

**LONG-TERM MONITORING
OF THE
GREAT BARRIER REEF**

Status Report
Number 3 1998

by

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Executive summary

The Great Barrier Reef World Heritage Area is of immense aesthetic value and great economic importance supporting tourism and fisheries worth more than \$1 billion annually to the Australian economy. Information on status and natural variability of populations is essential for informed management of such an extensive area. The AIMS Long-term Monitoring Program is designed to provide information on key groups of organisms (particularly crown-of-thorns starfish, corals, algae, and reef fishes) on appropriate spatial scales over the length and breadth of the Great Barrier Reef Marine Park (GBRMP).

This report represents the synthesis of monitoring data collected over the last six years which required approximately 3600 person days at sea. The report provides the first integrated analysis of patterns of change in numbers of crown-of-thorns starfish, abundances of reef fishes and cover of benthic organisms over most of the Great Barrier Reef (GBR). New results are presented from 1996 to 1998 and these build on previously reported information. The results contained within this report are intended as a primary source of strategic information for the effective management of the GBR.

Broadscale manta tow surveys have now been carried out, over the length of the GBR in 11 latitudinal sectors, for a continuous period of 13 years (1985-1998) and have played a significant role in our increased understanding of the crown-of-thorns-starfish (COTS) phenomenon. The perimeters of 110 reefs were surveyed using manta tows in the 1996 field season, 74 reefs in 1997 and 108 reefs in 1998.

Intensive surveys on reefs in six sectors began in the 1993 field season. Coral and fish are surveyed annually on fixed sites within one habitat on each reef. Fifty-one reefs were surveyed in 1996, 45 in 1997 and 48 in 1998. For most reefs, these surveys have been conducted at least five times in six years and consequently there are now sufficient data to estimate temporal trends.

Major results are:

Crown-of-thorns-starfish

The percentage of reefs on the GBR with outbreaks of COTS is increasing. Active or Incipient Outbreaks were observed on 14.8% of the 108 reefs surveyed in 1998. This compares with 12.2% in 1997 and 10% in 1996. The highest recorded percentage of reefs with Active Outbreaks over the 13 years of surveys was 17.1% in 1987.

A similar pattern is seen in the overall density of COTS on the GBR. The overall number of COTS per tow recorded in 1998 was 0.23. This has increased from 1997 and 1996 when the numbers were 0.14 tow⁻¹ and 0.11 tow⁻¹ respectively. For comparison, the overall number of COTS tow⁻¹ on the GBR during the last major COTS outbreak in 1989 was 0.87.

Details of their current distribution are as follows:

- ❑ The abundance of COTS is high in the Cooktown / Lizard Is. sector but did not increase greatly between 1996 and 1998.
- ❑ There is evidence of increases in COTS numbers in the Cairns and Innisfail sectors. This is consistent with a southward drift and supports the hypothesis that secondary outbreaks are caused by larvae being transported between reefs by the East Australian Current.
- ❑ COTS numbers increased greatly in the Swain Reefs in 1998, largely due to a dense population on Horseshoe Reef.
- ❑ There were no significant changes in COTS abundance within the other seven GBR sectors.

Coral Cover

The salient changes on the Great Barrier Reef over the last six years reflect the impact of cyclones and COTS on reef communities and their subsequent recovery from such disturbances. Key results found were:

- ❑ The highest mean values for cover of living coral on the perimeters of reefs were found in the Cape Grenville sector (43%) in 1996 and in the Pompey sector in 1997 (46%) and 1998 (43%). In recent years both of these sectors have been largely free from recorded COTS outbreaks or severe cyclone disturbances (Categories 3-5).
- ❑ Lowest values for reef-wide live coral cover were in the Cape Upstart and the Cairns sectors (18% each) in 1996, the Cape Upstart sector in 1997 (17%) and in the Cooktown / Lizard Is. sector (17%) in 1998. These sectors have been affected by both COTS and cyclones.
- ❑ Permanent survey sites on NE faces of reefs showed that cover of hard coral was highest in the mid-shelf region of the Townsville sector (47%) in 1996 and in the outer shelf region of the Cooktown / Lizard Is. sector in 1997 (43.7%) and 1998 (52.4%). These regions have been observed recovering from COTS and cyclone activity respectively.
- ❑ Coral cover on permanent survey sites was lowest in the mid-shelf region of the Cooktown / Lizard Is. sector in 1996 (18%), 1997 (14%) and 1998 (15%): an area where there is current COTS activity.
- ❑ Coral cover on the permanent survey sites increased over six years in inshore and outer shelf regions of the Cooktown / Lizard Is. sector, the mid-shelf and outer shelf regions of the Cairns and Townsville sectors and the Capricorn / Bunker sector.
- ❑ Coral cover on the permanent survey sites declined over six years in the inner region of the Swain sector. This was due to a COTS outbreak at Reef 22-088.

