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Status of shallow reefs around Apid Island, Inopacah, Leyte, Philippines

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ABSTRACT

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A rapid coral reef survey was conducted along selected sites in Apid and Digyo Islands on Aug. 30-31, 1999. Transect lines (20 meter) were laid in different sites in the reefs. The assessment revealed that the entire reef area is in a critical status. The combined effects of previous destructive fishing practices, over.exploitation, El Niño phenomenon and a *Crown-of-Thorns* seastar population outbreak resulted in severe damage to the reef. Dead corals were ubiquitous. Marine resources inside the protected marine sanctuary were higher and in better condition compared to areas which were open for exploitation. Ecological awareness was indicated by the absence of any trash in the reefs and the continuing effort of the community to maintain the marine sanctuary.

Keywords: coral reef. Cuatro Islas. destruction.

INTRODUCTION

The Cuatro Islas of Inopacan is an important fishing ground not only for the local fisherfolks, but also for small-scale fisherfolks from all over the

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Camotes Sea and for commercial fishing boats from Leyte and neighboring islands. The introduction of destructive fishing methods and the increasing number of commercial fishing boats even intruding into the municipal waters led to the destruction of the coral reefs of Cuatro Islas and the overfishing of the entire area in the early 1990s.

When the Small Islands Environmental Rehabilitation and Livelihood Project of the VISCA-gtz Tropical Ecology Program started its community-based activities in 1993, fish catch did not anymore meet the livelihood requirements of the people. Reef destruction was most evident in the island of Apid. Here a coral cover of only 20% was recorded during an assessment in January 1994 (Activity Report, 1994). Main causes of destruction were dynamite and cyanide fishing as well as the *muro-ami* fishing practice.

After a series of informal trainings and continuous community organizing efforts extended to the islands' communities, the islanders agreed to establish marine sanctuaries in the three islands of Apid, Mahaba and Digyo, constituting the island barangay of Apid (Milan *et al.*, 1996, Gatus *et al.*, 1997). The first two sanctuaries were established in selected reef areas of Apid and Mahaba island in March 1994 and a third sanctuary was established in Digyo in 1995 (Gatus *et al.* 1997). This, in combination with strict enforcement of fishery laws, led to the rehabilitation of the fish stock and an increase in fish catch over the years of implementation (Milan *et al.*, 1996; Schoppe, 1998a). With an average yearly growth of 1 cm, hard coral rehabilitation is much slower. However, coral cover improved from 20% in January 1994 (Activity Report, 1994) to about 45% in August 1998 in the sanctuary area of Apid (Schoppe, 1998b.). The increase in coral cover was mainly attributed to fast growing soft corals covering the reef platform in the sanctuary. Hard coral rehabilitation was also notable, especially of faster growing *Acropora* species.

Continuous improvement of the reef conditions was expected. However, the 1997/98 El Niño event reversed the achievement of man-made protection efforts. Water temperatures between 29 °C and 31°C over more than ten months led to coral bleaching and caused the death of many hard and soft corals in the last quarter of 1998. In addition, an outbreak of the coral-polyp-eating sea star, *Acanthaster planci*, resulted in the almost complete denudation of Apid's reef. The present study tries to analyze the current status of shallow reef areas around Apid Island.

MATERIALS AND METHODS

For the rapid survey of coral reefs around Apid, four 20 meter transects were laid parallel to the shoreline around the island on August 30–31, 1999 (Fig. 1). For comparison, an additional transect was laid in Digyo Island (Fig. 2). All transects were placed at about 50-200 m from the shoreline. No transect was taken on the slope. Thus, the areas of the transects were comparable. The depth of the transects was limited to a maximum of 2m based on the capacity of the assessment team. Slate boards with pencils were used for notation under water. A preliminary survey of the coral reefs around Apid was done by boat. Then, for each transect, the exact location was marked on a map of Apid and Digyo Islands.

Along the 20m transects, fishes and invertebrates such as sea stars, sea urchins, sea cucumbers and shellfishes were assessed within a 2 meter distance on both sides of the transect. The number of individuals was taken according to abundance classes (0, 1, 2-5, 6-10, 11-25, 26-50, 51+). Colonial organisms and vegetation (hard corals, soft corals, dead corals, seaweed, seagrass, rocks, sand, trash, fishing gear and other matters) intercepted by the transect were recorded for every meter. The values expressed indicate the presence of an organism within a meter (within 1 meter, within 2 meters, etc.) regardless of its frequency of occurrence within that meter. Here as well, replicates were taken and the means were used as result.

