



**Marine and Tropical Sciences Research Facility (MTSRF)  
September 2008 Milestone Report**

**Project 4.8.2– Influence of the Great barrier Reef Zoning Plan and inshore habitats and biodiversity, of which fish and corals are indicators.**

**Objective (b): Measure the response of biological communities (fish and benthos) to differential zoning of human use of inshore shoals – AIMS.**

**Project Leader: Dr Peter Doherty, Australian Institute of Marine Science.**

**Summary**

**Description Submit detailed work plan for shoal sampling in 08/09**

**Summary of Milestone report**

Because of uncertainty about Task (b) at the end of ARP 2, the first deliverable in ARP 3 is a detailed and costed work plan; which is delivered here.

**Background**

In ARP 1, AIMS searched the seafloor in the vicinity of Cairns, Cardwell, Townsville, Whitsundays, Rockhampton, and Gladstone using a multibeam acoustic swathe mapper, ground-truthed by towed video, to develop baselines in comparable “pairs” of fished (“blue”) and unfished (“green”) submerged shoals. The fish populations on these shoals were then sampled with baited remote underwater video stations [BRUVS] because the habitats of interest were below diving depth (i.e. >20 m).

In ARP2, the core sites (Cardwell, Townsville) were resampled with only partial success due to the exceptional wet season of 2007/08 and a very strong La Nina. On the advice of GBRMPA, Cairns shoals were abandoned because of uncertainty about the level of fishing effort. Southern shoals (Barcoo and Karamea Banks; East and West Warregoes) were sampled intensely in order to recommend an optimal strategy for sampling large, discrete, submerged shoals. Although there were some mixed results, these large shoals showed differences in the abundance of a dozen key “target” species consistent with an effect of fishing detectable since the rezoning (blue to green) of one shoal from each pair in July 2004.

In contrast, the low relief shoals in the vicinity of Townsville known as the Magnetic Shoals did not show any impact from the rezoning despite the likelihood of good enforcement resulting in substantial differential fishing effort on blue and green shoals. We believe that this is because the low-relief habitat is only a transient habitat for the large “target” species and that the mobility of these species soon exposes them to fishing.

During ARP 1 & 2, we searched a lot of ground for suitable targets in inshore shoal country without finding strong candidates for additional baselines and do not recommend extending this search further. We believe that we have useful baselines on the Brook Shoal (Cardwell) and the two pairs of southern banks (Rockhampton, Gladstone) but believe that it is too soon after the last sampling to revisit them.

As forecast towards the end of ARP2, we recommend that our key question and approach (detection of effects arising from rezoning of deep water habitats) be shifted offshore to support and expand the MTSRF study (1.1.2) which, in alternate years, is about testing the effect of the rezoning upon the shallow water biodiversity of mid-shelf coral reefs.

In the last year of CRC Reef (05/06), the Centre received advance funds from the MTSRF Program and implemented a new set of fish and coral surveys on 28 matched reef pairs, representing similar reefs with shared histories in which one reef became a 'no take' zone in the GBRMPA Zoning Plan (2003) while the neighbouring reef remained open to fishing. The reef pairs were clustered in five regional groups and the first set of surveys in 2006 (18-24 months after rezoning) showed patterns consistent with an "effect of line fishing" using coral trout abundance as a logical proxy (Attachment 1). Apart from the consistent difference between blue/green reefs across all regions, the three regions south of Townsville showed higher abundance of trout on both zoning classes. This is a known pattern in the abundance of this predatory fish that is most likely related to the higher natural productivity of these southern ecosystems, which also attracts higher fishing pressure.

This new sampling program is being implemented by AIMS Long-term Monitoring Team on a biannual tempo alternating with their broad-scale surveys of general reef health. Consequently, the "rezoning" surveys were repeated in ARP 2 with even greater divergence between blue and green reefs in the three southern regions most exposed to commercial fishing (Attachment 2).

Commercial line fishing for coral trout is concentrated on live captures, which means fishing in relatively shallow water (<20 m). Industry spokespersons have used this fact recently to argue that their impact is less because there is a large biomass of trout in depth water on the same reefs that is protected from fishing (because of barotrauma). This assertion is untested because coral trout abundance is typically determined by shallow water SCUBA surveys, where small fish prey (and hence their predators?) are also most abundant.

We propose to use our ability to assess fish abundance in deep water to establish the abundance of fish species vulnerable to line fishing around the bases of reefs where there is evidence of strong fishing effects. For this reason, we propose to focus on the three southern regions where there is evidence of a sustained and growing impact of fishing upon the trout populations in shallow water (Attachment 2).

### **Work Plan (08/09)**

In ARP3, we propose to apply proven approaches to assess fish species richness, abundance, and size distributions on the leeward bases of 32 southern reefs (blue/ green pairs) with a focus on deep water coral trout, emperors, snappers, cods and tuskfish.

