Malaysian Journal of Science **24**: 145 - 158 (2005)

Coral Reefs of North East Pulau Langkawi

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ABSTRACT The coral reefs of north east Pulau Langkawi was studied in the month of April 2004 to assess their present status. Five of the best sites according to their percentage of live coral cover were selected. Using SCUBA and a modified Reef Check method the sites were surveyed and the percentage of live coral cover was found to be ranging from 26.7-58.3%. Various coral growth forms and even giant clams were observed. The study also added a new record to the coral reef map of north east Pulau Langkawi.

ABSTRAK Kajian ke atas terumbu karang di kawasan timur laut Pulau Langkawi telah dilakukan pada bulan April 2004 untuk mengetahui keadaannya yang terkini. Lima kawasan kajian terbaik dipilih mengikut peratusan batu karang hidup yang hadir. Dengan menggunakan SCUBA dan kaedah Reef Check yang telah diubahsuai, kawasan kajian telah dikaji dan didapati peratusan batu karang hidup berada didalam julat 26.7-58.3%. Pelbagai bentuk tumbesaran batu karang dan juga kima gergasi telah di jumpai. Kajian ini juga menambah satu rekod baru kepada peta terumbu karang timur laut Pulau Langkawi.

(coral reefs, north east Pulau Langkawi, percentage live coral cover, coral growth forms)

INTRODUCTION

It is well known that coral reefs are a vital component of adjacent fisheries where juvenile fishes and invertebrates use the reef as their breeding ground and nursery. Reefs themselves are an excellent tourist attraction with its high biodiversity, multitude of colours and shapes. It is undeniably a rare and valuable asset to any ecotourism industry. The economical value of reefs had been estimated to be at USD 6,075 as a total value of reefs per hectare per year (Costanza *et al.*, 1997). This was an underestimate as their study did not take into account the value of erosion control, water regulation etc. Malaysian coral reefs in the Straits of Malacca has been estimated to be having a total value of about USD 26 million (Ebarvia, 1999).When reefs are damaged the rate of adjacent coastal erosion would increase, problems of strengthening coastlines with man-made barriers, relocation of infrastructure and coastal people would also rise. In addition reefs also play an important role in breaking big waves such as tsunamis from reaching the shoreline and minimising its damage.

Pulau Langkawi is situated on the northern part of the Straits of Malacca. It is one of about 104 islands in the Langkawi Archipelago and has an area of about 478.5km^2 (Hendry & McWilliams, 2001). Tourism has been aggressively targeted as the main source of economy for the island. Therefore substantial development has been made in the past 20 years with hotels, resorts, marinas, extensive roads, an international airport and also shopping centers as it was declared a duty free shopping island. Nevertheless the north east area of Pulau Langkawi has relatively low levels of development, an extensive mangrove ecosystem and astonishingly substantial coral reefs. This is a pleasant surprise as the waters around Pulau Langkawi is very turbid and has high sedimentation rates (Jonsson, 2002) typical of islands in the Straits of Malacca. Normally this is not a condusive environment for coral reefs to thrive in. Thus Pulau Langkawi is one of the only islands on the west coast of Peninsular Malaysia that can still boast of having coral reefs in its repertoire. It is then imperative that plans be made to gazette the north east of Pulau Langkawi as a protected area especially to conserve its unique coral reefs. By doing this it will ensure that we are able to sustainably reap its benefit for years to come particularly thru the ecotourism

industry. It would be a tremendous loss if the remaining reefs of north east Pulau Langkawi are not monitored, conserved and managed in a sustainable manner.

The present status of the reefs has to be known before any monitoring, conservation and management efforts be made in the near future. Current information in the literature on the corals of Pulau Langkawi is scarce except for a report by Zulfigar (1996) on the coral reefs of Teluk Datai on the north coast, a sedimentation study of Teluk Datai by Zaidnuddin (2001) and a sedimentation study on selected reefs of Pulau Langkawi by Jonsson (2002). The only study found that had looked at north east Pulau Langkawi was an extensive report on Pulau Langkawi coral reefs of Hendry & McWilliams in 2001 for World Wide Fund for Nature-Malaysia (WWF-M). Therefore the immediate objectives of this study were to record any coral reefs present and to assess their status in the northeast area of Pulau Langkawi.

STUDY SITES

The fieldwork for the study was done from 5-7th April 2004. Survey sites were selected as the best reef in the area according to the percentage of living hard coral cover observed from brief snorkel surveys. The five sites that were surveyed during this study are shown in Table 1 and in Figure 1.

Table 1. Showing the GPS location (WGS84) of sites surveyed

No	Station Name	GPS location
1	Pulau Anak Gua Cerita	N 6°27.772 E99°51.064
2	Pulau Langgun (Teluk Berangan)	N 6°25.525 E99°54.869
3	Pulau Tjg Dendang (Teluk Cina Mati)	N 6°25.609 E99°54.959
4	Pulau Tjg Dendang (Tjg Dendang)	N 6°25.863 E99°54.929
5	Teluk Dedap	N 6°28.300 E99°50.084

