

**PRELIMINARY OBSERVATION ON LIVING HABITS OF ACANTHASTER  
PLANCI (LINNAEUS) AT PULAU TIKUS, SERIBU ISLANDS**

by

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ABSTRACT

During the period of June 1975 to August 1975, observations on living habit and some ecological aspects of *Acanthaster planci* were made at Pulau Tikus, Seribu Islands. The observations, limited to 8 metres deep, were made at the outer reef located south of Pulau Tikus, covering an area of about 4000 square metres. The density of living stony corals and the damaged caused by the feeding activities of *A. planci* were also studied.

The results show that the average numbers of *A. planci* per month is 20 individuals per 4000 m<sup>2</sup>. The sizes of the starfish vary between 26-41 cm in diameter and the number of arms between 10 - 18. The moving distance of the starfish is 0.3 - 8 metres in 24 hours.

The stony corals affected are *Acropora squamosa* (BROOK), *A. spathulata* (BROOK), *A. Latistella* (BROOK), *A. quelchi* (BROOK), *Fungia* sp., *Montipora ramosa* BERNARD, *Porites* sp., *Diploria* sp., and *Goniatria* sp.

INTRODUCTION

*Acanthaster planci* (L.) is known as coral-eating starfish and its exploitation is reported to cause serious damage to living stony corals (DEFVANEY & RANDALL 1973; ENDEAN & STABLUM 1973 a, b.; HAYASHI & TATSUKI 1975; MARSH & TSUDA 1973; RANDALL 1973 a). MORTENSEN (1931) is the first to record the presence of *A. planci* which is quite common on the coral reefs of Seribu Islands.

The study of coral reef formation at Pulau Pari group, made during the period of 1969 to 1974, showed the presence of *A. planci* at several places (SUKARNO 1975). Pulau Pari group lies about 35 km northwest off Jakarta, located at 05° 50' 00" to 05° 52' 25" S, 106° 34' 30" to 106° 38' 20" E (GOODING 1969) (Fig. 1). The starfish is common at the outer reef, south of Pulau Tikus, very rare at other part of the outer reef, and is not found on coral patches close to the lagoon. *A. planci* is seen crawling over the top of living tabulate *Acropora*, branching *A. crocpora*, and plate *Montipora*. The native fishermen call this starfish "bulu-seribu" which means thousand thorns.

Observation on living habit, moving distance, relative abundance, size and number of arms, colour varieties, and position on the coral were made

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only at the reef-margin and reef-front parts of outer reef at the south of Pulau Tikus. According to GOREAU (1962) this starfish is potentially capable of moving at great distances in a single night.

## DESCRIPTION OF THE STUDY AREA

The southern part of Pulau Tikus is a sandy plateau, which is a part of the reef-flat zone. It is followed by reef-margin zone, reef-front zone, and seaward slope (Fig. 2). The reef zonation follows the system used by RANDALL (1973 b).

The reef-flat zone is about 200 metres wide measured from the lowest water line up to the end of reef rampart. The reef flat which is composed of limestone platform is covered with coral rubbles and sand. The reef-flat zone is divided into two sub-zones, the "Enhalus-bed" at the inner part and the "Sargassum-bed" at the outer part. The "Enhalus-bed" is about 120 metres wide while the "Sargassum-bed" is only about 60 metres wide. The floor of this bed is sandy. *Diadema setosum* are quite abundance in this sub-zone and are found in small groups consisting of 5 - 20 individuals. The floor of the "Sargassum-bed" is sandy with rubbles on it and inhabited by *Culcita*, *Linckia laevigata*, and some holothurians. The reef rampart, which is a part of the outer reef flat, has a total width of 10 - 20 metres, and is mostly covered by *Acropora* plateau. It is exposed at low tide.

