

A QUANTITATIVE STUDY OF THE REEF COMMUNITY AT PULAU SATUMU (RAFFLES LIGHTHOUSE)

Leng C.B., Lee K.S. and Esther G.L. Koh
Department of Zoology
National University of Singapore
Lower Kent Ridge Road
Singapore 0511

ABSTRACT

Data collected from four 100m line transects performed at Pulau Satumu (Raffles Lighthouse) at the 3m and 10m depth of two sites on opposite sides of the island were analysed to show the percentage cover of the various coral reef components. Differences in the coral cover between sites as well as between depths existed. The highest and lowest coral cover occurred at the western side of the island, with the highest (45.2%) at the 3m depth and lowest (1.0%) at the 10m depth. Corals with foliose and encrusting growth forms dominated both sites. The substratum was particularly rocky. Twenty-five scleractinian genera and one octocorallian genus (*Heliopora*) were recorded.

INTRODUCTION

Raffles Lighthouse is situated on the southern-most island (Pulau Satumu) from the Singapore mainland, (1° 10'N and 103° 45'E). Reclamation in 1976 to increase the island's size affected most of the reef flat of the surrounding fringing reef. The reef is also popular with sport divers. Water visibility is usually between 2-3 metres. Water current was observed to be stronger on the western side of the island, with the eastern side being more sheltered.

No previous study of this nature has been made on the coral reef community here. The present study seeks to characterise the reef slope communities at two sites on opposite sides of the island and is undertaken as part of the on-going "Living Resources in Coastal Areas" Project (Asean-Australia Cooperative Programme on Marine Science) to collect baseline data on coral reefs south of Singapore.

MATERIALS AND METHODS

The 100m line transect technique employed in this study has been fully described in Dartnall and Jones (1986). The method essentially involves the laying of a graduated

100m transect tape at a fixed depth along the contours of the reef slope. Data gathered from the transects were analysed to obtain the percentage cover of the various reef components at each site and depth. Scleractinian coral samples were brought back to the laboratory for identification, using coral taxonomic guides of Veron (1986) and Wood (1983).

Transects were carried out on the eastern (R1) and western (R2) flanks of the reef (Fig. 1), along the slope at two depths, 3m and 10m from the reef crest. The surveys were conducted between September 1987 and June 1988, using SCUBA equipment.

