



**Australian Government**

**Department of the Environment, Water, Heritage and the Arts**

## **Marine and Tropical Sciences Research Facility Milestone Report, 12 June 2009**

**Program 8: Sustainable use and management of marine resources of the Great Barrier Reef**

**Project 4.8.2: Influence of the GBR Zoning Plan on inshore habitats and biodiversity, of which fish and corals are indicators: reefs and shoals**  
[Objective (a) Measure the response of biological communities (fish and benthos) to differential zoning of human use on inshore coral reefs]

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### **Summary**

This report provides an overview of the temporal dynamics of coral trout (*Plectropomus* spp.) populations on long-term protected (green zone since 1998) and fished reefs of the Palm, Whitsunday and Keppel Island groups between 1984 and 2007. A brief overview of the status of *Plectropomus* spp. populations within Representative Areas Program (RAP) protected (green zone since 2004) and fished zones of the Palm, Whitsunday and Keppel Island groups is also provided. The report also provides a summary of the field work conducted during 2008/09 and the proposed field schedule for the remainder of 2009. A summary of communication activities undertaken during 2008 and proposed for 2009 is also provided.

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### **Project Results**

#### **1. Status of coral trout populations within long-term protected marine reserves (green zones), RAP protected green zones and fished zones of the Palm, Whitsunday and Keppel Island groups.**

Significant increases in mean density and biomass of coral trout were detected within protected (green) zones of the Palm and Whitsunday Island groups between pre-zoning baseline (1984) surveys and repeat surveys in 1999/2000 (Figure 1). Pre-zoning baseline coral trout data from the Palm and Whitsunday Island groups highlights the strong effects of zoning protection on these primary target reef fish species. In protected zones of the Palm Island group, the highest recorded density of coral trout (2000) was 4.82 times higher than the density in 1984. In 2001, when density in protected zones was at its lowest recorded level to date, the density remained 2.68 times higher than in 1984. In 2000, the biomass of coral trout in protected zones of the Palm Islands was 7.44 times higher than in 1984. At its lowest level in 2003, biomass remained 2.88 times higher than in 1984. Similar patterns were recorded in the Whitsunday Island group, where density and biomass of coral trout in protected zones in 1999 were 3.96 and 7.72 times higher respectively, than in 1984. In