The reef margin is represented by the seaward edge of the reef-flat platform that is constantly washed even at low tide. The reef margin varies in width from 10 to 15 metres along outer reef of Pulau Tikus and in depth from 1 to 3 metres. The floor of the reef margin is coral boulders and rubbles. The stony corals are represented by tabulate *Acropora*, *Hydnopora*, branching *Acropora*, plate *Montipora*, *Fungia*, *Porites*, *Pocillopora*, *Diploria*, *Goniastrea*, and *Psammocora*. At the eastern part, the reef margin is cut by a channel. The bottom of the channel is dominated by tabulate *Acropora* and has denser coral formation. The echinoderms at this zone are represented by holothurians, starfishes (*Linckia*, *Nardoa*, and *Fromia*), echinoids (*Echinometra*, *Diadema*), and ophiuroids.

The reef-front zone represents the extreme seaward edge of the reef platform, where the reef margin abruptly increases in depth and in degree of slope. At the outer reef, south of Pulau Tikus, the reef-front zone varies in width from 5 to 10 metres and from 1 to 8 metres in depth. The reef-front zone, then connected with that of the seaward slope zone, has its floor covered by dead coral, coral boulders, and rubbles. The stony corals are represented by huge *Porites* (about 1-2 metres in diameter), branching *Acropora*, *Pocillopora*, plate *Montipora*, and *Millepora*. Beside stony corals, alcyonarians, sea anemones, gorgonarians, and antipatharians are also found inhabiting the reef front and reef margin zones. Algae are represented by

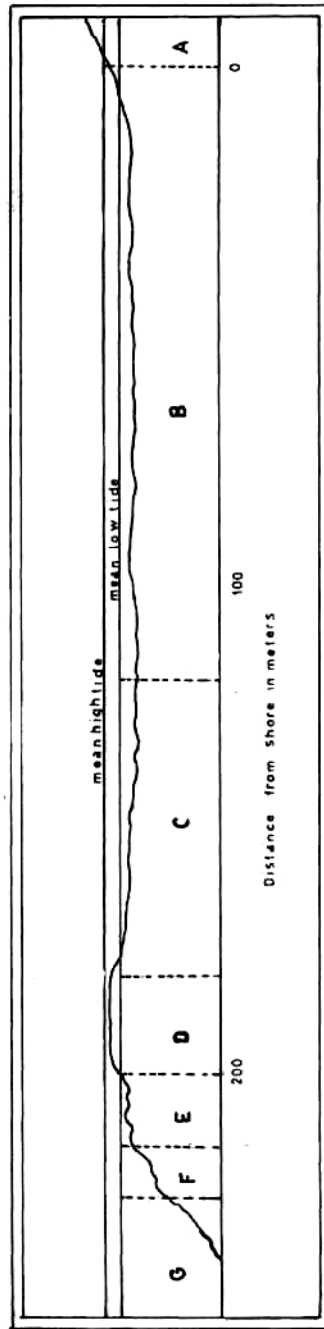


Figure 2. Reef profile of outer reef south of Pulau Tikus.

- A - Part of Pulau Tikus
- B - "Enhalus - bed"
- C - "Sargassum - bed"
- D - Reef rampart zone
- E - Reef margin zone
- F - Reef front zone
- G - Seaward slope

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*Halimeda*, *Caulerpa*, *Laurencia*, and *Galaxaura*. Echinoderms, besides *A. planci* are represented by starfishes (*Linckia*, *Fromia*), and crinoids such as *Comanthus*, *Comantheria*, *Ptasometra*, and *Stephanometra* which are found especially at the seaward side of the reef front.

#### MATERIALS AND METHODS

Observations of living habits of *A. planci* were made during the periods of June to August 1975 at the reef-margin zone and reef-front zone, south of Pulau Tikus. The observation area covers the edge of the reef rampart up to the seaward edge of reef front (about 20 metres wide and 200 metres long) (Fig. 3). *A. planci* is always observed to inhabit this area throughout the whole year.

Observations were done by snorkelling, two days each month. The moving distance of each animals within 24 hours was recorded firstly by identifying individual starfish according to its individual characteristics, such as colour varieties, number of arms, and size. Then the position of each starfish was marked and distance was measured after 24 hours. In order to avoid the possibility of counting an individual more than once, a plastic cap with number or code was placed beside each starfish as it was found. This method is adopted from MEYER (1973) (on crinoid at Ca-ribia). In this observation the term "exposed" is used for animals on the surface of substrate and "unexposed" for those who are hiding or covered. Size is measured from tip of arm to tip of opposite arm. Relative population density is the mean number of individual recorded in the observed area.