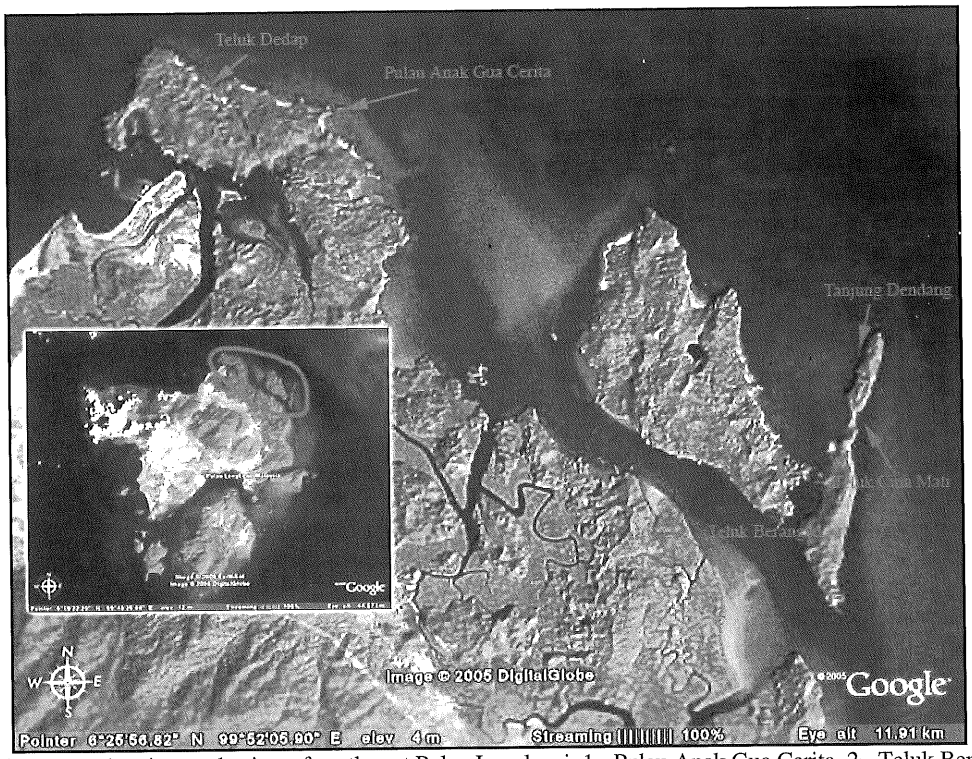

Figure 1. Map showing study sites of north east Pulau Langkawi. 1= Pulau Anak Gua Cerita, 2= Teluk Berangan, Pulau Langgun, 3= Teluk Cina Mati, Pulau Tjg Dendang, 4= Tjg Dendang, Pulau Tjg Dendang and 5= Teluk Dedap. Inset map showing north east Pulau Langkawi study area.
(Satellite pictures taken from Google Earth website on 10 August 2005).

MATERIALS AND METHODS

A modified Point Intercept Transect of Reef Check was used for this study. A SCUBA team of two divers deployed a 30m transect at each site between 2-8m depth parallel to the shoreline. At every 0.5m point the substrate type was recorded. Substrate was classified as (Biological) Hard Corals, Soft Corals, Dead Corals, Sponges, Macro Algae, Algae, Others and (Non Biological) Boulder, Rock, Sand, Silt. A percentage of each substrate type was then calculated to determine the substrate classification of the study area.

Small coral samples (2 cm) were broken from its colony using a hammer and chisel with accompanying underwater pictures (Canon A200 2.0 Megapixels camera) for coral identification. Identification was done using Veron & Stafford Smith (2000). Example of pictures is shown in Figures 6 (a) & (b), (g) & (h) and (u) & (v).

RESULTS AND DISCUSSION

Waters of all the study sites were very turbid with underwater horizontal visibility of less than 2m at best. Most corals are covered by fine sediment and this was observed to kill the top parts of massive corals [Figures 4 (a), 5 (a) and 5 (c)]. This could be an indicator of sediment stress on corals in the area (Nugues & Roberts, 2003).

As shown in Table 2 and Figure 2 from our study in April 2004 of north east Pulau Langkawi we had found up to 58.3% coral cover at two study sites. The percentage of living corals is good if compared to Harborne *et al.* (2000) survey done on the east coast islands of Peninsular Malaysia where they had found the mean coral cover was 42.2% for all sites combined. In addition if compared with the criteria set by the ASEAN-Australia Living Coastal Resources project (>75% = excellent, 75-50% = good, 50-25% = fair and <25% = poor) then north east Pulau Langkawi coral reefs studied are in poor to good condition. Nevertheless the coral diversity was lower when compared to the east coast where the study sites were significantly dominated by massive hard corals mainly of *Porites* spp. Other notable organisms found at some study sites were *Tridacna sp* (giant clam) where Hendry & McWilliams (2001) were not able to document any individuals from their extensive study of the Langkawi Archipelago. Surprisingly a significant amount of branching *Acropora* spp. corals were also found in one of our study areas.

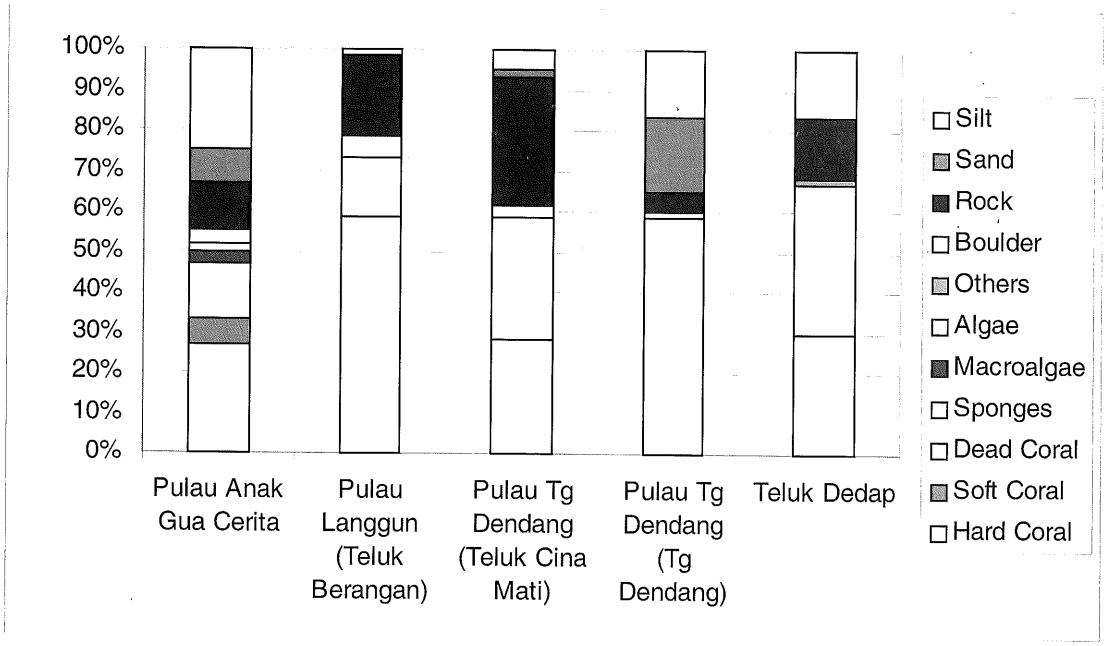

Figure 2. Bar Graph showing the percentage of substrate categories for the five study sites

Table 2. Showing the percentage values of the substrate categories for the five study sites

No	Site Name	Hard Corals (%)	Soft Corals (%)	Dead Corals (%)	Sponges (%)	Macroalgae (%)	Algae (%)	Others (%)	Boulder (%)	Rock (%)	Sand (%)	Silt (%)
1	Pulau Anak Gua Cerita	26.7	6.7	13.3	0	3.3	1.7	0	3.3	11.7	8.3	25.0
2	Pulau Langgun (Teluk Berangan)	58.3	0	15.0	5.0	0	0	0	0	20.0	0	1.7
3	Pulau Tjg Dendang (Teluk Cina Mati)	28.3	0	30.0	0	0	3.3	0	0	31.7	1.7	5.0
4	Pulau Tjg Dendang (Tjg Dendang)	58.3	0	1.7	0	0	0	0	0	5.0	18.3	16.7
5	Teluk Dedap	30.0	0	36.7	0	0	0	1.7	0	15.0	0	16.7

