheries managers. To date, only changes to the fisheries regulations in response to specific management priorities have been introduced. The QFS has indicated that once management arrangements for the coral reef finfish fishery are finalised, resources will be directed to preparing an East Coast Inshore Finfish Fishery Management Plan. The main issues in the fishery are ecological sustainability of current levels of effort, latent effort (substantial number of unused commercial fishing licences) and strong opposition to commercial netting in near-shore areas and estuaries from recreational fishers and the wider community.

The commercial inshore net fishery does not have high mobility. Most fishers work locally, towing their boats by vehicles or travel in small fishing boats from their home port to nearby fishing grounds. In Queensland, there are about 800 commercial netting licences, of which it is estimated that about three quarters are currently used. The commercial inshore net fishery underwent a significant management change in late 1997 when Dugong Protection Areas, which restrict or prohibit commercial netting operations, were introduced under Queensland fisheries legislation. Notwithstanding the lack of progress on a management plan for this fishery, the rezoning and issues identified in the management of this fishery have the potential to impact upon about 13% of GVP of this fishery.

*In summary:*

- Total GVP **$5.2 million**
- Historical GVP in proposed no-take areas in the GBR Marine Park: **$1.13 million**
- Value added component: **$210,000**
- Expected degree of adaptability to Zoning Plan: **Low** for some fishers

#### 5.8.2.5 Crab Fisheries

The east coast commercial crab fisheries comprise three fisheries: blue swimmer crab, mud crab and spanner crab. Commercial and recreational fishers use crab pots and/or dillies to target these crab species. Commercial crabbers in the Marine Park usually are small-scale operators who also participate in the inshore net fishery. The spanner crab fishery operates mostly to the south of the Marine Park. The spanner crab fishery is managed with a Total Allowable Catch (TAC). The main issue of concern in this fishery is the consistent decline in Catch Per Unit Effort (CPUE) in the fishing area within the Marine Park. CPUE is used to assess the health of fished stocks. About 30% of the catch is taken from the Marine Park and the potential negative impact on this fishery of the revised Zoning Plan likely to be 17% of GVP.

The mud crab fishery is believed to operate mainly in intertidal areas outside the Marine Park. It is difficult to determine exactly how much mud crab catch is taken in the Marine Park because of the scale in which fishers report their catches. The main concerns about the mud crab fishery are the ecological sustainability of current levels of effort, latent effort (substantial number of unused commercial fishing licences) and localised depletion of stocks. The blue swimmer crab fishery mostly operates in offshore areas south of the Marine Park with less than 5% of product taken in the Marine Park.

There are about 900 commercial crabbing licences for blue swimmer crab and mud crab in Queensland, of which the QFS has estimated that about 400 are used actively in the mud crab fishery and about 150 in the blue swimmer crab fishery. There are over 200 spanner crab licences, of which about 170 are currently in use.

Notwithstanding the lack of progression of a management plan for the mud crab and blue swimmer crab fisheries, the rezoning may have a potential negative impact on some 13% of commercial mud crab GVP and around 10% of the blue swimmer crab GVP. It is likely that some individual commercial fishers involved in crab fisheries will be affected by the proposed rezoning.

*In summary:*

***Mud Crab***

- Total GVP **$1.5 million**
- Historical GVP in proposed no-take areas in the GBR Marine Park: **$520,000**
- Value added component: **$100,000**
- Expected degree of adaptability to Zoning Plan: **Little effect**

*(Note: Hundloe et al (2003) consider this fishery entirely outside the Marine Park)*

***Blue Swimmer***

- Total GVP **$0.07 million**
- Historical GVP in proposed no-take areas in the GBR Marine Park: **$10,000**
- Value added component: **$1,900**
- Expected degree of adaptability to Zoning Plan: **Little effect**

***Spanner Crab***

- Total GVP **$3.7 million**
- Historical GVP in proposed no-take areas in the GBR Marine Park: **$630,000**
- Value added component: **$120,000**
- Expected degree of adaptability to Zoning Plan: **Low** for some fishers

#### 5.8.2.6 Beam Trawl Fishery

Beam trawling is restricted to specific inshore areas and bays often outside the Marine Park. It is calculated that only up to half of the GVP of the fishery ($0.25 million) is captured in the Marine Park. Although these figures are not as robust as estimates for other fisheries. Generally, beam trawl fishers operate also in the inshore net and mud crab fisheries.

Conservation Park and Marine National Park zones prohibit all trawling, including beam trawling. Some zones that prohibit trawling are proposed in the revised Zoning Plan in areas important to the beam trawl fishery. Alternative beam trawl areas are not always available. The rezoning potentially has some negative social and economic impacts because areas remaining available to beam trawlers will be further restricted. Best estimates are that this fishery's GVP is less than 1% of the value of all commercial fisheries combined.

| *In summary:* | |
|---|---|
| • Total GVP | **$0.25 million** |
| • Historical GVP in proposed no-take areas in the GBR Marine Park: | **Unknown** |
| • Value added component: | **Unknown** |
| • Expected degree of adaptability to Zoning Plan: | **Low** for some fishers |

#### *5.8.2.7 Harvest Fisheries*

***Sea Cucumber***

The annual quota for this fishery currently is set at 380 tonnes. There are few operators in this fishery and all operate over a large area. The fishery is located principally between Townsville and Princess Charlotte Bay. The revised Zoning Plan has the potential to negatively affect approximately 19% of GVP.

| *In summary:* | |
|---|---|
| • Total GVP | **$3 million** |
| • Historical GVP in proposed no-take areas in the GBR Marine Park: | **$570,000** |
| • Value added component: | **$110,000** |
| • Expected degree of adaptability to Zoning Plan: | **High** |

***Marine Aquarium Fish and Coral***

The marine aquarium fish and coral collection fisheries should be considered together in assessing the likely impacts of the revised Zoning Plan. The same people generally are involved in both fisheries, and supply fish and coral to the live aquarium market. Because they are specialised operations, require detailed knowledge of the areas they fish and require good shore-based and boat-based husbandry for product quality control, they are restricted in their ability to relocate. The revised Zoning Plan potentially impacts negatively on about 12% of GVP of this fishery. Some operators may be affected where the rezoning removes some of the fishery area. Under current management arrangements, coral collectors are restricted to specific areas of particular reefs. Management arrangements for the coral collection fishery are under review and it is expected that the current arrangement will be replaced by access to wider reefal areas.

| *In summary:* | |
|---|---|
| • Total GVP | **$4.5 million** |
| • Historical GVP in proposed no-take areas in the GBR Marine Park: | **$540,000** |
| • Value added component: | **$100,000** |
| • Expected degree of adaptability to Zoning Plan: | **Low** for some fishers<br>**High** for others |

***Tropical Rock Lobster***

This fishery is the most spatially concentrated fishery in the Marine Park. It is centred on only a handful of reefs in the Far Northern Management Area of the Marine Park. As very little of the fishery is located in the proposed new MNPZs, the Zoning Plan imposes minimal economic cost on the rock lobster fishery.

| *In summary:* | |
|---|---|
| • Total GVP | **$5 million** |
| • Historical GVP in proposed no-take areas in the GBR Marine Park: | **$10 500** |
| • Value added component: | **$2 000** |
| • Expected degree of adaptability to Zoning Plan: | **High** |

***Trochus***

The fishery is centred on the Swain Reefs that are east of Mackay. The fishery is driven more by exchange rate factors than product availability, and available quota is taken rarely. Shell quality is important. The fishery is highly selective, with many shells being unsuitable and consequently not harvested. Potentially, 8% of GVP may be affected by the new Plan and this is unlikely to have a significant impact on this fishery.

| *In summary:* | |
|---|---|
| • Total GVP | **$0.7 million** |
| • Historical GVP in proposed no-take areas in the GBR Marine Park: | **$60,000** |
| • Value added component: | **$11,000** |
| • Expected degree of adaptability to Zoning Plan: | **High** |

### *5.9 Shipping*

Shipping is a high value activity and of great importance to the regional economies of Queensland. Key ports include those at Bundaberg, Gladstone, Rockhampton, Hay Point, Mackay, Abbot Point, Townsville, Lucinda, Innisfail and Cairns. Approximately $14.5 billion of commodity exports were from GBR coastal ports totalling about 80% of Queensland's exports. OESR (2001) recognise that over a hundred million and up to billions of dollars of exports pass through each of the ten ports and just under $100 million in the case of Innisfail. Shipping access to ports will be facilitated by the revised Zoning Plan as it will be clearer, and therefore easier, to locate shipping channels in the Zoning Plan. Designated shipping areas will provide certainty of access for shipping in the Marine Park.

### *5.10 Defence*

There are important areas of defence activities in the Marine Park. Their activities will not be impeded by the revised Zoning Plan.

### *5.11 Research & Education*

Research in the Marine Park has value to Australians in its contribution to society's knowledge base as well as providing information to help managers of the Marine Park. Additionally, about $25 million of research funding comes into local economies due to GBR-research. Many researchers travel from overseas to conduct their research in the GBR. The management and permitting of research in the Marine Park will be streamlined and improved through changes in the revised Zoning Plan. Understanding the natural system and human interactions with the natural system is a major educational activity for more than

half a million Australian primary school, high school and university students annually. More MNPZs will provide greater learning opportunities for students.

