CHAPTER 5

CONCLUSION

The results have obviously exhibited that the predominant cryptofaunal animals are borers. These boring organisms naturally penetrate in coral substrates which are generally different in density and frequency of occurrence. The borers were more diverse in Porites lutea than in coral blocks. However, the predominant borer numbers in coral blocks were usually more numerous than in live corals. The difference may due to exposure time, zonation, some characteristics of such a coral substrate for example shapes, plains and the influence of various natural microhabitats condition in coral reef ecosystem which facilitate the borer succession. The species composition was quite similar between shallow and deep zones but with different ranking due to quantity and frequency occurrence of such borers. Furthermore, some borers such as sipunculids species were distinct in each zone which clearly showed zonally distribution in both coral substrates.

In Porites lutea; the borers could be divided into 3 groups. The sipunculids consist of Family Phascolosomatidae : Phascolosoma spp. and Family Aspidosiphonidae : Aspidosiphon spp. All of them are adult stage and clumply inhabit at the base of coral colonies which are mostly dead part. Especially each Phascolosoma spp. was abundantly found in

various zones. As Phascolosoma sp. D itself is dominant in shallow zone, contrary to Phascolosoma sp.B in deep zone.

The polychaetes: all of long lived polychaete borers were found in almost all of coral heads, especially planktivorous polychaetes which were mostly more abundant in deep zone than in shallow zone. They composed of Family Sabellidae : Hypsicomus sp. and Family Flabelligeridae : Pherusa parmata in deep zone and Family Eunicidae : Eunice spp. in shallow zone.

The bivalves; Family Mytilidae Lithophaga spp. especially L. lima were abundantly found in both dead and live Porites lutea colonies. They were relatively high density in deep zone. Therefore, they effectively bored by using combination both mechanical and chemical processes. In contrary, Lithophaga malaccana and L. teres generally distributed in shallow zone likewise Gastrochaena cuneiformis and Spengleria mytiloides, but at only dead part.

In coral blocks : The boring organisms were found only 2 main groups as follows :

Sipunculids: Phascolosoma spp. and Aspidosiphon spp. were found in coral blocks more abundant than in Porites lutea. However they were still juvenile. Otherwise, most of them were very small which made them rather difficult to identify due to some non-cleared characteristics. Moreover, all of Aspidosiphon spp. were true borers, but Phoscolosoma spp. seem to be true borers and common endocryptofauna which inhabit in between inter-

space of coral blocks.

Polychaetes: in shallow zone the boring polychaete numbers were increased by Family Cirratulidae : Dodecaceria sp., but in deep zone the sabellids : Megalomma quadrioculatum become the dominant borer. Furthermore, Family Spionidae : Polydora sp. and Hypsicomus spp. were rarely appeared on coral blocks in both zones.

However, the boring bivalves would not found during the study. The absence of boring bivalves in coral blocks may due to the short duration of study. In case of boring sponges, they were very rare. This may due to unsuitable habitat i.e. high resuspended sediment and large salinity fluctuation.

The Biological Index determination indicated that Phascolosoma sp. D, Phascolosoma sp. B and Eunice sp. were the predominant boring organisms in Porites lutea in shallow zone. In deep zone, Phascolosoma sp. A, Lithophaga lima, Hypsicomus sp. A and Pherusa parmata were the representatives of the most common bioeroders in Porites lutea.

In coral blocks, Phascolosoma spp. and Aspidosiphon spp. were obviously the most effective mechanical borers especially in shallow zone. However, some polychaetes were frequently found as well, such as Dodecaceria sp. in shallow zone, and Megalomma quadrioculatum in deep zone which this polychaete is a short lived borer according to the mature form had appeared in last two month of study period. The

results also exhibited that the borer communities in coral blocks were not yet in equilibrium, particularly polychaete borers tended to increase in number. However, it may depend upon season and various natural condition and biological competition to facilitate the borers succession on coral substrates.

In live coral the bioerosion rate caused by borers was greatly less than by grazers. However, the maximum bioerosion rate by borers was obtained in deep zone which may be due to the effect of boring bivalves. In addition, the large coral heads in term of longer exposured period were observed much more strongly destroyed which acted as the result of the dynamics of more borer generation.