This method of coral reef assessment was based and modified from the ReefBase Aquanaut Survey Manual of McManus *et al.* (1997) recommended for non-marine biologists. The observer identifies reef organisms not to species level but by broad categories (school of fish, juvenile fish, live coral, dead coral, etc.). Identification of organisms was based on the coral reef guide by Gosliner *et al.* (1996).

The following physical and chemical parameters were measured with a water quality checker (Horiba LCD, U-10): water temperature (°C), conductivity (mS/cm), turbidity (NTU), and salinity (‰). In addition, water transparency was measured using a Secchi disc. Final values are expressed as means of three replicates.

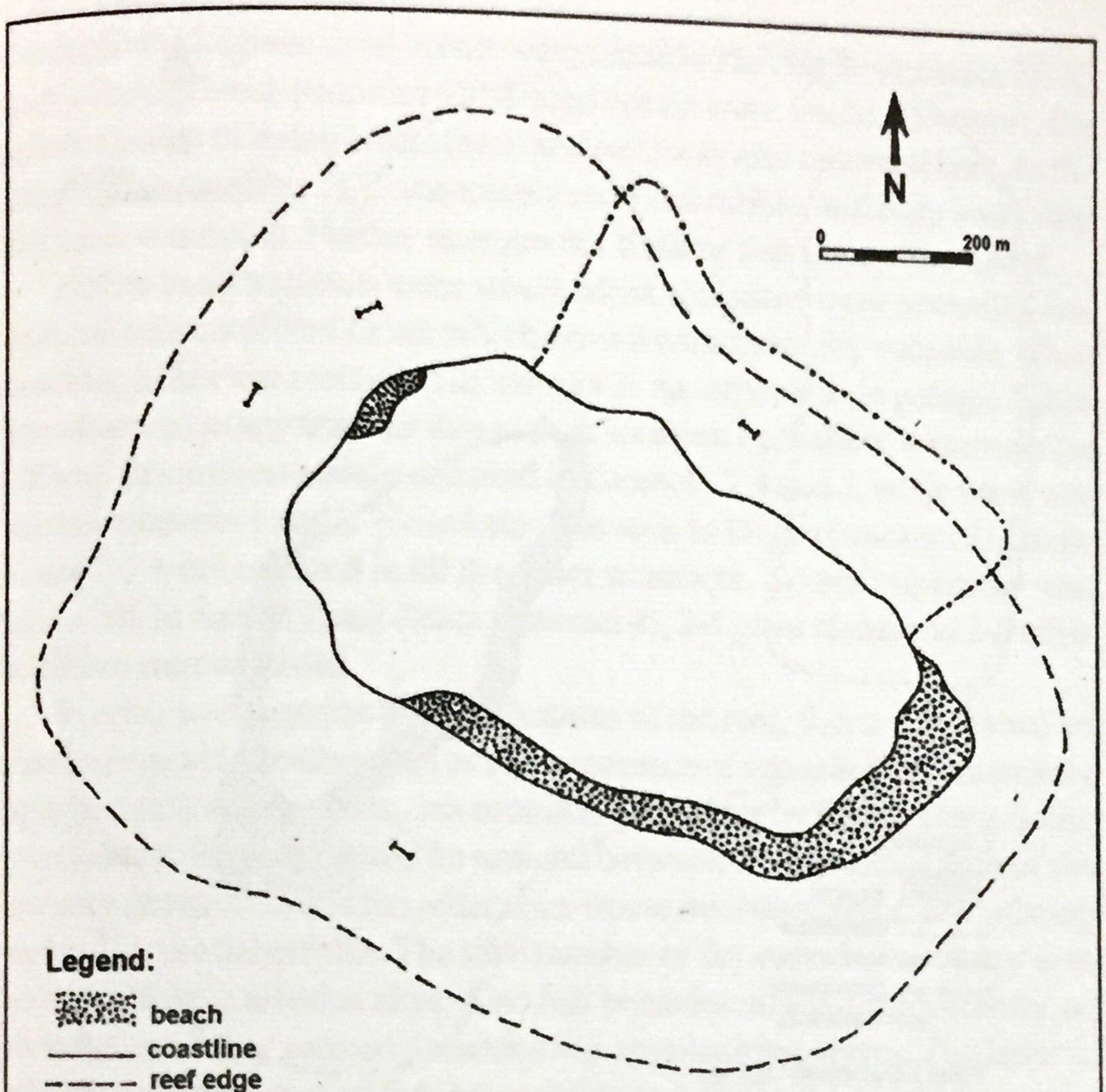

Figure 1. Map of Apid Island showing the locations of the different transect lines