### *5.12 Coastal development*

The revised Zoning Plan offers certainty to potential developers and coastal communities as to what zoning will occur in the coastal zone, especially the new coastal areas. The new Plan is unlikely to affect coastal development.

### *5.13 Summary of benefits and costs*

Table 10 summarises the analyses presented in the previous sections.

**Table 10** Benefits and costs to affected groups

| Group | Benefit | Cost |
|---|---|---|
| Australian public | Maintenance of biodiversity of GBR existence, option, bequest, vicarious use and other values. | Nil |
| Indigenous people including TOs | Recognition of interests of Indigenous people including Traditional Owners.<br>Clear statement that the Zoning Plan does not impair any Native Title.<br>Increased protection afforded to traditionally important resources | Nil |
| Local Queensland communities | As for Australian public & medium- long- term maintenance of direct & indirect use values. | Small and/or short-term localised impacts on use & economic values. |
| Other recreational users | Enhancement of the aesthetic, spiritual & recreational value of experience in GBR.<br>Short, medium and long term increase in economic values associated with non-extractive recreational use. | Some extractive users that are not fishers *may* be displaced (e.g. shell collectors). |
| Tourism industry representatives | Greater security for their members<br>Expansion potential for sustainable tourism<br>Higher quality destinations<br>Greater range of products to promote | Nil |
| Tourism operators | Maintenance & enhancement of existing values.<br>Increased fish biomass and diversity<br>Protection of prime tourism destinations and presentation opportunities<br>Greater incentive for site stewardship<br>Reduced incidence of conflicts of use<br>Greater range of protected areas to choose from<br>Expansion potential for sustainable tourism<br>Greater capacity for effective enforcement<br>Medium- to long-term improvement in resilience of system upon which they rely. | Nil |
| Tourists | Increased fish biomass and diversity<br>Higher quality destinations<br>Reduced incidence of conflicts of use<br>Greater range of products to choose from | Nil |
| Conservation | Enhanced protection of biodiversity is of value to this group. | Nil |
| All Fisheries - generally | Increased numbers and larger individuals of target species than otherwise available in the medium- to long-term due to 'spill-over effects'.<br>Improved recruitment from increased reproductive output (more larvae) in the medium- to long-term.<br>Essential insurance measure to assist in delivery of ecologically sustainable fisheries in the medium- to long-term. | Displacement of fishing effort from some fisheries into areas where fishing effort already occurs.<br>In some areas, potential loss of ability to catch fish in areas closed to fishing where few other local alternative areas are available.<br>Ecological, social and economic impacts of the above. |
| Recreational fishing | Benefits as for 'All Fisheries – generally', above.<br>Increases in areas available to conduct limited line fishing.<br>Maintenance or enhancement of economic value of sector in medium- to long-term. | Small reduction in areas that are accessible to recreational fishers. |
| Charter fishery | Benefits as for 'All Fisheries – generally', above.<br>Increases in area available to conduct limited line fishing, as conducted by most recreational fishers on charter boats. | Very little cost, as extensive areas will remain open to the charter fishery. |
| Otter Trawl (commercial) | Benefits as for 'All Fisheries – generally', above. | Minimal displacement of trawl effort or reduction in catch is envisaged. |
| Beam Trawl (commercial) | Benefits as for 'All Fisheries – generally', above. | Likely localised negative social & economic impacts because areas available and suitable to beam trawling will be restricted. |
| Offshore Line fishery (commercial) | Benefits as for 'All Fisheries – generally', above. | Minimal impact rezoning is envisaged. |
| Inshore Net and Line | Benefits as for 'All Fisheries – generally', above. | Some net fishers who operate in the inshore |

| | | |
|---|---|---|
| fishery (commercial) | | waters of the Marine Park are likely to be adversely affected. |
| Blue swimmer and mud crab fishery (commercial) | Benefits as for 'All Fisheries – generally', above. | Little cost of revised ZP. |
| Spanner crab fishery (commercial) | Benefits as for 'All Fisheries – generally', above. | Reduction in area accessible to fishers. Some restriction in ability to relocate. |
| Sea cucumber fishery (commercial) | Benefits as for 'All Fisheries – generally', above. | Minimal coasts as few participants and the fishing operates over a large area. |
| Trochus fishery (commercial) | Benefits as for 'All Fisheries – generally', above. | Little impact likely. |
| Tropical rock lobster (commercial) | Benefits as for 'All Fisheries – generally', above. | The effect of the revised Zoning Plan is likely to be minimal. |
| Aquarium fish & coral (commercial) | Benefits as for 'All Fisheries – generally', above. | Highly specialised fisheries restricted in ability to relocate or move significantly. |
| Shipping | Clearer definition of shipping channels in zoning plans | Nil |
| Defence | Nil | Nil |
| Research | Streamlined permitting process; more variety of zoning to attract more researchers and research | Nil |
| Education | More zoning within which to better learn about more natural systems | Nil |
| Coastal developments | Certainty about zoning for adjacent coastal areas in new coastal sections | Nil |

### *5.14 Identify distributional effects of benefits and costs*

In general, the non-use values benefits accrue to all Australians but the short-term costs are borne by local coastal GBR communities. These short-term costs will however be offset by the benefits accruing from increased protection of the GBR environment.

Of the 26 Local Government Areas on the GBR, four are rated as being more than 50 points below the Australian average for disadvantage. These are Bowen, Cook, Sarina and Bundaberg Shires, with the latter being the lowest. This ABS measure is a composite of several census variables: income, employment, education, housing tenancy and occupations. Four Local Government Areas were above the national average: Whitsunday, Douglas, Cairns and Calliope. While short-term impacts upon some commercial fishers will be the main negative impact, for none of the communities is commercial fishing the most important economic activity: ports, agriculture, tourism and / or recreational fishing deliver more to local economies than commercial fishing in all towns. For example, OESR (2001) recognise that over a hundred million and up to billions of dollars of exports pass through each of nine ports in the 20 Town Resource Clusters (TRCs see Fenton and Marshall 2001) analysed including Bowen, Lucinda, Yeppoon and just under $100 million in the case of Innisfail.

In Bowen, Miriam Vale and Innisfail, where commercial fishing makes up the highest proportion of the local labour force compared to other towns, commercial fishing is at about 3-4% of the labour force. Elsewhere, it is less (OESR 2002, Productivity Commission 2003, Fenton and Marshall 2001). The capacity for fishers and communities to adapt to the changes in access to fisheries resources will be high for the most part but dependent on the factors listed in Section 5.8.2). Information about the fisheries and communities was used to ensure minimal impact. For example, a small component of the commercial line fishing fleet and the recreational line fishers that operate from small vessels is not highly mobile. The draft zoning was reconfigured significantly to reduce potential impacts on these small scale operators, especially in the Cairns, Yeppoon, Gladstone and Bundaberg regions.

The Bureau of Rural Sciences (2003) note that commercial fishing, itself valued at 1% of the regional economy, may be affected by some 10% of its value (ie. 0.1% of the regional economy). The importance of other economic sectors in the region support the local economies. For example, although Gladstone and Mackay are potentially vulnerable as assessed by BRS (2003), strong industrial and urban growth and recreational tourism growth, respectively, offer resilience to the local communities.

A preliminary report by the Bureau of Tourism Research (Bailey et al 2003) found that around half of the domestic travellers and over three quarters of international visitors visit the Marine Park region to go and experience the GBR. In the year ending June 2003 there were almost 10

million visitors to the Marine Park region and they spent $4 billion while there. The benefits derived from tourism are not equally distributed but are very high compared to those derived from most other economic sectors:

- Towns in Far Northern Statistical Division (SD)(including Innisfail, Cairns, Port Douglas and Cooktown) have visitors who spent around $2000 million in 2002-03;
- Expenditure by visitors in the Northern SD including the Hinchinbrook area, Townsville and the Burdekin was $416 million;
- In the Whitsundays SD (including Bowen) it was $458 million;
- The Mackay SD visitors spent $261 million;
- Fitzroy SD (e.g. Yeppoon and Gladstone) received $373 million in expenditure; and
- Bundaberg SD and surrounds had over $159 million in expenditure.

Tourism expenditures represent, of course, an influx of 'new' money to these regions rather than a recirculation of money already within the region. All these values will be maintained or enhanced through protection of the 'product' that is being sold to the tourists.