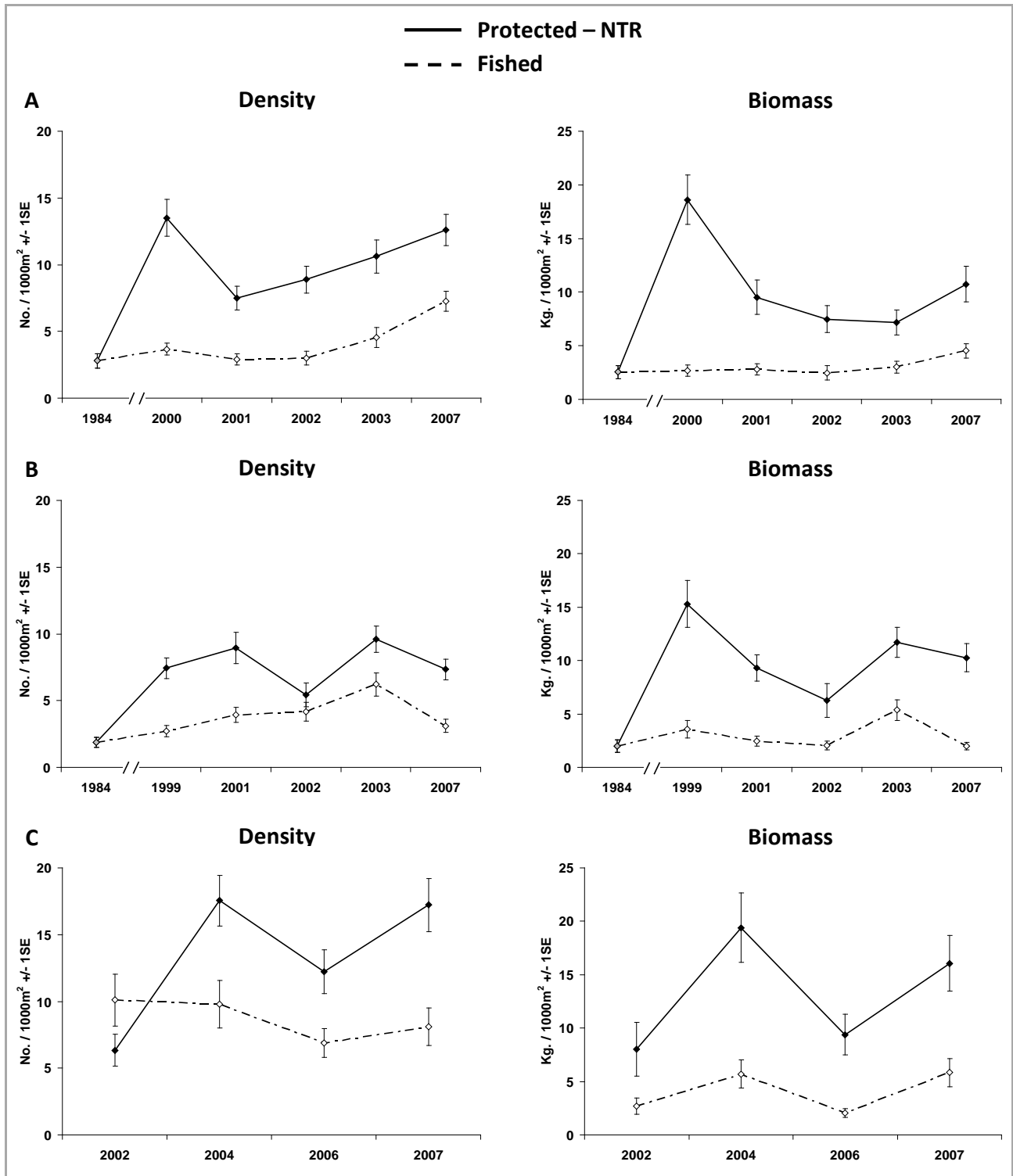
2002, when mean values for protected zones were at their lowest, density and biomass remained 2.89 and 3.17 times higher respectively than in 1984. In both the Palm and Whitsunday Island groups, the variation in density and biomass between the 1984 baseline and post 1999 fished zones remained small and non-significant (Figure 1).

Significant temporal variability in mean density and biomass of coral trout populations was detected within protected and fished zones of the Palm, Whitsunday and Keppel Islands between baseline monitoring surveys in 1999/2000 (Palm and Whitsunday), 2002 (Keppel) and the most recent repeat surveys of long-term monitoring sites in 2007. It is evident that these variations in density and biomass through time are predominantly a product of natural variability in the demographic structure of coral trout populations. In both the Palm and Whitsunday Islands, peak biomass estimates were recorded during 1999/2000 (Figure 1). Although not presented here, length frequency data revealed a significant decrease in the abundance of large fish (55-75 cm total length) between 1999/2000 and 2002 in protected zones of both the Palm and Whitsunday Islands. There is also some indication that a small component of the detected temporal population dynamics can be attributed to unavoidable variability in UVC sampling.