Pulau Anak Gua Cerita has the lowest percentage of live hard coral cover at 26.7% in this study. Nevertheless this site had the only soft corals (*Sinularia sp.*) at 6.7% and is considered to be a range extension of the same soft coral genus found by Hendry & McWilliams (2001). They had found significant amounts of soft corals only at their northern coast sites of Pulau Langkawi from Tanjung Hulur until Teluk Tok Manap which is about 15km away from Pulau Anak Gua Cerita. This was the only site that "Macroalgae" (*Halimeda sp.*) was observed at 3.3% and some algal growth at 1.7%. Hendry & McWilliams (2001) did not find any areas with macroalgae or algae. The presence of algae could indicate that the study area has some problems with eutrophication. The percentage of silt was the highest at this site (25.0%) when compared to the other sites studied. It is postulated that the high amount of sediment is a factor in producing the low percentage of coral cover in this area. The dominant coral growth shapes here were massive, sub-massive and encrusting. *Porites* spp. were dominant. Branching, foliaceous nor plate coral growth shapes were observed. Pictures of the study area are given in Figure 3 (a) – (d).

Teluk Berangan of Pulau Langgun is one of the two sites in this study that had the highest percentage of live hard coral cover at 58.3%. Hendry & McWilliams (2001) (Pulau Langun site G) had reported that this area had a medium level hard coral cover of about 5-35%. This vast difference in results could have been due to the patchy distribution of reefs in the area or just because different survey methods were used. Soft corals were not to be found in this area. This was the only study site that sponges were found at 5%. This is considered 'normal' as Hendry & McWilliams (2001) had found numerous sites around Pulau Langkawi that had the same percentage. Teluk Berangan had the lowest percentage of silt (1.7%) when compared with the other sites. This is considered to be the main factor that contributed to the high percentage of live hard coral cover. The dominant coral growth shapes here were massive, sub-massive and encrusting. *Porites* spp. and *Galaxea* spp. were dominant. Branching, foliaceous nor plate coral growth shapes were found. However foliaceous corals were found by Hendry & McWilliams (2001) at the same site but at only <5% cover. Whether this shape is now extinct or could not be seen due to bad visibility remains to be explored. They had found large amounts of dead corals at 30-65% at the time whereas from this study it was only at 15%. On a cheerful note several giant clams were documented in this area which to our best knowledge is the first report of this bivalve for the Langkawi Archipelago [Figure 4 (b)]. Giant clams are considered a vulnerable species in the IUCN red list. Pictures of the study area are given in Figure 4 (a) – (d).

Teluk Cina Mati of Pulau Tanjung Dendang has only a medium level live hard coral cover of

about 28.3% which is similar to Hendry & McWilliams (2001) that reported 0-25%. This is consistent when we found that this site had the second highest percentage of dead corals at 30% and they had also documented high levels of dead corals at 50-90%. This site had also some algae (*Caulerpa sp*) at 3.3%. The dominant coral growth shapes were massive, sub-massive and encrusting. *Porites* spp. was dominant in massive coral growth form. Neither branching, foliaceous nor plate growth forms were found whereas foliaceous was found by them at the same vicinity in 2001. As the underwater visibility was bad it could not be ascertained if this coral growth form is extinct at the site. Pictures of the study area are given in Figure 5 (a) – (d).

Tanjung Dendang of Pulau Tanjung Dendang not only has the highest percentage of live hard coral cover of 58.3% but also had the most diverse of coral growth shapes. They ranged from massive, submassive, encusting, foliose, plate, branching and free living coral growth shapes. Hendry & McWilliams (2001) had reported that the lowest number of coral species were found to be on the north east Pulau Langkawi with 10, 8, 9, 8 & 7 genera with Tanjung Dendang having only 9 genera. Their result is tested by this study as the west side of Tanjung Dendang through observation of a broad range of coral growth shapes found, we could assume that it has a very high diversity of coral species. Further examination of coral samples are currently being made to generate a species list. Branching and plate *Acropora* spp. corals were observed to be abundant here. This site is extraordinary as it is the only study site in north east Pulau Langkawi with branching and free living corals occurring. This site had the highest sand percentage of 18.3% and this could be a factor in having such a high coral diversity. In addition the profile of the reef was very steep with the reef sharply descends from the reef edge about 2m off the island rocky wall [Figure 6 (i) – (l)]. Thus this could lower the accumulation of sediments on the substrate and corals compared to the other study sites. It was observed by the author that most of the silt were accumulated at the lower parts of the reef slope (8m) with silt depth at >1m deep. The dominant coral growth shape was still the massive shape with *Porites* spp. and *Goniopora* spp. as the dominant species. Hendry & McWilliams (2001) surprisingly did not indicate any reefs west of Pulau Tanjung Dendang. Consequently our report would be an excellent addition to the coral reef distribution of Pulau Langkawi. Pictures of the study area are given in Figure 6 (a) – (x).

At the final study site of Teluk Dedap the reefs has a live hard coral cover of 30.0% but had the highest dead coral percentage of 36.7% when compared with the other study sites. Hendry & McWilliams (2001) had recorded 65-70% dead corals in 2001. During our study it was the only site with the "Other" category with zoanthids observed. Dominant coral shapes were massive and submassive but no observation of encrusting, branching, foliaceous nor plate growth forms were recorded. Pictures of the study area are given in Figure 7 (a) – (d).

Hendry & McWilliams (2001) stated that live coral cover of Pulau Langkawi ranged from 0-75% with Pulau Cepu in the south west being the highest with 25-75%, Pulau Langgun in the mid range and the north east coastline including Pulau Tanjung Dendang having the lowest with 0-25%. Nevertheless our study showed Tanjung Dedang as the highest among the five study sites. This discrepancy may have resulted from dissimilar methods used, very bad underwater visibility, or just by the coral reefs being very patchy with good and bad live coral cover occurring next to each other. They also stated that tabulate and branching corals were very scarce especially for north east Pulau Langkawi but in our study this was not the case as seen in our Tanjung Dendang study site.

From the study it was found that generally the coral reefs of north east Pulau Langkawi are very patchy and are dominated by corals of massive growth forms mainly of *Porites* spp. The statement by Hendry & McWilliams (2001) that this is due to the Porites group being able to produce thick mucous to protect themselves from sediment stress as stated by Veron & Stafford-Smith (2000) is further supported by the author to explain the situation of species dominance.