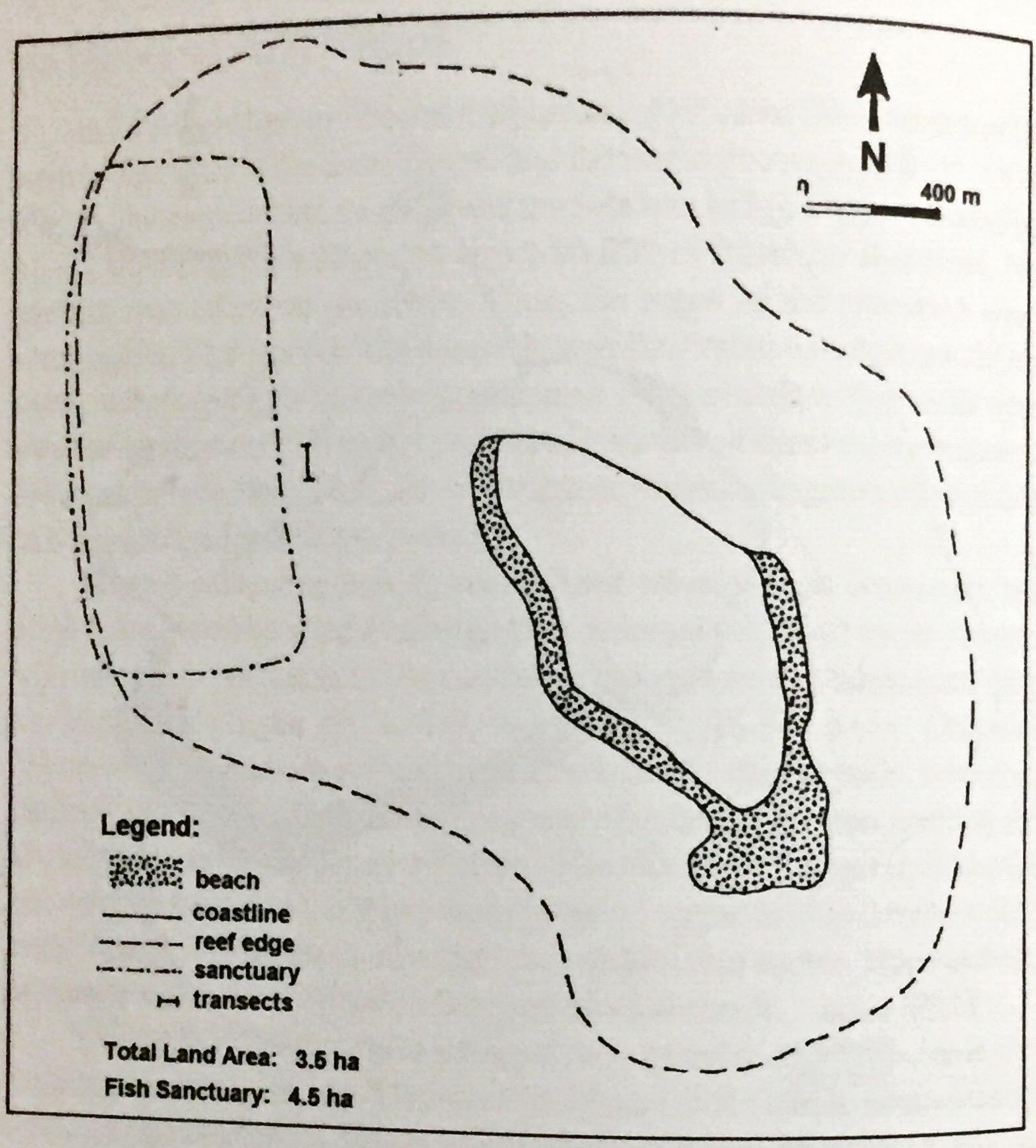

Figure 2. Map of Digyo Island showing the location of the transect line near the sanctuary

RESULTS AND DISCUSSION

The survey of the area revealed that Apid's coral reef is in a critical state. The number of occurrence of dead corals was high in all transects (Table. 1). Within all 20-m-transects, dead corals were found in 9 of the 1-meter-

interceptions. Highest dead corals were recorded in Digyo (transect 2). At Apid's Small Beach (transect 3) 14 dead corals were found. However, the highest number of living corals (hard and soft) was also recorded here. In the gleaning area (transect 5), it was mainly sand and rubble, and only one living hard coral was noted. Neither sponges nor trash or fish traps were found.

