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Great Barrier Reef
Marine Park Authority

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Environmental Status:

Inter-reefal and Lagoonal benthos

let's keep it great

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Inter-reefal and lagoonal benthos

Condition

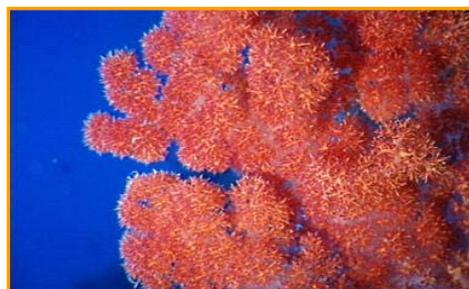
In contrast to its name, only about five per cent of the area of the Great Barrier Reef Marine Park is taken up by coral reefs, with most of the remaining 95 per cent comprised of seabed and benthic (bottom dwelling) communities, other than coral reefs. This seabed is ecologically complex and includes many different types of habitats. Generally it can be divided into three broad categories (as shown in the following map):

- the Great Barrier Reef *lagoon*: a relatively open area of primarily soft sediment seabed covering the area between the mainland and the part of the seabed where the reefs begin. Generally speaking, the lagoon in the northern region of the World Heritage Area is much narrower (in some places almost non-existent) than the southern lagoonal areas;
- the *inter-reefal* area: the seabed found between coral reefs at the outer edge of the lagoon and the reefs at the edge of the continental shelf; and
- the continental slope and associated habitats.

This chapter deals only with the first two categories as they share the same pressures.

The majority of sediments in the inshore region of the lagoon originate from the land adjacent to the reef, and are dominated by very fine mud and sand particles. In comparison, the sediments further offshore in inter-reefal areas are comprised of coarser sands of marine origin. Scattered throughout both the muddy and sandy areas are patches of hard substrate including rubble, bedrock, deep reef and shoals. These different types of substrate harbour very different communities of plants and animals, resulting in clear cross-shelf zonation of lagoonal and inter-reefal benthic communities related to the change in seabed sediments. The muddier areas have lower numbers of animals and are less diverse than the sandier areas and the areas of hard substrate.

Despite the fact that they cover most of the Great Barrier Reef Marine Park, lagoonal and inter-reefal seabed areas are generally much less studied and visited than coral reefs. However, it is widely recognised that these areas are critical elements of the Great Barrier Reef ecosystem. The lagoonal and inter-reefal seabed habitats are home to great biodiversity, thousands of species, most of which are as yet unnamed by science. Furthermore, these different areas are part of the network of habitats that not only make up the Great Barrier Reef ecosystem, but also connect its different parts.



Inter-reefal and lagoonal areas contain high biodiversity and are vital to the healthy functioning of the Great Barrier Reef ecosystem.



This interconnectivity is vital to the life cycles of many marine animals and to the healthy functioning of the Great Barrier Reef ecosystem as a whole. For example, many commercially important reef fish, such as red emperor, utilise different habitats at different stages in their life cycles. Disruption of these habitats or the connections that link them will ultimately impact red emperor populations on coral reefs. Furthermore, new habitat types such as deep water seagrass beds and mounds comprised of the marine algae *Halimeda* are still being discovered.

Some topics that could be included in this chapter are covered in other areas of the report. For example, most *seagrass habitat* occurs within the lagoon and inter-reefal areas (some of it is found on top of coral reefs) but because they are a specific topic in themselves, seagrasses are discussed in a separate chapter. This section considers those elements of the lagoon and inter-reefal areas that are not dealt with elsewhere.

The condition of inter-reefal and lagoonal benthos can be viewed from at least two perspectives:

- The *ecosystem and biodiversity* perspective that relates to the condition of the communities of plants and animals.
- The *fisheries* perspective concerning the relationships between stock, catch and effort for the benthic species of commercial interest living in these areas.

Condition: Ecosystem and biodiversity

From the perspective of the *ecosystem and biodiversity*, it is very difficult to determine the condition of the seabed communities. Despite the geographical extent and biological importance of these areas, only a small number of descriptive studies have been carried out. There are no historical scientific monitoring programs that describe how these seabed communities have changed over time. Furthermore, research into the effects of trawling completed in 1998 (see *Pressure*) suggests that trawling has significantly altered the seabed communities of some areas of the inter-reef and lagoon. The lack of research in these areas has meant that there is now little information on what “pristine” seabed habitats were like before trawling began.

In 2001, the Great Barrier Reef was mapped using the best available biological and physical information as part of the Representative Areas Program (RAP). With the assistance of an Independent Scientific Advisory Committee, the RAP identified 40 separate and unique “bioregions” in the inter-reefal, lagoonal and continental slope areas, containing a large number of different habitats such as isolates (thickets of sponges and soft corals), beds of deepwater seagrasses and underwater mounds comprised of the marine algae species *Halimeda*.