Area of observation is divided into 30 squares. At each corner of the square, a frame of 1 X 1 metres is placed. Percentage cover of stony corals is estimated by counting the mean percentage of stony corals inside the frame.

Recently killed corals are recognized by their stark white skeletons. Estimates of percentage of coral damaged by feeding activities of *A. planci*, were done by measuring white spots of stony coral *in situ*. Samples of damaged coral were taken to the laboratory for identification.

#### RESULTS

The moving distance of *Acanthaster planci* in 24 hours varies between 0.3 to 8 metres. The relative population density of *A. planci* is 20 individual starfishes per 4000 square metres. The size of starfish varies between 26 to 41 centimetres. The number of arms varies between 10 to 18. The percentage of coral cover is 13.9% (Table IV). The percentage of damaged coral caused by feeding activities of *Acanthaster planci* during observation is about 0.37% (Table V).

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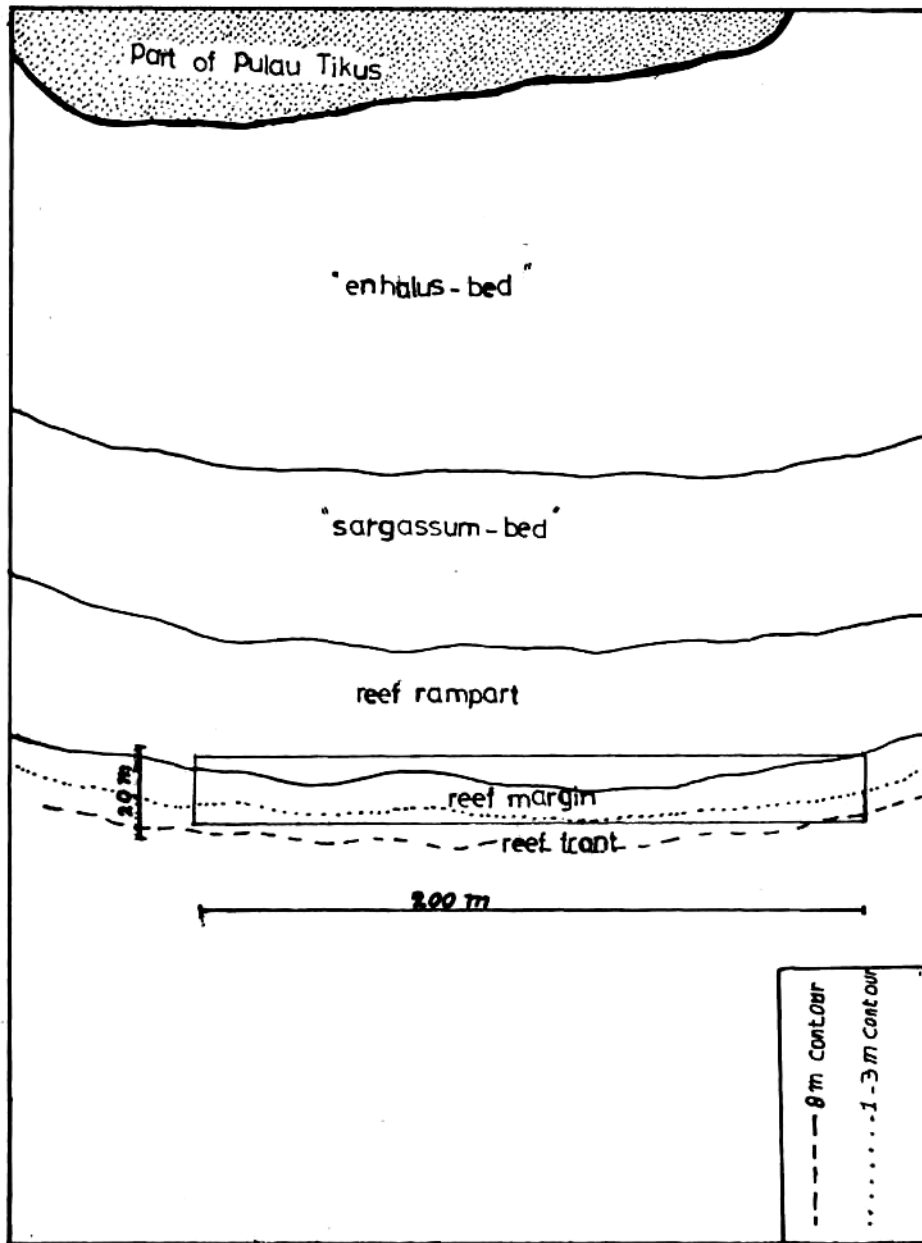