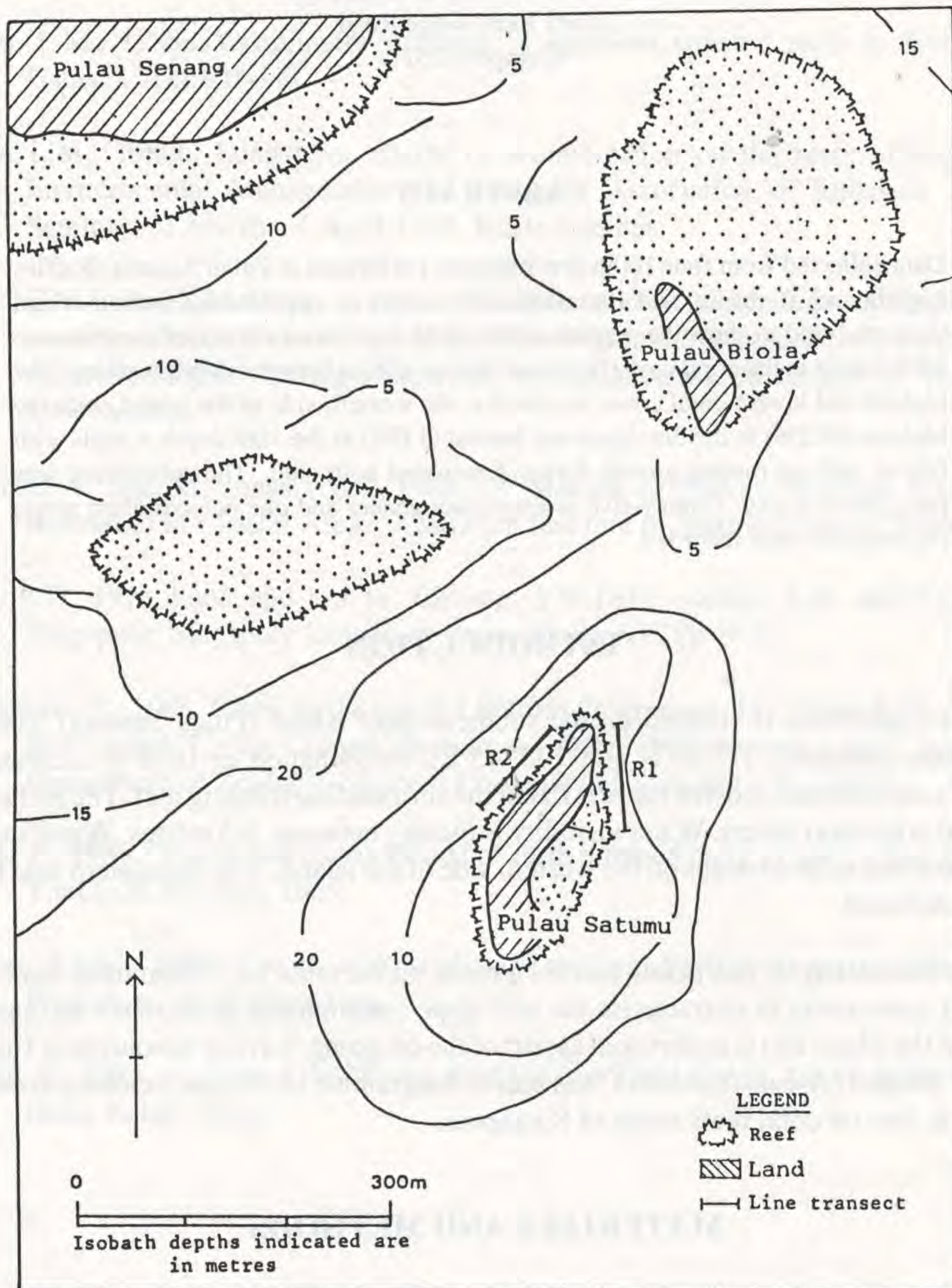


Fig. 1. Map of Pulau Satumu showing survey sites.

RESULTS

The distribution of the various reef components found from the transects at the two sites are summarised in Table 1 and Fig. 2. The highest live coral cover was found at R2 at the 3m depth (45.2%), which also had the highest dead coral cover (33.62%). The 10m depth of R2 also had a high percentage (31.15%) of dead coral cover and the lowest coverage of live coral (1.0%). Lowest dead coral cover was found at R1 at the 10m depth (10.17%).

Table 1. Distribution of biotic and abiotic components along transects at Pulau Satumu

Percentage cover						
Reef Site	Depth (m)	Live coral	Dead coral	Algae	Other Fauna	Abiotic
R1	3m	28.65	23.50	0.00	4.20	43.65
	10m	5.37	10.17	0.00	32.03	52.43
R2	3m	45.20	33.62	0.22	3.78	17.18
	10m	1.00	31.15	0.00	13.15	54.70

