

## CHAPTER 2: BOMMIE CROPPING OVERVIEW

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### Introduction

The floating hotel was towed to John Brewer Reef and moved into the lagoon in January 1988. The passage of the hotel and towing vessel into the lagoon would have been blocked by submerged bommies which were close to the surface (Figure 2). To facilitate the installation of the floating hotel, nine bommies (patch reefs) were cropped, i.e. the top of the bommies was removed so that the top of the bommies was deeper and the vessels could pass over their tops. The largest and shallowest of the bommies (Bommie #12) was approximately 50 m x 32 m in size, and required 4 m to be removed from the top, i.e. approximately 6400 cu.m. of material. The other bommies were smaller and required less material to be removed. The tops of the bommies contained variable amounts of living organisms which would be destroyed during the cropping process. A rapid survey of bommie #12 recorded the presence of at least 30 coral species, and over 80 colonies. Hard corals were predominantly pocilloporids and staghorn *Acropora* colonies.

The procedure followed for the bommie-cropping was as follows:

- a. Large organisms were removed from the bommie and transplanted to another bommie away from the area. Corals were collected and placed in a metal cage which was towed submerged to the transplantation site. Coral were placed carefully in their correct orientation and were wedged into crevices but were not otherwise attached to the substrate;
- b. A barge was positioned over the bommie and the reefal material was broken up with a pneumatic drill;
- c. The broken material was transferred to a floating bin along-side the barge using a back-hoe crane; and
- d. The material was dumped in a designated area several hundred metres away in the lagoon.

The objectives of this project were:

- a. to survey the bommies and to determine whether any of the organisms were suitable for transplantation away from the area which was to be damaged;
- b. to transplant some of the fauna to other bommies, and to determine the survival rates of the transplanted organisms; and
- c. to monitor the general impact of the bommie cropping on nearby areas.