Figure 3. Detail map of transect location

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The species of stony corals damaged are *Acropora squamosa* (BROOK), *A. spathulata* (BROOK), *A. quelchi* (BROOK), *Fungia* sp., *Montipora ramosa* BERNARD, *Porites* sp, *Diploria* sp, and *Goniastrea* sp.

## DISCUSSION

*Acanthaster planci* (L.) is rarely found around Pulau Pari group. This starfish lives only at outer reef which surrounds Pulau Pari group, especially south of Pulau Tikus. At coral patches in the lagoon of Pulau Pari group it was never seen. In the daytime it retreats into a dark crevice where it stays immobile, and feeding takes place mostly at night (GOREAU 1964). At the south of Pulau Tikus, it exposes on the top of stony coral or unexposes especially under the tabulate *Acropora* (Tables I, II, III). *Acanthaster planci*, in study area, is never seen in aggregation.

The moving distance of this starfish varies between 0.3 to 8 metres in 24 hours. It moves from one prey to another. According to GOREAU (1964), on the bare sand, it moved between 5 to 10 metres per hour. From the observation it is known that the starfish moves especially from reef margin to reef rampart (Tables I, II, III), and this movement may be due to feeding activities or caused by wave action. Some starfishes stay immobile after 24 hours. At reef rampart, *Acropora*, especially tabulate *Acropora*, is predominant stony coral. *Acropora* might be preferred by this starfish (GOREAU *et al* 1972). Other stony coral preferred by *A. planci* are *Montipora* (at Saipan) and *Pocillopora* (at Panama). During the observation at the outer reef, south of Pulau Tikus, *Pocillopora* is not preyed by this starfish.

*Acanthaster planci*, at the south of outer reef of Pulau Tikus shows colour variations; they are grey, purple, reddish-grey, and intermediate form. According to MORTENSEN (1931) these colour variations are evidently only individual. Number of arms of *A. planci* varies from 10 to 18, and the size varies from 16 to 42 centimetres. On this observation, the juvenile stage was never seen.

The mean relative population density of *A. planci* was 20 individuals per 4000 square metres. At Pulau Pari group it might be the highest, because at the south outer reef of Pulau Tikus the population of *A. planci* is greater than the other parts.

Damages of stony corals are caused by the accumulation of some factors such as man activities, wave action, and activities of feeding habit of *A. planci*. Estimate of coral damages by feeding activities of *A. planci* at outer reef south of Pulau Tikus is about 0.37%, and it is relatively low. The feeding activities of *A. planci* do not cause serious effect on reef communities. Man activities, such as collecting corals for road and house constructions or for decorations, besides the native fisherman who dig corals for *Trochus*,

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Table 1. June 1975 observation (time : 09 - 12.00; surface temperature at 09.00 : 28.5°C; surface temperature at 12.00 : 29.5°C)