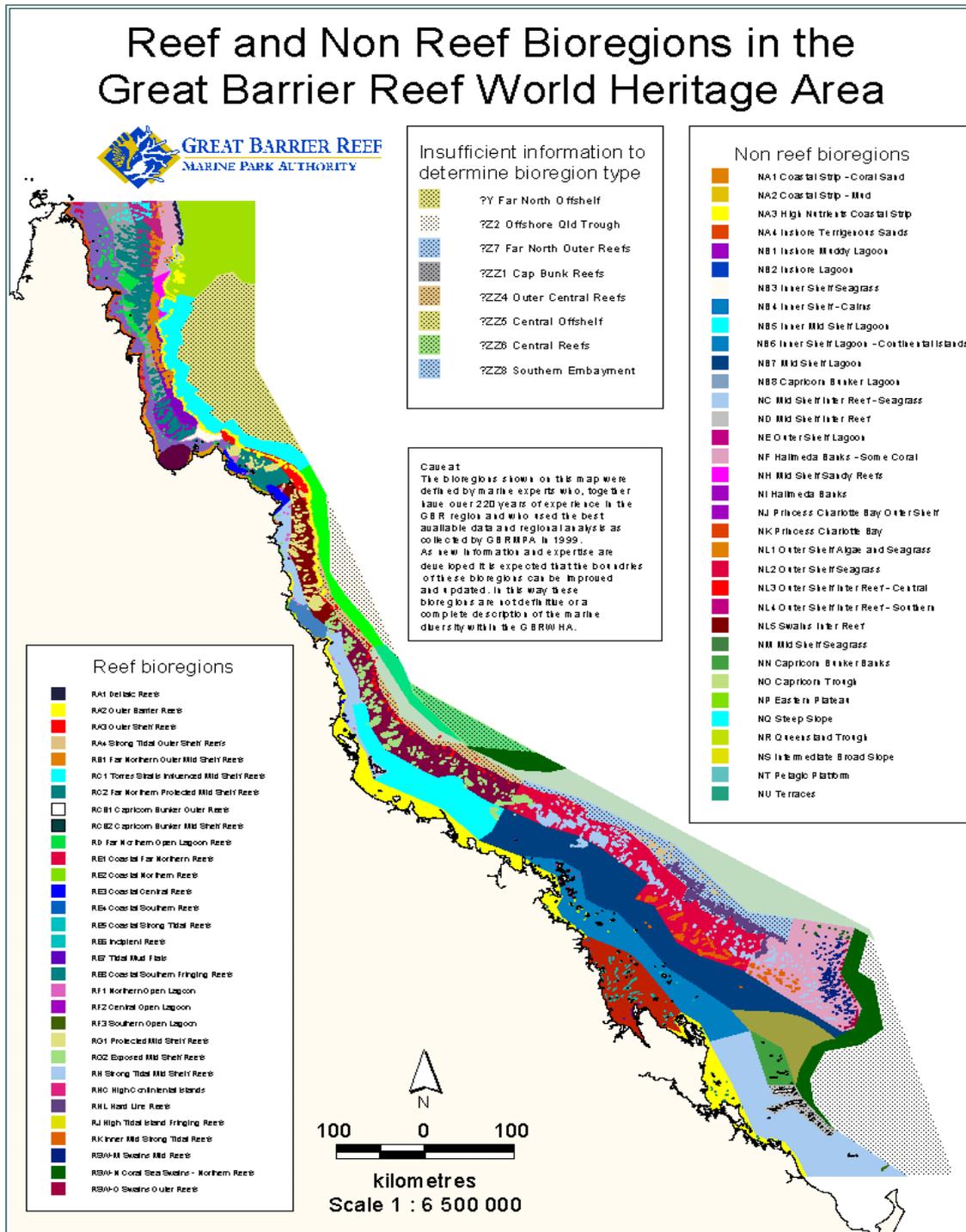
- A full description of the bioregions is available on line at:
<http://www.reefed.edu.au/rap/overview/principles/bioregions2.html>
- Bioregion maps showing the biological and physical traits of the Great Barrier Reef are available on line at:
http://www.gbrmpa.gov.au/corp_site/key_issues/conservation/rep_areas/maps.html



Currently, many inter-reefal and lagoonal benthos bioregions do not have adequate protection.

The Independent Scientific Steering Committee also identified that the current zoning regime is unlikely to provide adequate protection of the biodiversity and integrity of inter-reefal and lagoonal areas. Under the existing zoning system, less than five per cent of the Great Barrier Reef Marine Park (GBRMP) is highly protected (as a Marine National Park B, National Park, Preservation or Scientific Research zones). While 21per cent of coral reef area is included in these highly protected zones, only three to four per cent of non-reef areas are currently highly protected and the greatest concentrations of protected areas are concentrated only in the Far Northern Section of the GBRMP.