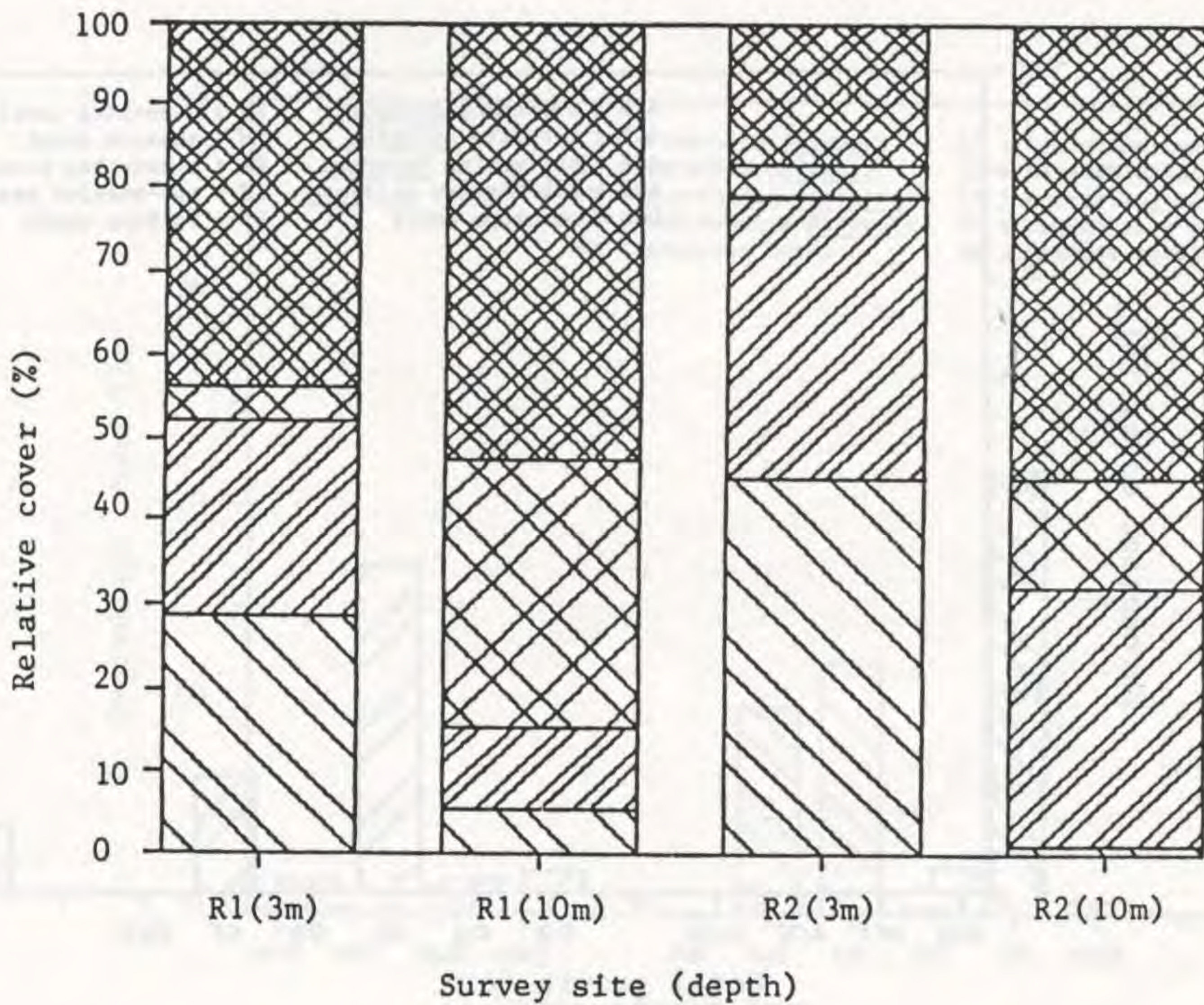


Fig. 2 Stacked bar chart showing relative proportion of various reef components at Pulau Satumu.

The proportion of non-coral benthic fauna was greater at the 10m depth than the 3m depth, with the 10m depth at R1 having the highest value (32.03%). These consisted mainly of soft corals and sponges, found in abundance here, together with sea urchins, sea anemones and gorgonians.

Abiotic components covered more than half the transects at the 10m depth with a large proportion of this consisting of rock. Along the transect carried out at the 10m depth at R1, rocks covered 46.53% of the transect while at the same depth at R2, they covered 17.87%. The data indicates the particularly rocky nature of the substratum. At the 3m depth, coral rubble accounted for most of the abiotic cover. No macroalgae was recorded along any of the transects.

