



Australian Government

Department of the Environment, Water, Heritage and the Arts

**Marine and Tropical Sciences Research Facility (MTSRF)
October 2007 Milestone Report**

Project 4.8.2 – Inshore Shoals and Monitoring Strategies on the Great Barrier Reef relevant to the Representative Areas Programme

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

Summary

Milestone Description:

Schedule of field activities including proposed methodology and contingency planning to complete objectives b [AIMS].

This coming year of field and laboratory work will accomplish three main objectives. Firstly, paired sites in zones open and closed to fishing will be re-surveyed off Rockingham and Halifax Bay using approaches and techniques established in ARP1. Secondly, there will be a major effort in consolidating all unread video footage from BRUVS and towed video. Finally, novel techniques to detect the effects fishing will be tested to make final recommendations on the approach and tool-kit needed to study the diffuse and consolidated habitats that comprise “shoal ground” in the inter-reefal waters of the GBRMP.

A point-wise summary of the future work is described below

1. Re-sampling of small or diffuse shoals in the Central region

Surveys of vertebrate diversity and abundance, and benthic habitat cover and topography, were designed in ARP1 to make longitudinal studies between pairs of shoals in “green” (closed) and “blue” (open to fishing) zones in the inter-reefal waters of the central GBRMP. Sampling sites were mapped off Rockingham Bay, Halifax Bay and Bowling Green Bay.

These surveys served to:

- establish ecological baselines in pairs of shoals against which future temporal changes can be detected
- enable detection of removal of line-fishing and prawn trawling on key vertebrates and macrobenthos inhabiting “shoal ground”

In Phase 1 of ARP1, local knowledge of “marks” supplied by recreational and commercial fishers guided intensive swathe-mapping and towed video surveys to characterise shoals and select zoned pairs for comparison. Suitable sampling pairs were established off Halifax Bay (Magnetic Shoals) and Rockingham Bay (Brook, Eva and Forty-foot Rock)

These sites will be resurveyed in November 2007 from the RV Cape Ferguson. A contingency plan is available in the case of adverse weather in the later use of RV Apollo for day trips.

The field schedule will comprise renewed and repeated sampling of the vertebrate community, topography and macrobenthic cover. Vertebrates (fish, sharks, rays, sea-snakes) will be resampled with the standards developed for BRUVS, stereo-BRUVS and timed digital-stills camera images. Topography (seabed categorisation), macrobenthic cover, and the occurrence of selected invertebrates, will be measured in real time using a towed video system developed during the project.

2. Baselines for the large “hard” shoals in the Southern section of the GBRMP

Discrete, “hard ground” shoals in the southern section have been the target of relatively heavy charter and commercial fishing for “reds” (*Lutjanus* species). Pairs of shoals open and closed to this fishing were chosen and mapped in the central lagoon NE of Rockhampton (Karamea and Barcoo Banks) and offshore from Agnes Waters (East and West Warregos).

Field work to establish ecological baselines in these consolidated southern shoals was completed in August, 2007. Sampling of vertebrates with BRUVS was stratified by position on the shoal tops and bases. The majority of BRUVS tapes (174) from that work remain to be interrogated in the coming year, but early analysis shows them to be outstanding in terms of diversity and abundance. All real-time habitat data from towed video has been compiled, but work remains in assembling the data in an accessible form by the wider team – and in testing alternatives for tape post-processing to enhance identification of macrobenthic cover. These baseline data will be analysed and reported in a format consistent with earlier reports comprising the MTSRF “Shoals” series.

3. Recommendations for optimal sampling of large diffuse or discrete patches of “shoal” habitat in future monitoring

Extensive and intensive habitat surveys of both diffuse (eg Magnetic Shoals) and discrete (eg Barcoo Banks) have revealed a discontinuous and patchy distribution of complex phototrophic or filter-feeding communities of macrobenthos. For example, spectacular gorgonian “gardens” on the hard southern shoal bases support high fish diversity, including *Lutjanus* species of importance to fisheries, and require a precise deployment of BRUVS on mapped features. The shallower phototrophic communities on the top of these shoals showed a zonation which required stratification of BRUVS sampling by habitat type. Sampling strategies appropriate to the nature and scale of these types of shoal habitat will be developed using the existing tape collection from the southern shoals, in order to define methods for detecting effects of zoning on vertebrate communities.

