## DISCUSSION

Correlating differences in life history and recruitment characteristics of coral communities on the six fringing reefs with differences in conditions caused by run-off due to road construction has been difficult for a number of reasons:

1. Major natural physical events (cyclones, bleaching) during the study period caused major effects on coral survival. These appeared to be greater than any factor attributable to increased sediment run-off;

2. No pre-road studies were available to give baseline data for the parameters measured in this study;

3. The northern drift of fine sediments reported in a concurrent study (Hoyal 1986) meant that the sites intended as controls probably received the higher levels of fine sediment. If these hydrodynamic data had been available before the project was designed, sites could have been selected to take this factor into account. Further analysis of Hoyal's data is necessary to determine the significance of sedimentation and its effects.

4. All sediments associated with the reef have high terrigenous contents (>50%), indicating the reefs have always grown under heavy terrigenous influx. (Johnson and Carter 1987) Sedimentological studies (Hoyal 1986; Johnson and Carter 1987) could not distinguish between new sediment from the road, sediment deposited at the reef and suspended sediments. No quantification of increase in sediment levels above ambient was available to correlate with the biological results.

Nevertheless, the study has produced some interesting biological results in one of the few studies of its kind on fringing reefs, and the results point out some major considerations for the design of similar studies in the future.

### Coral spat recruitment

Cape Tribulation reefs are in general self-contained within the coastal environment, i.e. they are separate from reefs elsewhere due to coastal dynamics and are unlikely to receive coral recruits from the mid-shelf reefs (Belperio 1983; I.Dight, pers.comm.; D.Hopley, pers.comm.). A good example is the presence of three coral species of these reefs which have not been recorded from elsewhere on the Great Barrier Reef (Veron 1987).

The highest spat densities from any coral reef studied to date were recorded in this study (up to 1098 spat/225cm$^2$). In comparison, Harriott and Fisk (1988) recorded up to 169 spat/225cm$^2$ at Green Island Reef and Sammarco and Andrews (1988) reported up to 108 spat/225cm$^2$ (converted from 600cm$^2$ settlement area) at Helix Reef.

The increase in spat settlement densities from the southern zone to the central-northern zones parallels the general south to north increase in fine sedimentation rates (Hoyal 1986). This indicates that there was a general northerly longshore drift of both sediment and coral larvae during the study period. Since water dynamics control coral larvae dynamics (Oliver and Willis 1986), and wind speed and direction determine the longshore drift in this area (Pickard 1983), the abundance of larvae along the coast for any given spawning season should be controlled by wind behaviour during the critical 5-7 days of obligate planktonic life of a coral larvae (Babcock 1984). Eddies have also been observed behind headlands (Van Woesik, pers.comm.) which may act as short term larval retention sites and aid in increased coral settlement. This feature could explain how specific reefs recorded consistently high coral settlement rates, e.g. reefs 2/6, 3/9, 3/10.

The differences in the relative abundances of spat families and total spat numbers between reefs and sometimes between zones suggests that there is not a single pool of larvae available to all reefs along this coastline. The relative abundances of some brooding species, e.g. the pocilloporids, affects local spat composition.

The fact that the area of apparently highest fine sediments also had highest coral recruitment indicates that larval availability is not affected by the fine sediment. However it is possible that availability of suitable settlement sites or early survival might have been affected.

In 1986/87, there was higher spat mortality in the more northern sites, which correlates with the higher fine sedimentation rates towards the north. In contrast, in 1987/88, there was no increase in mortality in the more northern sites. In that year, observed sediment deposition on the settlement plates in the northern sites was less than in the previous year. These differences in mortality may have been the result of 62 extra days immersion 86/87 compared to the 87/88 period, or may have been because of higher turbulence over the 1986/87 period.

**Juvenile coral dynamics**

Twenty-nine of the 50 genera recorded at Cape Tribulation were included in the study of juvenile coral dynamics. Acropora and Montipora corals dominated most quadrats, and species from these genera recruited commonly by fragmentation. The importance of fragmentation on these reefs is reflected in the high mobility of the substrate during the study period. Reef 1/1 in the southern zone was composed almost entirely of these two genera and had low survival rates and higher recruitment from fragments than the other reefs studied.

Apart from high recruitment of acroporids to reef 1/1, there was no significant difference in recruitment rates between reefs during the study period. Poritids and faviids appear to be more dependent on recruitment of larvae than acroporids.

Mortality rates of the juvenile corals did not differ significantly between reefs in either of the one-year periods. (41% to 90% over two years) could not be attributed to increased sediment fall-out from the road construction. Because of the natural episodic events during the study period, increased sediment fall-out from road construction could not be detected.

The difference in size class structure between 1986 and 1987 for the southern zone appears to be due to two factors: an increase in abundance of the 11-20cm mean diameter sizes in 1987 which was probably due to growth, and a corresponding decrease in numbers of colonies in the 0-2.5cm mean diameter sizes, indicating differential mortality leading to lower successful spat recruitment compared to previous years. The northern zone reefs differed in size structure between 1985 and 1986 because of higher numbers of colonies in the 11-15cm mean diameter size class in 1986 compared to 1985. This was probably due to the change in study reefs rather than growth of smaller colonies from the previous year.

The difference between sites in the taxonomic composition of recruits on settlement plates and in quadrats may be attributed to inter-annual variations (spatial and temporal) in recruitment patterns, habitat selection by spat such that the recruitment patterns of juveniles differs from the patterns found on the settlement plates, or differential mortality between recruitment and appearance as a visible colony.

During the study period, recruitment patterns of spat did not differ significantly from year to year. Habitat selection by spat could be expected to be similar from reef to reef. Therefore, differential mortality may be a significant determinant of variation in taxa between spat and juveniles.

For the acroporids, conditions may be more favourable for early survival in the southern zone than in the central and northern zone since they are proportionally better represented amongst the juveniles than in the spat in the south though these data are not sufficiently long term for definite conclusions. The trend is the reverse for the pocilloporids, poritids, and faviids, with juveniles recruiting in greater proportions than spat in the central and northern zones compared to the southern zone reefs (pocilloporids are rare in the central zone). Fragmentation may be contributing greatly to the currently high juvenile acroporid abundances on the northerly reefs.

The fact that size frequency distributions of the coral colonies were similar in the three zones for each of the three periods, implies that there has been no clear impact of increased run-off on the size structure of corals in the impact zone.