CONCLUSION

From this study we had found that north east Pulau Langkawi had good coral cover of 26.7-58.3%, presence of various coral growth shapes and even giant clams. This is even though the area has high sedimentation stress and shows that the coral reefs found here are quite unique and requires our immediate attention. The coral reefs

of north east Pulau Langkawi are in dire need to be monitored, conserved, managed and may yet even be able to be fully rehabilitated in the future.

Acknowledgements The author would like to thank Universiti Malaya for giving the grant for this project through the Vote F grant scheme, Universiti Malaya Maritime Research Centre (UMMReC) and Institute of Biological Sciences, Universiti Malaya for their support and comradeship during this study where without them this study would not have been a success. My gratitude goes to my dive team Badrul, Faedzul and Ai Lin.

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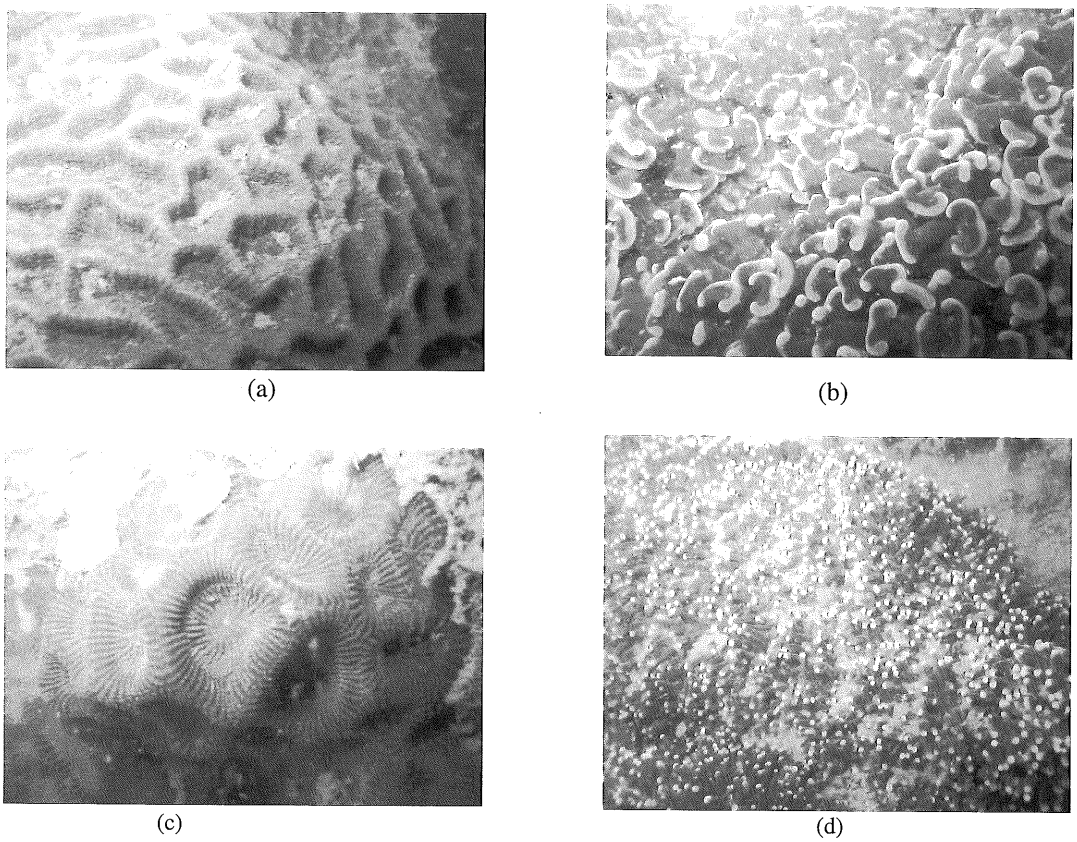


Figure 3. (a) – (d) Pictures of hard corals at Pulau Anak Gua Cerita. (a) = Faviid massive coral, (b) = *Euphyllia sp.* sub massive coral, (c) = Faviid massive coral, (d) = *Galaxea sp.* sub massive coral. Picture (a), (c) & (d) shows the fine sediments accumulated on the corals