Code No.	Individual characteristics		Position on the beginning of observation						Position after 24 hours			Moving distance	Direction of movement	Area of white spots
	colour	diameter	arms	substrate	depth	position	prey	substrate	depth	position	prey			
32.	purple	18	14	dead coral	1 m	un exposed	-	?	?	-	-	-	-	-
25.	grey	16	12	Acropora	5 m	un exposed	Acrop.	?	?	-	-	-	-	-
18.	purple	28	16	dead coral	1 m	un exposed	-	?	?	-	-	-	-	-
37.	grey	27	15	dead coral	1 m	un exposed	-	?	?	-	-	-	-	-
29.	purple	35	16	dead coral	1.5m	un exposed	Acrop.	Acropora	1 m	un exposed	Acrop.	5 m	to reef rampart	400 cm <sup>2</sup>
3.	purple	28	17	Montipora	3.5m	un exposed	Monti.	-	-	-	-	-	-	400 m <sup>2</sup>
9.	grey	25	16	dead coral	1 m	un exposed	Acrop.	dead coral	0.5m	un exposed	-	3 m	to reef rampart	300 m <sup>2</sup>
8.	purple	30	11	Acropora	1 m	un exposed	Acrop./Monti.	?	?	-	-	-	-	500 cm <sup>2</sup>
10.	redish grey	23	11	Acropora	0.6m	exposed	Acrop.	Acropora	0.6m	exposed	Acrop.	-	-	400 cm <sup>2</sup>
21.	grey	28	16	Montipora	2.5m	un exposed	Monti.	?	?	?	-	-	-	-
2.	grey	27	16	Acropora	3.2m	exposed	Acrop.	Acropora	3.5m	exposed	Acrop.	1.2m	to reef margin	400 cm <sup>2</sup>
x.	grey	23	14	Acropora	3.0m	un exposed	Acrop.	?	?	?	-	-	-	-
11.	grey	34	16	Acropora	1.2m	exposed	Acrop.	Acropora	1.8m	un exposed	Acrop.	2 m	to reef margin	400 cm <sup>2</sup>
1.	grey	31	16	Acropora	4 m	un exposed	Acrop.	Acropora	3.5m	un exposed	Acrop.	1.2m	to reef rampart	1200cm <sup>2</sup>
14.	grey	37	16	Acropora	2 m	un exposed	Acrop.	Acropora	1.5m	un exposed	Acrop.	4.5m	to reef rampart	300 cm <sup>2</sup>
5.	grey	32	14	dead coral	1 m	un exposed	-	?	?	?	-	-	-	-
6.	grey	25	13	Alyonaria	2 m	un exposed	Acrop/Monti.	Acropora	0.5m	un exposed	Acrop.	8 m	to reef rampart	1600 cm <sup>2</sup>
7.	purple	25	15	dead coral	1.5m	un exposed	Monti.	Acropora	1.3m	un exposed	Acrop.	5 m	to reef rampart	1500 cm <sup>2</sup>
20.	grey	25	15	Acropora	0.5m	exposed	-	?	?	?	-	-	-	-
23.	purple	30	16	Acropora	0.5m	exposed	Acrop.	Acropora	0.5m	un exposed	Acrop.	-	-	1000 cm <sup>2</sup>
26.	grey	30	14	Acropora	0.5m	exposed	Acrop.	Acropora	0.5m	exposed	Acrop.	1.5m	to reef rampart	1000 cm <sup>2</sup>

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Table II. July 1975 observation. (time : 09.00 – 12.00; surface temperature at 09.00 : 28.7°C; surface temperature at 12.00 : 30.5°C).

