



SECURING AUSTRALIA'S GREAT BARRIER REEF

WWF AUSTRALIA'S PROPOSAL:
WORLD CLASS PROTECTION FOR SPECIAL,
UNIQUE AND REPRESENTATIVE AREAS

"Coral reef ecosystems will not survive for more than a few decades unless they are promptly and massively protected from human exploitation."¹

23 September 2003

“I’ve been enthusiastically telling people for the last 20 years that one of the most beautiful things I’d ever seen was the Great Barrier Reef.

I’d tell people it was the eighth wonder of the world, that wherever you looked under the water you saw myriads of brilliantly coloured fishes of all shapes and sizes. They swam around you completely without fear. Snorkelling down a few metres would let you touch the incredibly soft lips of a giant clam.

Recently the second chance of a lifetime came to me.

To my terrible sadness we saw more dead coral than live coral. The few fish we saw were frightened of us. There were no giant clams, no brain corals. The reef was almost completely dead. I was devastated. I cried.

Coming back in the boat we had a cup of tea with the young guide and I pointed to a picture of a beautiful delicate fan coral in a brochure. She had never seen one. I hadn’t really believed the stories about the dying reef. Now I believe and I’m sad at what we’ve done.”

Kevin McCready, letter to Tweed Heads Daily News, 26 August 2003.

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Park Authority

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MANAGING THE REEF FOR ALL AUSTRALIANS

Throughout Australia's history, the Great Barrier Reef has been a source of wonder, awe and inspiration. Its unparalleled beauty now inspires people the world over, and it continues to provide wealth through tourism and fishing.

Until recently, the Great Barrier Reef was regarded as a well-protected, pristine wonderland. A place of delicate corals, abundant fish life and a haven for other marine life.

As scientists have understood more about the Reef's complexities, a different picture has emerged of the Reef's brilliance being tarnished by overfishing, land-based pollution and coral bleaching exacerbated by increased sea temperatures due to global warming.

The Reef is unlikely to die in the coming decades. However, it is likely to change significantly from the system that we now know.

The good news is that due to its remoteness from the coastline, its size and Australia's small and generally affluent population, the Great Barrier Reef hasn't suffered from the extreme human impacts that have caused catastrophic damage to many other coral reefs around the world.

We can protect the Reef.

Australians have a far better chance of giving our coral reefs to future generations in a healthy state, than anywhere else in the world.

It's not too late.

In early 2003, 94% of Australians (including more than 90% of coastal Queenslanders) said they wanted greater protection for the Great Barrier Reef.² Currently, only 4.6% of the entire Marine Park is highly protected in green zones (places where commercial and recreational fishing are prohibited).

Aside from its unparalleled biological riches, the Great Barrier Reef is also the source of enormous economic wealth. Tens of thousands of Australian families depend on the Reef to maintain their way of life.

Tourism is by far the biggest Reef-based industry. The Great Barrier Reef attracts in excess of 1.6 million visitors annually and it is consistently rated as one of the top three attractions for visitors coming to Australia.³ Tourism contributes \$4.2 billion to the gross value of production in the Great Barrier Reef catchment and is by far the largest employer with 47,660 employees.⁴

*"The health and future of Reef-based tourism is dependent on the long-term health and future of the Great Barrier Reef."*⁵

By comparison, recreational fishing contributes around \$187 million and commercial fishing is estimated to add another \$118 million to the regional economies along the Reef coastline.

The Australian and Queensland governments have recognised the biological and economic importance of the Great Barrier Reef, and the threats it faces. They are putting in place the following initiatives:

- The Representative Areas Program: an Australian government program to protect the biodiversity of the Great Barrier Reef World Heritage area by rezoning the Marine Park to establish a comprehensive network of green zones; and
- The Reef Water Quality Protection Plan: a joint Australian and Queensland government plan to halt and reverse the decline in the quality of water flowing into the Reef caused by poor land management practices in the catchments adjacent to the Great Barrier Reef World Heritage area.

*"The Representative Areas Program and the Reef Water Quality Protection Plan are both critical to maintaining and restoring the health of the Reef. They therefore underpin the future health of the tourism industry in Queensland."*⁶

State fisheries management plans are also slowly being developed to ensure that the various fisheries in the Marine Park are ecologically sustainable.

This document presents WWF Australia's proposal for a world class network of green zones throughout the Great Barrier Reef Marine Park. We describe why greater protection is beneficial and where additional green zones should be placed. Our full submission to the Representative Areas Program can be found at www.gbr.wwf.org.au.

THREATS TO THE GREAT BARRIER REEF

The following section gives an overview of the three major threats to the Great Barrier Reef:

- Overfishing
- Land-based sources of pollution
- Coral bleaching caused by global warming

Overfishing has greatly depleted the abundance of marine organisms in the Park, particularly the large animals: dugongs and turtles. Pollution arising from poor land practices is increasingly placing inshore reefs at serious risk of degradation. Increased sea temperatures due to global warming have already resulted in two mass bleaching events. In the future, bleaching events are likely to increase in frequency and severity.

Overfishing

Fish are often seen as resources available for human capture and consumption. In reality, they are the wildlife of the sea. They have a vital function in the ecosystem, just as animals and birds perform a vital function in a forest. Their widespread removal can have unforeseen and ecosystem-wide effects.

The introduction of commercial fisheries in the Marine Park has greatly reduced the abundance of many species, and some of the Park's most charismatic animals such as dugongs, loggerhead turtles and coral trout.

Over 100 years ago large herds of dugong were a common sight along the east-coast of Queensland. The following is a description of a herd of dugongs seen in Hervey Bay, just to the south of the Marine Park, in a book published in 1876:

*"For between three and four hours there was a continuous stream of dugong passing while the tide went out, which those in the boat could only liken to the rush of cattle out of a stockyard after a general muster...some thousands must have gone out with the tide..."*⁷

European settlement saw the commencement of a dugong oil industry off the east-coast of Queensland. The oil industry persisted until dugongs were protected in 1967.⁸ Their recovery over the past 40 years has been constrained because many thousands have drowned in shark and commercial gill nets.

If we better protect our Reef, large herds of dugong may once again become a common sight for our children.

Turtle numbers have also fallen drastically along the east-coast of Queensland as a result of bycatch from commercial fishing. For example, nesting loggerhead turtles have declined in Queensland by 50-80% between the mid 1970s and 1990.¹⁰ The National Recovery Team for marine turtles identified loggerhead turtle decline as an issue of importance prompting the following guiding statement:

*"In view of the apparent drastic decline of loggerhead turtles in Australia, the lead conservation and fisheries management agencies in each jurisdiction will make every effort, care and precaution to reduce loggerhead mortality to almost zero."*¹¹

The national Threatened Species Scientific Subcommittee recommended that the bycatch of turtles in otter trawl fishing operations in northern waters be listed as a key threatening process, and this became effective from April 2001 under the Environment Protection and Biodiversity Conservation Act 1999.¹²

The massive slaughter of humpback whales by the Queensland whaling industry earlier last century is more well-known. Since the cessation of commercial whaling, the population of humpbacks has been increasing by 10% per annum.¹³

Indicators of overfishing, for example decreasing catches, are evident in the tropical rock lobster fishery in the northern Great Barrier Reef.¹⁴ The black teatfish (a species of sea cucumber) fishery is overfished in Torres Strait and the Coral Sea.¹⁵ In 1999, fishing of black teatfish was banned in the Great Barrier Reef due to the commercial collapse of the fishery.¹⁶

Of great concern is the current plundering of coral trout stocks. Catch levels in this fishery have almost doubled since 1995, from 2582 tonnes to 4830 tonnes in 2001. Yet managers, stakeholders and researchers have agreed that this fishery was full exploited at 1996 catch levels.¹⁷

Seafloor trawling is another major concern. Although a management plan and effort reduction scheme are in place, seafloor trawling remains a destructive fishing practice in a World Heritage Area. The incidental catch of marine life in trawl nets ranges from 2 to 15 times the catch of the targeted prawns.¹⁸ Much of this is thrown back dead.