Fishes in all transects were small. Most abundant were juveniles and small colorful coral reef fishes which are not commercially valuable. Most schooling fishes were recorded in transect 3. As expected, no pelagic fishes were observed in any transect due to their location in shallow waters on the platform. Sea urchins mainly occurred in transects 3, 4 and 5, while none was found in transects 1 and 2. No sea star was seen in Digyo (transect 2), while at least 2-5 were counted in all the other transects. No sea cucumber was found at all. In Apid's Small Beach (transect 4), 2-5 giant clams and 2-5 other shellfishes were recorded.

In order to categorize the health status of the reef, focus was placed on some ecological indicators such as the occurrence of schooling commercially important fishes, seaweeds, sea urchins, and butterflyfishes. Here, some remarkable differences could be noticed between the protected area of the sanctuary (transect 1) and the other sites where intensive extraction is being practiced by the fisherfolks. The total number of fishes in the sanctuary area was higher than in all other sites. Also fish behavior differed significantly, as fish in the sanctuary seemed not scared by approaching divers. The latter is probably a consequence of fishing prohibition in this area. Considering the importance of a sanctuary as a protected breeding area for fishes, a higher number of schooling juvenile and adult fishes was expected. Their absence might be explained by the location of the sanctuary transect. It was placed in shallow water, at some distance from the reef edge, which is considered to be the preferred site for schooling fishes.

Algae rapidly overgrow dead corals. If they are abundant in an area, it can be assumed that few organisms that feed on them are present. On the other hand, their absence or scarcity may indicate the abundance of grazers such as fish and sea urchins. The absence of seaweed along the transect in Apid's sanctuary was notable since they were found to be abundant along all

Table 1. Occurrence of corals and other substrate and abundance of fishes and invertebrates along 20 m transects laid in Apid and Digyo Island.

Apid	Apid sanctuary beach	Apid small beach	Apid small area	Digyo gleaning
Corals and other substrate	*T1*	*T3*	*T4*	*T5*	*T2*
Hard Coral 11	11	12	1	12	
Soft Coral	0	3	1	0	0
Dead Coral	9	14	10	9	15
Seaweed	0	4	2	9	2
Seagrass	0	1	1	0	1
Rocks	16	9	4	1	2
Sand	0	3	6	13	3
Rubble	0	2	2	11	0
Sea Anemone	1	1	1	0	1
Water	1	0	0	0	1
Sea fan	0	0	0	0	0
Sponge	0	0	1	0	0
Trash	0	0	0	0	0
Fish traps	0	0	0	0	0
Fishing gear	0	0	0	0	1
Fishes					
Commercially valuable species					
Schooling fishes	0	51+	1	0	0
Non-schooling fishes	6-10	2-5	6-10	0	0
Pelagic fishes	0	0	0	0	0
Other fish species					
Scorpion fishes	0	0	1	0	0
Surgeon fishes	0	0	0	0	6-10
Lizard fishes	2-5	2-5	0	1	0
Butterfly fishes	6-10	2-5	2-5	0	6-10
Small colorful fishes	51+	51+	11-25	11-25	51+
Juvenile fishes	51+	26-50	26-50	26-50	51+
Invertebrates					
Sea urchins					
(*Diadema* spp.+ *Echinothrix* spp.)	0	6-10	11-25	11-25	0
Sea stars (mainly *Linckia laevigat*)	2-5	6-10	6-10	2-5	0
Crown-of-Thorns (*Acanthaster planci*)	2-5	1	2-5	0	2-5
Sea cucumbers	0	0	0	0	0
Shellfishes	1	1	2-5	0	0
Giant clam	1	0	2-5	0	0
Others (Hermit crabs)	2-5	0	0	0	0

transects in the unprotected areas. This might indicate heavy grazing in the area. This might also be related to the better competitive colonization of very abundant soft corals in Apid sanctuary before. The time lapsed between the massive death of soft corals and the time of this survey may not be long enough for seaweeds biomass to be high. The absence of sea urchins (Table 1) might be the result of the absence of seaweeds to feed upon. Fishes, some of which are grazers seem to compete successfully with the sea urchins in the sanctuary. Due to the protected status of the area, fishes are much more abundant in the sanctuary than outside. The highest number of seaweeds occurred in the gleaning area of Apid Island where dead corals were dominant.