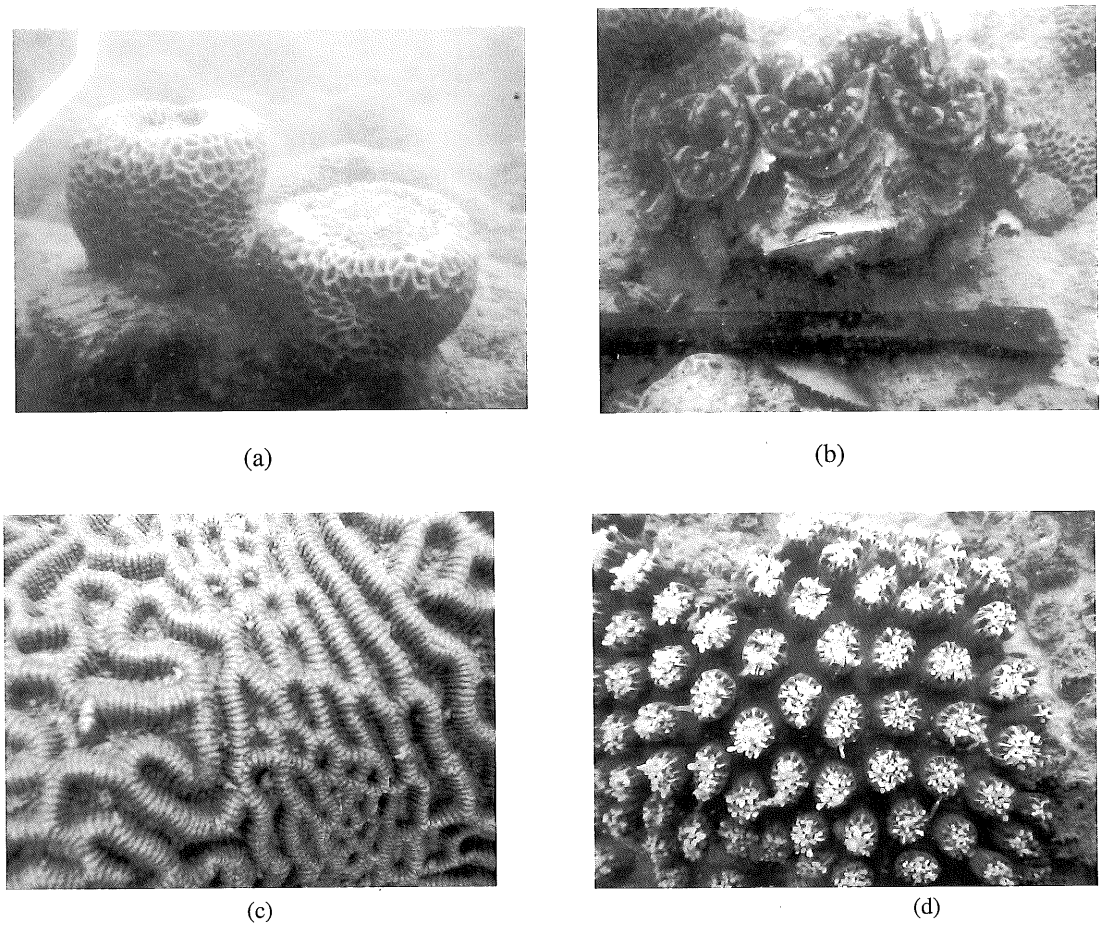


Figure 4. (a) – (d) Pictures of organisms found at Teluk Berangan, Pulau Langgun. (a), (c) & (d) are pictures of hard corals whereas (b) is a picture of a *Tridacna sp*. (giant clam). (a) = Faviid massive coral which has the top parts of the colony dead due to sedimentation stress. (c) = Faviid massive coral, (d) = *Galaxea sp.* sub massive coral

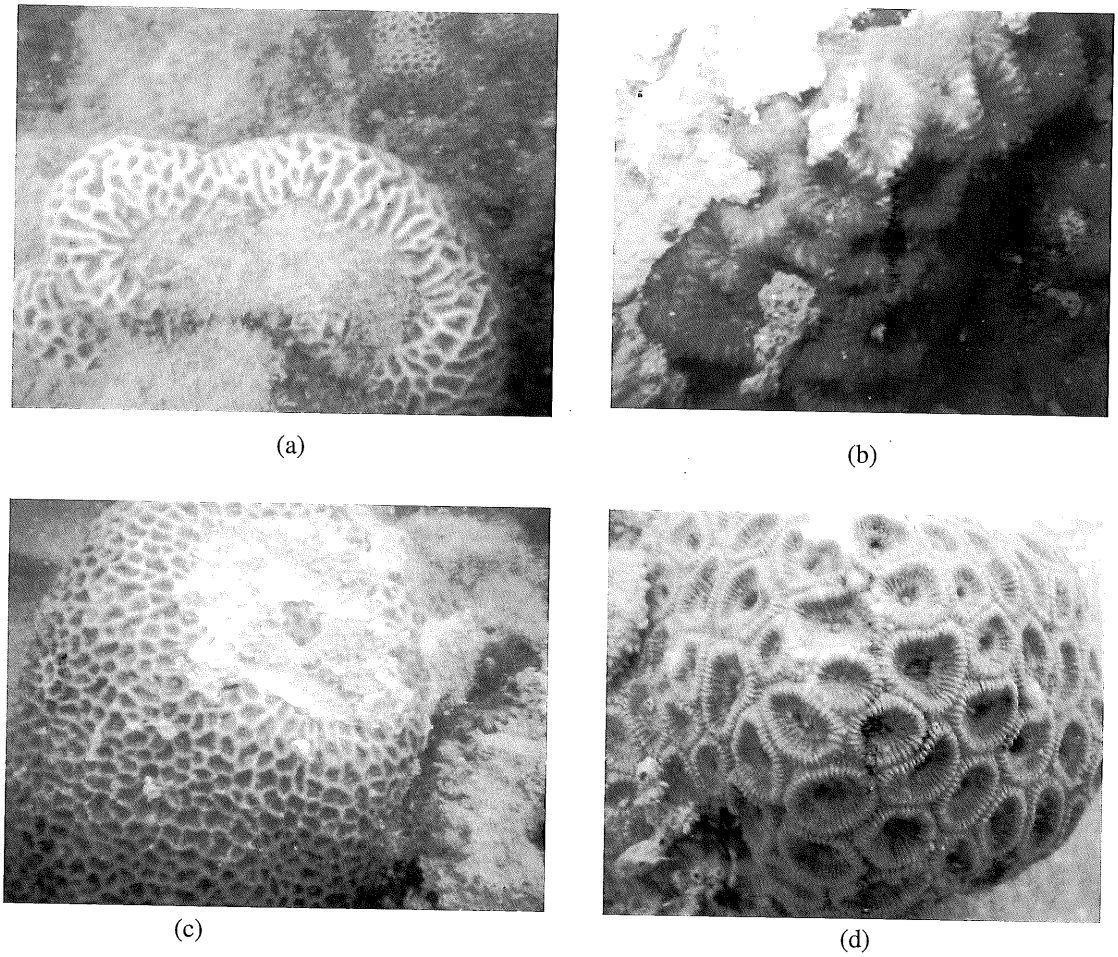
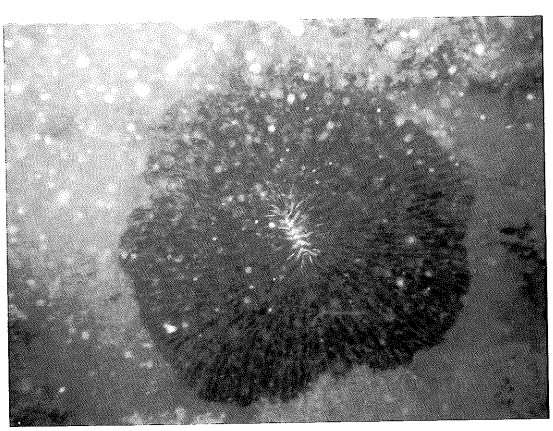


Figure 5. (a) – (d) Pictures of hard corals at Teluk Cina Mati, Pulau Tanjung Dendang. (a) & (c) = Faviid massive corals with the top parts of the colony dead due to sedimentation stress, (b) Faviid massive coral with sediments on the colony, (d) = Faviid massive coral



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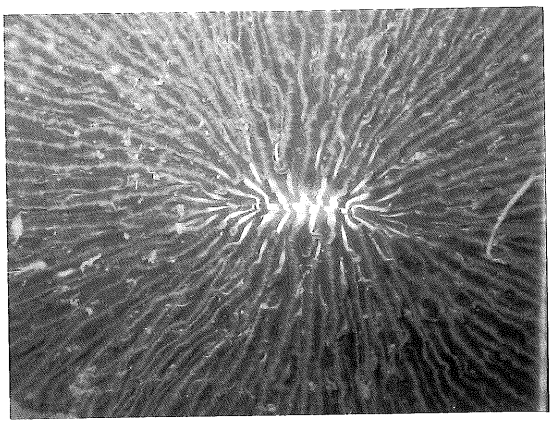