Intensive, repeated trawling also causes irreversible physical damage to seafloor habitats (for example, assemblages of sea-whips, sea fans, delicate sponges and hard and soft corals). Some fauna that are attached to the seafloor are particularly vulnerable to trawling and are at high risk of localised extinction.¹⁹

In recent years, the popularity of recreational fishing along the Queensland coast has increased dramatically. "It is becoming clear that the potential impact of recreational fishing on a number of fish and aquatic invertebrate species may be greater than was previously thought."²⁰ There are 785,000 recreational anglers in Queensland.²¹

Overfishing reduces the resilience of a marine ecosystem. The depletion of an ecosystem's biodiversity makes it weaker in the face of other pressures.

Land-based sources of pollution

The Great Barrier Reef and its catchment are an integrated ecosystem. Over the past 150 years, sediment and nutrient levels flowing into the Reef have quadrupled, largely due to grazing and cropping expansion in the catchment and loss of native vegetation, wetlands and riparian areas.²²

At present, it is estimated that current sediment discharges into the Reef are around 14 million tonnes per year, which is much higher than prior to European settlement (between 1-5 million tonnes per year).²³ Current estimates suggest that around 43,000 tonnes of nitrogen (at least twice the pre-European level) and 7,000 tonnes of phosphorus (at least three times the pre-European level) flow into the Great Barrier Reef every year.²⁴ Annual loads are increasing.²⁵

About 750 reefs lie within 20km of the coastline, between Port Douglas and Gladstone. It is these reefs that are directly influenced by coastal runoff. The reefs most at risk are between Port Douglas and Hinchinbrook and between Bowen and Mackay. These regions encompass the Cairns and Whitsundays regions, which comprise over 90% of Reef tourism activity.

Scientists have found that reefs at a number of inshore locations along the coast have been disturbed and have remained in a disturbed state. These reefs exhibit characteristics consistent with altered ecological function due to enhanced nutrient availability or sedimentation.²⁶

A Science Panel established by the Queensland Premier, the Hon Peter Beattie, confirmed that there is a serious risk to the long-term future of at least the inshore reef area as a result of land-based sources of pollution, and that action is necessary to avoid such damage.²⁷

If more effective action is not taken to reduce sediment, nutrient and pesticide runoff, the present threat to the World Heritage Area and adjacent freshwater systems will worsen.²⁸

Global warming and coral bleaching

*"What the bleaching process essentially means is that the beautiful colours of corals and equally brilliant fish communities presently seen on the reef could be replaced in the future with a panoramic graveyard of algal covered coral skeletons and a scarcity of fish. This would be a tragedy for Australia."*²⁹

The sea in the Great Barrier Reef warmed by between 0.3-0.4°C during the 20th Century. The waters of the Great Barrier Reef are expected to continue to warm at an accelerated rate throughout the 21st Century.³⁰

The first mass bleaching event in the Great Barrier Reef occurred in 1998. The worst ever-recorded bleaching event occurred four years later in 2002. Of all the reefs surveyed across the whole Marine Park, 60-95% were bleached to some extent. Around 5% of reefs have been severely damaged – between 50-90% of corals on these reefs are dead.³¹

The most likely outlook for Australian coral reefs is that mass coral bleaching will become a

more frequent event in coming decades³². In relation to the Great Barrier Reef specifically, the Intergovernmental Panel on Climate Change stated:

System: Great Barrier Reef

Description of Change: Reef death or damage from coral bleaching

Certainty and Timing: Medium to high, next 20-50 years.³³

Apart from the urgent message this sends to policy makers to make significant cuts to greenhouse emissions both globally and domestically, it also sends a message to relieve other pressures on our Reef locally.

The capacity of the Reef to cope with overfishing, pollution from the catchment and global warming is limited. The Reef cannot continue to bear these threats without serious consequences.

SECURING THE HEALTH OF THE REEF

*"It is vital that managers and scientists...use their knowledge to protect and restore 'resilience' – the ability of coral reefs to remain healthy in the face of ongoing environmental disruption."*³⁴

Protecting and restoring reef resilience is the single most important goal for future management of the Great Barrier Reef.

Resilience will be considerably enhanced by establishing a comprehensive network of green zones, reducing land-based pollution and implementing sustainable fisheries practices.

Conserving biodiversity

*"No-take (no-fishing) areas are currently the best management tool for conserving coral reefs and many other marine systems."*³⁵

Evidence from around the world shows that green zones benefit biodiversity and fish populations and this in turn provides benefits to commercial and recreational fishing.³⁶

Green zones *"result in long-lasting and often rapid increases in the abundance, diversity and productivity of marine organisms. These changes are due to decreased mortality, decreased habitat destruction and to indirect ecosystem effects."*³⁷ They also reduce the probability of extinction for marine species resident within them.

Fish grow bigger in green zones, and larger fish produce more offspring than smaller fish.³⁸ Spillover of adults and larval dispersal can replenish depleted areas outside green zones, producing broader ecosystem-wide benefits.

The benefits accrue over a relatively short period of time, with fish biomass frequently doubling or tripling in two to five years inside green zones. For example, in the Maria Island Reserve in Tasmania, large fish (>32.5cm) became at least three times more common after six years of protection.³⁹

Currently, only 4.6% of the Great Barrier Reef Marine Park is protected in green zones. This level of protection is well below what the Marine Park needs, what the community expects and what would benefit both the fisheries and tourism industries.

The Australian government, in recognition of its international obligations to protect the Great Barrier Reef's World Heritage values, is doing something about it.

The Australian government established the Representative Areas Program, which aims to create a network of green zones throughout each of the 70 bioregions in the Marine Park. The Minister for Environment and Heritage, the Hon Dr David Kemp, released a Draft Zoning Plan on 2 June 2003 which proposed protecting 32.5% of the Marine Park in no-fishing zones. This is a big step forward for conservation.

Australian Prime Minister, the Hon John Howard, has stated that the Representative Areas Program is a 'visionary historic plan'.⁴⁰ Whilst WWF Australia agrees, the final plan needs to take account of the future impacts of global warming and we address how to do this further on.

Protecting water quality

In August 2002, the Prime Minister and Queensland Premier released a Memorandum of Understanding to jointly progress the development of a Reef Water Quality Protection Plan.

The plan, still draft at the time of writing, aims to halt and reverse the decline in water quality entering the Great Barrier Reef within 10 years.

It sets out a range of strategies to stem the flow of sediment, nutrients and pesticides to Reef waters.

This initiative is to be applauded.

The plan is a vital element in the architecture needed to protect and restore the Reef's resilience. It is a credit to both the Australian and Queensland governments that they have worked cooperatively together to achieve this historic initiative.