Butterflyfishes are considered as indicators of healthy reefs, where they occur in abundance and high diversity. Slightly higher numbers of butterflyfish were registered in the sanctuary of Apid (Fig. 3) and in Digyo (Table 1). Even if these reefs are disturbed, they still seem to be a suitable habitat for these

Figure 3. Butterfly fish (Chaetodon), indicator of a healthy reef

species. In Apid, this can be attributed to the protected status of the sanctuary. Even if Digyo is also an exploited area, the presence of butterflyfishes seems to be related to the diversity of coral life forms providing shelter for coral reef fishes even when they are dead. The density of fish population not subjected to fishing pressure will eventually build up. Eventually as the condition inside becomes crowded, some of the fishes will move out from the protected area (the spill-over effect). The fishes observed in Digyo area could be a spill over from the sanctuary since the reef surveyed was very near the Digyo sanctuary.

The differences in the general conditions between the Apid sanctuary and other areas including Digyo may not only be due to human interference but also due to the reef's geomorphology. While the other reef areas assessed are wide (200-600m), slightly sloping areas with patchy occurrence of corals, the Apid sanctuary consists of a narrow (50m) and shallow strip of flat form reef, adjacent to the reef crest with a sudden and steep slope which fishes prefer.

Data on physicochemical parameters showed figures (Table 2) within normal conditions. But it must be pointed out that during months prior to the survey, the El Nino phenomenon was felt in the Pacific rim. The increase in

Table 2. Physical-chemical parameters along selected transects in Apid and Digyo Islands.

Location	Apid Sanctuary	Apid Small beach	Digyo Sanctuary
Transect	T1	T3	T2
Date	30.08.99	31.08.99	30.08.99
Time	15:30	08:00	17:00
Depth (m)	1.5-2.0	1.5-2.0	1.5-2.0
Water temperature (^{0}C), surface	29.4	28.9	29.3
Salinity (%)	34.3	34.3	34.0
Transparency (m)	Bottom visible	Bottom visible	Bottom visible
pH	8.76	8.72	8.76
Conductivity (mS/cm)	48.5	48.5	48.6
Turbidity (NTU)	0	0	0

water temperature brought about massive and devastating coral bleaching. The observed recently dead corals might be due to this natural catastrophe. This event affected areas such as the sanctuary where soft corals already had recolonized the reef (Fig. 4) where a coral cover of about 45% had been reported before (Schoppe, 1998b).

Additional damage was caused by the *Crown-of-Thorns* starfish (*Acanthaster planci*) which was observed in high numbers while examining the state of the reef (Fig. 5). According to literatures, *Acanthaster planci* can cause severe damage when their number exceeds six individuals per km^2. In Apid sanctuary as well as in transects 2 and 4, two to five Crown-of-Thorns starfish were found along the 20m-transects which cover 80 m^2. This number expressed in km^2 will give 20,000 individuals per km^2. Hence, the situation can be described as a severe *Acanthaster* infestation.