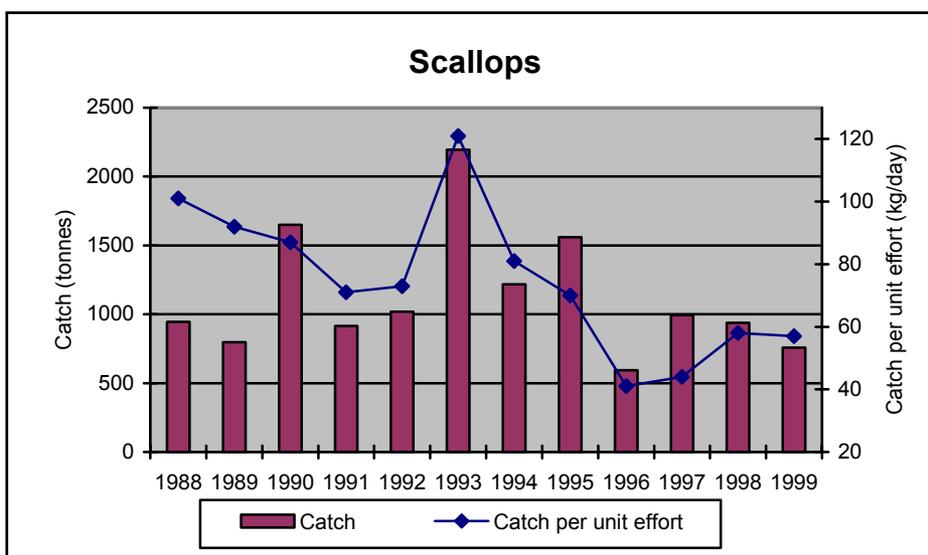
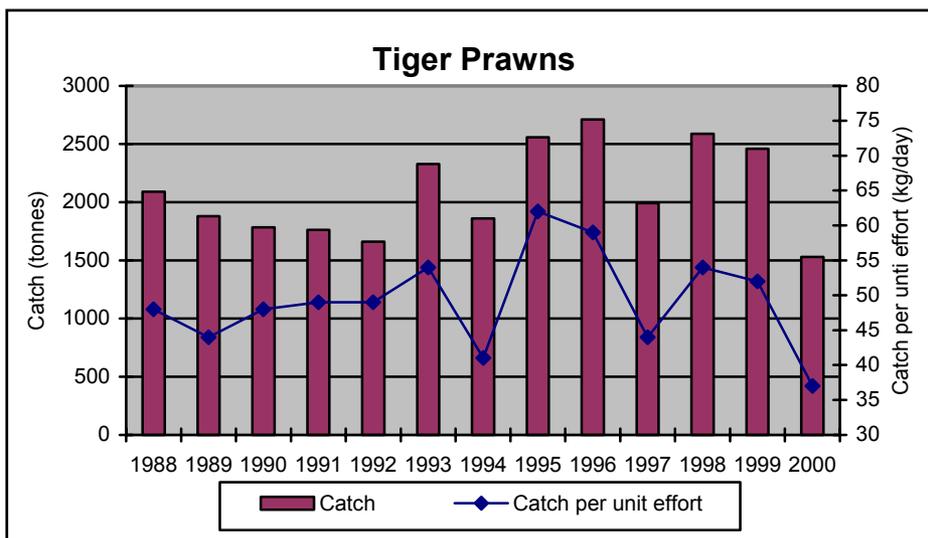
Seventy bioregions (places with particular biological and physical traits) were identified in the Great Barrier Reef. Forty of these are in the inter-reefal, lagoonal and continental slope areas.



Although the RAP conducted the most comprehensive collation of scientific knowledge from scientists and scientific publications, significant knowledge gaps were highlighted. There are only limited data about the biota for large sections of reefs, particularly in the Far Northern Section of the GBRMP, and for most GBR deepwater (>50 m) reefs. Furthermore, little information was available about the patterns of biodiversity in pelagic habitats, on the continental slope and abyssal plain, and there is an urgent need for more information relating to the biodiversity and distribution of inter-reefal fauna (infauna and epifauna) and flora.