Code No.	Individual characteristics			Position on the beginning of observation				Position after 24 hours				Moving distance	Direction of movement	Area of white spots
	colour	diameter	arms	substrate	depth	position	prey	substrate	depth	position	prey			
33.	grey	27	14	Acropora	1 m	exposed	Acrop.	Acropora	1 m	un exposed	Acrop.	1 m	along reef margin	750 cm <sup>2</sup>
25.	grey	32	16	Acropora	1.3m	exposed	Acrop.	Acropora	1.3m	un exposed	Acrop.	1 m	to reef rampart	—
36.	grey	29	12	Acropora	1.4m	exposed	Acrop.	Acropora	1.4m	un exposed	Acrop.	1.5m	to reef rampart	100 cm <sup>2</sup>
3.	grey	27	14	Acropora	1.7m	exposed	Acrop.	—	—	—	—	—	—	—
26.	grey	30	12	Acropora	1 m	un exposed	Acrop.	Acropora	1 m	un exposed	Acrop.	—	—	250 cm <sup>2</sup>
15.	grey	30	?	Acropora	1 m	un exposed	Acrop.	Acropora	1 m	un exposed	Acrop.	—	—	200 cm <sup>2</sup>
4.	grey	17	13	dead coral	2 m	un exposed	—	dead coral	2 m	un exposed	—	—	—	—
22.	redish grey	32	14	dead coral	1 m	exposed	Acrop.	—	—	—	—	—	—	—
24.	redish grey	34	11	Acropora	0.7m	exposed	Acrop.	Acropora	0.7m	exposed	Acrop.	—	—	500 cm <sup>2</sup>
10.	purple	24	16	Acropora	0.6m	exposed	Acrop.	Acropora	0.6m	exposed	Acrop.	—	—	160 cm <sup>2</sup>
9.	grey	33	16	dead coral	0.9m	un exposed	Acrop.	Acropora	1.5m	exposed	Acrop.	1.2m	to reef rampart	150 cm <sup>2</sup>
2.	grey	30	15	Acropora	1.3m	exposed	Acrop.	Acropora	1.3m	exposed	Acrop.	—	—	450 cm <sup>2</sup>
31.	purple	36	15	Acropora	1.3m	exposed	Acrop.	Acropora	1.3m	exposed	Acrop.	—	—	600 cm <sup>2</sup>
1.	grey	28	16	dead coral	1m	un exposed	Acrop.	dead coral	1 m	un exposed	Acrop.	—	—	100 cm <sup>2</sup>
19.	grey	28	11	dead coral	1.3m	un exposed	Acrop.	dead coral	1.3m	un exposed	Acrop.	—	—	150 cm <sup>2</sup>
38.	redish grey	28	11	dead coral	1 m	un exposed	Acrop.	Acropora	1 m	exposed	Acrop.	1.2m	to reef margin	220 cm <sup>2</sup>
17.	grey	22	16	Montipora	1.7m	un exposed	Monti.	Montipora	1.7m	un exposed	Monti.	—	—	1300 cm <sup>2</sup>
8.	redish grey	15	10	Acropora	1.2m	un exposed	Acrop.	Acropora	1.2m	un exposed	Acrop.	—	—	100 cm <sup>2</sup>
20.	grey	32	16	Acropora	2.2m	exposed	Acrop.	Acropora	2.2m	exposed	Acrop.	—	—	500 cm <sup>2</sup>
22.	grey	41	15	Acropora	1.5m	exposed	Acrop.	Acropora	1.5m	exposed	Acrop.	—	—	600 cm <sup>2</sup>

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Table III. August 1975 observation. Time: 09.00 - 12.00; surface temperature at 09.00-27.6°C; surface temperature at 12.00-30.5°C.