The Bureau of Rural Sciences (2003) found that of 20 communities analysed in the form of Town Resource Clusters (TRCs), Bowen is the community likely to be most negatively impacted by the rezoning given the lower regional and family resilience and the relatively high level of commercial fishing activity in the Marine Park. Note that for Bowen this still only means 3.45% of the labour force. The level of impact on all communities is, however, likely to be lower than the amount of GVP or VA displaced for the reasons discussed above and (Section 5.8). Other communities that BRS identified as potentially impacted include Lucinda, Innisfail, Cooktown and Yeppoon however these communities have greater resilience than Bowen either regionally or in terms of family[6]. BRS also identified that the GVP for commercial fishing in Cooktown was low. This makes Bowen one of the more vulnerable areas in terms of impacts from the revised Zoning Plan. The GBRMPA has taken this into account in locating new zones. Commercial fisheries operating from Bowen tend to fish locally or to the north. There are few new green zones located near the coast or north of Bowen. Where there are valid individual or community impacts in the short term, the Australian Government has undertaken to consider structural adjustment assistance.

### *5.15 Effect of feasible option on existing Regulations and regulatory bodies*

Existing Regulations and regulatory bodies are governed by a variety of Commonwealth and Queensland legislation. The effects of the revised Zoning Plan on relevant legislation and regulatory agencies are addressed below.

#### *5.15.1 Australian Government bodies*

##### *Great Barrier Reef Marine Park Authority*

The GBRMPA operates under the *Great Barrier Reef Marine Park Act 1975* and *Great Barrier Reef Marine Park Regulations 1983*. Zoning, and the review of zoning are core business for the GBRMPA, hence the effects of the revised Zoning Plan, while requiring additional resources, are within the normal operations and mandate of the organisation.

##### *The Department for the Environment and Heritage*

The Department for the Environment and Heritage (DEH) is the lead agency for implementation of the EPBC Act. The DEH liaises with the GBRMPA in its implementation of the EPBC Act. The proposed new management arrangements under the revised Zoning Plan for the Marine Park complement DEH policy and the EPBC Act.

##### *Australian Maritime Safety Authority (AMSA)*

The AMSA is responsible for the regulation of safety and environmental performance of trading ships engaged on international and interstate voyages. Search and rescue functions of

[6] Regional resilience was assessed by consideration of housing, age, labour force, occupation, weekly incomes, education, family and indigenous persons (BRS 2003). Family resilience was assessed with consideration of age, family structure, income, housing type and employment at the family level (Fenton and Marshall 2001).

the AMSA can be carried out unimpaired by the proposed Zoning Plan. Navigation aids are provided for and construction of new navigation aids is required to try to minimise impacts on the Marine Park in consultation with the GBRMPA. Designated shipping areas in the revised Zoning Plan will facilitate shipping access through the Marine Park.

***Australian Hydrographic Office (AHO)***

The AHO is responsible for providing Australia's national charting service under the terms of the UN Safety of Life at Sea (SOLAS) Convention and the Navigation Act 1912. Hydrographic surveys will be able to continue unimpeded in the Marine Park. New charts will need to be published and disseminated showing the new zoning system within the Marine Park - the zoning provides for this to occur.

***Department of Defence***

Defence operations continue to be provided for.

### *5.15.2 State bodies*

***The Queensland Environmental Protection Agency (EPA)***

The EPA will be affected by the revised Zoning Plan in two ways:

1. As far as possible, the EPA and the GBRMPA have historically attempted to maintain complementary zoning in the Marine Parks with GBR. The Queensland Government is 'finalising a framework for the establishment of a continuous set of marine parks from the Gold Coast to the Gulf….' (State Budget 2001-02, 'Valuing the environment'). If complementary zoning is to be achieved across jurisdictions, then the EPA will need to consider the revised Zoning Plan when zoning its waters or when reviewing any existing zoning. While this is clearly a matter for the State of Queensland, the work falls within planned operations for EPA as evidenced by their Draft Planning Framework – Marine Protected Areas in Queensland which refers to support for RAP and the need to develop and implement a strategy to protect marine biodiversity.
2. Day-to-day management (DDM) of the GBRWHA (which includes the Marine Park, State marine parks and island national parks) is achieved through an agreement between the Australian and Queensland Governments. DDM is predominantly delivered by the Queensland Parks and Wildlife Service (a component of the EPA), although it also utilises other State and Commonwealth agencies including the Queensland Boating and Fisheries Patrol and Queensland Water Police. Although DDM will need to accommodate zone changes in different locations, zones of larger size and simpler shapes will facilitate compliance and enforcement.

***Queensland Fisheries Service (QFS)***

Under the *Offshore Constitutional Settlement 1995* (OCS) between the Commonwealth of Australia and the State of Queensland, the QFS has responsibility for the day-to-day management of all fish stocks in waters adjacent to Queensland's east coast, except for tuna and tuna-like species and other Coral Sea fisheries managed by the Commonwealth. This administrative arrangement is subject to the provisions of the *Great Barrier Reef Marine Park Act 1975*. The underlying basis for the relationship between the GBRMPA and QFS is to have an ecosystem-management framework within which fisheries are managed. The Marine Park contains 64 per cent of Queensland's east coast waters in which fisheries are managed by the QFS.

There is a Memorandum of Understanding (MOU) between the GBRMPA and Queensland fisheries managers to develop and implement management plans for the GBR Region. The MOU provides a framework for integrated marine protected area and fisheries management in the Marine Park. The GBRMPA is committed to mitigating the ecological impacts of fishing in the Marine Park. The GBRMPA is obliged to set policies which ensure its basic responsibilities are met and that the ecological integrity of the Marine Park is conserved. Zoning has been applied to minimise displacement of fishing effort as far as possible. However, as the vast majority of fishing licences allow access throughout the east coast

waters off Queensland, some movement in fishing effort will still occur. Overall it is expected the rezoning will assist QFS in its efforts to put management arrangements in place to ensure ecologically sustainable fisheries for Queensland.

***Maritime Safety Queensland (MSQ)***

MSQ is the Queensland Government agency responsible for safety and environmental regulation of intrastate trading ships, tourism, recreational and fishing vessels. It also has responsibility for some port authority operations and for marine pollution response within port limits and State waters, and provision of some navigation aids and charting services. MSQ administers the Queensland Coastal Contingency Action Plan for responding to marine pollution incidents within Queensland and the Marine Park. They will not be directly affected by the revised Zoning Plan.

### *5.16 Data sources and assumptions*

Databases used to conduct the impact analysis and implement the rezoning of the Marine Park are listed in Appendix 1. Other sources of information including in-house and external expertise are referred to in the draft Basis for Zoning document (GBRMPA 2003). The datasets provide more information than has ever been collated before for use in zoning the Marine Park. Nonetheless, there are limitations with some of the datasets with regard to spatial extent, accuracy in spatial location, accuracy of numbers, and accuracy due to the age of the data or bias in the sampling method or design. The revised Zoning Plan has focused on placing the least cost on users, such as fishers, while satisfying the biological operational principles.

## 6 Consultation

The Act specifies the manner in which a zoning plan is to be prepared. The process includes two statutory (formal) phases of public consultation. Both require public advertising, inviting the public to make submissions, and binds the GBRMPA to '… give due consideration to any representations so made' (Section 32(3) of the Act).

The first formal Community Participation phase of RAP (CP1) was conducted 7 May – 7 August 2002, and was designed to canvas the views of the public on the proposal to prepare a zoning plan (Section 32(2) of the Act. A range of material was made available to the public, including the operational principles (refer Section 3.1.2). An enormous effort was made to inform the public, including:

- Over 1,500 Community Service Announcements on television;
- Over 200 meetings involving over 5,000 people face-to-face, including Community Information Program visits to 22 regional centres;
- 33,000 submissions brochures distributed;
- Over 100 newspaper articles and more than 70 radio and TV spots;
- About 70 newspaper advertisements at the beginning and end of the phase; and
- 38,000 hits on the RAP area on the website and over 4,000 calls to the GBRMPA freecall number.

As a result of this level of public engagement, 10,190 submissions were received, 5,646 from coastal Queensland communities, 92 from overseas and the rest from other parts of Australia. Informal, targeted consultations were also held with people between the formal periods of CP1 and CP2. These meetings were primarily to clarify submissions and/or to seek additional information.

The submissions, along with a range of additional information, assisted in the development of the Draft Zoning Plan (DZP) for the entire Marine Park plus the 28 new coastal areas. Potential zoning networks that met the biophysical operational principles were identified, including a minimum of 20% no-take protection per bioregion, and consideration of such aspects as special/unique sites, advice on dugong habitat, etc.

The DZP implemented the operational principles as far as was possible, and incorporated social, economic, cultural and management feasibility principles (see Section 3.1.3) to maximise complementarity of people's uses and values with the proposed zoning. Concurrently, zone provisions were also revised to ensure a consistent GBR-wide approach.

The DZP was released for public comment on 2 June 2003 and was mailed to all who provided input during the first formal Community Participation phase, and all key groups and organisations. This second formal phase of community participation (CP2) was one of the largest examples of public engagement in any environmental issue in Australia's history, and included:

- Over 10 000 packages of information, more than 50 000 submission forms, 29,000 explanatory brochures and over 76 100 Draft Zoning maps were distributed throughout Australia;
- A range of materials was developed to communicate the DZP to users, and all rezoning information was available on the GBRMPA website and provided on a CD (2,100 CD's distributed).
- GBRMPA staff attended over 360 meetings and info sessions along the GBR coast in some 90 centres with local communities, conservation groups, commercial and recreational fishing organisations, Traditional Owners, tourism operators, local councils and State and Federal politicians;
- There were over 35,000 'hits' on the GBRMPA website (63% from Australia, the rest from 99 countries); and
- RAP media coverage included:
- More than 500 media reports; and
- 88 newspaper advertisements.