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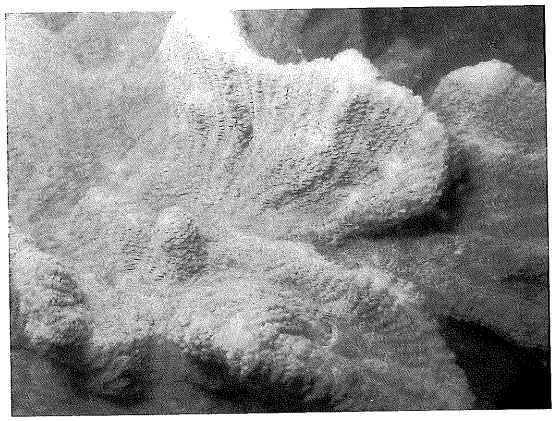

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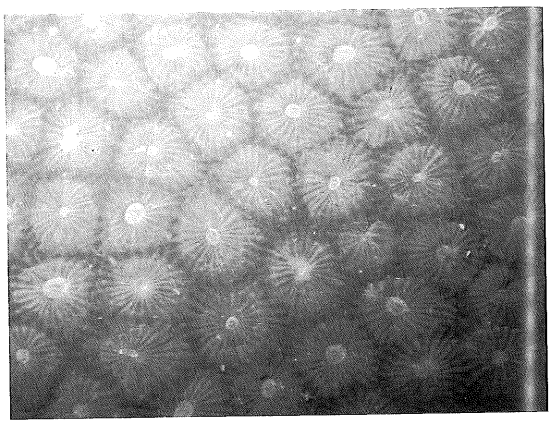

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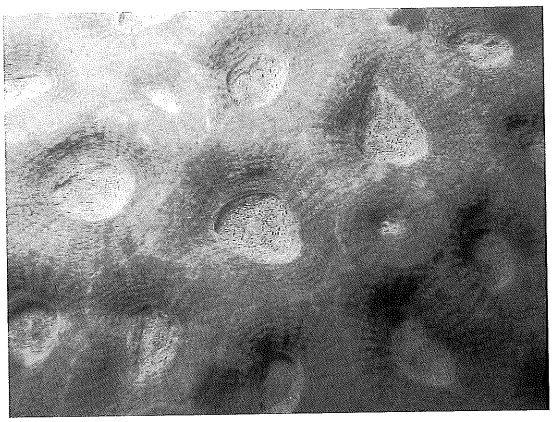

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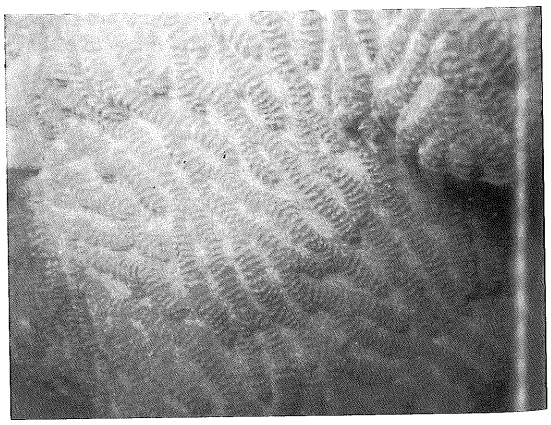
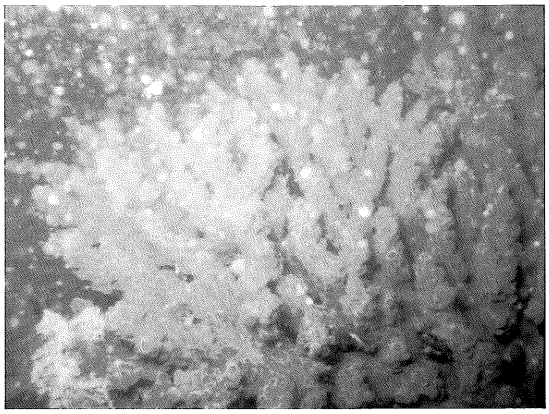


(f)

Figure 6. (a) – (x) Pictures taken at Tanjung Dendang, Pulau Tanjung Dendang. (a) & (b) = Fungidae free living coral, (c) = *Pectinia sp.* foliaceous coral, (d) & (e) = Faviid massive corals, (f) = *Merulina sp.* foliaceous coral



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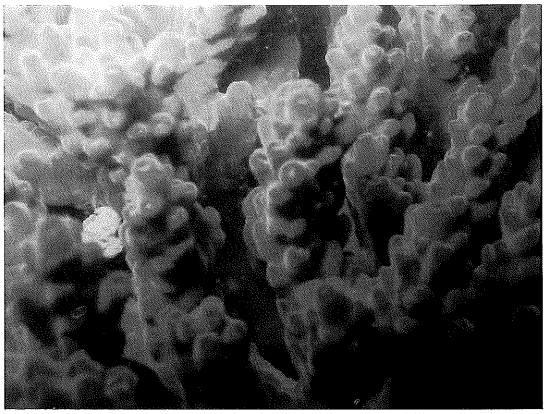

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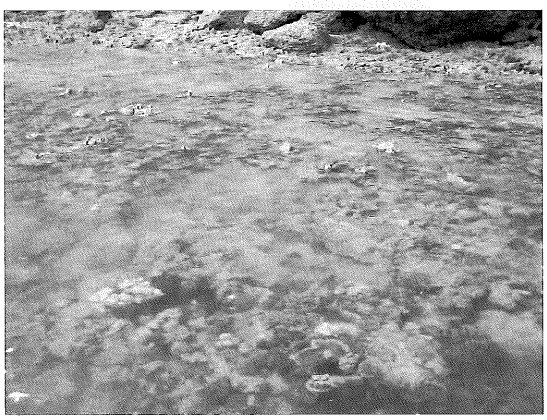

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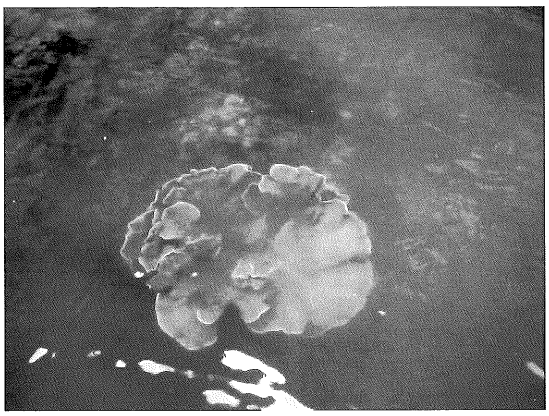