- Analysis of stereo-BRUV data to compare fish size in the best fished/unfished contrast(s)

Precise and accurate measurements of fish by use of stereo-video in complex habitats have been used to measure the differences in size and spawning biomass between Marine Protected Areas and adjacent reefal habitats open to fishing (see Watson et al. 2007). Work to date has yielded 90 unanalysed stereo-BRUVS sets from all areas in which baseline surveys have been conducted (Townsville 20, Cairns 16, Cardwell 3, Karamea/Barcoo 25 and Warregos 26). These stereo-BRUVS units have been calibrated and test measurements have been made successfully, with a note that repeated measurements of the same red emperor (*Lutjanus sebae*) in sequential frames can result in minor differences in estimates (+/- 5mm total length). Therefore an aim of the current year of work is to develop a protocol to enable accurate fish measurement for comparing “open” and “closed” shoals in terms of length of selected fish species

These will include both the targets of fisheries (such as serranids, lutjanids, lethrinids) and their major bycatch (eg sharks) and prey species (eg. caesionids).

The right-hand camera of the stereo-pairs will be interrogated using the BRUVS2.1.mdb software developed by AIMS for reading single BRUVS tapes, and the timing of species sightings and abundance will then be exported to custom stereo-video comparator (SeaGis PhotoMeasure). This enables the comparator to step straight to the frames where measurement opportunities are optimal. Measurements of fork length will then be obtained and plotted by habitat and zoning to test for effects of fishing.

The primary candidate species for this process will include those directly influenced by the removal of fishing. As the work off Cairns has been discontinued, the 16 stereo BRUVS from that location will be set aside. Additionally, it is unlikely that the few sets available off Cardwell will provide meaningful baselines to track changes in fish size, and these too will be ignored. At this time, the stereo imagery from the southern shoals is the most likely source of data to track any affect of zoning on the size of fish.

4. Comparison of methods based on video and digital stills to determine the optimal application of each approach

The major bottleneck in monitoring vertebrate abundance and diversity with BRUVS lies in the laboratory time needed to interrogate entire tapes, and the relatively colourless imagery obtained using natural light in deep water. An alternative approach is to use still images obtained with strobe lighting at frequent intervals. Each of these images can then be zoomed to help identify small species in full colour, and fish can be counted easily.

High resolution (5 megapixels) still imagery was acquired in the course of setting many of the stereo-BRUVS by attaching a strobe and digital still camera to the unit during deployment. To date, 53 sets of stills/stereo Bruvs are available for analyses encompassing all shoals surveyed with the exception of those off Cardwell. Stills were typically taken at 15 second intervals throughout the nominal 1 hour soak (= +/- 240 images) and each of these images will be enumerated for the abundance of each species. The high resolution stills images are particularly useful for the identification of small "prey" species among the wrasses and pomacentrids.

A methodological comparison will be made by comparing the BRUVS video footage with the same field of view surveyed by still images. This will determine for the first time the utility of stills imagery in improving fish identification, providing a robust discrimination of fish assemblages and reducing the labour involved in processing the imagery. Various strategies will be tested to reduce the number of still images required to generate data on fish assemblage suitable to detect spatial and temporal differences.

5. Assessment of the precision of BRUVS in sampling fish communities

All previous studies with BRUVS in the GBRMP have provided only snapshots of vertebrate community structure and abundance. Whilst these studies have proven very useful in describing spatial patterns at broad scales, they have not been tested in terms of their utility in detecting daily, seasonal or inter-annual variability at the same locations. A limited number of BRUVS (64 sets) were redeployed as near as possible to the spot they were recently recovered from on the southern shoals to assess the short-term temporal variation that might mask future detection of any effects of zoning. This tape load will be interrogated in the coming year of work.

Reference:

Watson, DL, Harvey, ES, Kendrick, GA, Nardi, K, and Anderson MJ (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

With the exception of the scheduled outstanding field work directed at re-sampling the Townsville and Cardwell shoals, all data is either consolidated in the relevant database or the imagery is available for processing. At this stage, the work is scheduled to meet commitments.

Communications, major activities or events

During milestone reporting period

Mike Cappo gave a presentation on the project to the annual convention of the Qld Branch of the Australian National Sportfishing Association [ANSA] at Yeppoon in August 2007