Over 21,300 public submissions were received commenting on the DZP; more than double the number in the first phase. The high number of submissions compared with all previous community participation activities in the Marine Park shows a high level of successful public engagement.

A team of 18 officers from the GBRMPA were involved in the comprehensive analysis of the public submissions in a three-stage process. During the first stage, specific details from each submission were recorded in a database, a unique identifying number assigned, and an acknowledgement card sent to the person or organisation that made the submission.

In the second stage, all submissions were individually scanned and loaded into the submissions database. This was an enormous task, as over 18,000 hard copy submissions were received, many with maps attached. The third stage was the most comprehensive: all the submissions were read and analysed. Submissions were sorted into the database according to the issues or zones to which they referred, enabling officers to search the database for specific issues, user groups or particular zones. Individual scanned submissions and / or all other submissions with similar views could then be viewed quickly.

The submissions and additional planning information was used to revise the DZP taking into account the many different priorities of stakeholders. The DZP changed markedly, particularly in some areas, in the light of the submissions and follow-up consultation. Some 40-50 follow-up meetings were held to clarify issues raised in submissions or to gather more detailed information on particular points.

The consultation for the RAP was the most comprehensive planning initiative ever undertaken by the GBRMPA. The revised Zoning Plan, which has resulted from this process, is due to be presented to the Marine Park Authority Board and to the Federal Minister for the Environment and Heritage, Dr David Kemp, by the end of 2003.

### 6.1 Main parties affected

The main parties affected are a subset of the groups identified in Section 5.1, and include:

- The Australian public;
- Indigenous people, especially Traditional Owners;
- The coastal Queensland communities adjacent to the Marine Park;
- Commercial fishers;
- Recreational fishers;
- Other recreational users;
- Marine tour operators;
- Conservation groups;
- Commercial fishers;
- The Shipping industry and Pilots and pilotage providers; and
- Queensland Government agencies, especially those with responsibilities for actions and activities within the Marine Park.

### 6.2 Views of main affected parties

This assessment of the views of main affected parties is derived primarily from submissions and / or independent, random sampling of the population. In the latter case, the relevant references are cited. These views have been taken into account in development of the revised Zoning Plan. Details of the GBRMPA's responses to issues raised will be available in the Report on the Great Barrier Reef Marine Park Zoning.

#### 6.2.1 The Australian public

Their views include:

- Need to protect biodiversity including plants, animals and habitats and rare and endangered species, and to ensure shipping safety (CP1 Submissions & Moscardo, 2001).
- Support for biodiversity protection through increasing highly protected areas, even if restrictions on human use are required to do so (Moscardo, 2001).
- Thousands of submissions make mention of the need to reduce commercial fishing activities.
- Concern regarding serious threats from oil spills and shipping, crown-of-thorns starfish, coral bleaching, pollution from everyday chemicals and other land-based impacts (submissions, Moscardo, 2001).

#### 6.2.2 Coastal Queensland communities adjacent to the Marine Park

- Over 76% of people surveyed believe the GBR is under threat (AEC Research, 2003).
- Over 90% of survey respondents support increased protection of the GBR, with more than about 70% believing that more than 30% of the Marine Park should be protected by MNPZs (AEC, 2003).
- More than 80% of respondents believed that some personal loss of usage was acceptable to achieve greater protection of the GBR (AEC, 2003).

#### 6.2.3 Indigenous people

Their views include:

- Need to maintain access and opportunities for Traditional fishing, hunting, and gathering, and for recreational fishing.
- Protection of cultural heritage values, World Heritage Values and particular species and habitats are needed.
- Submissions raised Native Title rights and co-management opportunities.
- Some concern for negative impacts on peoples' lifestyles from introduction of MNPZs and for negative economic impacts due to loss of opportunities for tourism based on recreational fishing.

Between the two phases of community participation, meetings have been conducted with all the Traditional Owner groups along the coast to discuss proposed management arrangements for traditional use of marine resources. It is anticipated that traditional fishing and collection be conducted 'as of right' (without a permit) in all zones that generally allow for fishing and collecting. However, traditional hunting of dugong and turtles and traditional use in other zones will be managed under Traditional Use Marine Resource Agreements. It is anticipated that more Traditional Use Marine Resource Agreements will be prepared and developed by the Traditional Owners with assistance from the GBRMPA. Draft Regulations will be developed to provide regulatory support, once all relevant parties have signed off on an Agreement. The Zoning Plan does not extinguish Native Title and Section 211 of the Native Title Act continues to apply.

#### *6.2.4 Tourism operators*

***Non-extractive tourism users*** *(including dive companies, film and photography companies, day trips and other non-extractive tourism operations)*

Their views include:

- Support the RAP process as a way of achieving a healthy GBR on which their industry is dependent.
- Support MNPZs to separate conflicting extractive and non-extractive uses.
- Favour Conservation Park Zones (CPZs) in new coastal sections for recreational fishing.
- Believe that at least 50% of the Marine Park should be protected in MNPZs.
- Need to restrict or ban certain commercial fishing practices, particularly netting, and licence recreational fishers.

***Extractive tourism users*** *(including charter fishing, tourism operations that include fishing as an activity, accommodation houses and resorts)*

Their views include:

- Concern that closure of inshore fishing grounds will result in loss of visitors / clients who currently come to the GBR region to undertake fishing and use their accommodation houses.
- Concern about the effect that MNPZs will have on local communities, especially those relying on fishing tourism.
- Concern regarding effort displacement resulting from increased MNPZs.
- Suggest use of CPZs as an alternative to MNPZs.
- Suggest other alternatives such as greater use of fisheries input controls including bag and size limits, seasonal and spawning closures, recreational fishing licences and increased, more effective enforcement.

#### *6.2.5 Conservation groups*

Their views were:

- Strong support for an increase in MNPZs and for MNPZs to be large and interconnected.
- Believe 25 % protection of the Marine Park in MNPZs is inadequate.
- Need to protect biodiversity, connectivity, particular endangered species (including dugongs, turtles and dolphins) and habitats, cultural heritage and the World Heritage values of the region.
- Need for protection of in-shore areas to complement terrestrial protected areas and continuity in protection and management between interconnected terrestrial and marine environments.
- Need to protect large areas of coastal bioregions including mangroves, estuaries, inshore reefs and seagrass meadows.
- Concern about impacts of commercial fishing activities.
- Need to address land based impacts and a range of other threats such as marine pollution, shipping, coral bleaching and motorized water sports.
- Need to improve enforcement capacity.

### 6.2.6 Commercial fishers

Their views were:

- Support for protection of biodiversity based on objective scientific information.
- Need to maintain access to areas for extractive commercial activities and recreational fishing.
- Concern that the Regulations, restrictions and closures that have already been introduced to the commercial fishing industry for sustainability of marine resources have already had a major impact on industry and individual livelihoods and further management controls through proposed rezoning are unfair.
- Concern regarding consequences of fishing effort displacement, transfer and concentration; particularly displacement of commercial netting and crabbing effort in coastal areas.
- Need to consider economic impacts of rezoning on the fishing industry and on the large economic and social contribution that it makes to Queensland and local GBR communities.
- Adequate compensation and structural adjustment funding must be provided to mitigate negative economic, social and environmental impacts of closures on the commercial fishing industry and fish stocks.
- Zone boundaries should be as simply defined as possible and maps of the final zoning plan should be digitised and provided to all commercial fishers for use in plotters and other navigational equipment to aid interpretation and enforcement of the zoning plan.
- Additional compliance, monitoring and enforcement funding should be provided to police closures to ensure their effectiveness and integrity.
- Need for consistent reef-wide definitions and use and entry provisions for all commercial fishing activities and a need for greater consistency with QLD fisheries legislation.
- Need for specific provisions for most commercial harvest fisheries to enable their conduct in relevant zones without a permit if undertaken in accordance with accredited management arrangements.
- Concern that other forms of zoning, such as Conservation Park Zones (Yellow Zones), were to do with resource reallocation away from commercial fishing rather than biodiversity protection.

### 6.2.7 Recreational fishers

Their views include:

- Need to maintain access to areas for extractive recreational activities, particularly beaches and inshore coastal areas within small boat range of the coast and adjacent to populated coastal areas.
- Concern about effort displacement, especially in coastal areas.
- Concern regarding perceived inequities between commercial and recreational fishing effort and impacts, including a need for various types of commercial fishing to be reduced or banned.
- Need for more CPZs especially in inshore areas and closest reefs to mainland and consideration of locating green zones offshore, away from the coast.
- Suggested alternatives such as greater use of fisheries input controls including bag and size limits, seasonal and spawning closures, recreational fishing licences and increased, more effective enforcement.
- Need for fairer access to the Conservation Park Zone for limited extractive uses, including limited line fishing, limited spear fishing and limited collecting due to the proposed large increase in MNPZs.
- Zone boundaries need to be clearly defined by natural features, floating markers, fixed posts or GPS co-ordinates shown on the GBRMPA charts.
- Need for consistent reef-wide definitions and use and entry provisions for all recreational fishing activities and greater consistency with QLD fisheries legislation.
- Need for greater protection of fish species of conservation importance.