Condition: Fisheries

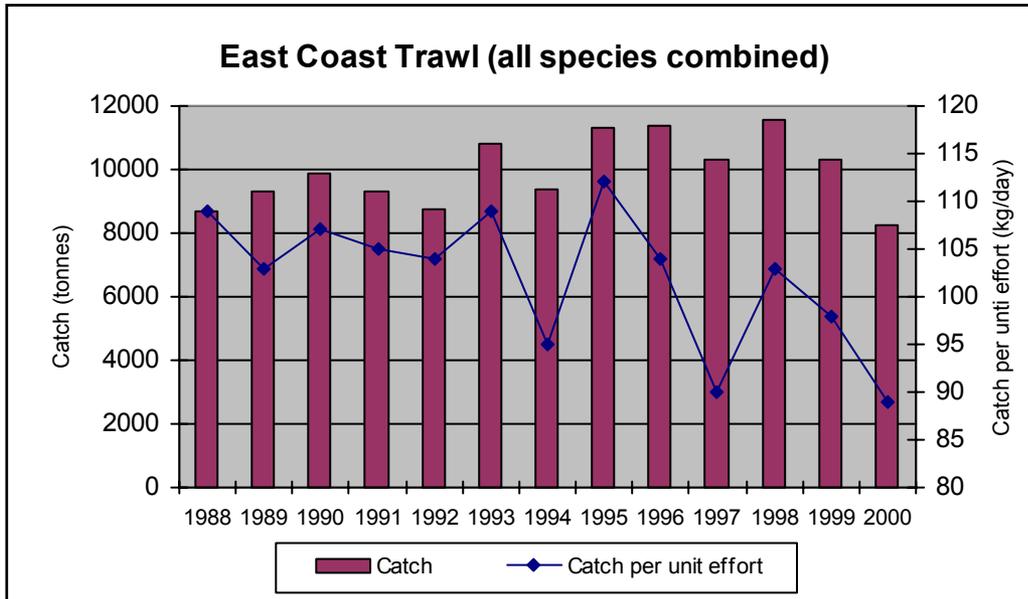
From the *fisheries* perspective, detailed and quantitative assessment of the condition of target species and ecological sustainability of fisheries are only just becoming a reality. However, data from 1988 onwards are available and suggest that most target species in the Queensland East Coast Otter Trawl Fishery (ECOTF) are being exploited at a high level with some species fully exploited. For most species, the average annual harvest and daily catch rate per vessel (or Catch Per Unit Effort - CPUE) vary significantly from year to year with few clear trends. However, when considering total catch of all target species, there has been an apparent decline in the CPUE per boat between 1988 and 2000. Some target species such as scallops show more dramatic declines while others show declining catch rates only in specific trawl grounds.



Annual catch statistics for selected species in the East Coast Trawl Fishery. For Tiger Prawns annual CPUE varies widely with slight downwards trends. For scallops the decrease in CPUE is more pronounced.

The use of CPUE data for stock assessment is problematic. It is possible that decreases in stock abundance are occurring that are not reflected in CPUE data.

Note: Scallop fishery data for 2000 not yet available.



When all species catches are combined, the total harvest does not show any clear trends. However the CPUE has shown an apparent decline

The use of modern technology and navigation aids (for example Global Positioning Systems) makes trawling increasingly efficient. This is likely to disguise trends in CPUE statistics that would otherwise indicate a decline in stocks. Additionally, the tendency of some species to aggregate allows 'targetting' of these species which further reduces the accuracy of CPUE data. Seasonal and inter-annual variability in stock abundance complicate the use of CPUE as an indicator of stock condition. Furthermore, data collected prior to the introduction of logbooks suggest that historically, stocks may have yielded much higher catch rates which would indicate that the fishery had already declined by 1988. Considering the uncertainties of the available catch per unit effort data and the trends for some target species, there is concern that declines in stock condition have occurred and there is a need for more information to both clarify the extent of any declines and to assess the sustainability of the fishery.



Assessing the condition of prawn stocks is difficult due to complications of existing CPUE data. There are concerns about the current condition of stocks.

With the commencement of the *Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act)* in July 2000, the Queensland trawl fishery is being assessed against the Commonwealth's *'Guidelines for the Ecologically Sustainable Management of Fisheries'*. The Guidelines require the collection of detailed information on the sustainability of the fishery to evaluate it against principles of ecologically sustainable development. Although there is little such information currently available, the Queensland Fisheries Service has initiated several projects to collect this information including the development of critical stock assessment models and sustainability indicators.

Pressure

The two most readily identifiable sources of direct human pressure on the biodiversity, ecosystem function and ecological integrity of inter-reefal and lagoonal benthos are trawling and increased run-off from the land (including sediments, nutrients and other pollutants). Relatively speaking, far more information exists about trawling and its effects on seabed communities than about the effects of increased run-off or fishing other than trawling such as line fishing and netting on these areas.

Pressure: Trawling

In 2000, the ECOTF produced some 8,300 tonnes of product. The mean annual Gross Value of Production of the fishery in the Great Barrier Reef for 1996-2001 was \$87.3 million. Most of the Queensland catch is taken from the Great Barrier Reef World Heritage Area with prawns, scallops, bugs and squid being the main fishing targets. In addition, sand crabs, barking crayfish and a few other species are caught. Only seven of the 22 species of penaeid prawns found in the World Heritage Area are of commercial significance. Prawns and other by-product species are also taken by beam trawlers, however beam trawlers account for only five per cent of the trawl harvest and only operate in estuarine and inshore areas.