We will use BRUVS (including stereo-BRUVS for accurate size measurements) to sample fish abundance (and sizes) in deep (~45-60metres) water around blue/green pairs where diver surveys have shown either weak or strong contrasts in coral trout abundance in shallow water (Russ *et al.* 2008). The 32 target reefs lie offshore in the Mackay, Swains and Capricorn-Bunker regions (Attachment 3).

The sampling will be done in 40 days of fieldwork in late summer (Jan/Feb 2009) as a single charter out of Townsville using the JCU vessel (RV James Kirby), which is well suited to the tight manoeuvring required near reefs. Each reef will be sampled on its leeward side, where more fishing is expected, with three drops of four baited cameras including one stereo unit in each drop.

We will analyse this as a hierarchical analysis in order to detect regional effects (Attachment 2) but our focus will be on the main effect (zoning). The analyses will also include depth and micro-habitat type (recorded in the immediate field of view of the BRUVS) as explanatory variables, using regression trees.

The design will reveal whether the “effect of fishing” signals detected by shallow-water surveys are reflective of relative abundance also for deepwater sweetlips (*Lethrinus miniatus*), snappers (*Lutjanus sebae*), cods (*Plectropomus leopardus*, *Epinephelus undulatostratus*) and tusk fish (*Choerodon venustus*). The starry triggerfish (*Abalistes stellatus*) and iodine bream (*Gymnocranius audleyi*) will be considered as unfished “controls” to ensure comparability in habitats.

*References:*

Russ, G.R., Cheal, A.J., Dolman, A.M., Emslie, M.J., Evans, D.R., Miller, I., Sweatman, H., and Williamson, D.H. (2008). Rapid increase in fish numbers follows creation of world's largest marine reserve network. *Current Biology*, Vol 18, R514-R515.

Watson, D.L., Harvey, E.S., Kendrick, G.A., Nardi, K., and Anderson M.J. (2007). Protection from fishing alters the species composition of fish assemblages in a temperate tropical transition zone. *Marine Biology*, 152: 1197-1206.

## Project Results

### *Description of the results achieved for this milestone*

- A new work plan has formulated that makes best use of available resources and can be delivered within time and budget constraints with reasonable certainty.
- Ship time has been booked for summer 2008/09, and all BRUVS gear has been refurbished.
- Three tape readers have each completed three repeated readings of the same 16 “southern shoals” tapes to ensure the highest precision possible and statistical analyses are underway
- Precise and accurate stereo-video measurements of “target” (*Choerodon venustus*, *Lutjanus sebae*, *Plectropomus leopardus*) and “control” (*Abalistes stellatus*, *Gymnocranius audleyi*) species have been completed for sets made on southern shoals during ARP 2. Target species are large on “closed” shoals, but there is also an effect of variable recruitment visible amongst “open” and “closed” shoals for *P. leopardus*.

### *Explanation of Activity changes*

As indicated in the ARP3 proposal, we consider the proposed work plan to be the best investment of capacity and resources. Our work plan is based upon a new time and resource budget as follows:

### *Project 4.8.2 Task (b) commitments 2008/2009*

Title	Organisation	Role	FTE
Mike Cappel	AIMS	Shoals Task Leader	0.75
Marcus Stowar	AIMS	Fish biologist	0.50
Charlotte Johansson	AIMS	Tape reader	0.35
Aaron MacNeil	AIMS	Biostatistician	0.10
Gavin Ericson	AIMS	Database/programmer	0.05
Peter Doherty	AIMS	Project Leader	0.05

### *Year 3 – 2008/2009 Project Funding and Partnerships*

Contributing Organisation	Cash	In-kind	Total
MTSRF	138,000	-	138,000
CRC residual	100,000		100,000
AIMS		320,000	320,000
<b>Total</b>	<b>238,000</b>	<b>320,000</b>	<b>558,000</b>

### ***Problems and opportunities***

A November-December booking on RV Gwendoline May was cancelled due to QDPI priorities, forcing us to delay field work to early 2009.

There is a small risk that this will push tape reading and analysis time out close to the final reporting deadline in June.