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- ❑ Currently coral cover on the permanent survey sites is increasing in the outer shelf region of the Cooktown / Lizard Is. sector and in the Capricorn / Bunker sector. Both these regions have been recovering from storm disturbance.
 - ❑ Currently coral cover on the permanent survey sites is declining in the inshore region of the Cairns sector, possibly due to COTS, and the mid-shelf regions of the Townsville and Whitsunday sectors, attributed to the influence of Cyclone Justin in March 1997.
 - ❑ The recent wide spread coral bleaching occurred after most sampling in the 1998 field season was complete. The extent of mortality due to bleaching will be assessed by the 1999 surveys.

Reef fishes

While many groups of fishes showed significant long term and current trends in various regions, there were only a few instances where a majority of groups showed a consistent trend in a region:

- ❑ The majority of larger, more mobile fish taxa showed an increase in abundance over the six years of surveys in the Capricorn / Bunker sector. Several groups, such as surgeonfishes, butterfly fishes and wrasses, continue to do so. Coral cover has increased greatly in this region from very low levels in 1989; the fish assemblages may be changing as the coral communities recover.
- ❑ The majority of groups of reef fishes showed an increase in relative species richness over the time of the surveys in the outer shelf region of the Cooktown / Lizard Is. sector and the Capricorn / Bunker sector. These are both regions where coral cover has increased greatly over that time.
- ❑ The majority of groups of reef fishes showed a declining trend in relative species richness in the outer shelf region of the Whitsunday sector. This was not associated with significant trends in coral cover but may be related to the effects of Cyclone Justin.

1. Introduction

Background

The Australian Institute of Marine Science set up a long-term monitoring program for the Great Barrier Reef (GBR) in 1992 in conjunction with the Great Barrier Reef Marine Park Authority (GBRMPA). The program was based on some monitoring initiatives on smaller scales and represents the first concerted attempt to assess a range of ecological variables across most of the GBR. In 1993 the Long-Term Monitoring Program (LTMP) became a task in the Cooperative Research Centre for Ecologically Sustainable Use of the Great Barrier Reef.

Scope and limitations of the program

Coral reef monitoring concerns the detection of change. Coral reefs are always changing through natural processes such as recruitment, growth, mortality and disturbance by storms. A major function of the LTMP is to document status and to describe change in reef communities on the GBR. This information allows managers to place small scale, site specific changes in the context of the types of changes that are observed over much larger scales. This provides some perspective on the importance and significance of site specific status and change.

Specifically the objectives of the program are:

- to monitor the status and changes in distribution and abundance of reef biota on a large scale.
- to provide environmental managers with a context for assessing impacts of human activities within the Great Barrier Reef Marine Park and with a basis for managing the GBR for ecologically sustainable use.

The program addresses long-term regional change in benthic assemblages, reef fishes and crown-of-thorns starfish on coral reefs of the GBR. It does not address associated habitats: mangroves, seagrass beds and areas of soft substrate between reefs. Intensive sampling of benthic organisms and reef fishes is concentrated in one habitat: the NE face of each survey reef, but the perimeter of each reef is also surveyed by manta tow which gives a reef wide estimate of hard coral cover.

Structure of this report

This report presents an analysis of the changes that the Program has detected on the GBR since 1993. This contrasts with the first and second status reports (Oliver *et al* 1995, Sweatman 1997), which were primarily concerned with geographic patterns in the distribution of organisms. This report includes data collected between 1993 and 1998.

The format of the report has been modified to describe the changes at three scales: a large scale including most of the GBR, a regional scale by latitude (sector) and at the scale of individual reefs.