The Trawl Plan capped the number of days trawlers can operate at 1996 levels

In order to take part in the ECOTF, a boat must have a licence from the Queensland Fisheries Service. The allowable size of fishing vessels is currently limited to 20m. In October 2002, there were 517 licensed trawlers of which 485 were both licensed and operationally capable of fishing in the Great Barrier Reef Marine Park with otter trawl gear. This is a significant decrease from the 870 licensed vessels operating in the GBRMP in 1998. In 2001, the average number of days fished per boat was 110 days with a total of 75,351 days fished by the fleet. With the introduction of a new fisheries management plan for the ECOTF, the Trawl Plan, in December 2000, the number of fishing days was capped at 1996 levels and reduced by 15 per cent through a structural adjustment scheme. The capping of fishing days has removed latent effort and reduced the effort (measured by the number of allowable fishing days) from peak levels recorded between 1995 and 1998. Nevertheless, while one of the main objectives of the Trawl Plan is to reduce effort, the current number of allowable days is based on

the number of days fished in 1996 which was the third highest recorded, and is not derived from biological stock assessment or sustainability data. The current number of allowable fishing days is some 22,000 days more than that in 1988 and technological advances have increased fishing efficiency, further increasing the potential pressure on stocks, bycatch and the ecosystems on which they depend.

Trawling effort is spread along the Queensland east coast. However, most of the catch comes from the GBRMP with more than 50 per cent of the catch taken from less than 30 per cent of the area. About eight per cent of the GBRMP is trawled in excess of 100 boat days per year. Trawling pressure is concentrated in the lagoonal area because it tends to be the preferred habitat for commercial prawn species, other than the red spot king prawn which is associated with reefal and inter-reefal habitats. Within



Trawling produces large amounts of bycatch

the GBRMP the greatest catch comes from Princess Charlotte Bay and the waters offshore from Townsville.

Trawling is a very unselective method of fishing with no ability to selectively catch target species. In addition to the take of target species, trawlers bring up very large amounts of plants and animals that are of no use to the fishers. These plants and animals are known as *bycatch*. Compared to other kinds of fishing, bottom trawling, especially trawling for tropical prawn species, generally generates the highest amounts of bycatch. Some trawl fisheries catch eight to ten times more weight of bycatch than of target species. Bycatch is typically thrown back into the sea, where most of it dies.

In 1998, the Commonwealth Scientific and Industrial Research Organisation and the Queensland Department of Primary Industries completed the most detailed study of the effects of trawling on tropical seabed communities yet undertaken. The research was carried out in the Far Northern Section of the Great Barrier Reef Marine Park. The results show that the effects of trawling are complex and highly variable according to the frequency of trawling on a particular area of seabed and the physical and biological characteristics of the area. The results of the study indicate that trawling affects three different types of biological community:

- the community of animals and plants that live more or less permanently attached to the seabed (sessile organisms);
- the community of animals (mostly fishes) that live near to the seabed; and
- various groups of animals that scavenge on trawler discards (including aquatic animals on the seabed and in the open water, and birds).

The effects of trawling on sessile organisms is highly dependent on the frequency of trawling. Trawling over a previously untrawled area removes about one tonne of attached seabed animals and plants per square kilometre trawled, typically about ten per cent of the biomass attached to the seabed. Repeated passes of a trawl over the same area can remove a large proportion of the seabed life. However, the total area of seabed that is trawled 13 or more times each year may be less than one per cent of the total inter-reefal and lagoonal habitat. After 13 passes of a trawl, 70-90 per cent of the biomass on the seabed was removed.

Removal rates vary between about five per cent and 20 per cent per trawl for different species. Additionally, benthos that is not removed by the passage of a trawl net may suffer significant damage. Because various species are impacted to different degrees by trawling, intensive trawling can cause changes in the community composition of intensively trawled seabed. In practice, the typical pattern of commercial trawling is to trawl many times over high-yielding areas. Thus, areas subjected to such intensive trawling are likely to be significantly impacted.

In the Far Northern Section trawl study, 245 species of fishes were caught in prawn trawl nets out of the 340 fish species found living near the seabed. Prawn trawl nets caught 28 kg



Repeated trawls can remove between 70 percent and 90 percent of seabed biomass.

of fish per hour of operation, with fish comprising between one-half and three-quarters of the bycatch. Few of these species were of commercial or recreational fishing importance, with no trout or cod species being caught.