Improving fisheries management

Green zones are a powerful tool, but they can only work if combined with effective management of surrounding areas.⁴¹ Sustainable fisheries management is crucial to ensure the effectiveness of green zones.

The Queensland government manages fisheries in the Great Barrier Reef Marine Park, with the Australian government having a vital interest due to its legal obligations to protect the area's World Heritage values.

In the 1990s the Australian government worked closely with Queensland to introduce a Queensland East Coast Trawl Management Plan. Despite the Trawl Plan being a major step forward, over 500 trawl operators remain in the fishery. Turtle excluder devices are now mandatory following the Australian government's intervention, as are bycatch reduction devices, however, the effectiveness of the latter is still marginal.

On 8 September 2003, the Queensland government announced a new management plan for the coral reef finfish fishery. The plan will reduce fishing activity by 30%, fully protect seven species of fish and close the fishery during the spawning season.

Provided the Queensland government invests substantial resources into enforcement, the plan is likely to achieve a significant improvement in sustainable management of this important fishery.

Other fisheries in the Marine Park – inshore net and crab pot – are still at least two years away from being managed under a state fisheries management planning framework. Rapid and decisive action is required by the Queensland government to reduce overfishing in these fisheries.

CONSERVING BIODIVERSITY

On 2 June 2003, the Australian Minister for Environment and Heritage, the Hon Dr David Kemp, released a Draft Zoning Plan for the Great Barrier Reef Marine Park which will create the world's largest network of highly protected areas. These areas have been identified through the government's Representative Areas Program.

The objective of the Representative Areas Program is the conservation of the biodiversity of the Great Barrier Reef World Heritage area.

From mangrove estuaries and seagrass beds to continental islands, sponge and algal gardens, sandy and coral cays, coral reefs, continental slopes and deep sea trenches – the Great Barrier Reef is a rich storehouse of the world's marine biodiversity and habitats.

The Park is home to over 30 species of marine mammals from whales to rare inshore dolphins to threatened dugong, six of the world's seven species of threatened turtle, 1,500 fish species, one third of the world's soft corals, and many thousands more species.

Yet only 4.6% of this treasure is protected from commercial and recreational fishing.

The Representative Areas Program will change this. It is built on 11 Biophysical Operating Principles, that guide the design of the world's largest proposed network of green zones. Meeting these principles is central to the effectiveness of the overall plan.

WWF Australia has examined how well the Australian government's Draft Zoning Plan meets these vital principles. In some cases the principles have been met in full and in other cases only in part.

WWF Australia's proposal endorses the Draft Zoning Plan and builds on the green zone network to more fully meet these principles.

Below we highlight areas that if included in green zones would:

- Build greater resilience against climate change
- Protect special and unique places
- Create green zones next to National Parks
- Create green zones from the coastline to the eastern Park boundary
- Protect the coastline and inter-reef areas
- Protect turtles and dugongs
- Create a network of preservation zones
- Avoid damaging uses

Building greater resilience against climate change

The Scientific Steering Committee that advised the Great Barrier Reef Marine Park Authority on the Biophysical Operating Principles stated:

*"These biophysical operating principles refer to minimum amounts of protection. The Scientific Steering Committee considers that to achieve the objectives of Representative Areas Program the Great Barrier Reef Marine Park Authority should protect at least these amounts in each bioregion and each habitat – none of these recommendations are for 'ideal' or 'desired' amounts. Ideal or desired amounts required for full protection are likely to be greater than indicated by the biophysical operational principles."*⁴²

The Townsville Declaration scientists, an eminent group of Australian and international coral reef scientists who met in Townsville in October 2002, stated that:

*"To be effective, 30-50% of the available reef area should be no-take (no-fishing) for long-term protection of coral reefs and their services."*⁴³

The scientists based these figures on historic and current threats of overfishing and pollution, and current and future threats of climate change.

Scientists have also argued that catastrophes are quite probable over the long-term and that the size of a proposed green zone should be increased as an insurance policy.⁴⁴

However, increasing the size of green zones must be balanced against the community's desire to use the Marine Park for recreational and commercial fishing.

A minimum of 30% of each bioregion in green zones would provide greater insurance in the face of dangerous climate change, whilst fishing effort and land-based pollution are cut back.

Along with the full implementation of the other Biophysical Operating Principles, this would result in a total of 52.7% of the entire Marine Park being protected in green zones.

Zoning around 50% of the Marine Park green balances the need for a high level of protection with ongoing uses and therefore provides the best possible insurance policy that Australia can give the Reef to cope with global warming.

Protecting special and unique places

The Representative Areas Program is about protecting parts of each bioregion that are typical or representative of each bioregion. However, the Marine Park has some special or unique places that do not fall neatly into a representative approach, yet are still worthy of a high level of protection.

The Great Barrier Reef Marine Park Authority has identified 53 special and unique sites that are within, or partly within, the Marine Park.

The Biophysical Operating Principles state that special and unique sites should be included in green zones. Of the 53 sites identified, 27 have been fully included in green zones, a further 15 have been partly included in green zones and 11 have no green zone protection in the Draft Zoning Plan.

The following places are of great significance and should receive full green zone protection.

Hedge Reef

Hedge Reef, in the Far Northern Section, is a special sand reef⁴⁵ and contains rich seagrass beds providing habitat for threatened dugongs and turtles.

Ribbon Reef No 10 and the lagoon westward of Hicks, Day, Carter and Yonge Reefs

Ribbon Reef No 10 and the lagoon lie at the northernmost part of the Cairns-Cooktown section. They have some of the most spectacular dive sites in the Marine Park and provide habitat for a large number of dwarf minke whales. Ribbon Reef No 10 is the largest of the Ribbon Reefs and there is strong support from the tourism and dive industries to protect this entire area.

Hinchinbrook Region

The Hinchinbrook region is world-renowned for its spectacular scenery and exceptional beauty. Missionary Bay is a haven for dugongs and is also important for green turtles.

Bowling Green Bay

Bowling Green Bay south of Townsville lies adjacent to an internationally listed wetland site and next to Bowling Green Bay National Park. The Bay has important seagrass beds which provide dugong and turtle feeding habitat and fish spawning aggregation sites.

Repulse Bay (Northern)

Repulse Bay lies between the Whitsundays and Mackay. This area has exceptional wildlife values. It provides habitat for rare Irrawaddy inshore dolphins, seabirds, dugongs and turtles and crocodiles. It also contains a fish nursery.

North West Island Reef, Heron Island Reef and Wild Duck Island

These three areas, in the Mackay-Capricorn section, are very high priority turtle nesting sites. North West and Heron Islands are significant for their seabird habitat.

Creating green zones next to National Parks

One of the 11 Biophysical Operating Principles is to consider adjacent land uses in placing green zones, as “existing no-take areas and areas adjacent to terrestrial National Parks are likely to have greater biological integrity than areas that have been used heavily for resource exploitation”.⁴⁶

The Draft Zoning Plan shows that this principle has been applied, but there is scope for its broader application in the final plan. The following areas are high priorities for green zone protection, but have not received sufficient protection in the Draft Zoning Plan.

Jardine River National Park

Part of the coastline adjacent to this Park (on Cape York Peninsula) is already zoned green. This should be extended along the entire coastline of the National Park, to protect a very important dugong habitat at Orford Ness.