The distribution of coral growth forms along the four transects is shown in Figs. 3 to 6. The transect at the 3m depth at R1 had a higher proportion of foliose and encrusting forms (16.25% & 5.7% respectively). These two growth forms were also prominent at the 3m depth of R2 (foliose, 21.59%; encrusting, 12.30%), together with massive colonies (10.09%).

At the 10m depth, mostly branching, encrusting and submassive corals were found at R1, while at R2, mainly encrusting forms were present. No dominance by any growth form was evident. Branching and tabulate forms of *Acropora* were found only at the 3m depth, and in small quantities (0.3% at R2 and 1.15% at R1).

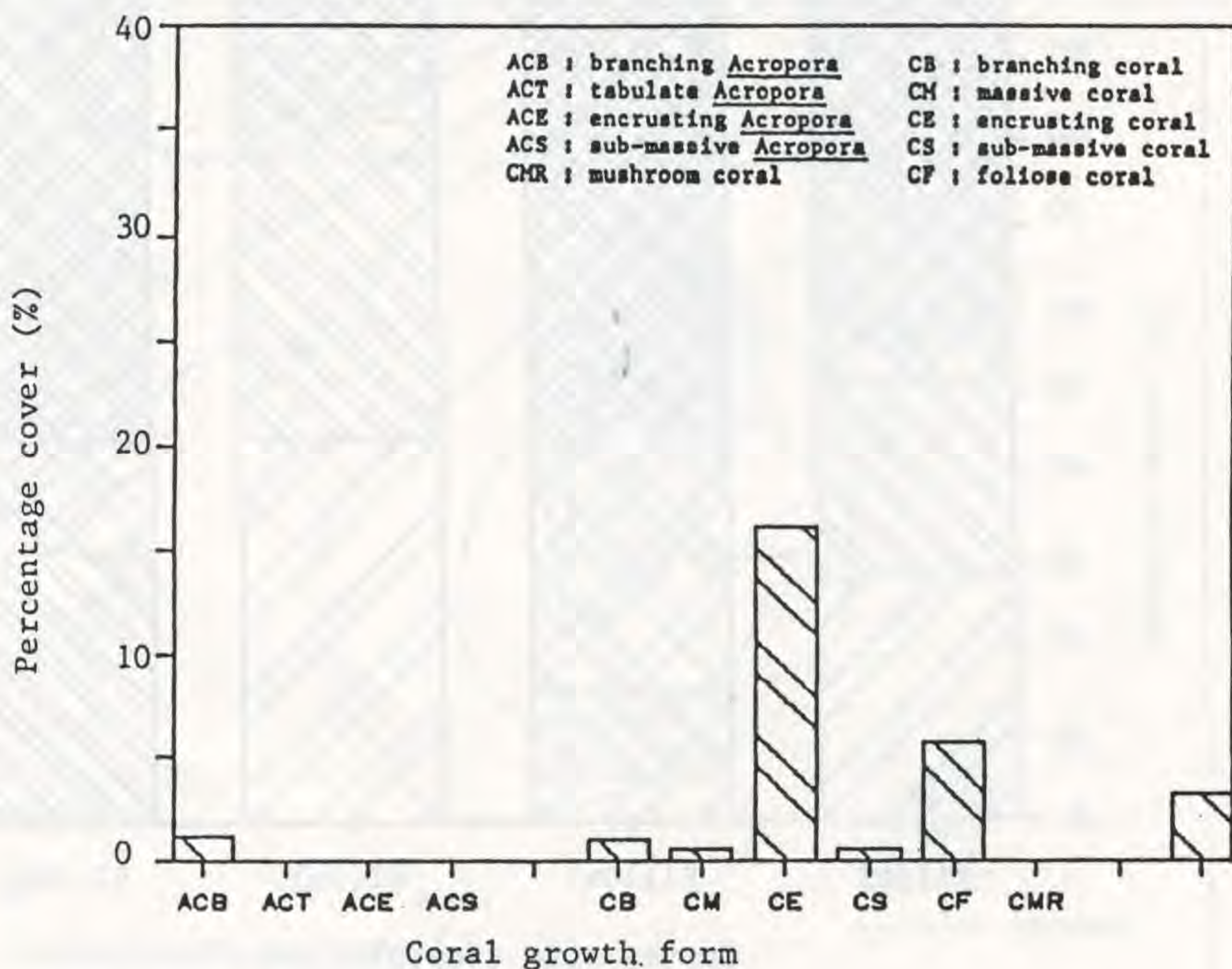


Fig. 3. Percentage distribution of various coral growth forms at 3m depth of transect R1.