Trawling also has indirect effects on populations of scavengers such as seabirds, sharks, dolphins and small fishes and invertebrates living on the seabed. Scavengers that are highly mobile (mostly birds, sharks and dolphins) congregate around trawlers to feed on the bycatch as it is thrown overboard. Between 60 and 90 per cent of discards sink and thus are not available to surface scavengers such as seabirds, dolphins and some sharks. The effect of these discards on the populations of such scavengers is mostly unknown, however the population of at least one species of seabird (crested terns) in the Far Northern Great Barrier Reef may be unnaturally high due to the increased amount of food made available through trawler discards.

Pressure: Terrestrial run-off

Another pressure on lagoonal seabed communities is increased run-off of sediments, pesticides and nutrients from the land. This increased run-off is a result of development, particularly agriculture, on the mainland adjacent to the Marine Park, and the loss of coastal habitats such as rainforests and wetlands that would otherwise “filter” run-off. For more information on the processes involved, see [Environmental Status - Water Quality](#). It is likely that increased run-off of nutrient laden sediments and other pollutants, and changes in the type of sediment run-off adversely affect nearshore seabed communities. Mechanisms by which this could happen include:

- the smothering of benthos by increasingly fine sediment and marine snow (sticky mucous like tendrils of suspended marine mud that form in estuarine waters that have high nutrient and sediment levels);
- increased turbidity which reduces the amount of light available to photosynthetic organisms such as seagrass;
- direct toxic effects of pollutants such as heavy metals, and pesticides such as diuron that can cause abnormal growth and reproduction, and mortality;
- algal blooms that cause changes in community composition (increase in the number of filter feeding organisms, decrease in the number of organisms that are susceptible to overgrowth by algae); and
- metabolic changes in some organisms that lead to reduced reproductive output and lowered resistance to environmental stresses.



Run-off from the land can adversely affect inter-reefal and lagoonal benthos through a variety of mechanisms.

There is little research specifically directed to answering the question of whether or not nearshore seabed communities have been affected by these pressures. Furthermore, there are no scientific data available about the condition of nearshore areas prior to grazing and intensive cropping to use as a comparison. Nevertheless, unequivocal evidence that inter-reefal and lagoonal benthos were being adversely affected by runoff would likely only appear after these areas had been severely degraded.

Meanwhile, it is widely accepted that land use patterns in the Great Barrier Reef

catchment have significantly changed, that coastal wetlands and rainforest habitats have

been severely degraded and that the amount of sediment, pesticide and nutrient runoff has significantly increased. There is also evidence that some *coral reefs* in inshore areas show signs of ecological dysfunction characteristic of nutrient and sediment stress. Considering these factors, the pressure from land based run-off on inter-reefal and lagoonal benthos is a significant concern.

Additional pressures

Other factors apart from trawling and terrestrial run-off exert pressure on the inter-reefal and lagoonal benthos. Factors such as climate change may have widespread effects on the condition of inter-reefal and lagoonal benthos, however the mechanisms by which these changes occur and the effects such changes may have are difficult to predict and are largely unknown.

Response

Management of inter-reefal and lagoonal seabed areas is carried out both by the Great Barrier Reef Marine Park Authority and the Queensland Fisheries Service. Common to both of these agencies are the principles of conservation, ecologically sustainable use, protection of critical areas, equitable resource use and integrated management. However, the Great Barrier Reef Marine Park Authority is primarily responsible for the care and development of the GBRMP, and is only involved in fisheries management where it affects Marine Park values. The Queensland Fisheries Service is responsible for the management of fishing and collecting operations and optimisation of the use of available fisheries resources. Further details of the management activities of these two agencies can be found in [Management Status - Fisheries](#).

Response: Protection of ecosystem function and biodiversity

The GBRMPA launched the [Representative Areas Program](#) (RAP) in 2001. The RAP used the best available scientific information to map the GBRMP and divide it into distinct [bioregions](#), each bioregion comprising an area with a specific mix of biological and physical traits. While the RAP identified 40 separate and unique non-reef [bioregions](#) in inter-reefal and lagoonal areas and the continental slope, it also highlighted that under the existing zoning system, only three to four per cent of the inter-reefal and lagoonal areas are currently highly protected and some inter-reefal and lagoonal bioregions do not have any highly protected areas at all. This exposes some habitats and the organisms living in them to significant risks as their entire geographic range may be subjected to extractive activities. This also means that in some regions, there is inadequate protection of the ecological resources that would be required to help nearby habitats recover should they be subjected to some type of disturbance.



The RAP is designed to protect biodiversity, preserve ecosystem function and maintain ecological connectivity throughout the Great Barrier Reef.

