

METHODS

STUDY SITES

Four sites were chosen, all of them on the sheltered back reef region that was and is the focus of tourist activity (see figure 3).

The first was in the immediate vicinity of the Hayles (now Great Adventures) reef destination pontoon (see figure 4). Swimmers and snorkelers at the pontoon are restricted by buoyed lines to the area east and south of the pontoon to avoid conflict with the semi-sub and glass bottomed boat operation. The majority of swimmers and snorkel divers do not venture more than 100m from the pontoon. The deep transects were positioned either immediately beneath the indicated position of the pontoon or within an estimated 20m of the pontoon edge. The shallow transects at this site were set up around the edges of the patches of reef flat closest to the pontoon position; it was reasoned that these would receive the greatest level of snorkeler/swimmer impact. The semi-sub and glass bottom boat moorings at the Pontoon site were in deeper water some distance out from the pontoon over a predominantly sand bottom; no detrimental effects were expected from these moorings.

Site 2 was in the area of the permanent mooring used by the Deep Sea Divers Den boats "Tropic Queen" and "Tropic Princess" for their diver training operations and covered an area approximately 200m square (see figure 5). The permanent transects at this site were set up about a month after the DSDD had shifted their mooring to the new site and were confined to the area that observation and consultation suggested was the most intensively used by the trainee divers.

The third site was a control about 200m wide mid-way between the first two sites that was out of bounds to both operations (see figure 6).

Site 4 incorporated the area to the north of the pontoon that was used by the two semi-submersibles operating from the pontoon (see figure 7). As at the DSDD site the transects at this site were set up about a month after operations had started to ensure that they were immediately adjacent to the semi-sub route that was being used in practice rather than that proposed before operations began.

CORAL TRANSECTS

Encrusting organisms were assessed using permanent 20m line intersect transects. Transects were marked with 100mm masonry nails driven into the coral basement or massive corals at intervals of 2-4m. The length of intersection of all encrusting organisms with the transect line was recorded in cm - the sum of these intersects giving a measure of percentage cover for the various species. Five replicate transects were positioned haphazardly in each of two depth strata at each site. The five shallow transects were between 0-2m below mean low water (MLW), while the deep transects were between 6-10m below MLW. No deep transects were surveyed at the semi-sub site. Differences in the cover of encrusting organisms between sites and depths were tested using a two factor analysis of variance, while changes through time, being non-independent, were tested using a t-test for the comparison of the means of paired samples. As 101 separate t-tests were necessary for this analysis the level of probability taken as significant was 99% rather than the normal 95%.

CORAL HEIGHTS

One of the concerns about heavy tourist use of a coral reef area is that snorkelers and divers may inadvertently break portions off erect and branching corals and eventually cause significant degradation to the area around a regularly used destination. Similarly it has been thought that regular bumping of reef edges by semi-submersibles trying to get as close as possible to the coral may cause additional damage to corals. In an attempt to quantify this type of damage measurements of the maximum height of branching and plate type corals were made along each of the permanent transects. The highest piece or clump of live coral in a square metre centred on each metre of the transect line was measured, giving 20 height measurements for each transect. If there was no erect hard coral within this square metre the piece nearest to the line outside this area was measured. Changes in coral height were tested using a t-test for the comparison of the means of paired samples.

FISH COUNTS

Selected groups of fishes were counted along five haphazard 50 x 20m transects at three of the sites; no fish counts were made at the semi-sub site. Each count was marked using a 50m central fiberglass tape run out at a depth of about 5-8m and fish counted 10m each side of the line. Fish counted were those that experience suggested could be affected by the fish feeding and other tourist activities and included: large non-secretive cods and coral trout (family - Serranidae); jacks and trevallies (Carangidae); snappers or sea-perch (Lutjanidae); fusiliers (Caesionidae); sweetlips (Haemulidae); emperors (Lethrinidae); batfishes (Ephippidae); butterflyfishes (Chaetodontidae); large wrasses (Labridae); parrotfishes (Scaridae); surgeonfishes (Acanthuridae); and rabbitfishes (Siganidae). As both sets of fish counts were made using haphazard and hence independent samples a two factor analysis of variance was used to test for differences among sites and between times.

RESOURCE MAPPING

The area around the tourist destination pontoon was mapped in detail using aerial photographs and the position of all large massive corals, large coral clumps and giant clams plotted. It was anticipated that this map would be of use to the operators as an aid to help tourists understand what they were seeing while investigating the reef community. It would also provide a baseline for looking at the long term effect of tourist activities on the larger coral colonies and giant clams.

SAMPLING DATES

A special trip to the study area was made at the end of March 1987 to survey the Pontoon Site prior to the establishment of the pontoon moorings: the 10 encrusting organism transects were set up and surveyed at this time, along with the first group of fish counts. The remainder of the initial survey of all sites, including the resource map, was made during the period June-July 1987. The final survey at all sites was made in June 1988.