Lakefield National Park, Hinchinbrook Island National Park and Bowling Green Bay National Park

These Parks all lie adjacent to special and unique areas.

Cape Upstart National Park

Part of the coastline next to Cape Upstart National Park (between Ayr and Bowen) is proposed for green zoning in the Draft Zoning Plan. Protecting the entire National Park coastline from fishing, including the Upstart Bay dugong sanctuary, would considerably enhance the ecological integrity of this area.

Cape Conway National Park

Cape Conway National Park is a land-based treasure next to the magnificent Whitsunday Islands. The Draft Zoning Plan places a green zone next to part of the National Park. This green zone should be extended to create a continuous green zone from the National Park boundary to the special and unique area in northern Repulse Bay.

Cape Palmerston National Park

Cape Palmerston National Park lies between Mackay and Shoalwater Bay. National Parks are scarce in this region, making Cape Palmerston of great regional significance. A green zone should be extended around the entire coastline of this Park and should include the Ince Bay dugong sanctuary.

Creating green zones from the coastline to the eastern Park boundary

The Far Northern Cross-shelf Transect is the only one of its kind in the Great Barrier Reef Marine Park.

It extends from the coastline to the eastern boundary of the Marine Park, capturing the enormously rich cross-shelf diversity of species and habitats. The following additional cross-shelf transects are recommended.

Cape Melville to Lookout Point – Far Northern/Cairns – Cooktown Management Area

This region contains a special and unique site, considered “seagrass heaven”.⁴⁷ Seagrasses are almost continuous from the coast out to the Ribbon Reefs. This makes the area very important for turtles, dugongs and fish.⁴⁸ The region also contains the Howick Island Group, another special and unique site, of great significance to hawksbill turtles as a rich feeding area. The expanded zone should include Wainy Reef, which is very important for solitary corals.

Hinchinbrook – Townsville-Whitsunday Management Area

A continuous green zone from the Hinchinbrook special and unique region, across the Great Barrier Reef lagoon, to the large green zone proposed in the Draft Zoning Plan for the outer barrier reef and eastern boundary, would provide substantial protection for the cross-shelf biodiversity in this section of the Park.

Shoalwater Bay – Mackay-Capricorn Management Area

The Draft Zoning Plan proposes two large green zones in this area of the Marine Park – one in Shoalwater Bay extending northeast and another along the eastern boundary of the Marine Park. Linking these two large green zones to form a continuous strip of green from the coastline to the Park boundary would provide substantial protection for the cross-shelf biodiversity in this section of the Park.

Protecting the coastline and inter-reef areas

One of the zones used to manage the Marine Park is 'General Use' which allows seafloor trawling, along with other types of fishing such as line, net and pot.

Seafloor trawling is a controversial activity in inshore areas, where there is intense competition for resources. Some trawl operators in inshore areas dump bycatch close to the coastline, resulting in fish kills washing up on local beaches, much to the dismay and anger of local communities and the tourism industry. In response to community concern, the Minister for Environment and Heritage, the Hon Dr David Kemp, implemented a prohibition of trawling in the Mission Beach region in early 2002.

Intense opposition to inshore trawling exists in many local communities along the coastline, because of the wastage of fish resources and damage to seafloor habitats. The removal of beam and otter trawling in estuaries and along the coastline would be a hugely popular initiative with local communities.

It would also protect a highly sensitive part of the Marine Park. The inshore bioregion that extends from south of Cooktown to the southern boundary of the Marine Park has the greatest number of known special and unique sites of any bioregion in the Marine Park and is also home to the greatest number of dugong habitats.

The restriction of otter trawling to the Great Barrier Reef lagoon, away from the inter-reef area, would be another great step forward for conservation of the Reef. Trawling is permitted between reefs in the southern Swains region and between reefs and shoals in the northernmost section of the Marine Park. General Use zoning should be removed from these very sensitive habitats.

Where green zones are proposed for inshore areas, they must be up to the mean low water mark (the Marine Park's western boundary). The majority of Australian and local residents do not engage in recreational fishing.⁴⁹ They should have the right to visit parts of the coastline without the conflicting use of recreational and commercial fishing.

Protecting turtles and dugongs

Turtle nesting sites

Six of the world's seven threatened turtle species are found in the Great Barrier Reef Marine Park.

The Biophysical Operating Principles state that 100% of very high, and high priority, turtle nesting sites in the Great Barrier Reef Marine Park should be protected in green zones. Yet only 42% of these priority loggerhead and green turtle nesting sites have been proposed. Loggerheads are the most endangered species of turtle in the Marine Park, yet they have been given the least amount of protection.

The following very high and high priority sites have very little, or in some cases no, green zone protection. They should all be zoned 100% green.

Priority sites

- North West Island (Capricorn-Bunker Group) – important for endangered loggerhead and vulnerable green turtles.
- Heron Island (Capricorn-Bunker Group) – important for endangered loggerhead and vulnerable green turtles.
- Wild Duck Island (northwest of Shoalwater Bay) – important for vulnerable flatback turtles.
- Crocodile Cay (unnamed reef 11-034) (just north of the far northern cross-shelf transect) – important for vulnerable hawksbill turtles.

Turtle Feeding Areas

The Biophysical Operating Principles state that a minimum of 20% of each turtle species feeding habitat should be protected in green zones. This principle has not been met in two instances. This problem should be rectified in the final plan.

- Loggerhead feeding areas in the Swains Region
One of the two major endangered loggerhead turtle feeding areas in the Marine Park is in

the Swains Region due east of the Whitsundays. Only 4% of the feeding area in the Swains is proposed for protection.

- Green turtle feeding areas from Tully to Bowling Green Bay
One major green turtle feeding area is in the Tully to Bowling Green Bay region. However, only 13% of turtle feeding habitat is proposed for green zone protection in this region.

Dugong habitats

Dugongs are gentle herbivorous mammals, growing up to 400 kg, and feeding exclusively on seagrasses. They are listed as 'vulnerable' under Queensland legislation.

The Biophysical Operating Principles state that about 50% of all high priority dugong habitats should be protected in green zones. Whilst the Draft Zoning Plan meets this principle, it does not protect some of the most important areas.

High priority areas should be given greater protection than lower priority areas.

- Princess Charlotte Bay is one of the most important dugong habitats in the northern Great Barrier Reef.⁵⁰

The coastal section of Princess Charlotte Bay is proposed for 'dark blue' zoning, which allows all commercial fishing other than seafloor trawling. This proposal will allow the reintroduction of a key threat to dugongs – commercial mesh netting – in one of their most important habitats in the Marine Park.

This is the only area in the Draft Zoning Plan where an increased level of fishing use is being proposed.

Princess Charlotte Bay is identified as a special and unique site, is home to many threatened turtles, rare inshore dolphins and a large range of species and habitats and is adjacent to Lakefield National Park.

The entire Princess Charlotte Bay should be zoned green.

- Cape Melville to Barrow Point coastline is another highly significant region for dugongs

in the northern Great Barrier Reef.⁵¹ Yet, a large area is proposed for General Use zoning. General Use zoning allows trawling which can destroy seafloor habitats and result in substantial bycatch. The General Use area proposed near the coastline south of Cape Melville should be zoned green.