To redress this imbalance, the GBRMPA is currently rezoning the entire Marine Park through the [RAP](#). The aim is to ensure that the new zoning system provides adequate protection for the range of biodiversity contained within each bioregion, preserves the ecological function of these areas and maintains the biological connections between different parts of the Great Barrier Reef. To achieve these aims, scientists have recommended that at

least 20 per cent of the area of each bioregion should be highly protected and included in an interconnected network of protected areas. Scientists have also suggested that the zoning system should be based on certain '[principles](#)' to reduce any negative effects the new zoning plan may have on users of the Marine Park, and to maximise the chance of the system achieving its aims and recommend the inclusion of special and unique sites in the overall network.

For information about the *biological* principles being used:

<http://www.reefed.edu.au/rap/overview/principles/bops.html>

For information about the *social, economic, cultural and management* principles used:

<http://www.reefed.edu.au/rap/overview/principles/seps.html>

The desired outcome is a network of protected areas that ensures the healthy functioning of the Great Barrier Reef ecosystem by:

- protecting biodiversity;
- preserving ecological functions; and
- maintaining biological links.

From May to August 2002, the first round of formal community consultation was undertaken to explain the principles behind the RAP and to gain feedback from the community about current use of the Marine Park and the best options for placing protected areas. Over 10,000 submissions were received. These submissions were analysed and were used to develop a [Draft Zoning Plan](#) that was released on 2 June 2003 for the second round of formal community consultation. The [Draft Zoning Plan](#) contains the proposed network of protected areas.

Response: Sustainable fisheries

Both spatial and seasonal closures under the fisheries management regime and the zonal management system for the GBRMP apply to the trawl fishery. The area of the Great Barrier Reef lagoon where trawling is prohibited is approximately ten per cent. A much larger proportion, over 50 per cent, of the inter-reefal areas is not available for trawling. With the commencement of the Trawl Plan in 2000, further management strategies were introduced to reduce effort, minimise impact on non-target species and to improve the ecological sustainability of the fishery, including the following:

Reducing effort by:

- limiting fishing gear and maximum engine power of fishing vessels;
- capping and reducing fishing effort (109,879 days in 1996, reduced to 102,929);
- a voluntary licence buy back and licence surrender upon trade of effort units removing about 260 licences from the fishery (from 800 boats in 1999 to 517 boats in October 2002);
- allocation of a maximum number of fishing nights to individual licensees;
- permanent closure to trawling of areas that had not been trawled previously, making 50 per cent of the area of the GBRWHA now closed to trawling;



Fishing effort has been reduced by capping the number of fishing days and through a licence buy-back scheme.

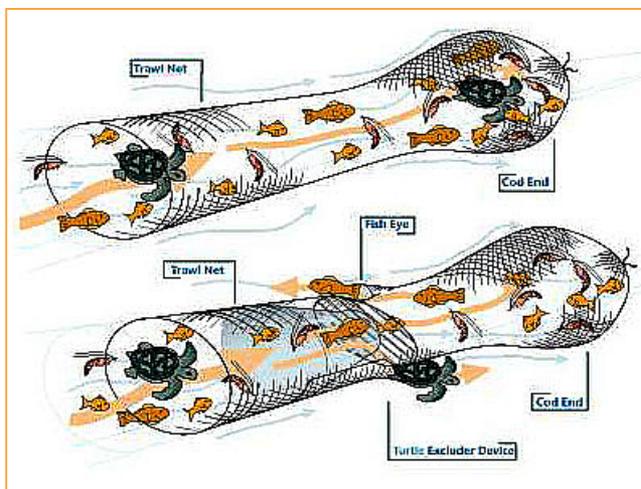
- major annual seasonal closures to protect fishery viability;
- closures to protect habitats and/or juvenile target species; and
- rotational closures within key scallop production areas to maintain viable levels of broodstock.

Reducing impact on non-target species through:

- seasonal area closures to protect sea turtles during their mating and nesting; and
- mandatory use of Bycatch Reduction Devices (BRDs) and Turtle Excluder Devices (TEDs) on all trawl nets.

More effective monitoring and management of the fishery through:

- installation of Vessel Monitoring System (VMS) technology on all vessels;
- introduction of bycatch and by-product recording in logbooks;
- possession and size limits on several by-product species;
- introduction of sustainability reference systems and review provisions for target species, bycatch and benthic communities; and
- provisions for licence suspension for Serious Fisheries Offences.



The use of TEDs became mandatory throughout the trawl fishery in 2000. There are many different types of TEDs and BRDs, many of which are custom designed to meet the needs of individual fishers.

While the trawl plan has made significant improvements in the management of the

trawl fishery, there are significant information gaps that need to be addressed before the condition of the stock and the ecological sustainability of the fishery can be assessed.