### ***Other issues***

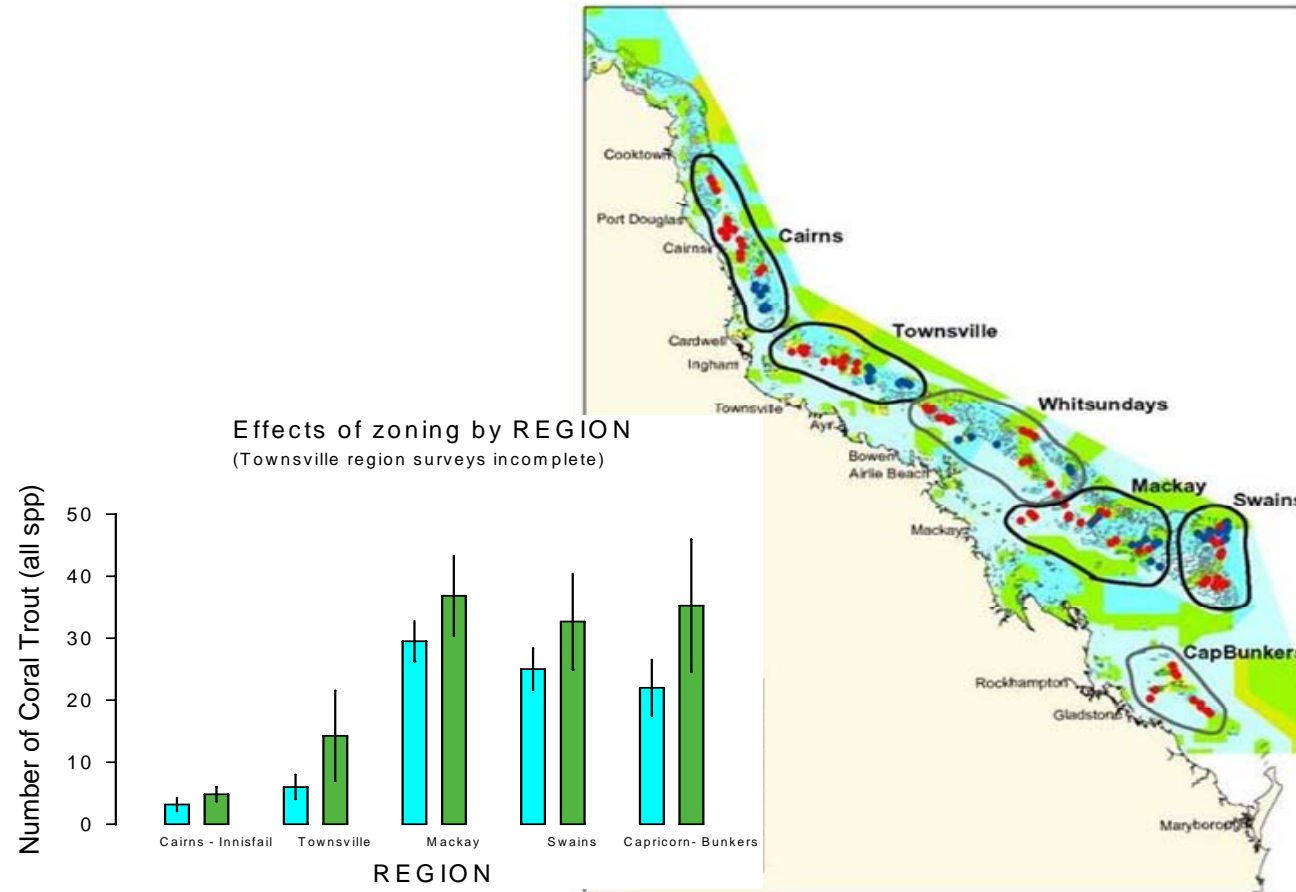
Nil

### ***Communications, major activities or events***

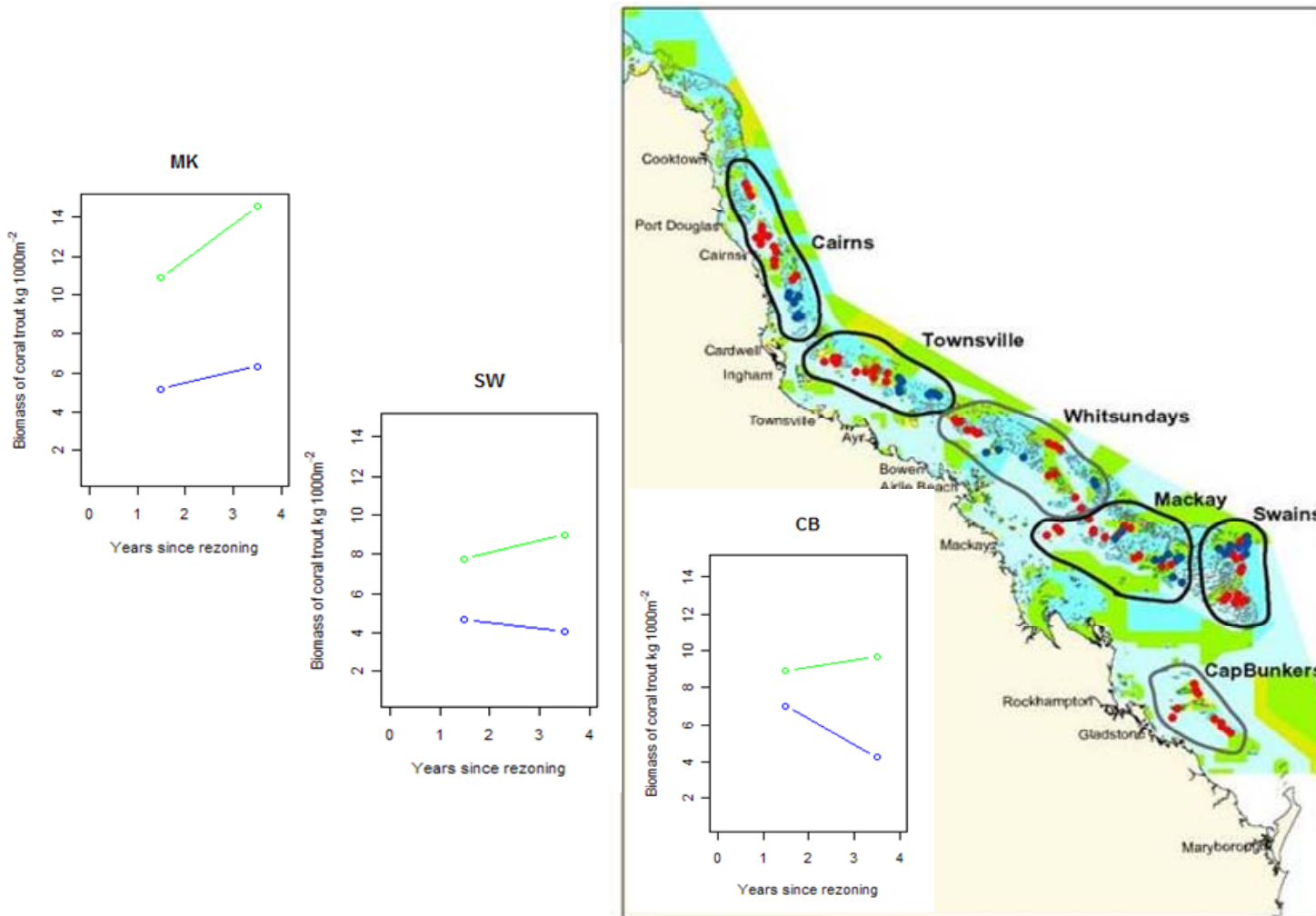
#### ***During milestone reporting period***

Mike Cappel gave a presentation on the "shoals" BRUVS and mapping work at the monthly meeting of the Balgal Beach Fishing Club, on 31 August.

Mike Cappel submitted an information summary to the CAPREEF Steering Committee on the status of ARP2 and ARP3 for their September 2008 meeting



**Attachment 1.** Results from MTSRF 1.1.2 of surveys of coral trout abundance on blue/green reefs in 2006 following the rezoning of the Marine Park in July 2004.



**Attachment 2.** Results from MTSRF 1.1.2 of surveys of coral trout abundance on blue/green reefs in 05/06 and 07/08 following the rezoning of the Marine Park in July 2004 (three southern regions only).

### Attachment 3

Table 1. Reef pairs to be included in surveys of fishes, sharks, rays and sea snakes of deep (~45-60 metre) reef bases in the southern sectors of the GBRMP. C=Zoned closed to fishing ("Green") and O= Zoned open to fishing ("Blue").