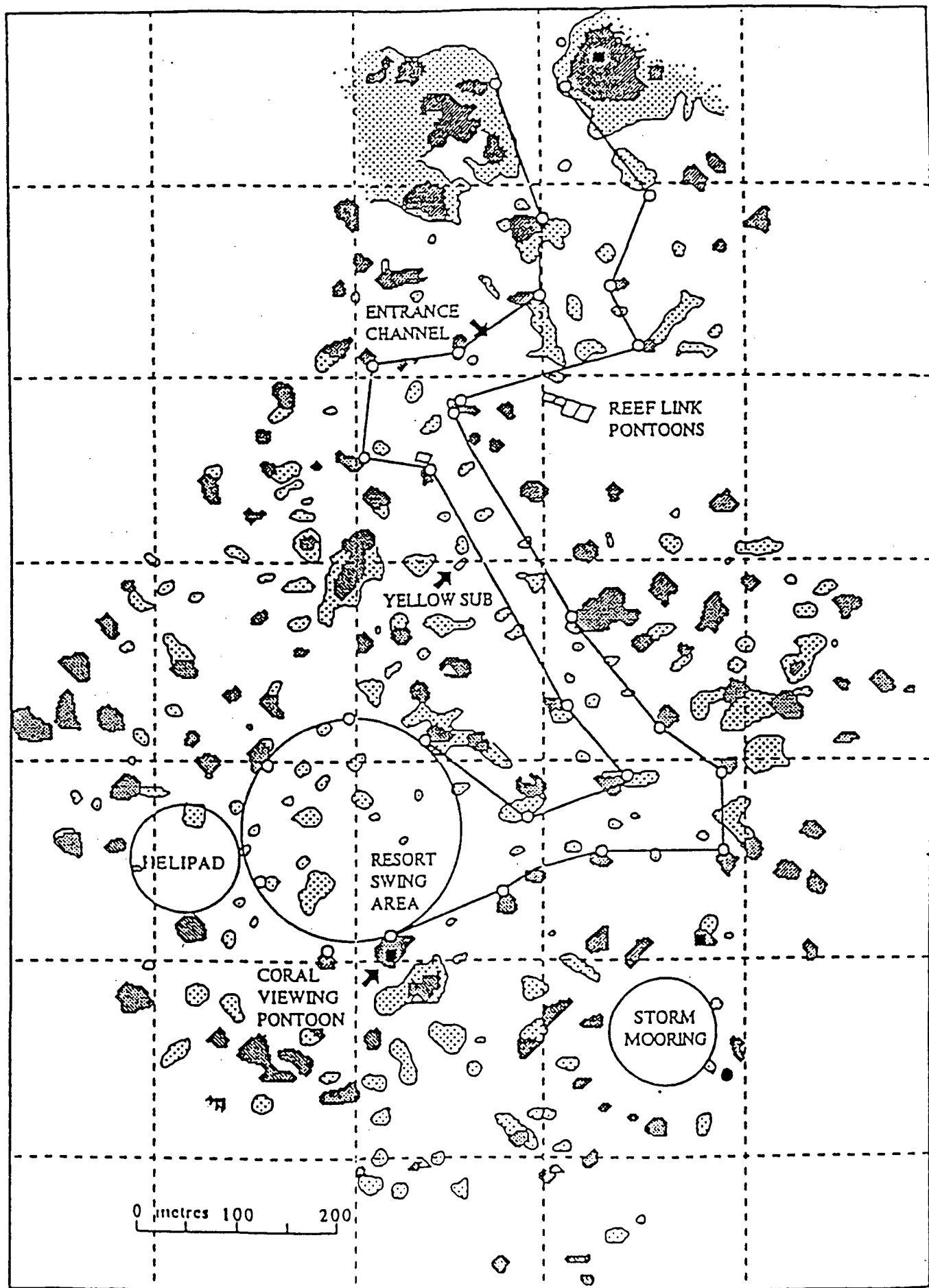
### Methods

Surveys were done in May, July and August, 1987 and January 1988. The first stage of the project was a brief survey of the benthic fauna on the first and largest bommie to be cropped (described above), with particular attention to the hard corals. Many corals outside the immediate excavation area were tagged to determine their survival rate in situ, but many of these were eventually removed when it became clear that the drilling operation was going to have a major impact on any remaining organisms on the bommie.

At intervals of one to two months, the survival rates of the transplanted colonies were monitored. Observations also were made about the general effects of the operation.

### Impacts of the bommie cropping

The removal of living corals from the bommie surfaces was incomplete at the time of the start of bommie cropping, and was done on a voluntary basis by the excavation contractors only at times when the weather was too rough for the excavation works. The excavation works resulted in the dislocation of large amounts of debris down the bommie sides, adjacent to areas which were heavily impacted by the operations. One month after the beginning of the operations, over 50% of the coral colonies, some soft corals, and Tridacnid clams had been transplanted away from the excavation site. They appeared to have been handled carefully and subsequent mortality of transplanted organisms was low.



**Figure 2** Map of John Brewer Reef showing the passage of the hotel and the towing vessel into the lagoon

The drilling operation ran into several technical problems which slowed operations greatly, and was limited by weather conditions in which work could not proceed. The initial plan of supporting the drilling barge with steel studs was unsuccessful for excavations and as well, the studs moved, damaging organisms which had not been removed from the bommie tops.

The use of stakes and cable ties to stabilise the barge was more successful. The drill operations either killed any remaining organisms directly or severely affected nearby organisms to a distance of about 3 m, probably as a result of fine sediment plumes generated by the excavation activities. Most individuals of a common reef-top sponge apparently died as a result of the drilling operations.

The removal of material from the bommie created several sources of sedimentation: one source was heavy sediments which rolled down the side of the bommie to a distance of up to 30 m from the base of the bommie, producing a thick sediment layer which covered the slope in less than two hours after the commencement of operations; the second source was from fine sediments discharged from the excavating bin holding mostly solid fragments broken from the bommie. This plume of fine sediment extended up to 150 m in the direction of the prevailing currents, and sank slowly as it moved away.

Any organisms remaining on the bommie within about 20 m of the operations showed clear reactions to the presence of the sediment. Soft and hard corals reacted by producing copious mucus, and some were covered in medium-sized sand grains.

### **Survival of transplanted corals**

Corals and clams were transplanted over a two to three month period from May 1987. On 18 July 1987, the transplanted corals were surveyed using SCUBA. Of 318 colonies transplanted, only 1.6% (five colonies) had died. These corals represented approximately 24 species, but most (77%) were pocilloporids. One of the 16 transplanted clams had died, and two were over-turned.

A rapid snorkel survey around the site on 27 August 1987 showed that the transplanted corals continued to appear to be in good health, and with only a few corals dislodged. On 14 January 1988, the transplants were inspected again using snorkel. Survivorship appeared to be high, and the tips of the arborescent corals damaged during transplantation were re-growing. Most of the corals were in the correct orientation, indicating that the initial efforts by the transplanters to wedge the corals into position seemed to be effective. Larger fragments appeared to have survived better than smaller fragments and this is supported by other results (Harriott and Fisk, 1988). Some of the larger colonies showed partial mortality of some of the lower parts of their skeletons. This is common for transplants, but there was no sign of recent partial mortality. Of the transplanted clams, all appear to have survived and only one was not in the correct orientation.

### **Conclusions**

In an area where construction activity is likely to physically disrupt large areas, or result in the discharge of large amounts of sediment, it is advisable to remove as many organisms as possible from the construction site. Transplantation of corals and clams at John Brewer Reef was successful with high survival rates over at least six months. The corals were wedged into place, but not otherwise attached. This was successful in the short term, but long term survival rates in adverse weather conditions may be improved by a better attachment method.

There were organisational problems with the John Brewer Reef bommie cropping program. Transplantation was not complete at the time of commencement of the destructive phase, and methods for the removal of the material had to be modified as the need arose. These changing methods meant that potential impacts of the process could not be predicted with any certainty. Flexibility in the management response was required, e.g. in removing organisms from the sides of the bommies when it became clear that these areas would be extensively damaged.

Following the success of the coral transplantation, the hotel management was interested in transplanting a wider variety of organisms onto one of the cropped bommies close to the hotel to improve the snorkelling amenity of the hotel guests. This technique of accelerated regeneration is feasible for the relatively small areas involved and quite likely could have included organisms removed from the same bommies prior to the cropping exercise. Unfortunately, financial difficulties intervened before the project could be started. The concept of removal of organisms from an area to be physically impacted, their storage, and subsequent use to regenerate the damaged area is one which may have relevance in a variety of situations.