- Concern regarding consequences of closures to communities including social and economic impacts of closures on recreational fishing and fishing-based tourism, associated industries and suppliers, property and boat values, families and lifestyle.
- Need to address impacts including land-based impacts, impacts of tourism, anchor damage and marine pollution, shipping impacts, coastal development and crown-of-thorns starfish and coral bleaching.

#### *6.2.8 Shipping and Port users*

***Shipping industry*** *(including cruise ships)*

They consider that:

Accessibility of coastal areas to all vessels needs to be maintained, particularly in light of the likelihood of more highly protected zones along the coastline.

- Access to a range of scenic shipping channels requested, and to scenic shipping transit lanes.
- Accessibility of cruise ships to indigenous culture, such as on Stanley Island, should be maintained and encouraged elsewhere.
- Unsupportive of any measures designed to move shipping to the outer route.
- Support the simplification of the Regulations governing shipping, particularly perceived over-regulation of the cruise ship industry in relation to other recreational (and fishing) vessels.
- Routing measures should not lead to increased costs for shipping.

***Pilots and Pilotage Providers***

Consider that:

- Existing shipping lanes are unaffected by the current system of zoning.
- Shipping has minimal impact on the GBR.
- Unsupportive of any move to direct shipping to outside of the GBR.

#### *6.2.9 Other recreational users*

Their concerns include:

- Need to protect biodiversity, World Heritage values and particular species and habitats.
- Concern about the level of commercial fishing and damage done to the GBR ecosystem by trawling and net fishing.
- Concern regarding the possible impacts that might occur to lifestyle and family values if more MNPZs reduced opportunity to access areas for recreational activities.
- Support for MNPZs from the perspective that an increase in the number of green zones would be good for tourism and for fish stocks.
- Concern is about land-based impacts such as agricultural run-off, urban development and aquaculture and about marine pollution, coral bleaching, shipping and anchor damage.
- Consideration of Native Title and co-management with Indigenous people is required.

#### *6.2.10 Research users*

Their views include:

- Unanimous support for increase in MNPZs to 25% or more and for the establishment of an independent Scientific Steering Committee and application of the BOPs by the GBRMPA.
- Vitally important that access to undertake research within the Marine Park is retained because research and monitoring are essential for sustainable management and protection of the GBR.
- Essential that appropriate scientific research, including manipulation and / or extraction, be allowed to continue in MNPZs.
- Need for continued access to conducting research around island and coastal research stations, either through Scientific Research Zones or Designated Areas.

- Need for a cost-effective way to study key environments and imperative for the continued education of skilled coral reef researchers and managers.

#### *6.2.11 Queensland Government*

The Queensland Government's views include:

- Support establishment of a system of marine representative areas as 'no take zones'. Support that these zones should not exclude public or other commercial access.
- Support minimising adverse economic, social and cultural impacts on existing fishing (commercial, recreational and indigenous) and aquaculture activities, acknowledging implications for regional economies need to be addressed.
- Consideration should be given to all current and proposed fishery closures. Temporal fisheries management closures may be compromised if declared as MNPZs.
- If closures are placed in areas currently available to fisheries, compensation or structural adjustment measures may need to be put in place by the Australian Government prior to any decisions being made.
- Duplication of administration across jurisdictions should be avoided.
- Recognise the importance of indigenous consultation and encourage this during the re-zoning process.
- There should be no impediments to safe and sustainable shipping movements (including cruise ships).
- Maintain tourism use of MNPZs.
- Maintain the need for separating conflicting uses and supporting the management of rare, vulnerable, endangered or otherwise significant species, such as turtles, seabirds and turtles.
- Complementary zoning of adjacent national parks is supported.
- Supportive of minimising adverse economic, social and cultural impacts during re-zoning.
- Need to take into account future potential benefits from bio-discovery activities in the Marine Park.

#### *6.2.12 Australian Government*

##### *Department of Environment and Heritage*

The Department of Environment and Heritage's submission to the GBRMPA focussed on the protection of cultural heritage sites and values. Their three main areas of concern were historic shipwrecks, indigenous values and the Register of the National Estate properties.

##### *Australian Defence Forces (ADF)*

ADF concerns include:

- The need to maintain access for Defence operations within the Marine Park.
- Defence Areas provide conservation benefits, as they are regularly unavailable to fishermen due to Defence Area closures.
- Other areas of the Marine Park outside Defence Areas are used more frequently by the ADF for transit and other routine activities that are considered compatible with MNPZ objectives, however areas with less human usage may be more appropriate for MNPZ
- The ADF conducts activities throughout the Marine Park, some of which can assist directly or indirectly with the management of the Marine Park, including maritime surveillance and response, emergency requirements, search and rescue, fisheries law enforcement and hydrographic survey services.

##### *Australian Maritime Safety Authority (AMSA)*

AMSA's submission to the GBRMPA concerned:

- The need for consistency of Marine Park zoning with International, National and Regional Conventions, Laws, Legislation and the Regulations relating to the Shipping industry (to protect Australia's rights and obligations etc).
- The need to review the Ship Safety and Pollution Prevention Measures report.

- The need for the Zoning Plan to allow for ship safety and pollution prevention measures, safe havens for stricken vessels, safe (sheltered) anchorages, accessibility of scenic transit lanes to cruise vessels, port accessibility, maintenance of navigational aids, and accessibility for hydrographic surveys, to meet safety at sea obligations.

***Coastwatch***

The Coastwatch's submission to the GBRMPA primarily concerned enforcement of the new MNPZs.

# 7 Conclusion

## *7.1 Summary of impact analysis*

There will be significant short-, medium- and long-term benefits to all 19 million Australians including those in coastal Queensland communities (approx. 730 000 people). These include positive economic impacts, especially for the tourism industry, and, in the medium and longer term, for both recreational and commercial fishing. There will be particular individuals and values that will be negatively impacted, mainly in the short-term, and mainly within coastal Queensland communities (see Section 5 and summary of benefits and costs). In the medium- to long- term, impacts on almost all affected parties are expected to be positive or, at worst, neutral. Table 10 summarises the analyses presented in the previous sections.

## *7.2 Preferred option*

The preferred option is to implement the revised Zoning Plan.

## *7.3 Main assumptions*

The level of pressure on the GBR has risen steadily over the last 25 years the Marine Park has been in place. The level of protection afforded by the present zoning is inadequate to provide for the long-term sustainability of the reef. The bioregions that form the basis of the RAP were defined by panels of experts in the GBR region using the best data and regional analysis available to the GBRMPA. The bioregions reflect consensus among the experts on the delineation of 'bioregions' within the GBRWHA. The attributes for each bioregion were distinguished by the experts based on the direct observations of locations within the bioregions and extrapolation from the understanding of how habitats relate to location and the environment. This was supplemented by analytical methods (spatial cluster analysis) using the available data. The biophysical operational principles are the best scientific advice available to managers of the Marine Park (see Section 3.1.2). The justifications and assumptions upon which they are based are given in the GBRMPA's Technical Information Sheets. This analysis assumes increasing population size and corresponding increase in human pressures upon the GBR ecosystem. The GBRMPA has legal obligations to protect the biological diversity of the GBRMP.

## *7.4 Justification for preferred option*

The options are either long-term decline of the GBR ecosystem (or a risk of the same) or pro-active zoning of the Marine Park to enhance protection of biodiversity, including, medium to long-term positive effects on fish stocks (Ward *et al* 2001, Gell and Roberts 2002, Halpern 2003). The best scientific advice for management of the Marine Park recommends particular levels of protection via MNPZs (Section 3.1.2). Although thought to be adequate at the time of introduction, existing levels of protection provided through current zoning are inadequate on the basis of current knowledge. To protect a smaller part of the Marine Park than recommended increases the risk of failure in achieving biodiversity protection objectives and in maintaining associated values to society and economies.

The GBRMPA is required under the Act to prepare a Zoning Plan for any area included in the Marine Park (e.g. the 28 new coastal sections) and endeavours, under Policy No. 2002/24, to review Zoning Plans on a regular basis. According to best available information, the revised Zoning Plan offers adequate protection to representative examples of every kind of habitat,

plant and animal in the Marine Park. Better protection of biodiversity will enhance the values that people place upon the Marine Park (Section 5). Evidence from around the world, for example, cites positive or, at worst, neutral impacts of MNPZs on fisheries, despite any displacement of fishing effort (Ward *et al.* 2001, Gell and Roberts 2002, Halpern 2003). Better protection of the GBR ecosystem through significantly more area being in MNPZs conforms with public support, views and expectations (see Section 5.5 and Section 5.6). While this option will cause short-term costs to some individuals it will help to mitigate against medium- to long- terms costs those same individuals might otherwise face. The basis for changes to zoning, or new zoning, conforms to these expectations and other community views. The preferred option provides an improved framework and greater efficiency for managing permitted activities. Changes to the Zoning Plan will ensure that provisions are up-to-date and consistent throughout the Marine Park.