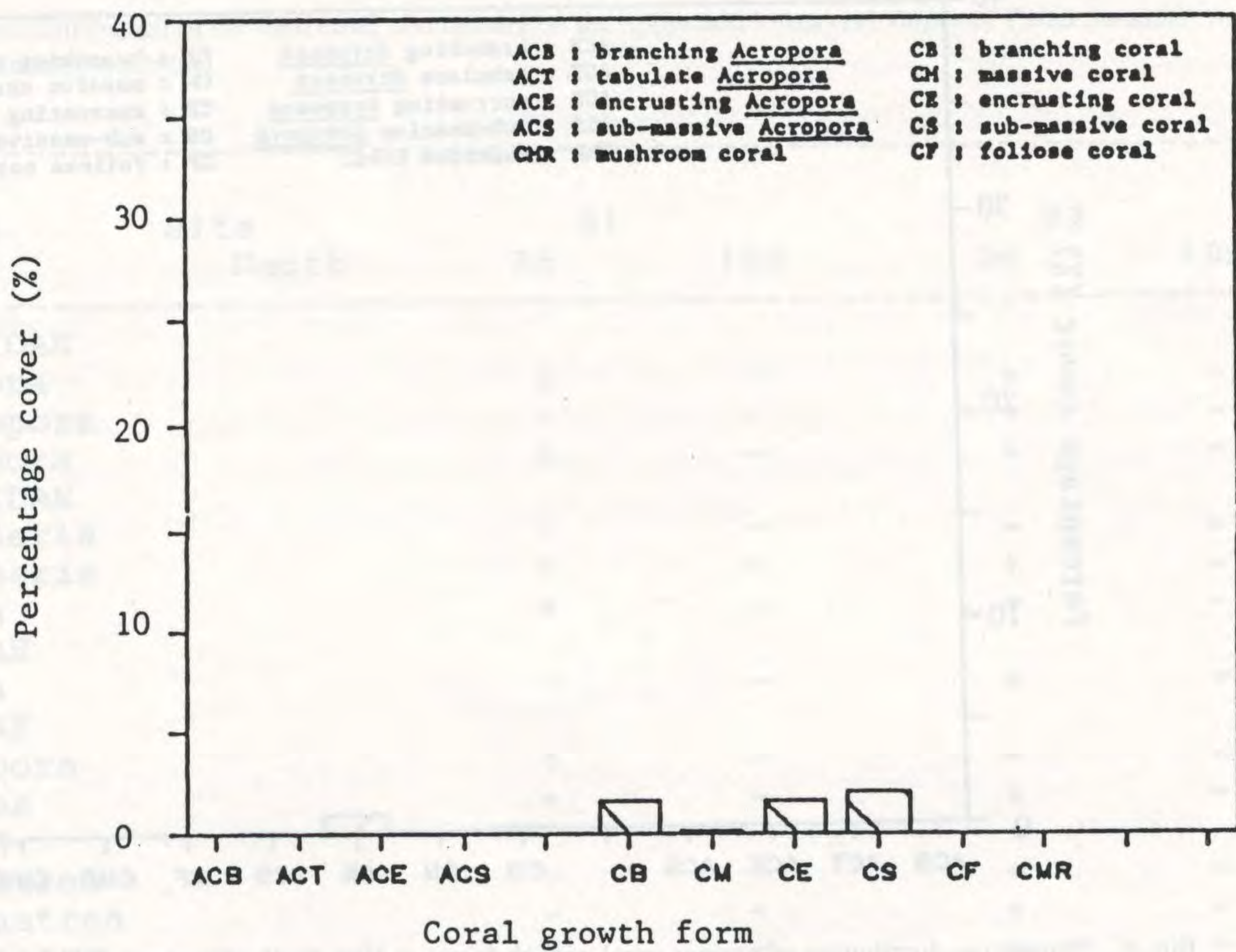


Fig. 4 Percentage distribution of various coral growth forms at 10m depth of transect R1.

