Australian Government
Department of the Environment, Water, Heritage and the Arts

Marine and Tropical Sciences Research Facility (MTSRF)
Progress Report September 2007

Project 4.8.2 – Effects of GBR Zoning plan on inshore habitats and biodiversity: reefs and shoals

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Summary

This Project has a common purpose, "to know the response of fish and coral populations to variations in fishing pressure created by the recent rezoning of the GBR", that will be monitored in two significant coastal habitats for line-caught fishes: fringing coral reefs and submerged shoals.

Before the recent rezoning, which came into force on 1 July 2004, a research team from James Cook University (JCU) surveyed fish and coral communities on multiple sites with a history of fishing in three groups of coastal islands (Palm, Whitsunday, and Keppel). During the MTSRF transitional year (05/06), the JCU team repeated their surveys in two of the three island groups and found that top predators had become more abundant and dominant (as measured by biomass) at sites given less than two years of protection from fishing compared with similar sites remaining available to fishing. In the reporting year (06/07), the team has extended these comparisons to the third island group (Keppels).

Because the importance of submerged shoals as fishing targets emerged only during the public consultation around rezoning, there are no equivalent pre-zoning surveys from this habitat. Given the rapid response of fish populations observed on shallow fringing reefs (above), there is some urgency to establish baseline surveys in deeper shoal habitats. In 2006, a team from the Australian Institute of Marine Science (AIMS) surveyed submerged "fishing hot-spots" identified through community consultation in order to establish baselines for fish populations on shoals in two areas (Rockingham Bay, Magnetic Shoals). Progress to date has involved locating shoals suitable for sustained monitoring, collecting information about their physical properties (swathe mapping, video analysis of habitat), and measuring fish assemblages with baited video stations in order to create the necessary baselines for future monitoring.

For reference: Milestone extracted from Project Schedule

Objective	Targeted Activity	Date
(a) (b)	Submit detailed work plans for both Objectives	30 Nov 2006

(a) Measure the response of biological communities (fish and benthos) to differential zoning of human use on inshore coral reefs.

(b) Measure the response of biological communities (fish and benthos) to differential zoning of human use on inshore shoals.

Project Results

(a) Measure the response of biological communities (fish and benthos) to differential zoning of human use on inshore coral reefs.

Description of the results achieved for this milestone

Between November 2003 and June 2004, baseline fish community and benthic data were collected using UVC from 22 sites located in areas that would change from 'blue' fished reefs to 'green' no-take protected reefs and 22 sites that remained open to fishing after the implementation of the RAP in the Palm, Magnetic, Whitsunday and Keppel Island groups. In 2004/2005 a further 24 sites either newly changed or that would change to green under RAP and 24 sites remaining fished were surveyed on a cluster of mid-shelf reefs in the Central section of the GBRMP. This represents a total of 92 sites. Sites were defined as a 300m stretch of reef edge. Sites were chosen haphazardly but they were positioned at least 200 m apart from each other.

In 05/06, the MTSRF Transitional Year, sites in the Palm and Whitsunday Islands were resurveyed and results widely publicised in a report available on the DEH website. In 06/07, the reporting year, sites in the Keppel Islands have been resurveyed to add to this data set on the impact of the rezoning.

Survey Methods

Five replicate transects were surveyed within each site using an underwater visual census (UVC) technique. Approximately 160 species of fish from 13 Families (Acanthuridae, Chaetodontidae, Haemulidae, Labridae, Lethrinidae, Lutjanidae, Mullidae, Nemipteridae, Pomacanthidae, Pomacentridae, Scaridae, Serranidae, and Siganidae) were counted by two observers who swam side by side along a 50m transect line observing fish 3m either side (total area/transect = 300m^2). A third diver swam directly behind observers one and two, rolling out the transect tape to measure the distance covered. This UVC technique reduced diver-negative behaviour of several of the surveyed fish species. To ensure accuracy of the fish counts the species list was divided into two for the observers. The grouping of different families of fish depended on their abundance, behaviour and how conspicuous they were.

Observer one surveyed the fish families Acanthuridae, Balistidae, Chaetodontidae, Pomacanthidae, Pomacentridae, Scaridae, Siganidae, Zanclidae and small 'non-targeted' species of Labridae. Observer two surveyed the families Haemulidae, Lethrinidae, Lutjanidae, Mullidae, Nemipteridae, Serranidae and the larger 'targeted' species of Labridae. To avoid any bias in counts and size estimation of the different families, observers one and two alternated roles within protected and fished areas. Size estimation training was carried out at the start of each day, using wooden fish models.

Two methods were used to assess the sessile benthic community. Structural complexity was estimated every 10m within each transect by a simple index combining categorical estimates (5-levels) of slope and rugosity. Diver one recorded this information during return transect swims, while diver three used a line intercept method to record a benthic point sample every metre along each transect tape (50 samples per transect). Categories sampled were live hard coral (for example branching, solitary, tabular, massive, foliose, encrusting), soft coral, sponge, clams (Tridacna spp.), other invertebrates (such as ascidians and anemones), macro-algae and turf algae, dead coral, rock, rubble or sand. All transects were carried out within a depth range of 2-9m with an average depth of 6m. Visibility was recorded on each transect and typically ranged from 6 to 12m. Surveys did not proceed if visibility was <4m.

(b) Measure the response of biological communities (fish and benthos) to differential zoning of human use on inshore shoals.

During the MTSRF transitional year (05/06), acoustic surveys of Halifax and Rockingham Bays were used to locate submerged grounds identified by local fishing communities as targets for recreational fishing that were affected by the rezoning; i.e. converted from fished to unfished areas. Several of these targets were visualised with towed video in order to characterise the benthic habitat with the surprising result that "fishing marks" encompassed a broad range of physical structures from discrete high-relief habitat (essentially deep reefs) to unresolved low relief habitat (ranging from debris fields to sparse invertebrate gardens). In the Reporting Year (06/07), considerable effort has been expended on the Magnetic Shoals to locate and characterise additional sites in order to develop a balanced design for monitoring fish assemblages on similar habitat units in zones of contrasting human use created by the new zoning plan. The task group has now identified three sites in the Halifax Bay green zone (MNP-18-1082) and three suitable control sites that remain open to fishing. Acoustic bathymetric surveys need to be completed for some of these sites but the fish communities associated with all sites in Halifax Bay have been sampled several times with baited video stations. The latter have been deployed on and around habitat patches in order to comprehend the role of such habitat in structuring the fish communities.

Survey Methods

Because shoal grounds are not detectable from the surface, we have relied upon information from many sources to identify "areas of interest". Once given these 'fishing marks', we have used swathe mapping (collaboration with JCU) to remove the water and visualise the detailed bathymetry of the benthic habitat. Following this identification, towed video is used to characterise the habitat (e.g. reef covered with corals or sparse epibenthic gardens). This approach has allowed us to ensure that future comparisons are based on similar habitat units, which encompass a broad range of structures (see above). Once identified, suitable targets are sampled with multiple baited video units dropped on and around the target, which record fish abundance for at least 45 min. Among these sets, one camera unit uses stereo videography to allow accurate size discrimination of the observed fishes because fish size is typically reduced by fishing.

Problems and opportunities

It is a huge challenge to sample the occurrence of fish species targeted by recreational fishers upon small habitat patches because of their mobility and hence variable presence. Additionally, some of the target species, notably the "reds" (three species in the genus, Lutjanus), appear to be sedentary during daylight hours and feeding actively at night. We intend to try night-sampling with red light.