Code No.	Individual characteristics			Position on the beginning of observation				Position after 24 hours			Moving distance	Direction of movement	Area of white spots	
	colour	diameter	arms	substrate	depth	position	prey	substrate	depth	position				prey
14.	purple	28	16	dead coral	1.6m	exposed	-	dead coral	1.5m	exposed	-	6 m	to reef margin	-
16.	grey	28	17	dead coral	1.5m	exposed	-	dead coral	1.5m	exposed	-	2.4m	to reef rampart	-
32.	grey	20	10	Acropora	1.8m	exposed	Acrop.	dead coral	2.3m	un exposed	Acrop.	0.5m	to bottom	500 cm <sup>2</sup>
34.	grey	?	?	Acropora	1.8m	un exposed	-	Acropora	1.8m	un exposed	-	-	-	-
13.	grey	26	15	Acropora	0.7m	exposed	Acrop.	Acropora	1 m	un exposed	Acrop.	0.3m	to bottom	700 cm <sup>2</sup>
5.	redish grey	26	16	dead coral	1.6m	exposed	-	dead coral	2 m	exposed	-	3.5m	to reef margin	-
29.	purple	27	15	dead coral	2.4m	exposed	-	dead coral	3.8m	exposed	-	4.5m	to reef margin	-
40.	purple	26	14	dead coral	1.6m	un exposed	-	dead coral	1.3m	exposed	-	1 m	to reef rampart	-
23.	grey	28	15	dead coral	1.5m	exposed	Acrop.	Acropora	1.5m	exposed	Acrop.	-	-	1000 cm <sup>2</sup>
37.	purple	33	16	Acropora	1.3 m	exposed	Acrop.	dead coral	0.8m	un exposed	-	1.5m.	to reef rampart	300 cm <sup>2</sup>
18.	redish grey	24	15	dead coral	1.2m	exposed	-	dead coral	0.8m	exposed	-	3 m.	to reef rampart	-
6.	purple	28	14	Acropora	1.4m	exposed	Acrop.	Acropora	1.4m	exposed	Acrop.	-	-	750 cm <sup>2</sup>
30.	grey	27	13	Acropora	1.5m	exposed	Acrop.	Acropora	1.5m	exposed	Acrop.	-	-	700 cm <sup>2</sup>
7.	redish grey	26	14	Acropora	1.5m	un exposed	Acrop.	Acropora	1.2m	exposed	Acrop.	3.5m	to reef margin	200 cm <sup>2</sup>
4.	redish grey	27	14	Acropora	1.2m	exposed	Acrop.	Acropora	1.2m	exposed	Acrop.	-	-	100 cm <sup>2</sup>
27.	redish grey	28	17	Acropora	1.7m	exposed	Acrop.	Acropora	1.7m	exposed	Acrop.	-	-	800 cm <sup>2</sup>
35.	grey	?	?	dead coral	1.7m	un exposed	-	dead coral	1.7m	un exposed	-	-	-	-
11.	purple	22	16	dead coral	0.7m	exposed	-	dead coral	1.5m	un exposed	-	3.5m	to reef rampart	-
3.	purple	33	14	dead coral	1.3m	exposed	Acrop.	Acropora	0.8m	exposed	Acrop.	2 m	to reef rampart	-
10.	grey	32	15	Acropora	2 m	exposed	-	Acropora	2 m	exposed	-	-	-	150 cm <sup>2</sup>

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**Table IV. Percentages of coral cover on the outer reef south of Pulau Tikus.**

Total square : 4000 m<sup>2</sup>  
 Depth : 0.2 to 8 m.  
 Date : July 29 1975.

no. frames y no. frames x	I cm <sup>2</sup>	II cm <sup>2</sup>	III cm <sup>2</sup>	IV cm <sup>2</sup>	V cm <sup>2</sup>	VI cm <sup>2</sup>
1.	0	900	0	400	2125	225
2.	1800	2700	150	550	1800	850
3.	450	675	3150	0	1125	1575
4.	1800	225	2475	2250	3600	2475
5.	3150	900	1575	3600	675	450
Total square frames of each quadrat (cm).	7200	5400	7350	6800	9325	5575
Percentage of each quadrat per total area.	14.4	10.8	14.7	13.6	18.65	11.15
Mean percentage of coral cover	13.9 %					

**Table V. Estimation of coral damage by feeding activities of *A. planci*.**

Month	Area of monthly coral damage in cm <sup>2</sup>
June	9400
July	6130
August	5200
Total of coral damages in cm <sup>2</sup>	20730
Percentage of damaged coral during observation :	0.37 %

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*Tridacna*, and *Lambis* will cause really serious damage to the coral communities.

During the observation the corals which are affected by the feeding activities of *A. planci* are *Acropora squamosa* (BROOK), *A. spathulata* (BROOK), *A. latistella* (BROOK), *A. quelchi* (BROOK), *Fungia* sp., *Montipora ramosa* BERNARD, *Porites* sp., *Diploria* sp., and *Goniastrea* sp. This starfish is never seen crawling on the top of *Millepora* coral and probably avoiding this group. The same case is also seen at Great Barrier Reef, it avoids *Millepora* coral (ENDEAN & STABLUM 1973).

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