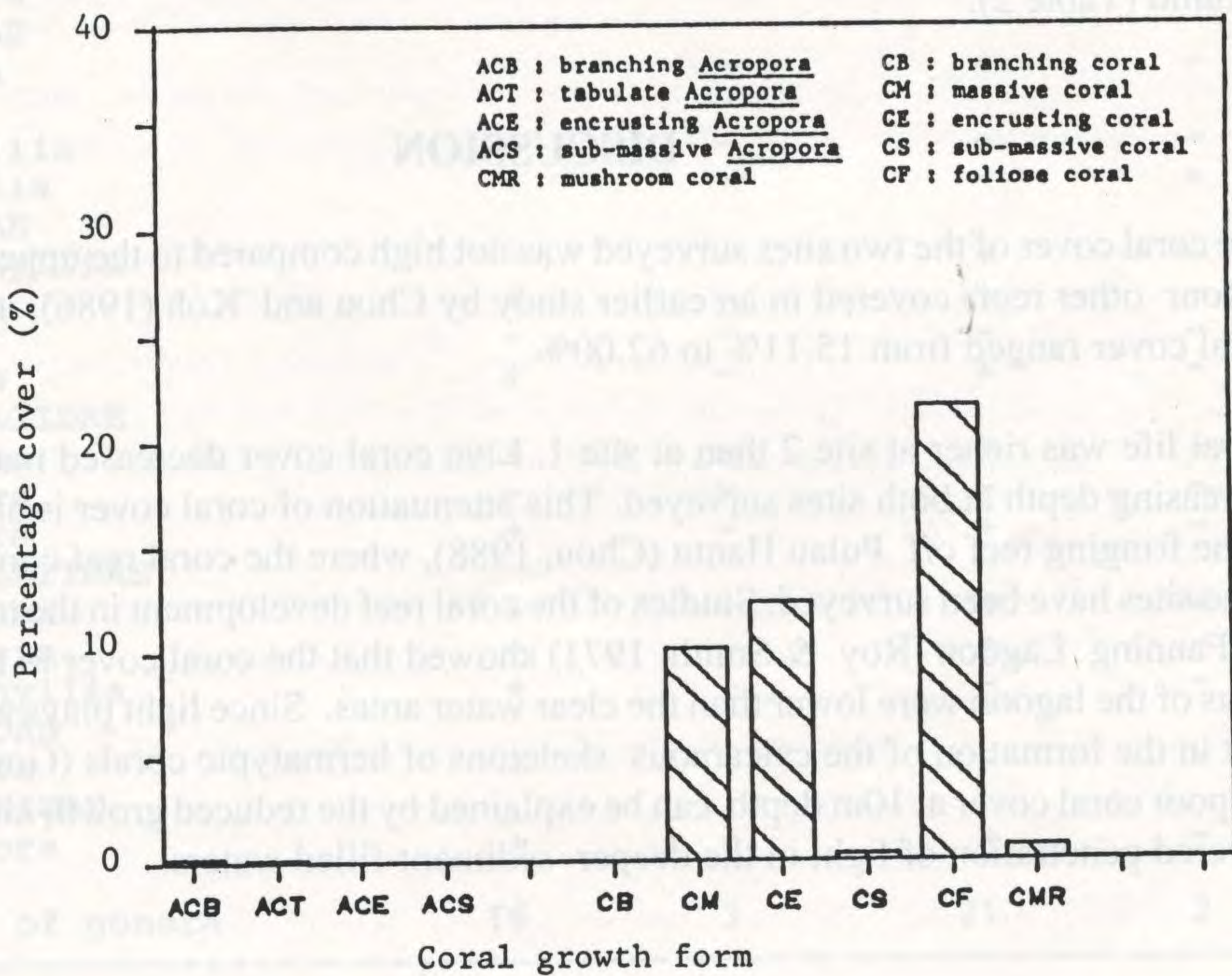


Fig. 5. Percentage distribution of various coral growth forms at 3m depth of transect R2.