In coral blocks, the maximum bioerosion rate in shallow zone was 67.98 $\pm$ 45.09 gm/m^2/yr and 214.74$\pm$ 157.85 gm/m^2/yr in deep zone. The minimum bioerosion in shallow zone was up to 31.80 $\pm$ 3.42 gm/m^2/yr and 85.7 $\pm$ 16.92 gm/m^2/yr in deep zone. Both values significantly related to number of polychaete borers in positive manner which indicated polychaetes as effective agents on new coral substrates. The comparison between the bioerosion rates in living coral and coral blocks exhibited that coral blocks tended to be more affected by borers due to exposure of available substrates for various bioerosional factors. Furthermore, it was found that density and porosity of coral blocks did not influence the increasing or decreasing of bioerosion rates. In addition, the bioerosion rate also varied due to exposure time and season which continually

increased chance for boring destruction. Otherwise, the bioerosion by grazers as Diadema setosum played as the most effective bioeroder in Kang Kao coral reef in particular, the algal abundant area.

From the borer successional investigation by using coral substrates, both sipunculid and polychaete borers had occurred within 4 months after algal and epifaunal succession. Moreover, each borer groups could independently attack coral blocks depending upon distance from their initial microhabitats or zonally distribution, spawning period, predators such as coral reef fishes, biological competition between borers and epifauna food supply. The borers were found clumply distribution inside the same coral block. The juvenile borers would directly enter between pore interspace of coral exoskeleton to inhabit.The natural live corals are usually bored by boring organisms at the base, crevice which may be made by death of coral themselves or initial boreholes due to borers including grazers. Anyway, the live part of the corals have some specific mechanisms to prevent faunal succession.

Some environmental factors could generally obstruct the borer succession on coral substrates. Such factors mostly concerned their life cycle and survival such as recruitment, feeding, breeding. Likewise, sediments and wave energy could coinside to protect the borer succession by increasing the unstabilized substrates owing to covering and infill on coral substrates which may decrease boring

ability of penetration and alive. In case of primary productivity, it acted as the influencing factors by increasing food supply to some planktivorous borers such as Lithophaga lima and sabellid polychaetes; Hypsicomus sp., Megalomma quadrioculatum. Furthermore, the biological competition concerned with prey-predators relationship or species association including aggressive interaction between coral, epifauna and borers themselves particularly play the roles on bioerosion process by boring organisms. Moreover, their penetration ability using some specific structural mechanisms such as combination of strong muscle and papillae on phascolosomatids skin or chemical dissolution by pallial gland enzyme in Lithophagas, may facilitate the differential destruction on coral substrate.

Suggestion

1) The effect of bioerosion by borers as already presented, may be very important in maintaining the high diversity of coral reefs owing to roles of crevices and boreholes. Hopefully these results will stimulate long term detail studies for solution of some ecological problems including coral reef ecosystem management.

2) The results do not clearly answer about the relationships between some environmental factors and bioerosion due to boring organisms. Thus, the further study should add some special planning to obtain more information.

3) The seasonal effects on bioerosion due to some predominant borers such as Lithophaga lima, Hypsicomus sp. and Megalomma quadrioculatum etc. should be investigated through their life cycles.

4) Because the grazers, especially Diadema setosum , acted as the most important bioeroders in Kang Kao coral reef, thus the detail experiment should be done to understand its role on coral reef ecosystem.

5) Particularly, taxonomic study of boring organisms should be identified to at least genus level for further investigation about their boring behaviours including

the interaction of such species or groups.

6) How bioerosion effects on coral community such as community structures and reef morphology will need to be investigated further.

7) The quantitative method to extract infauna for comparison was unsuitable due to inaccuracy,so they should be done by new applied method which could be used both in live coral and coral blocks.

8) The control experiment such as removal of the grazers should be investigated further not only to affirmed the roles of those grazers on succession of borers communities in coral blocks but also to study on the interaction among some borers.