Region	Reef ID	Reef pair	Open/Closed	Reef
Mackay	20351	13	C	Pompey Reef (No 1)
	21060	13	O	21-060
	20351	14	C	Pompey Reef (No 2)
	21591	14	O	21-591
	20348	15	C	20-348S
	21062	15	O	21-062S
	20353	16	C	30-353S
	21064	16	O	21-064
	21139	17	C	21-139
	21187	17	O	21-187
	20309	18	C	Tern Reef
	21025	18	O	Penrith Island Reef
Swains	21278	19	C	21-278S
	21245	19	O	21-245S
	21584	20	C	Jenkins Reef
	21572	20	O	Small Lagoon Reef
	21588	21	C	Wade Reef
	22102	21	O	Chinaman Reef
	22084	22	C	22-084S
	21550	22	O	21-550S
	21558	23	C	21-558S
	21305	23	O	East Cay Reef
	21296	24	C	21-296
	21302	24	O	21-302
Capricorn - Bunkers	23045	25	C	North Reef (North)
	23048	25	O	Broomfield Reef
	23080	26	C	Hoskyn Islands Reef
	23079	26	O	Boult Reef
	23081	27	C	Fairfax Islands Reef
	23082	27	O	Lady Musgrave Reef
	23068	28	C	Erskine Island Reef
	23069	28	O	Masthead Island Reef