# 8 Implementation and review

## *8.1 How will implementation occur*

The Act establishes the mechanism for implementation of the Zoning Plan. The Board of the GBRMPA, after consideration of the revised Zoning Plan, will submit this plan to the Federal Minister for Environment and Heritage, the Hon. Dr. David Kemp for his approval. Once he has approved the revised Zoning Plan, the plan is laid before both Houses of Parliament. If no motion of disallowance is passed, the Minister shall, by public notice, state that the plan is to come into operation on a date specified in the notice (not being a date earlier than the date of publication of the notice in the *Gazette*). The Zoning Plan comes into operation on that date, together with the Regulations, giving effect to the Zoning Plan. A communication strategy is being developed for public extension and education. This communication and extension is part of normal operating procedures and, hence, is within existing budget allocations. The community will be able to access zoning information through:

- The GBRMPA website;
- The GBRMPA freecall number;
- Direct mail (if they have made a submission or are a permittee of the GBRMPA);
- Community access points (e.g. Regional QPWS offices, the GBRMPA offices, Fisheries and Boating Patrol Offices, bait and tackle retailers and municipal libraries);
- Boat ramp signs;
- Advertisements in newspapers;
- Advertisements in sector publications and magazines (e.g. fishers and divers); and
- Interactive CDs containing all relevant documentation, including maps.

The role of education and public participation in much of the decision making related to the Marine Park cannot be underestimated. Day to day management of the Marine Park will continue in partnership with other government agencies, particularly the EPA / QPWS and Coastwatch. Boat and aircraft patrols operate in the Marine Park on a regular basis, monitoring a variety of activities. The GBRMPA has always, and will continue, to view education as an effective strategy to encourage compliance with the Marine Park management principles. However, enforcement action and prosecution are also important management tools.

The Queensland Boating and Fisheries Patrol (QBFP) carries out specialist surface surveillance, particularly in remote offshore areas where illegal fishing has been identified as a major problem. The QBFP also conducts aerial fisheries patrols, particularly targeting inshore areas closed to trawling and netting. By reporting on enforcement matters during normal fisheries patrols, the QBFP greatly boosts the presence of surveillance and enforcement officers in the Marine Park waters.

Coastwatch is used by the GBRMPA for surveillance and enforcement purposes with two Coastwatch bases situated adjacent to the Marine Park. Members of the public who use the Marine Park for both commercial and recreational purposes, also provide reports about

suspected illegal activities and general usage patterns which provide an invaluable source of surveillance information (see Incident Report form at http: www.gbrmpa.gov.au / rap).

The GBR compliance program has been improved greatly in recent years. During the last four years, the Australian Government allocated an additional $3.4 million to support this program. Patrols have been increased. Intelligence gathering and analysis has enabled strategic and tactical planning of operations to target identified threats. The new approach has proved successful in apprehending offenders. In 2001-02 a total of 59 commercial line fishing boats were found operating illegally in green zones, more than 3 times the number detected in each of the previous two years. Evidence collection and prosecution procedures have also strengthened. All of the Marine Park offences heard in court in the last two years have resulted in successful prosecutions.

Technology plays an increasing role in the Marine Park enforcement program. Under an arrangement with the Queensland Fisheries Service, the GBRMPA is now able to track the movements of hundreds of commercial fishing boats fitted with satellite transponders (vessel monitoring system) to ensure compliance with Zoning Plan provisions. High-resolution photography, night vision equipment, global positioning systems and forensic chemical analysis have been used to identify offences and provide evidence for prosecution. The GBRMPA is continuing to assess new technologies in consultation with collaborating agencies.

### *8.2 Is the preferred option clear, consistent, comprehensible and accessible to others*

Yes. Zoning Plans are an established, widely recognised and understood management tool for all users and managers of the Marine Park. The Zoning Plan is widely available and is published along with a series of interpretive materials.

### *8.3 Is the preferred option sufficiently flexible*

Once a Zoning Plan comes into effect, it remains operational until it is amended or a new plan is prepared. Amendments to Zoning Plans must occur in accordance with Sections 32, 33 and 37 of the Act, including two public consultation phases.

Permission is required from the GBRMPA (or its delegate) for certain activities in accordance with the relevant Zoning Plan. Within this framework there is sufficient flexibility, through granting, refusing or applying appropriate permit conditions, to adapt to various situations and circumstances. Zoning Plans incorporate the capacity to declare special management provisions for certain purposes, which apply to identified, designated areas. The capacity to designate new areas also exists. These provisions ensure management flexibility over time.

### *8.4 Impact on businesses*

There are currently five Zoning Plans for the Marine Park developed over the years, with definitions, management provisions and zone names differing slightly across the various Sections. The current zoning process (RAP) has resulted in the development of a single Zoning Plan for the Marine Park and will remove discrepancies between the five zoning plans that represent five Sections. This will allow for consistency of management provisions across the Marine Park and make it easier for all users to understand and comply with the Zoning Plan provisions, throughout the Marine Park.

A number of organisations and businesses have urged speedy completion of the RAP, believing that prolonged uncertainty is already impacting on consumer confidence. For example, this view was strongly enunciated by the Boating Industry Association at a meeting in Townsville in October 2002. In the light of these concerns, it is hoped that the revised Zoning Plan can pass the necessary legislative processes as soon as possible. Only after the Zoning Plan has been through the legislative process, and on a date chosen by Minister, will changes ‘on the water’ come into effect (planned for mid 2004).

The revised Zoning Plan will be available electronically. The Internet is increasingly becoming a very useful tool to disseminate information to the broader public at very little cost to either the GBRMPA or the person obtaining the information, at the click of a mouse. The new zoning plan will also be available on CD-Rom, reducing the paper burden, and will be provided in a form suitable for use with navigational chart plotters used on board many vessels. Businesses using the Marine Park will benefit from simplified zone boundaries that will enhance their ability to identify them and reduce chances of accidental infringements. The GBRMPA acknowledges that, although accessing information via electronic means is becoming increasingly popular, it is not suitable for all clients. Accordingly, hard copies of the zoning plan will be available along with information over the telephone via an 1800 number. Permitting arrangements will be simplified as permits will not have to refer individually to 33 separate sections – this will reduce the paper burden on both businesses and government. Beyond the changes mentioned above, the preferred option will result in mainly implementation changes to existing Regulations. For this reason there will not be a significant burden imposed on businesses.

### *8.4.1 Assessing the effectiveness of the preferred option*

There are numerous mechanisms through which the GBRMPA assesses and reviews the effectiveness of management, including the effectiveness of its Zoning Plan(s). They are use of monitoring, performance indicators, community feedback, reporting and policy review.

#### *8.4.1.1 Monitoring*

Harriott *et al.* (2002) refers to 88 programs for monitoring, survey and assessment research within the GBRWHA. Of these, 21 provide information that will be of assistance in monitoring the health of the GBR ecosystem with specific regard to the effectiveness of the zoning in the Marine Park. One example is a new program to survey, comprehensively, seabed biodiversity across much the Marine Park. More generally, GBR researchers have offered advice and assistance in ensuring that monitoring the impacts of zoning in the Marine Park is conducted effectively.

#### *8.4.1.2 Performance indicators*

The GBRMPA used key performance indicators (KPIs) in its 2002-03 Annual Report to assist in assessing the effectiveness of management. The KPIs include indicators reflecting zoning effectiveness: the relative numbers of reefs that are 'healthy' compared to 'not healthy' as assessed by the Australian Institute of Marine Science Long-term Monitoring Program and the number of bioregions with adequate MNPZs (GBRMPA 2003).

#### *8.4.1.3 Community and stakeholder feedback*

Feedback from local communities and stakeholders offers a useful mechanism for identifying potential management effectiveness, issues and problems. The GBRMPA has established ten Local Marine Advisory Committees (LMACs) comprising interested local community members with a variety of expertise and interest in the Marine Park. Through the GBRMPA Senior Manager allocated to each LMAC, or through the LMAC coordinator, the LMACs can provide information about local concerns and issues back to the GBRMPA. This provides an early warning system that enables the GBRMPA to address problems.

The Great Barrier Reef Consultative Committee is a legal entity whose role is to provide advice to the Minister, in respect of matters relating to the operation of the *Great Barrier Reef Marine Park Act 1975* and to provide advice to the Authority, in respect to matters relating to the Marine Park. Their expertise offers insights to help ensure the effectiveness of management, including zoning plans. The GBRMPA also receives expertise-based input and feedback through its four Reef Advisory Committees whose expertise is issue-based rather than geographically based.