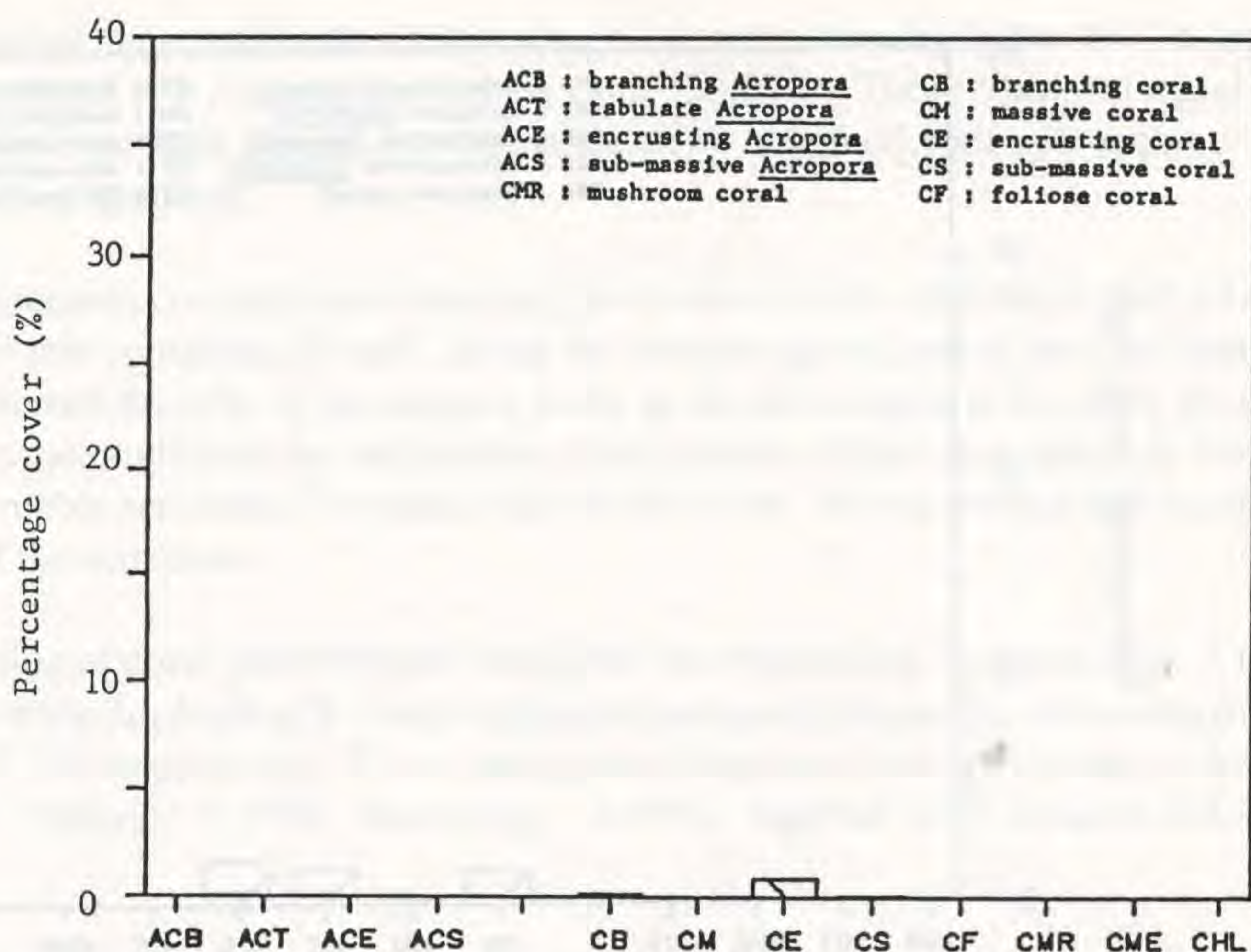


Fig. 6. Percentage distribution of various coral growth forms at 10m depth of transect R2.