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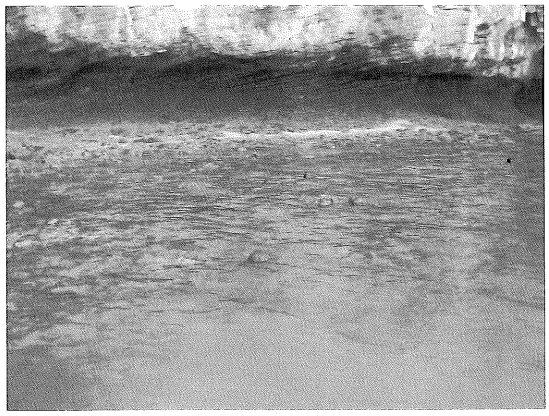

(l)

Figure 6. (g) & (h) = *Acropora sp.* branching coral, (i) = Surface picture of Tanjung Dendang study site showing the western side of the cliff, (j) & (l) = Pictures of the coral reef flat joining the cliff face of the island, (k) = Foliaceous hard coral seen from the surface

(m)

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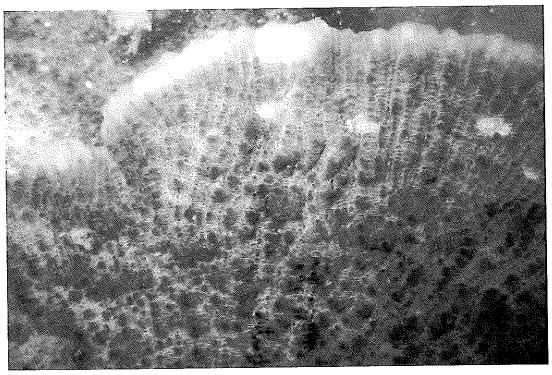

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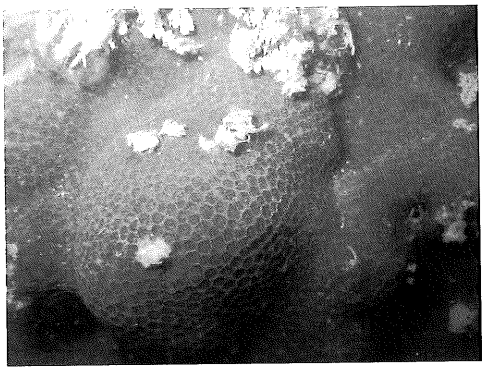

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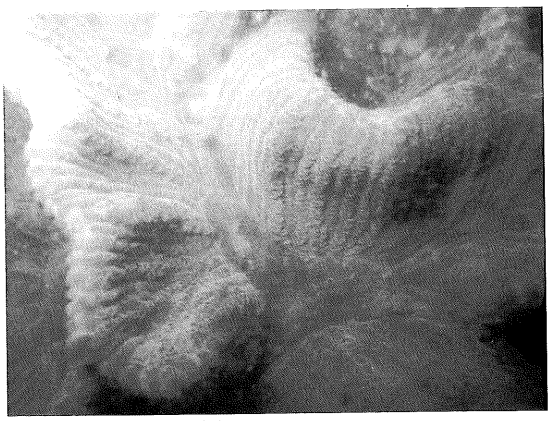

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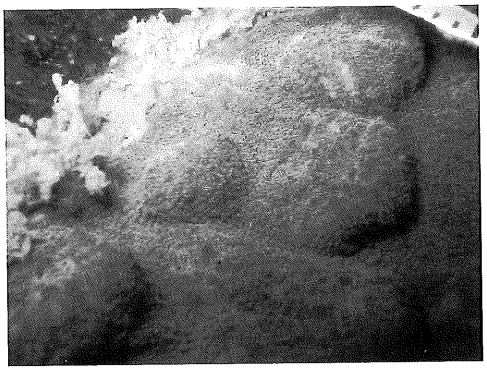
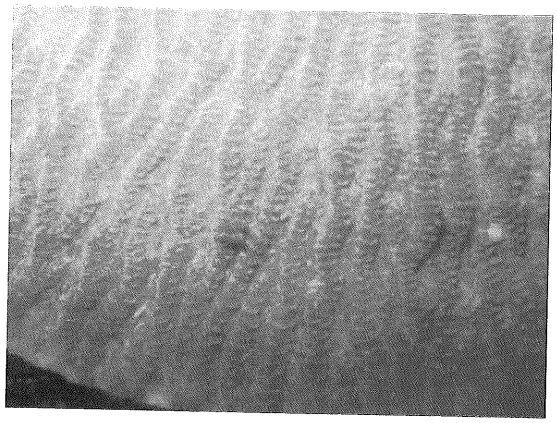
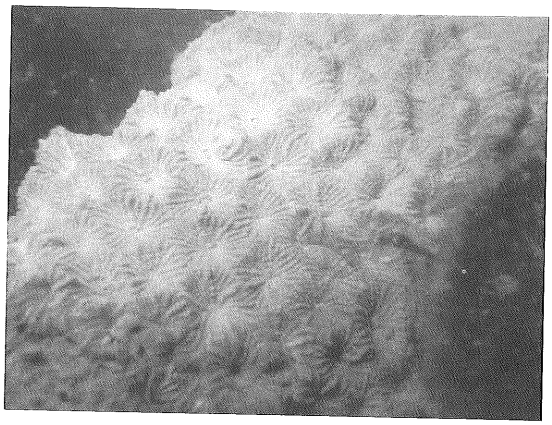


(r)

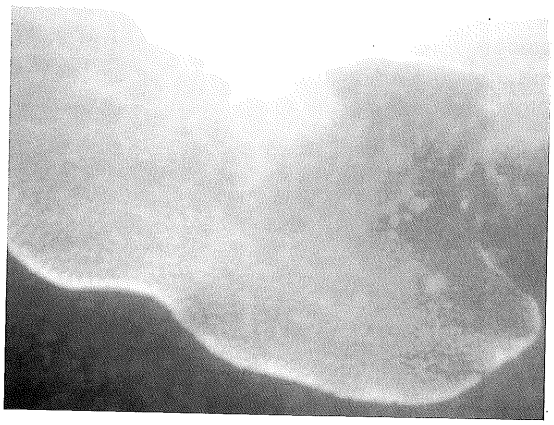
Figure 6. (m) = *Acropora sp.* branching coral, (n) = *Pachyseris sp.* sub massive coral, (o) = *Pectinia sp.* foliaceous coral, (p) = *Porites sp.* massive coral, (q) = *Pectinia sp.* foliaceous coral, (r) = *Lobophyllia sp.* massive coral