The GBRMPA also seeks feedback through its representation on relevant Commonwealth and Queensland fisheries Management Advisory Committees (MACs), including ECTunaMAC, HarvestMAC, TrawlMAC, ReefMAC, InshoreFinfishMAC, and CrabMAC. Invaluable information is provided to the GBRMPA from fishery stakeholder representatives and managers via these fora. In addition, illegal activity in the Marine Park may be reported to day-to-day managers by any person. This is facilitated using a widely available incident report form referred to above. The GBRMPA's day-to-day managers, including QPWS Marine Parks officers, have a direct conduit to the GBRMPA. They keep the GBRMPA informed of issues on the water, such as effectiveness of zoning and other management issues.

#### *8.4.1.4 Reporting*

The GBRMPA reports on the outcome of monitoring and assessment programs by various means. Examples of the main reports include the:

- State of the Reef Report (Chin, A., 2003 and Wachenfeld *et al.* 1998)
- Day-to-Day Management Report (DDM 2002)
- The GBRMPA Annual Report (GBRMPA 2003)
- Periodic Report on the GBRWHA for the World Heritage Centre (2002)
- Global Coral Reef Monitoring Network (Wilkinson 2002)

These reports ensure that information regarding the effectiveness of management, including zoning, is available to both the public and to the GBRMPA managers so that management actions can be adjusted accordingly.

#### *8.4.1.5 Policy of review of Zoning Plans*

Early in the history of the GBRMPA, a policy decision was made to review zoning plans as soon as practicable after they had been in operation for five years (Policy No. 2002/245). This policy intends that improvements to Zoning Plans be based upon zoning reviews and information gathered in the intervening period.

# 9 References

Australian and New Zealand Environment and Conservation Council / Task Force on Marine Protected Areas 1998 *Guidelines for establishing the National Representative System of Marine Protected Areas.* Environment Australia, Canberra

Australian Government, 2001, Our Future Action Plan: A Better Environment, Oct 2001, p. 55

Australian Bureau of Statistics. 2001, *Australian Standard Geographical Classification*, Cat. no. 1216.0,Canberra.

AEC Group, 2001, *Market research for Great Barrier Reef Marine Park Authority,* GBRMPA Internal Report.

AEC Group, 2002, *Market research for Great Barrier Reef Marine Park Authority,* GBRMPA Internal Report.

AEC Group, 2003 *Market research for Great Barrier Reef Marine Park Authority,* Coastal Research – 2003. Preliminary results V_2. GBRMPA Internal Report.

American Association for the Advancement of Science. 2001. http://www.nceas.ucsb.edu/Consensus/

Appledorn, R.S. and Meyers, S. (1993) Puerto Rico and Hispaniola. *FAO Fisheries Technical Paper*, 99: 99-158, Food and Agriculture Organisation, Rome.

Bailey, G, Heaney, L., Lubulwa, M., Riley, C., Barry, T. and U. Salma (2003) Assessment of tourism activitiy in the GBRMP region – draft final report. Bureau of Tourism Research, Canberra.

Bellwood, D.R., Hoey, A.S., and Choat, J.H. (2003) Ecosystem function on coral reefs, *Ecology Letters* (in press).

Brown, K., Pearce, D. Perring and Swanson, T. 1993. *Economics and the conservation of global biological diversit*, Working Paper No. 2. Washington D.C.: Global Environment Facility.

Bureau of Rural Sciences (2003) *Implementing the Representative Areas Program in the Great Barrier Reef Marine Park – BRS assessment of potential social impacts on commercial fishing and associated communities.* Bureau of Rural Sciences, Canberra.

Commonwealth of Australia 1998, *Australia's Ocean's Policy*, Environment Australia, Canberra.

Coopers and Lybrand Consultants, 1996, *Structure and economics of the marine tourism industry in the Cairns Section of the Great Barrier Reef*, Final Report to Reef Tourism 2005.

Day, J.C, L Fernandes, A Lewis, G De'ath, S Slegers, B Barnett, B Kerrigan, D Breen, J Innes, J Oliver, TJ Ward and D Lowe (2000) The Representative Areas Program for protecting biodiversity in the Great Barrier Reef World Heritage Area. Proc. 9th Int. Coral Reef Symp., Bali, Indonesia, October 2000, Vol 2.

Day-to-Day Management 2002, *Day-to-Day Management Six Month Report*, Internal GBRMPA Working Document.

De Groot, R.S. 1992, *Functions of nature*. The Netherlands: Wolters-Noordhoff.

Department of Local Government Planning, 2001, Population Trends and Statistics. Queensland Government, Brisbane.

Fenton, D.M. and Marshall, N.A. 2001, A guide to the fishers of Queensland. Part A: TRC analysis and social profiles of Queensland's commercial fishing industry. CRC Reef Research Centre Technical Report No. 36. Townsville, CRC Reef Research Centre.

Fenton, D.M. and Marshall, N.A. 2001, A guide to the fishers of Queensland. Part B: TRC analysis and social profiles of Queensland's harvest industry. CRC Reef Research Centre Technical Report No. 36. Townsville, CRC Reef Research Centre.

Fenton, D.M. and Marshall, N.A. 2001, A guide to the fishers of Queensland. Part C: TRC analysis and social profiles of Queensland's Charter Fishing industry. CRC Reef Research Centre Technical Report No. 38. Townsville, CRC Reef Research Centre.

Fenton, D.M. 2002. Report on the social and economic impacts of proposed fisheries spawning closures on the Charter Fishing industry. Final Report to Great Barrier Reef Charter Association Inc. North Mackay.

Gell, F.R. and Roberts, C.M. 2002. The fishery effects of marine reserves and fishery closures. WWF-US, Washington DC.

Graham, N.A.J., Evans, R.D. and G.R. Russ (2003) The effects of marine researve protection on the trophic relationships of reef fishes on the Great Barrier Reef. Environmental Conservation 30(2): 200-208.

Great Barrier Reef Marine Park Authority 2002 Annual Report 2001-2002. Great Barrier Reef Marine Park Authority, Townsville.

Great Barrier Reef Marine Park Authority 2003 Annual Report 2002-03. Great Barrier Reef Marine Park Authority, Townsville.

GBRMPA, QDPI and QFS. 1988 Memorandum Of Understanding: Fishing and Collecting in the GBRMP

GBRMPA (Ed) 1994 A 25 year strategic plan for the GBRWHA. GBRMPA, Townsville.

GBRMPA 2003, Identifying special-unique sites in the Great Barrier Reef World Heritage Area. Internal GBRMPA Working Document. GBRMPA, Townsville.

GBRMPA (in prep), A Social And Economic Profile Of Great Barrier Reef Coastal Communities, GBRMPA, Townsville.

GBRMPA (2003) Basis for Zoning Decisions Report. Consultation Draft. GBRMPA, Townsville.

Green, D., Moscardo, G., Greenwood, T., Pearce, P., Arthur, M., Clark, A., & Woods, B. 1999. Understanding Public Perceptions of the Great Barrier Reef and its Management. CRC Reef Research Centre Ltd. Technical Report No. 29 Townsville; CRC Reef Research Centre Ltd, 64 pp.

Halpern, B.S. 2003, The impact of marine reserves. Ecological Applications 13(1): 117-137.

Harriott V.J., Goggin C.L., Barnett B., Edgar S., Kininmonth S. and Harvey T. 2002, The status of monitoring in the Great Barrier Reef World Heritage Area. CRC Reef Research Centre, Townsville.

Haycock, A. and Driml, S. 2002, Total economic values: the Great Barrier Reef Marine Park and other marine protected areas. Research Report. Queensland Environment Protection Agency, Brisbane.

Higgs, J.B., K.L. McInnes, 2003, 2001 biennial recreational fishing survey of Queensland residents. State of Queensland, Department of Primary Industries, Brisbane.

Hill, A. 2000. Reserve selection in the marine environment - Literature Review and Discussion Paper. Internal GBRMPA report.

Hodgson, G. (1993). Sedimentation damage to coral reefs. In *Colloquium on global apects of coral reefs: health, hazard and history.* University of Miami, Miami. p298-303.

Hoegh-Guldberg, O. 1999. Climate change, coral bleaching and the future of the world's coral reefs,' Marine & Freshwater Research, 50:839-66. *Marine and Freshwater Research* 50:839-66.

Holling, C. S. 1973. Resilience and stability of ecological systems. *Annual Review of Ecology and Systematics* **4**: 1-23.

Holmlund, C.M. and Hammer, M. 1999. Ecosystem services generated by fish populations. Ecol. Econ. 29: 253-268

Hughes, T.P. (1994) Catastrophes, phase shifts, and large-scale degradation of a Caribbean coral reef. *Science*. **265**: 1547-1551.

Hundloe, T.J.A., McPhee, D.P. and J.S. Toon (2003) The economic impacts of the GBRMPA RAP on the commercial seafood industry. Environmental Management Centre, School of Geography, Planning and Architecture, University of Queensland.

Innes, J. and Gorman, K. 2002, A social and economic profile of Great Barrier Reef coastal communities. Draft Internal Research Report. Great Barrier Reef Marine Park Authority, Townsville.