- Shoalwater Bay and the Hinchinbrook area (including Rockingham Bay) are the two most important dugong habitats in the southern Great Barrier Reef (south of Cooktown).⁵² Yet, only 67% of Shoalwater Bay and 16% of the Hinchinbrook area are proposed for green zoning under the Draft Zoning Plan. These two areas should be zoned 100% green.
- Edgumbe Bay is proposed for dark blue zoning, which is an inappropriate use for a dugong sanctuary, given the intensive fishing pressure in this zone type. Edgumbe Bay should be open to limited line fishing only ('yellow' zoning).
- The Newry Region and Sand Bay are proposed for General Use zoning, with some green and yellow zoning. The Newry Region should be zoned 100% green, with Sand Bay zoned yellow to allow for limited line fishing.

Creating a network of preservation zones

Preservation zones are vital scientific reference areas. These are areas where human access is totally prohibited, giving them a unique role in helping to understand the effects of human use elsewhere in the Park.

Only one new preservation zone has been proposed in the Draft Zoning Plan – the Milman Islet/Aplin Reef complex in the Far Northern Section. This area is the largest turtle nesting site in the World Heritage Area.

If a comprehensive monitoring program is to be established that takes account of the bioregional framework of the Representative Areas Program, then it makes sense to place a preservation zone in each of the Park's 70 bioregions. Under the Draft Zoning Plan, 37 bioregions have no preservation zones.

WWF Australia has submitted a GIS-based map to Great Barrier Reef Marine Park Authority proposing specific locations for preservation zones in each of the bioregions where they currently do not exist. In total WWF Australia's proposal for preservation zones would only represent 0.6% of the Marine Park.

Avoiding damaging uses

The current zoning system is silent on marine-based aquaculture. This allows a developer to apply to the Great Barrier Reef Marine Park Authority for a permit to undertake intensive aquaculture anywhere in the Park, other than in green or preservation zones. The Draft Zoning Plan proposes to make intensive aquaculture (meaning, the addition of feed) a permitted use in General Use zones only, which occupy 34% of the Marine Park, or about 117,500 km². Currently, there are no intensive aquaculture operations in the Marine Park.

The plan also proposes extensive aquaculture (where the addition of feed is not permitted) in both General Use and dark blue zones. Currently, four extensive aquaculture permits have been issued by the Great Barrier Reef Marine Park Authority for the Marine Park.

Although the Draft Zoning Plan proposes to restrict the area available to intensive aquaculture, it also makes this form of aquaculture an explicitly permitted use, unlike current or past zoning plans.

Experience from overseas demonstrates that marine-based intensive aquaculture is potentially a highly polluting activity.⁵³ To allow intensive aquaculture in over a third of the Marine Park runs contrary to the Reef Water Quality Protection Plan, which calls on farmers to reduce nutrient input to the Reef. Allowing intensive aquaculture would open up a new industry that contributes new sources of nutrient pollution into the Reef. The community has been so focused on commenting on the proposed green zone network, that there is virtually no awareness of this proposal.

Intensive aquaculture is not a reasonable use in the Marine Park and should not be allowed. Extensive aquaculture is a reasonable use and should be subject to environmental standards that ensure the Reef is not polluted.

MAKING THE PLAN WORK

The Representative Areas Program will have economic and social benefits and costs.

The tourism industry stands to gain significantly and, as tourism is by far the most economically important Reef-based industry, the benefits of the program are likely to substantially outweigh the costs.

The importance of Reef-based industries

In February 2003, the Productivity Commission published a report entitled *Industries, Land Use and Water Quality in the Great Barrier Reef Catchment* which examined the socio-economic importance of industries in the Great Barrier Reef catchment, including mining, tourism, agriculture and processing.

Here, we present socio-economic data from the Productivity Commission report that highlights the relative values of the Reef-based industries: tourism, recreational fishing, commercial fishing and seafood processing.

Table 1 shows that, of all the Reef-based industries, tourism is by far the greatest contributor to gross value of production (GVP) in the region.

Table 1: Economic importance of industries in the GBR catchment⁵⁴ (2001, unless otherwise stated)

Industry	Gross Value of Production ^a \$m	Percentage GVP	Total Employed persons by no. ^b	Percentage employed persons
Tourism	4,228	92.6	47,660 ^c	96.2
Recreational Fishing	187	4.1	na	na
Commercial Fishing	118 ^d	2.6	1,691	3.4
Seafood Processing	33 ^e	0.7	180 ^f	0.4
TOTAL	4,566	100.0	49,531	100.0

a Approximated with expenditure by tourists and recreational fishers and turnover (processing). Calculated using landed prices (commercial fishing).

b Week prior to 7 August 2001.

c 1998 - 99.

d Other sources estimate commercial fishing GVP to be higher (for example Queensland Fisheries Service estimate that over a three year period, GVP from the Great Barrier Reef ranges between \$143.7 – 181.5 million, depending on catch variability).

e Due to confidentiality restrictions, GVP for the catchment cannot be reported. This figure refers to production in the catchment, plus production by an additional seafood processing location in the Moreton statistical division. These figures are for 1999-00.

f 1999 - 00.

Table 2 shows the GVP of each Reef-based industry within each region⁵⁵ adjacent to the Great Barrier Reef.

Table 2: Distribution of the gross value of production across regions⁵⁶

(2001, unless otherwise stated)

Industry	Far North	Northern	Mackay	Fitzroy	Wide-Bay Burnett	Total
	\$m	\$m	\$m	\$m	\$m	\$m
Tourism	1,937	579	658	475	579	4,228
Recreational Fishing	72	55	36	22	3	187
Commercial Fishing	48	19	23	28	0.47 ^a	118
Seafood Processing	–	–	–	–	–	33

a Figures are the portion of the Wide Bay-Burnett Statistical Division within the study area. It is assumed that 5 per cent of total Wide Bay-Burnett activity occurs in the study region.

Table 3 shows the percentage of employment in the tourism and seafood processing industries across the five regions.

Table 3: Distribution of employment across regions by percentage^{57a}

(7 August 2001, unless otherwise stated)

Industry	Far North	Northern	Mackay	Fitzroy	Wide-Bay Burnett	Total ^a
	%	%	%	%	%	%
Tourism ^b	41	15	16	13	16	100 ^c
Commercial Fishing	36	13	7	13	30 ^d	100
Seafood Processing	27	8	6	19	40	100

a Due to rounding, figures might not sum to 100 per cent.

b 1998-99.

c The regional statistical breakdown percentages add to 101% [WWF Australia].

d Percentage covers the whole Wide Bay-Burnett Statistical Division.

Table 4 shows the employment of each Reef-based industry within each region.

Table 4: Distribution of employment across regions^a (2001, unless otherwise stated)

Industry	Far North	Northern	Mackay	Fitzroy	Wide-Bay Burnett	Total
	No.	No.	No.	No.	No.	No.
Tourism ^b	19,445	7,054	7,530	6,101	7,530	47,660
Commercial Fishing	691	294	363	322	22 ^c	1,691
Seafood Processing	49	14	11	34	72	180

a Includes a correction factor of -0.02% for the tourism industry to adjust for the regional percentage of the tourism industry adding to 101% in Table 3. The figures for tourism and seafood processing need to be treated with caution, as they are derived from percentages, based on ABS unpublished data 2001 Census. The figures for commercial fishing are quoted directly from the Productivity Commission report (Table G.21).

b 1998-99.

c Figure is for the portion of the Wide Bay-Burnett Statistical Division within the study area. It is assumed that 5 per cent of total Wide Bay-Burnett activity occurs in the study region.