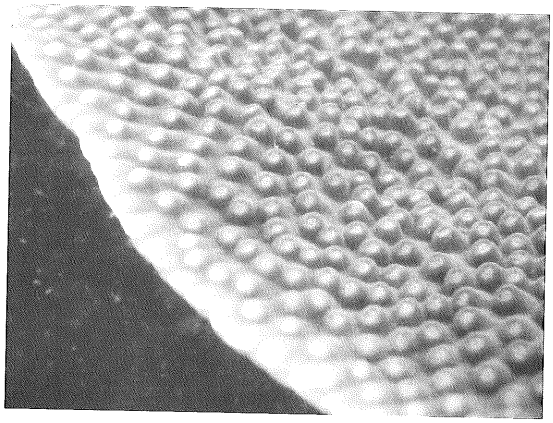
(s)



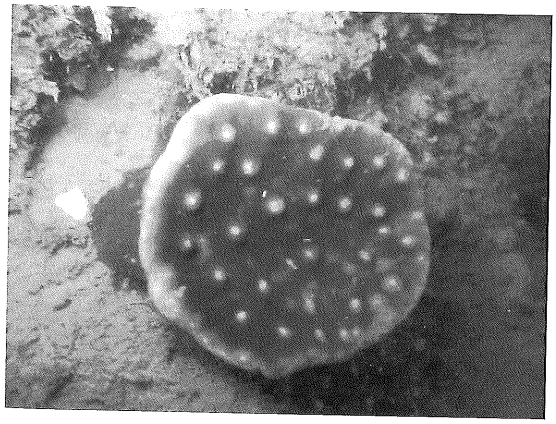
(t)



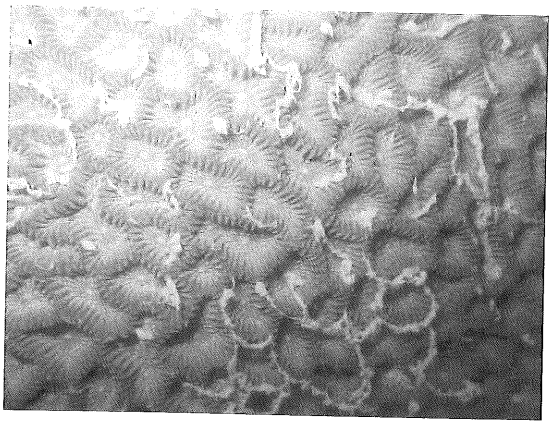
(u)



(v)



(w)



(x)

Figure 6. (s) = *Merulina sp.* foliaceous coral, (t) = Faviid massive coral, (u) & (v) = *Turbinaria sp.* foliaceous coral, (w) = Juvenile *Turbinaria sp.* foliaceous coral, (x) = Faviid massive coral.

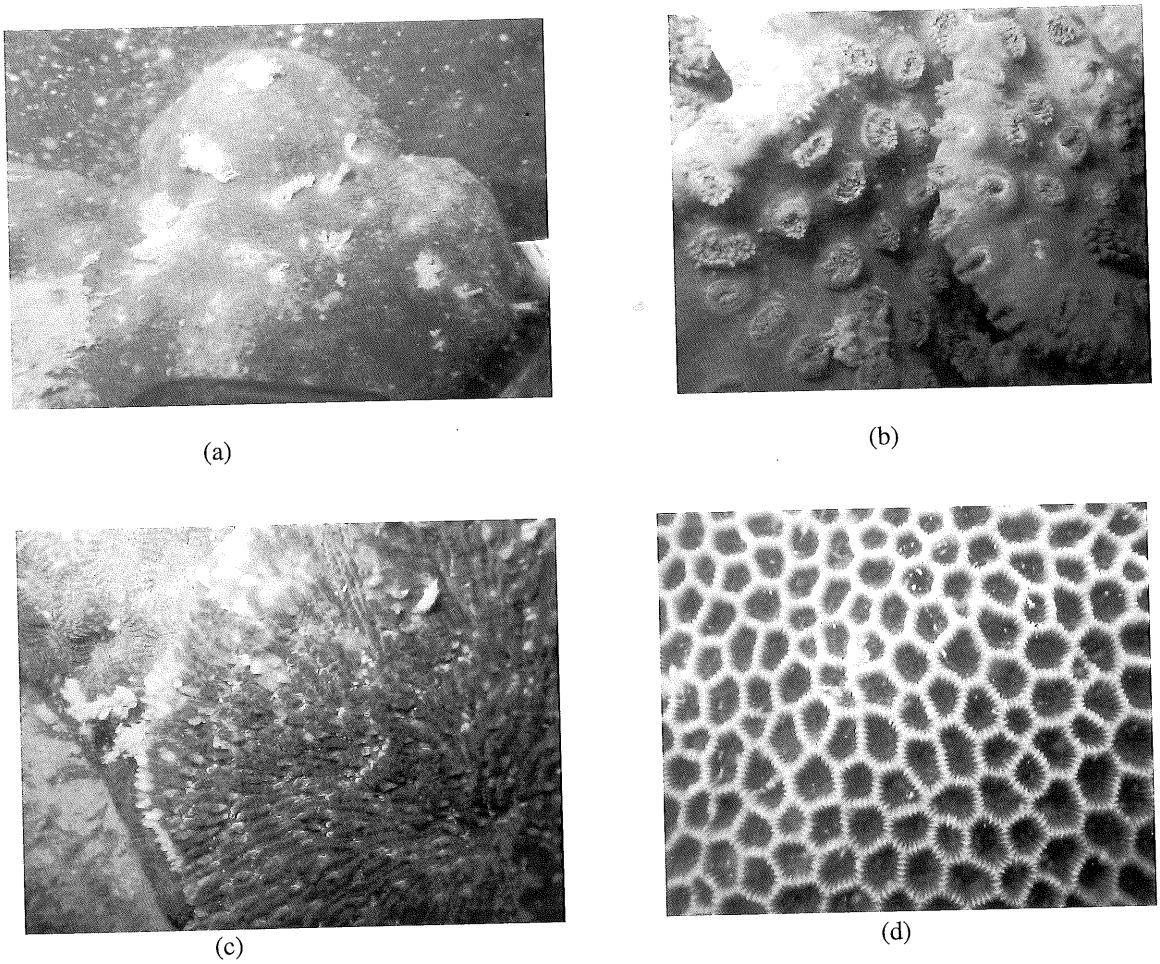


Figure 7. (a) – (d) Pictures of hard corals at Teluk Dedap. (a) = *Porites sp.* massive coral, (b) = Faviid massive coral, (c) = *Merulina sp.* encrusting coral, (d) = Faviid massive coral.