Jackson, B.C., Kirby, M.X., Berger, W.H., Bjorndal, K.A., Botsford L.W *et al.* (2001) Historical overfishing and the recent collapse of coastal ecosystems. *Science* 293: 629-635.

Kelly, R. and Ryan, G. 1999, Crossing the Blue Highway. Australian Coral Reef Society, Australia.

Kerrigan, B., Breen, D., De'ath, G., Day, J., Fernandes, L., Partridge, R. and K, Dobbs. (in prep.) Classifying the biodiversity of the Great Barrier Reef World Heritage Area. Draft GBRMPA Internal Report on the Classification Phase of the Representative Areas Program. GBRMPA, Townsville.

Lapointe, B. and O'Connell, (1989). Nutrient enhanced growth of Cladophora prolifera in Harrington Sound, Bermuda: eutrophicatrion of a confined, phosphorus limited marine ecosystem. Esturaine, Coastal abnd Shelf Science, 28, 347-360.

Lewis, A., Slegers, S., Lowe, D., Muller, L., Fernandes, L. and Day, J. (2003) Use of spatial analysis and GIS techniques to re-zone the Great Barrier Reef Marine Park. Paper for Coastal GIS Workshop, Wollongong, NSW, 7-8 July 2003.

Ludwig, D., B. Walker, and C. S. Holling. (1997). Sustainability, stability, and resilience. *Conservation Ecology* [online]**1**(1): 7.

Mapstone, B.D., Davies, C.R., Little, L.R., Punt, A.D.M., Pantus, F., Lou, D.C., Williams, A.J., Jones, A., Russ, G.R. and A.D.McDonald. 2003. The effects of line fishing on the Great Barrier Reef and evaluation of alternative potential management strategies. CRC Research Centre, Townsville.

McClanahan, T.R. and Shafir, S.H. (1990) Causes and consequences of sea urchin abundance and diversity in Kenyan coral reef lagoons. *Oecologia* **83**:362-370

McCook, L. (2002) Land based threats to the Great Barrier Reef: Why the GBRMPA needs to manage them now. Presentation GBRMPA seminar series 2002.

McCoy, A. (2003) Understanding Great Barrier Reef visitors: comparing visitors of 2001 and 2002. CRC Reef Project B2.1.1. Data Summary Report 1.Townsville, Australia.

Moberg, F. and Folke, C. 1999. Ecological goods and services of coral reef ecosystems. Ecol. Econ. 29: 215-233

Moscardo, G. 2001. Public perceptions of the management of the Great Barrier Reef 2001. CRC Reef Project B2.5. Data summary report. Townsville, Australia.

OESR, (Office of Economic and Statistical Research), 2001. Queensland Regional Profiles June 2001. OESR Queensland Government Statistician. Queensland Government

OESR, (Office of Economic and Statistical Research), 2001. Queensland Regional Profiles June 2002. OESR Queensland Government Statistician. Queensland Government

Pandolfi, J.M., Bradbury, R.H., Sala, E., Hughes, T.P., Bjorndal, K.A., Cooke, R.G., Mcardle, D., McClenachan, L., Newman, M.J.H., Paredes, G., Warner, R.R. and J.B.C. Jackson 2003. Global trajectories of the long-term decline of coral reef ecosystems. *Science* 301: 15 August 2003 955-958

Poiner, I., Glaister, J., Pitcher, R., Burridge, C., Wassenberg, T., Gribble, N., Hill, B., Blaber, S., Milton, D., Brewer, D. and Ellis, N. 1999. The environmental effects of prawn trawling in the Far Northern Section of the Great Barrier Reef Marine Park : 1991-1996. Final report to the Great Barrier Reef Marine Park Authority and Fisheries Research and Development Corporation.

Productivity Commission, 2002, Industries in the Great Barrier Reef Catchment and Measures to Address declining water quality – issues paper August 2002, Commonwealth Government.

Queensland Parks and Wildlife Service. 2000, Marine Protected Areas in Queensland – a draft planning framework. Brisbane: State of Queensland, Environment Protection Agency.

Queensland Government. 2002, Valuing the environment. Outline of the Queensland Government's environmental management program. State Budget 2001-2002. Queensland Government's Environment Protection Agency: Brisbane.

Roberts, C.M. 1995, Effects of fishing on the ecosystem structure of coral reefs. *Conservation Biology*. **9** (5): 988-995.

Roberts, C.M., and J.P. Hawkins (2000) Fully-protected marine reserves: a guide. WWF Endangered Seas Campaign, Washington, DC 20037 USA.

Rogers, C. 1990, Responses of coral reefs and reef organisms to sedimentation. Mar. Ecol. Prog. Ser 62, 185-202.

Ronnback, P. 1999. The ecological basis for economic value fo seafood production supported by mangrove ecosystems. Ecol. Econ. 29: 235-252

Roughgarden. J., and Smithe, F. 1996, Why fisheries collapse and what to do about it. *Proceedings of the National Academy of Sciences.* **93**(10): 5078-5083.

Russ, G. 1991, Coral reef fisheries: effects and yields. In: P.F. Sale (ed) *The ecology of fishes on coral reefs*. Academic Press, San Diego, California. Pages 601-635.

Russ, G. 2002, Great Barrier Reef Green Zones could double spawning stocks of fish. Media release, James Cook University http://media.jcu.edu.au/story.cfm?id=96

Russ, G.R., 2002, *Yet Another Review of Marine Reserves as Fishery Management Tools. Coral Reef Fishes*, 2nd edition. Elsevier Science. Pp421-443

Sampson, K. 2001, How much of the marine environment should be protected in Highly Protected Areas? A literature review of theoretical and empirical evidence. Internal GBRMPA report.

Shafer, C.S., Inglis, G.J., Johnson, V.Y. and Marshall, N.A. 1998, Visitor experiences and perceived condition of the Great Barrier Reef. CRC Reef Research Centre Technical Report No. 21. CRC Reef Research Centre, Townsville.

Smith *et al*. 1981, Kaneohe Bay sewage diversion experiment: perspectives on ecosystem responses to nutritional perturbation. Pacific Sci 35, 279-385.

Spurgeon, J.P.G. 1992, The economic valuation of coral reefs. Mar. Pollut. Bull. 4(11): 529-536

Tomascik, T. and Saunders, F. 1985, Effects of eutrophication on reef building corals 1. Growth rates of the reef building coral *M. annularis*. Marine Biology 87, 143-155.

Townsville Forum 2002 Townsville Declaration on Coral Reef Research and Management. http://www.jcu.edu.au/school/mbiolaq/ccrb/Tsv%20forum.htm

Wachenfeld, D.R., Oliver, J.K. and Morrissey, J.I. (eds) 1998, State of the Great Barrier Reef World Heritage Area. Great Barrier Reef Marine Park Authority, Townsville.

Watson, R.T. and Core Writing Team. (eds) 2001. Assessment report of the Intergovernmental Panel on Climate Change. Climate Change 2001: Synthesis Report. http://www.ipcc.ch/pub/syreng.htm

Walters, C. and Kitchell, J.F. (2001) Cultivation/depensation effects on juvenile survival and recruitment: implications for the theory of fishing. *Canadian Journal of Fisheries and Aquatic Sciences* **58**: 39-50.

Ward, T.J., Heinemann, D. and Evans, N. 2001, *The role of marine reserves as fisheries management tools – a review of concepts, evidence and international experience.* Bureau of Rural Sciences, Canberra.

Wilkinson, C. (2000). *Status of coral reefs in the world.* Global Coral Reef Monitoring Network and AIMS, Australia.

Wilkinson, C. (2002) Coral bleaching and mortality the 1998 event 4 years later and bleaching to 2002. In: Wilkinson C. (ed) *Status of coral reefs of the world 2002.* Australian Institute of Marine Science, Townsville. Pages 33-44.

Wilkinson, C. (2002). *Status of coral reefs in the world.* AIMS, Townsville, Australia..

Williams, L. (ed) 2002. *Queensland Fisheries Resources – Current Condition and Trends 1988-2000*. Queensland Fisheries Service, Brisbane.

## *Appendix 1: Social, economic, cultural and management datasets used to develop the Revised Zoning Plan*

- Existing GBRMPA zoning
- Queensland Government Fisheries Closures
- Queensland Government adjacent National Parks
- Australian Maritime Safety Authority shipping lanes
- Australian Maritime Safety Authority ship reports
- GBRMPA Spill risk map
- Ports
- Land Use Characteristics
- Coastal developments
- Native Title claims
- Key informant recreational fishing information
- Boat ramps
- Suntag – fish tagging data
- Recreational fishing diary and logbook data
- 6 minute and 30 minute commercial crab-pot fishing data
- 6 minute and 30 minute commercial net fishing data
- 6 minute and 30 minute commercial reef-line data
- 6 minute and 30 minute commercial trawl data
- 6 minute and 30 minute commercial harvest data
- 6 minute and 30 minute commercial charter data
- Historic shipwrecks
- National Estate
- Museum specimen sampling sites
- Anchorage and mooring data
- More than 30,000 public submissions to GBRMPA on the rezoning process