Finally, Table 5 shows projections for each of the reef-based industries in terms of both output and employment growth rates.

Table 5: Projected industry output and employment growth rates for the GBR catchment^a

Industry	2001 to 2010		2010 to 2020		2001 to 2020	
	Output	Emp.	Output	Emp.	Output	Emp.
	%	%	%	%	%	%
Tourism ^b	15	na	31	na	51	na
Recreational Fishing	1	na	0	na	1	na
Commercial Fishing	-6	-17	-16	-21	-21	-35
Seafood Processing	na	na	na	na	na	na

a Base case. In constant 2000-01 prices; rounded to the nearest whole percentage value.

b These tourism projections do not take account of the effects of global warming and coral bleaching.

The tourism industry is projected to become even more important. Tourism GVP is projected to increase by more than 50 per cent by 2020. At the same time, commercial fishing GVP is projected to fall.

The case for financial assistance

The commercial fishing industry has argued that more green zones will concentrate fishing effort in areas that remain open to fishing, thereby increasing pressure on fish stocks and conflict between users, reducing returns to fishers and creating many unviable businesses.

The industry has argued that adequate compensation and structural adjustment funding must be provided to mitigate these negative impacts on the industry and fish stocks. These claims are explored below for each of the three types of fisheries in the Marine Park:

- offshore (otter trawl and coral reef line)
- inshore (net, crab pot, beam trawl)
- harvest fisheries (trochus, sea cucumber, aquarium fish, rock lobster, coral).

Offshore fisheries at a Marine Park scale

Offshore fisheries are characterised by high value, larger, more powerful boats than inshore fisheries, greater mobility and therefore a greater potential to shift to other locations.

Trawl

From 1 January 2001, the Queensland government implemented a management plan that removed latent effort and reduced active fishing effort by 15%. It was achieved with a \$20 million joint Australian/Queensland structural adjustment package.

After the implementation of the management plan, the area open to trawling in the Great Barrier Reef Marine Park was 171,944 km². Of this area, 106,519 km² was trawled in 2001.⁵⁸ Under the Draft Zoning Plan, 118,074 km² are proposed to remain open to trawling, which is still in excess of the area trawled in 2001. In addition, the management plan requires that trawling in the Marine Park be reduced each year for three years, starting 2001.

This means that there will still be more space to trawl in the Marine Park, if one third of the Park is closed to fishing, than the industry actually uses.

The greater mobility of this fishery means that it has greater capacity to adapt to the changes proposed under the Draft Zoning Plan.

Coral Reef Line

The Queensland government announced approval of a coral reef line management plan on 8 September 2003. The plan will remove latent commercial effort in November 2003 and reduce active commercial effort by 30% from July 2004.

In 2001, the commercial fishery caught 4,830 tonnes of fish. About 96% of this catch comes from the Marine Park.⁵⁹ We can therefore estimate that approximately 4,590 tonnes were taken in 2001 from the Marine Park. Currently, 320,844 km² of the Marine Park is open to commercial scale reef line fishing.

The new Queensland management plan sets a Total Allowable Catch of 3,061 tonnes per annum for the fishery. Of this, approximately 2,908 tonnes are likely to be caught from the Marine Park. Under the Draft Zoning Plan, 224,331 km² are proposed to remain open to commercial scale reef line fishing.⁶⁰

Therefore in 2001, on average 1 tonne of coral reef fish was taken from 70 km², whereas in 2005 on average 1 tonne of coral reef fish may be taken from 77 km², assuming the Draft Zoning Plan is implemented with no changes.

This means there will be more space to catch each tonne of coral reef fish in the Marine Park, if one third of the Park is closed to fishing. This is due to the implementation of the Queensland government's coral reef line fishery management plan.

The greater mobility of this fishery means that it has greater capacity to adapt to the changes proposed in the Draft Zoning Plan.

If there were no management plans in place for the trawl and coral reef line fisheries, then there would definitely be a problem of concentration of effort at a Marine Park scale as a result of the Representative Areas Program. However, both management plans reduce fishing activity to a level where increased concentration of effort due to the Representative Areas Program is avoided at a Marine Park scale.

Offshore fisheries at a local scale

Although at a Marine Park scale, the case for adjustment assistance for offshore fisheries due to concentration of effort is weak or non-existent, this may not be the case at a local level.

The Representative Areas Program will protect areas that are both substitutable and non-substitutable. Substitutable areas are those that are proposed as green zones to protect a minimum of 20% per bioregion, as required under the Biophysical Operating Principles. Non-substitutable areas are those that have special or unique biological values (for example, high priority turtle nesting sites or unique assemblages of species), again as required by the Operating Principles.

Green zones proposed for non-substitutable areas may overlap with areas that are of high value to the offshore fishing industry (for example, a high priority turtle nesting site may also be an area of high prawn density). Crocodile Cay, in the Far Northern Section of the Marine Park, is an example of a high priority hawksbill turtle nesting site, with high value to the trawl industry.

Where this occurs, WWF Australia supports adjustment assistance being provided. Fishers would need to be able to demonstrate a history of effort in the area proposed for closure and that relocation to other areas would cause their business to become unviable.

WWF Australia's proposal would impose further area restrictions in the Marine Park on trawling (a reduction to 81,514 km²) and reef line fishing (a reduction to 151,976 km²). With respect to coral reef line fishing, the costs of increased concentration of effort need to be weighed against the benefits of green zones (significantly increased dispersal of larvae from bigger, older and more fecund coral reef fish into surrounding fishing areas).

Further, a significant proportion of the additional area to be closed to trawling and to commercial scale line fishing under the WWF Australia proposal would be substitutable areas that would be selected on the basis of least cost to industry. WWF Australia's proposal would require further adjustment assistance than the government's Draft Zoning Plan, but we argue that it is in the long term public interest to do so from a conservation and tourism perspective.

Inshore Fisheries

The inshore fisheries are characterised by low value, smaller, less powerful boats than offshore fisheries, less mobility and therefore less capacity to shift to other locations. They tend to be more lifestyle fisheries.

Due to the lack of Queensland fisheries management plans, these fisheries have substantial latent effort and excessive active effort. There is real concern that after the implementation of the Representative Areas Program, concentration of effort in these fisheries will cause increased fishing pressure at a local level and increased social conflict.

Net

Approximately 600 net licence holders are permitted to use large mesh nets along the Queensland east-coast. Of these, around 200 are inactive, meaning substantial latent effort exists in this fishery. Intense competition for resources in inshore areas has resulted in substantial community conflict at a regional level between commercial net and recreational fishers.

Crab Pot

Approximately 800 east-coast crab licences are current along the Queensland east-coast. Of these around half are inactive, meaning substantial latent effort exists in this fishery.

Beam Trawl

A total of 157 beam trawl licenses are current along the Queensland east-coast. The beam trawl fishery GVP is very small (approximately \$160,000 to \$300,000). Many operators work in very specific areas (two to three bays).

The inshore fisheries are less resilient to fisheries closures than the offshore fisheries as they are characterised by smaller boat sizes, limited mobility and fewer options. It is likely that affected fishers will need adjustment assistance to avoid increased concentration of fishing effort, increased user conflict, reduced returns to fishers and potentially unviable businesses.