Research projects currently underway include:

- estimating and characterising bycatch in various sectors of the fishery, testing the effectiveness of TEDs and BRDs and collection of population parameters for by-product species;
- assessing effectiveness of on-board devices (e.g. hoppers) for increased survival of discarded bycatch;
- standardisation of fishing effort to integrate the trawl fleet's long-term increase in fishing power into catch rate estimates for stock assessments;
- refinement of sustainability reference points for management;
- improved stock assessment methods using Vessel Monitoring System technology;
- developing stock recruitment and spawner level indicators; and
- assessing the effects of fishing effort reduction on target species and fishery ecosystems.

The GBRMPA has completed an audit of the East Coast Trawl Fishery that outlines the achievements and weaknesses of this fishery in achieving the objectives set out in the Trawl Plan. For more information on the management of the trawl fishery, see [Management Status - Fisheries](#). The ECTF is in the final stages of review by Environment Australia which is assessing the existing management arrangements against the principles of ecologically sustainable management practices under the *EPBC Act 1999* and the [Guidelines for the Ecologically Sustainable Management of Fisheries](#).

Response: Improving water quality

In 2002, the Queensland and Commonwealth governments signed a Memorandum of Understanding to develop a [Reef Water Quality Protection Plan](#) to address the issue of declining water quality in the Great Barrier Reef. The process included a review of water quality issues by an independent Scientific Panel which, in 2003, confirmed that there has been significant increases in nutrient run-off and signs that inshore coral reefs have been affected. A Productivity Commission report into Great Barrier Reef catchments was also released in February 2003 that also identified declines in water quality, but recommended that programs and policies for improving water quality should be implemented at a sub-catchment level. The [Reef Water Quality Protection Plan](#) will be developed with regional Natural Resource Management bodies to ensure that water quality programs are appropriate for each region. For more information on the [Reef Water Quality Protection Plan](#), see Management Status – [Water Quality and Coastal Development](#).

Summary

- The vast majority of the Great Barrier Reef World Heritage Area is made up of soft-sediment habitats between coral reefs and in the Great Barrier Reef lagoon.
- While being critically important, these habitats have received only a fraction of the scientific attention devoted to coral reefs and as a result, both the condition and trends are poorly known.
- The condition of fisheries stocks is difficult to ascertain but declining trends are a cause for concern.
- The current zoning regime does not provide adequate protection for many of these habitats.
- Many areas are under considerable pressure from trawling and (to a lesser extent) terrestrial influences. It is likely that the damage to habitats and removal of bycatch are not sustainable in heavily trawled areas.
- Research has established the adverse effects of intensive trawling on soft sediment habitats.
- The Trawl Plan and the [EPBC Act](#) have introduced measures to reduce trawling effort, the impact on bycatch, and to assess the fishery's ecological sustainability.
- The Representative Areas Program will redress the imbalance in the current zoning system to provide adequate protection of the biodiversity, ecosystem function and interconnectivity of inter-reefal and lagoonal benthos by including them in a network of protected Representative Areas.
- The [Reef Water Quality Protection Plan](#) is currently being developed by both the Commonwealth and Queensland governments to address water quality issues.

Further reading:

Biodiversity and the Great Barrier Reef

- http://www.gbrmpa.gov.au/corp_site/key_issues/conservation/rep_areas/info_sheets.html#Biodiversity%20and%20why%20it's%20important
- http://www.gbrmpa.gov.au/corp_site/info_services/publications/misc_pub/fana_flora/index.html
- <http://www.env.qld.gov.au/environment/coast/habitats/mb.html>
- <http://www.wri.org/biodiv/b02-koa.html>
- <http://www.coralreefalliance.org/professorpolyp/2002/march.html>

About interconnectivity and the Great Barrier Reef

- <http://www.abc.net.au/science/bluehighway/>
- <http://www.aims.gov.au/pages/research/project-net/ugbr/ugbr-00.html>

About trawling in the Great Barrier Reef

GBRMPA Trawl Audit

- http://www.gbrmpa.gov.au/corp_site/key_issues/fisheries/commercial/rawl_fish_report.html

Draft assessment report by the Queensland Fisheries Service

- <http://www.ea.gov.au/coasts/fisheries/assessment/qld/eco-trawl/index.html>

Also see the chapter *Management status - Fisheries*

About Turtle Excluder Devices (TEDs)

- <http://www.dpi.qld.gov.au/fishweb/10559.html#b>

CSIRO study on the effects of trawling in the Great Barrier Reef:

- <http://www.marine.csiro.au/LeafletsFolder/26trawl/26.html>
- <http://www.marine.csiro.au/LeafletsFolder/pdfsheets/26trawli.pdf>

About the Representative Areas Program

- <http://www.reefed.edu.au/rap/>
- http://www.gbrmpa.gov.au/corp_site/key_issues/conservation/rep_areas/

Research publications about the Great Barrier Reef are available at:

- http://www.gbrmpa.gov.au/corp_site/info_services/publications/index.html
- <http://www.reef.crc.org.au/publications/techreport/index.html>

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