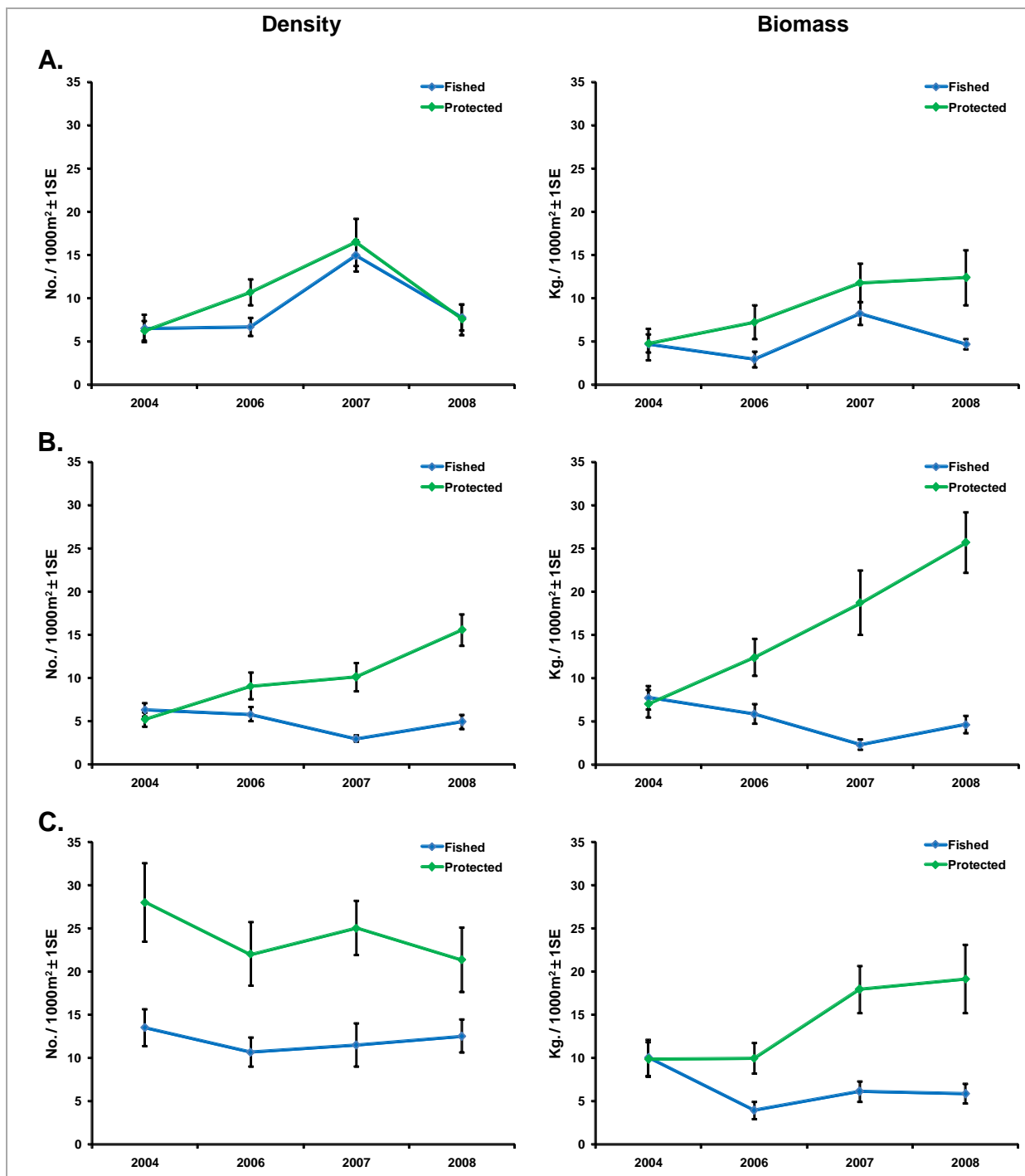
Regardless of this temporal variability, mean density and biomass of coral trout had remained consistently and generally significantly higher in protected zones than in fished zones of the Palm, Whitsunday and Keppel Island groups since regular monitoring of these reefs was initiated (Figure 1).