Due to the low value of these fisheries, the cost to government is likely to be minimal.

Harvest Fisheries

The GVP for harvest fisheries in the Great Barrier Reef is estimated to be between \$12.7-23.6 million. The impacts of the WWF Australia's proposed closures are likely to be mixed and in some cases very minimal. It is likely that affected fishers will need adjustment assistance, due to the characteristics of this diverse fishery.

Structural adjustment

In some instances, there is a case for adjustment assistance as a result of the Representative Areas Program. The case is much stronger for the low value inshore fisheries, than for the higher value offshore fisheries, which have greater mobility and greater potential to shift to other locations. However, in areas that are non-substitutable, offshore fisheries should also be considered for adjustment assistance.

An adjustment scheme must reduce active fishing effort and preclude latent effort from becoming active. Fishers should not be permitted to re-enter a fishery operating in the Great Barrier Reef until such time as a state fisheries management plan is in place that removes latent effort and reduces active effort.

The Great Barrier Reef Dugong Protection Area compensation scheme resulted in a voluntary buy-out of 38 commercial fishing boat licences, but "Anecdotal evidence suggests that many fishers used their ex gratia payments to buy another licence and resume fishing."⁶¹ This must be avoided with a Representative Areas Program adjustment scheme.

The responsibility to protect the World Heritage values of the Great Barrier Reef rests with the Australian government. The objective of the Representative Areas Program is to conserve the biodiversity of the Great Barrier Reef World Heritage area. Responsibility to pay for a Representative Areas Program adjustment scheme therefore lies with the Australian government.

Complementary zoning by Queensland

The Queensland government made an election commitment in 2001 to refine "the zoning of State marine parks to complement, where practicable, the Great Barrier Reef Marine Park Authority's plans".⁶²

Complementary zoning of Queensland waters is essential to secure the biological integrity of green zones in the Marine Park. WWF Australia acknowledges and welcomes the Queensland government's commitment to complementary zone state waters.

Enforcement and compliance

In recent times, the Great Barrier Reef Marine Park Authority has significantly improved its capacity to coordinate surveillance and enforcement activities throughout the Park. This was due to an injection of \$3.4 million of Australian government funds over the past 4 years to enhance the Great Barrier Reef Marine Park Authority's enforcement program. These funds have now expired.

During the two public consultation phases for the zoning plan, all sectors of the community expressed a very strong view that the Great Barrier Reef Marine Park Authority must make enforcement of the new green zone network a very high priority.

Although the Great Barrier Reef Marine Park Authority has developed excellent compliance and enforcement networks and systems, it would be unrealistic to expect this to continue without continued funding and with a new network of green zones to manage.

SECURING AUSTRALIA'S SPECTACULAR MARINE HERITAGE

Australians love the Reef. They consistently support a high level of protection, even if it means restricting human use.

We see the Reef as iconic - a place that is exceptionally beautiful, fun, magical, and an escape from everyday life. We want it to stay this way forever.

Australia is recognised as a global leader in marine conservation. The establishment of the Great Barrier Reef Marine Park in 1975 showed the world that marine protected areas could be implemented on a grand scale. The listing of the Great Barrier Reef on the World Heritage register in 1981 provided global recognition for the outstanding universal value of this unique ecosystem.

The creation of the world's largest network of highly protected areas represents the third great phase in the history of Great Barrier Reef conservation. If we get it right, it will be an inspiration to other countries around the world to better protect their marine and particularly coral reef environments.

The WWF Australia proposal for a world class Representative Areas Program for the Great Barrier Reef proposes:

- Building greater resilience against climate change
- Protecting special and unique places
- Creating green zones next to National Parks
- Creating green zones from the coastline to the eastern Park boundary
- Protecting the coastline and inter-reef areas
- Protecting turtles and dugongs
- Creating a network of preservation zones
- Avoiding damaging uses.

Coral reefs are probably the most threatened ecosystem on earth today, due to overfishing, pollution and climate change. If the Great Barrier Reef is to 'survive' as we know and enjoy it today, then we will need to introduce a massive level of protection.

FOOTNOTES

¹ Pandolfi J et al, 2003, *Global Trajectories of the Long-term Decline of Coral Reef Ecosystems*, Science, Vol 301, 19 August 2003.

² AEC Group, 2003, *Market Research for Great Barrier Reef Marine Park Authority – Coastal Research*, Townsville.

³ Gschwind D, 2003, *A Tourism Perspective on the Representative Areas Program*, Queensland Tourism Industry Council, Canberra.

⁴ Productivity Commission, 2003, *Industries, Land Use and Water Quality in the Great Barrier Reef Catchment*, Research Report, Canberra.

⁵ National Tourism Futures Conference, 2003, *Great Barrier Reef Forum*, Sunshine Coast, Queensland, 22 July 2003.

⁶ Ibid.

⁷ Thorne E, 1876, *Queen of the Colonies*, cited by the CRC Reef Research Centre, April 2002.

⁸ Oliver J and R Berkelmans, 1999, *A Dugong Research Strategy for the Great Barrier Reef World Heritage Area and Hervey Bay*, GBRMPA Research Publication No. 58, May 1999.

⁹ Marsh H and I Lawler, 2001, *Shark Control Records Hindcast Serious Decline in Dugong Numbers off the Urban Coast of Queensland*, GBRMPA Research Publication No. 70.

¹⁰ Limpus C and D Reimer, 1994, *The loggerhead turtle, Caretta caretta, in Queensland: a population in decline*. In: Proceedings of the Australian Marine Turtle Conservation Workshop. Compiled by R. James. Queensland Department of Environment and Heritage and [the] Australian Nature Conservation Agency, 34-48.

¹¹ Marine Species Section, Approvals and Wildlife Division, Environment Australia in consultation with the Marine Turtle Recovery Team, 2003, *Recovery Plan for Marine Turtles in Australia*, Canberra.

¹² Ibid.

¹³ Lucas PHC et al, 1997, *The Outstanding Universal Value of the Great Barrier Reef World Heritage Area*, Great Barrier Reef Marine Park Authority, Townsville.

¹⁴ Great Barrier Reef Marine Park Authority, *Management Status, Fisheries*, cited at GBRMPA website on 9 September, 2003.

¹⁵ Department of Agriculture, Fisheries and Forestry, 2003, *Fishery Status Reports 2002-03 – Overview*, Canberra.

¹⁶ Great Barrier Reef Marine Park Authority, *Management Status, Fisheries*, cited at GBRMPA website on 9 September, 2003.

¹⁷ Queensland Department of Primary Industries, October 2002, *Coral Reef Fin Fish Fishery Consultation Paper*, Queensland government.

¹⁸ Huber, D, May 2003, *Audit of the Management of the Queensland East Coast Trawl Fishery in the Great Barrier Reef Marine Park*, Great Barrier Reef Marine Park Authority, Townsville.

¹⁹ Poiner, I et al, 1998, *The Environmental Effects of Prawn Trawling in the Far Northern Section of the Great Barrier Reef: 1991 – 1996, Introduction: Summary, Conclusions and Recommendations*, CSIRO Division of Marine Research, Cleveland.

²⁰ Ibid.