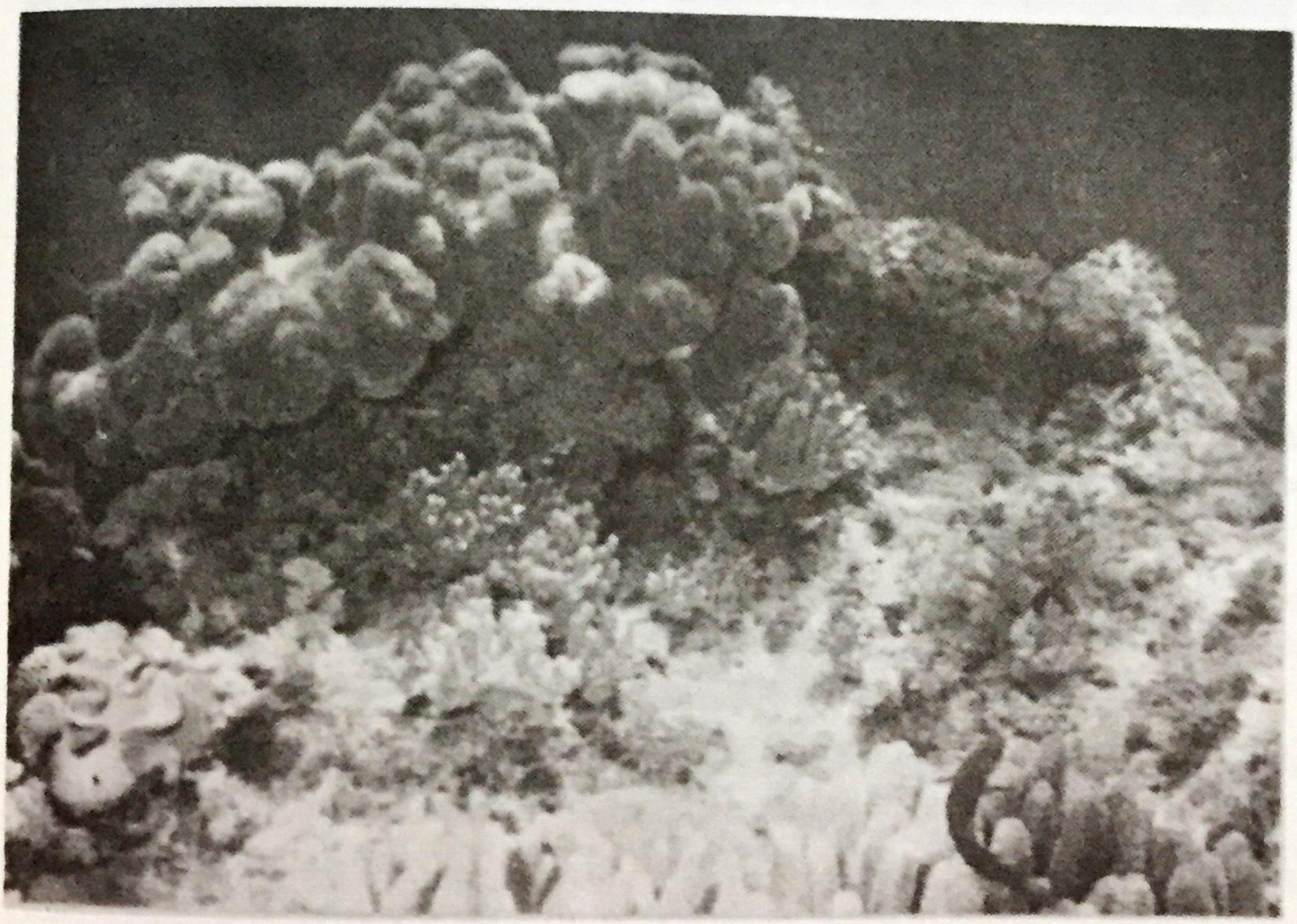

Figure 4. Soft coral (*Sarcophyton*)