Seventeen coral genera were recorded at R1 and 21 genera at R2, with 11 genera common between the two sites. In all, a total of 26 genera was recorded from the reefs at Pulau Satumu (Table 2).

DISCUSSION

The coral cover of the two sites surveyed was not high compared to the upper reef slopes of four other reefs covered in an earlier study by Chou and Koh (1986), in which live coral cover ranged from 15.11% to 62.00%.

Coral life was richer at site 2 than at site 1. Live coral cover decreased markedly with increasing depth at both sites surveyed. This attenuation of coral cover is also recorded at the fringing reef off Pulau Hantu (Chou, 1988), where the coral reef communities at three sites have been surveyed. Studies of the coral reef development in the turbid waters of Fanning Lagoon (Roy & Smith, 1971) showed that the coral cover in turbid water areas of the lagoon were lower than the clear water areas. Since light plays an important part in the formation of the calcareous skeletons of hermatypic corals (Goreau, 1963), the poor coral cover at 10m depth can be explained by the reduced growth rate due to the lowered penetration of light in the deeper sediment-filled waters.

Table 2. Generic distribution of the hard coral community on the upper and lower reef slopes of Pulau Satumu.
 (+ = present, - = absent)

FAMILY & Genera	Site Depth	R1		R2	
		3m	10m	3m	10m
ACROPORIDAE					
Acropora		+	-	+	-
Astreopora		-	-	-	-
Montipora		+	-	+	-
AGARICIIDAE					
Leptoseris		-	-	-	-
Pachyseris		+	-	+	-
Pavona		+	-	+	-
FUNGIIDAE					
Fungia		-	-	+	-
PORITIDAE					
Goniopora		+	-	-	-
Porites		+	-	+	-
FAVIIDAE					
Cyphastrea		-	-	+	-
Diploastrea		-	-	+	-
Echinopora		-	-	+	-
Favia		-	-	+	-
Favites		-	-	-	-
Goniastrea		+	-	-	-
Hydnophora		+	-	-	-
Leptoria		-	-	-	-
Montastrea		-	-	-	-
Platygyra		-	-	+	-
MERULINIDAE					
Merulina		+	-	+	-
MUSSIDAE					
Lobophyllia		-	-	+	-
Symphyllia		-	-	-	+
PECTINIIDAE					
Echinophyllia		-	-	+	-
Mycedium		+	-	-	-
Oxypora		-	-	-	-
Pectinia		+	-	+	-
CARYOPHYLLIIDAE					
Euphyllia		+	-	+	-
Physogyra		-	-	-	-
Plerogyra		+	-	+	-
DENDROPHYLLIIDAE					
Tubastraea		-	+	+	+
Turbinaria		-	-	+	-
Dendrophyllia		+	+	-	-
HELIOPORIDAE					
Heliopora		+	-	-	-
SIDERASTREIDAE					
Psammocora		+	+	+	-
Total no. of genera		16	3	21	2

With reference to the generic diversity, the total of 26 genera recorded at Pulau Satumu is lower than the total number of genera recorded at the patch reef west of Pulau Hantu, and reefs at P. Hantu, Cyrene and P. Semakau, with 28, 29, 31 and 32 genera respectively (Chou & Koh, 1986).

The dominance of foliose and encrusting growth forms at both sites suggests that these morphological forms are more efficient than the other forms for growth and the deposition of skeletal material in low light conditions (Davies, 1980). Branching corals, apart from *Acropora*, were scarce at site 2 perhaps due to the exposed nature of the site, causing breakage of the more delicate branching forms. This site is also exposed to the strong wash of tankers that sail by just off the southern shore of the island.

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