²¹ Henry, GW & JM Lyle, 2003, *The National Recreational and Indigenous Fishing Survey*, NSW Fisheries

²² Productivity Commission, 2003, *Industries, Land Use and Water Quality in the Great Barrier Reef Catchment*, Research Report, Canberra.

²³ Ibid; Baker J, 2003, *A Report on the Study of Land-Sourced Pollutants and their Impacts on Water Quality in and Adjacent to the Great Barrier Reef, for the Intergovernmental Steering Committee GBR Water Quality Action Plan*, Brisbane.

²⁴ Baker J, 2003, *A Report on the Study of Land-Sourced Pollutants and their Impacts on Water Quality in and Adjacent to the Great Barrier Reef, for the Intergovernmental Steering Committee GBR Water Quality Action Plan*, Brisbane.

²⁵ Great Barrier Reef Marine Park Authority, 2001, *Great Barrier Reef Catchment Water Quality Action Plan*, a report to Ministerial Council on targets for pollutant loads.

²⁶ Baker J, 2003, *A Report on the Study of Land-Sourced Pollutants and their Impacts on Water Quality in and Adjacent to the Great Barrier Reef, for the Intergovernmental Steering Committee GBR Water Quality Action Plan*, Brisbane.

²⁷ Ibid.

²⁸ Williams D, C Roth, R Reichelt, P Ridd, G Rayment, P Larcombe, J Brodie, R Pearson, C Wilkinson, F Talbot, M Furnas, K Fabricius, L McCook, T Hughes, O Hough-Gulberg, T Done, 2003, *The current level of scientific understanding on impacts of terrestrial run-off on the Great Barrier Reef World Heritage Area*, CRC Reef Research Centre, Townsville.

²⁹ Hoegh-Guldberg O, Media Release 15th August, 2003, *Reef at Risk: Leading Scientists Join to Save Australian Icon Centre for Marine Studies*, University of Queensland

³⁰ Done T et al, 2003, *Global Climate Change and Coral Bleaching on the Great Barrier Reef*, prepared for Queensland Government Department of Natural Resources and Mines, Brisbane.

³¹ Marshall P & D Wachenfeld, 2003, *Ecosystem Resilience – An insurance policy against climate change for the Great Barrier Reef*, Great Barrier Reef Marine Park Authority, Townsville.

³² The Intergovernmental Panel on Climate Change, 2001, *Climate Change 2001 – Impact, Adaptation and Vulnerability*, Third Assessment Report, Chapter 12: 'Australia and New Zealand'.

³³ Ibid.

³⁴ Connolly, S, Media Release 15th August 2003, *Cover story in Science reveals new global vision for managing coral reef threatened by climate change*, Centre for Coral Reef Biodiversity, James Cook University

- ³⁵ Roughgarden, J, Media Release 15th August 2003, *Cover story in Science reveals new global vision for managing coral reef threatened by climate change*, Stanford University.
- ³⁶ National Centre for Ecological Analysis and Synthesis, 2001, *Scientific Consensus Statement on Marine Reserves and Marine Protected Areas*, University of California.
- ³⁷ Ibid.
- ³⁸ Hughes, T, 2003, *What are the benefits of no-take zones? How do they work?*, James Cook University.
- ³⁹ Gell FR and CM Roberts, 2003, *Benefits beyond boundaries: the fishery effects of marine reserves*, Trends in Ecology and Evolution, 18:9:448-455
- ⁴⁰ Howard, the Hon John, Prime Minister, House of Representatives, Question Time, Thursday, 5 June 2003
- ⁴¹ Bellwood D, M Card, S Connolly, C Folke, R Grosberg, O Hoegh-Guldberg, T Hughes, J Jackson, J Kleypas, JM Lough, P Marshall, M Nyström, J Pandolfi, P Pockley, B Rosen, J Roughgarden, 2002, *The Townsville Declaration on Coral Reef Research & Management*, Townsville, 18 October 2002
- ⁴² Great Barrier Reef Marine Park Authority, 2001, *Biophysical Operational Principles as recommended by the Scientific Steering Committee*, GBRMPA, Townsville.
- ⁴³ Bellwood D, M Card, S Connolly, C Folke, R Grosberg, O Hoegh-Guldberg, T Hughes, J Jackson, J Kleypas, JM Lough, P Marshall, M Nyström, J Pandolfi, P Pockley, B Rosen, J Roughgarden, 2002, *The Townsville Declaration on Coral Reef Research & Management*, Townsville, 18 October 2002
- ⁴⁴ Allison, GW, SD Gaines, J Lubchenco and H Possingham, 2003, *Ensuring persistence of marine reserves: Catastrophes require adopting an insurance factor*, Ecological Applications, 13(1) Supplement, 2003, S8-S24
- ⁴⁵ Great Barrier Reef Marine Park Authority, 2003, *Draft Great Barrier Reef Marine Park Zoning Plan – Basis for zoning decisions report*, GBRMPA, Townsville
- ⁴⁶ Great Barrier Reef Marine Park Authority, 2001, *Biophysical Operational Principles as recommended by the Scientific Steering Committee*, GBRMPA, Townsville.
- ⁴⁷ Great Barrier Reef Marine Park Authority, 2003, *Draft Great Barrier Reef Marine Park Zoning Plan – Basis for zoning decisions report*, GBRMPA, Townsville
- ⁴⁸ Ibid.
- ⁴⁹ Henry GW & JM Lyle, 2003, *The National Recreational and Indigenous Fishing Survey*, NSW Fisheries
- ⁵⁰ Marsh H. and I. Lawler, 2002, *Dugong distribution and abundance in the northern Great Barrier Reef Marine Park – November 2000*, GBRMPA Research Publication No. 77.
- ⁵¹ Ibid
- ⁵² Marsh, H et al, 2001, *Dugong Distribution and Abundance in the Southern Great Barrier Reef Marine Park and Hervey Bay: Results of an Aerial Survey in October-December 1999*, GBRMPA Research Publication No. 70
- ⁵³ Staniford D, 2002, *Sea Cage fish farming: an evaluation of environmental and public health aspects*, Paper presented to the European Parliament's Committee on Fisheries.
- ⁵⁴ Productivity Commission, 2003, *Industries, Land Use and Water Quality in the Great Barrier Reef Catchment*, Research Report, Canberra.
- ⁵⁵ Queensland Office of Economic and Statistical Research, cited at OESR website on 10 September, 2003.
- ⁵⁶ Ibid.
- ⁵⁷ Ibid.
- ⁵⁸ Queensland Fisheries Service, September 2002, *Status of the Queensland East Coast Otter Trawl Fishery after the First Effort Year (2001)*.
- ⁵⁹ Great Barrier Reef Marine Park Authority, 2003, *State of the Great Barrier Reef*, cited at GBRMPA website on 10 September, 2003.
- ⁶⁰ Great Barrier Reef Marine Park Authority, 2003, *Draft Great Barrier Reef Marine Park Zoning Plan – Basis for zoning decisions report*, GBRMPA, Townsville
- ⁶¹ Marsh H, July 2000, *Evaluating management initiatives aimed at reducing the mortality of dugongs in gill and mesh nets in the Great Barrier Reef World Heritage Area*. Marine Mammal Science, 16(3):684-694.
- ⁶² Australian Labour Party (Queensland), 2001, *Putting Queensland First: Reef Protection Plan*.

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