After four years of no-take protection (2004 to 2008) under the Representative Areas Program (RAP), coral trout populations have reached substantially higher mean biomass in protected green zones than in zones which have remained open to fishing at all three island groups (Figure 2). The divergence of the biomass trajectories has been most pronounced in the Whitsunday Islands, of an intermediate level in the Keppel Islands and least in the Palm Islands (Figure 2). The patterns of density of coral trout are not as clear as those for biomass (Figure 2). After four years of protection, density of coral trout was significantly higher in no-take zones than fished zones of the Whitsunday Islands, and higher, but not significantly so in the Keppel Islands. During 2008 in the Palm Islands however, there was virtually no difference in the density of coral trout between protected and fished zones (Figure 2a).

Within the Palm Island group the mean density of coral trout increased significantly in both newly protected and fished zones between 2004 and 2007 (Figure 2a), but declined significantly in both zones between 2007 and 2008. Although not presented here, length-frequency data suggests that the increase in mean density between 2004 and 2007 was driven by small to mid-size (20-35cm total length) fish which almost certainly recruited to the reefs during the summer months of 2004/05 and 2005/06. By late 2007, many of those fish would have reached the minimum legal size of 38cm and thus would have been exposed to increased fishing mortality at that stage. There is also some preliminary evidence that there was a breakdown in compliance with zoning regulations at Curacoa Island (Palm Island group) between the monitoring survey periods in April 2007 and November 2008. These zoning infringements have likely contributed to the decline in mean density of coral trout within the Curacoa green zone. Another potential contributing factor to this observed decline may be fish movement and spawning aggregations at sites other than those surveyed in November 2008. Longer term monitoring of these reefs will provide further insight into the drivers of these temporal dynamics in fish distribution and abundance.



**Figure 1:** Temporal dynamics in mean ( $\pm$  1SE) density and biomass of *Plectropomus* spp. in protected (green) zones and fished zones of the Palm (A); Whitsunday (B) and Keppel (C) Island groups. Mean density and biomass estimates are also provided for the pre-protection period (1984) in the Palm and Whitsunday Island groups.



**Figure 2:** Mean density and biomass ( $\pm 1$  SE) of coral trout (*Plectropomus* spp.) populations on protected (green zone) and fished (blue zone) reefs of the Palm (A); Whitsunday (B) and Keppel (C) Island groups, from 2004 to 2008. No-take protection was implemented in July 2004. Data for 2004 was collected prior to protection status being applied.

## 2. Summary of field work conducted during 2008/09 and proposed field activities for 2009.

Table 1: Field activities during 2008 and 2009.

Date	Field Activity	No. Field Sites Surveyed
May 2008	Keppel Islands: Four-year post-zoning surveys	8
November 2008	Whitsunday Islands: Four-year post-zoning surveys	18
November 2008	Palm Islands: Four-year post-zoning surveys	6
February 2009	Keppel Islands: Five-year post-zoning and long-term monitoring surveys	20
July 2009	Magnetic Island: Five-year post-zoning surveys	8
October 2009	Palm Islands: Five-year post-zoning and long-term monitoring surveys	30
November 2009	Whitsunday Islands: Five-year post-zoning and long-term monitoring surveys	42

## 3. Communication activities undertaken during 2008 and proposed for 2009.

### April 2008

Garry Russ presented recent findings of long-term monitoring of inshore reefs and preliminary results of second re-survey of the RAP sites at the Annual MTSRF Conference in Cairns.

### July 2008

Richard Evans and David Williamson provided presentations at the 11<sup>th</sup> International Coral Reef Symposium (ICRS) in Fort Lauderdale, USA. Presentations included a summary of findings in the long-term monitoring of inshore reefs and preliminary results of the second re-survey of the RAP monitoring sites.

### August 2008

David Williamson provided a presentation at the annual general meeting of the Australian National Sportfishing Association (ANSA) in Rockhampton. The presentation included an overview of data from the inshore reefs monitoring program.

### June 2009

David Williamson will provide a presentation at the Indo-Pacific Fish Conference in Fremantle, WA. The presentation will include a brief overview of current findings from the inshore reefs monitoring program.