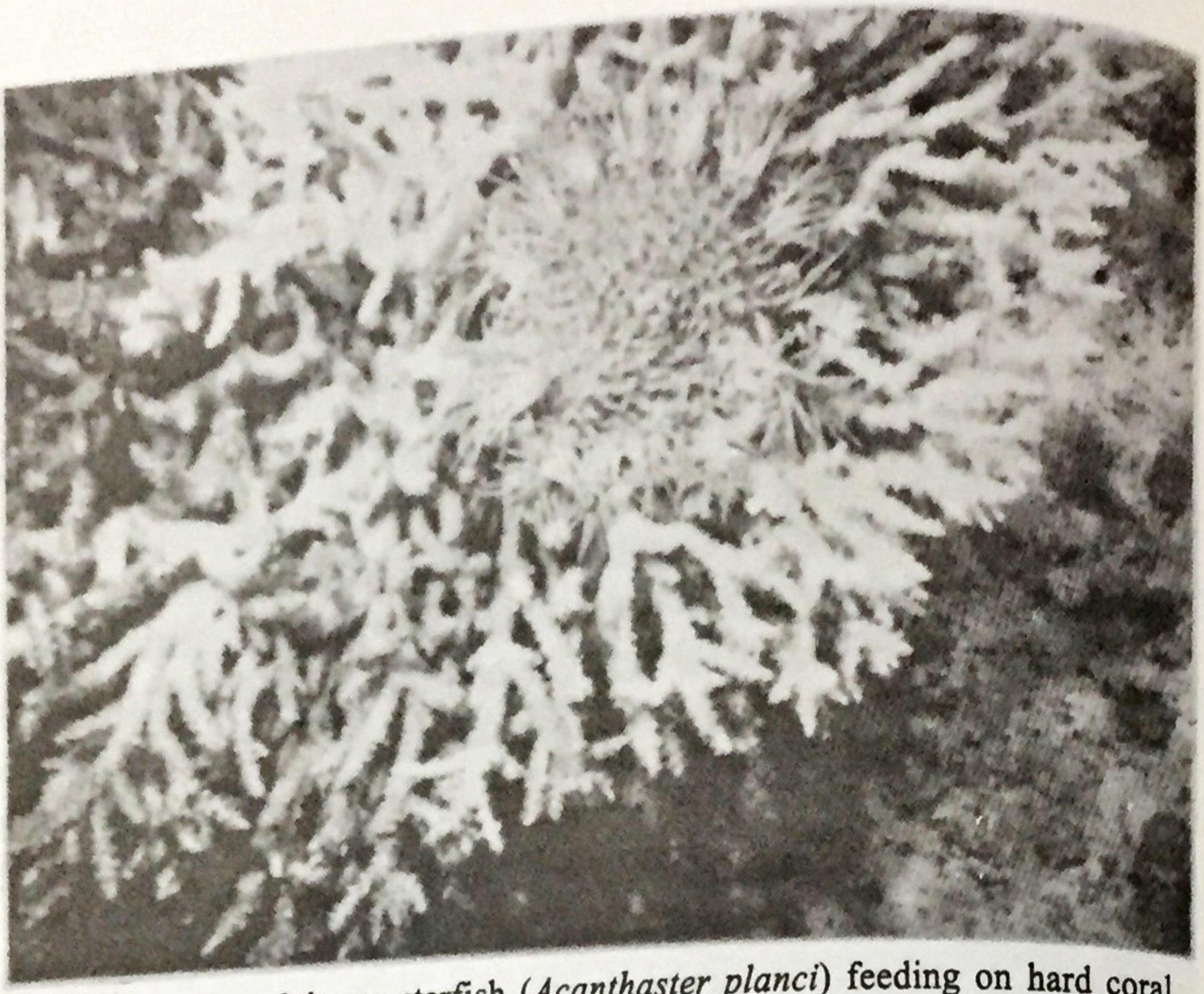

Figure 5. Crown-of-thorns starfish (*Acanthaster planci*) feeding on hard coral (*Acropora*)

CONCLUSIONS

The generally poor conditions of the reef surrounding Apid Island are seen in various indicators. Dead corals are ubiquitous and abundance of fish and other reef related organisms is low. These conditions can be attributed to several causes. First, the long history of highly damaging fishing practices mentioned above. Although a sanctuary has been established, other coral reef areas are still subjected to indiscriminate anchor damage and trampling while harvesting marine resources. This is especially true for the gleaning area. In addition, the devastating effects of the 1997/98 El Niño phenomenon resulted in coral bleaching. The population explosion of the coral-polyp eating starfish left its own mark as seen by the death of corals to the extent that the once abundant soft corals in the area almost totally disappeared.

Despite the natural phenomena that ravaged the entire area, the quality of habitat inside the sanctuary was better as evidenced by its higher number of fish and the absence of algae over coral heads. Butterflyfishes, which indicate a healthy coral reef, were also observed. The better status of resources in the Apid sanctuary and the seeming spill-over effect in Digyo manifest the resilience of the ecosystem. Its natural ability to recover after a natural destruction was faster than in areas subjected to anthropogenic destruction which aggravates the impact of natural disasters.

Evident was the absence of trash in all examined areas. This can be considered as an indicator of the concern of the Cuatro Islas' population for their environment.

Unfortunately, only half of the planned transects could be done due to bad weather conditions. This severely restricted the reliability of the results especially the comparison between Apid and Digyo. Data collected together with the observations of the researchers clearly showed the generally bad status of the unprotected coral reefs around Apid but also that the conditions in the sanctuary were better. It is recommended that further studies be done on the recovery rate of the areas. In addition, the possible spill over effect of the sanctuary to sustain the fishery in the neighboring areas should be investigated and documented.

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