IS SILT RUN-OFF AFFECTING CORAL COMMUNITIES ON THE CAPE TRIBULATION FRINGING REEFS?

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INTRODUCTION

There was considerable controversy during 1984 over the decision to construct a coast road through rainforest from Cape Tribulation to the Bloomfield River in Far-North Queensland. This unsealed road was completed in late 1984 and subsequent observations during the 1985 wet season showed that there was heavy local run-off of silt into coastal waters from the road. There was concern that this silt run-off could cause permanent damage to the fringing reef communities in the area. Sea Research was contracted by the Marine Park Authority at the end of 1985 to make a three year study on the fringing reefs in the Cape Tribulation area to determine if the observed silt run-off was affecting the coral communities.

The 25km stretch of coast between Noah Head and the Bloomfield River includes about 13km of fringing reef much of which is based on deltaic gravel fans. The intertidal portion of these reefs is over a metre above the level of low spring tides. From low tide level the reefs fall steeply to the sediment bottom at depths between 3 and 6m (low water spring), with a reef width of between 10 and 70m.

The Cape Tribulation coast is characterised by steep rainforest covered hills falling directly to the sea from over 1000m. Rainfall is high, averaging over 4,000mm per year, with annual totals of more than 6,000mm not unusual. Most rainfall occurs between January and April and during this period 24hr falls sometimes exceed 50Omm.

Between April and October SE trade winds blow onshore, stirring up the shelf sediments and holding a wide band of turbid water against the coast. Water visibility in these prevailing conditions ranges from 50cm to less than 2m; during extending calm periods water visibility is usually only between 2 and 6m, although it may occasionally exceed 10m.

The main problem faced was how to resolve the question of whether any damage detected was resulting from the run-off of silt in view of the absence of any comprehensive pre-road biological data from the area. As the road was constructed in late 1984,there had been a full wet season of run-off before this study started. It was decided that the Cape Tribulation coast could be divided into three locations, two of which could be used as controls for the third in relation to this problem.

Location 1. Coastline from Noah Creek north past Cape Tribulation, adjacent to the long-established section of the road that runs from the Daintree River to 2km north of Cape Tribulation (control 1).

Location 2. Coastline from 2km north of Cape Tribulation to Cowie Point where the newly constructed road runs adjacent to the coast and where silt laden,run-off from the road was observed during the 1985 wet season.

Location 3. Coastline from Cowie Point to just south of the Bloomfield River where the new road is diverted inland and direct run-off is unaffected by any road construction.

There are further problems with this approach; it could be argued that silt run-off may also, be affecting the adjacent control areas, but these are unavoidable.

METHODS

After a preliminary assessment of all reefs between Noah Head and the Bloomfield River four similar sites where the reef reached a depth of at least 4m at low tide were chosen at each location. Each site was restricted to a homogeneous length of reef less than fifty metres long having broadly similar coral communities. Four sites were used within each location to give some indication of the natural variation present in the area.

As a preliminary to the main survey the depth stratification of the coral communities was measured at two sites by running five replicate 10m intersect line transects to measure the abundance of corals and other encrusting organisms at four depths. These surveys indicated that there was a marked depth stratification in the reef community. The intertidal reef flat supported a low algal turf but was largely devoid of hard corals. The large brown alga *Sargassum* occurs in a dense band from about mean low tide level down to lm and then decreases in density down to about 3m depth. Hard corals increase in abundance with increasing depth, approaching 70% cover below 5m. This level of coral cover is high compared with off-shore reefs where cover in the richest areas is only 30-50%. In addition the species composition of the hard coral community changes with depth. It was decided to restrict the main *survey* at each site to *the Montipora/Acropora* depth strata between about 2 and 4m depth; this strata was present at all sites.

Only one component of the survey will be discussed here.

At each site five permanent 20m line transects were marked with stakes every 5m and recorded for coral cover. A fiberglass tape was stretched tightly between the stakes and the intersection of this tape with each coral colony beneath it was recorded in cm. From this a measure of percentage cover can be made and if necessary an estimate of the size frequency of the population from which the intersections were drawn can be made.

The permanent transects were set up and surveyed initially in October/November 1985 and resurveyed in September 1986.

RESULTS

In the 1985 survey the mean percentage cover of hard coral for the 5 permanent transects at each site ranged from 33.2 to 62.6 (see table 1). Comparison through time shows that there has been a considerable reduction in coral cover at ALL sites between Oct 85 and Sept 86 (mean reduction of 24%). This, however, was due to the small tropical cyclone Manu that broke up just south of Cooktown on 26-27 April 1986 and resulted in winds of around 40-50 knots in the Cape Tribulation area. Examination of the sites in early May showed considerable coral damage down to about 4m depth, especially in the most northerly location 3 sites that were closest to the cyclone.

Two factor analyses of variance indicates that while there were significant differences between sites in locations 1 and 2 there were no differences in live hard coral cover between locations, either before or after the cyclone damage. This suggests that there has been no influence in the new road location 2 over and above that of the cyclone that may have been caused by siltation. In fact the mean reduction in coral cover in location 2 was 16%, less than in location 1 (24%) or location 3 (32%).

DISCUSSION

At this early stage of the study we have detected no evidence of hard coral death due to siltation at any of these sites, either from the permanent line transect measurements reported here, or from the other survey components or from general observation in the area.

The picture of these reefs that emerges to date can be summarised in the following general points:

Hard corals are more abundant on these fringing reefs than on most off-shore reefs: the grand mean cover of hard corals on these sites was initially 50.8 ± 9.0%, compared with 23.0 ± 10.9% on a selection of 42 reefs in the Central Section of the GBR Marine Park, and 22.6 ± 12.8% on 38 reefs in the Capricorn Section.

The corals that grow in the area are silt tolerant and must normally cope with a high silt content and severely reduced light penetration for long periods when the SE trade winds are blowing. Most of the corals are dark brown in colour, presumably to maximise light absorption.

These fringing reefs are able to cope with regular, often *severe* disturbance. Tropical cyclone Manu, although it caused an overall reduction in coral cover of 24%, was a minor episode and such events probably occur with a return time of about five years - extremely severe episodes have occurred in the Cape Tribulation area at least twice this century: in 1911 and 1934.

Preliminary observations suggest that many of the corals grow very rapidly and can regenerate from small broken fragments after episodes of damage. Others, such as *Porites* colonies, are massive enough to survive high wind episodes and heads up, to 8m in diameter have been found in this area.

Table 1. Cape Tribulation Fringing Reefs: Comparison of Hard Coral Cover Before and After the 1986 Wet Season and TC Manu (26-27th April 1986)

Recorded as mean % cover from five permanent 20m intersect line transects at each site

		Nov. 1985		Sep. 1986		Change
		mean	st.dev.	mean	st.dev.	
Location 1	Site 1	40.4	5.5	29.3	6.9	-27%
	Site 2	53.4	5.4	45.7	10.3	-14%
	Site 3	62.6	11.6	48.1	13.9	-23%
	Site 4	56.0	12.5	38.3	8.9	-32%
Location 2	Site 5	33.2	12.7	25.0	17.7	-25%
	Site 6	53.2	9.4	47.4	6.9	-11%
	Site 7	58.6	7.9	44.9	9.2	-23%
	Site 8	39.4		37.6	6.8	-5%
Location 3	Site 9	54.2	17.5	41.4	8.4	-24%
	Site 10	51.9	9.1	37.1	6.6	-29%
	Site 11	47.3	7.2	29.1	9.6	-38%
	Site 12	59.1	5.3	38.1	8.5	-36%