

CHAPTER V

CONCLUSIONS

Coral reef bleaching in the summer months of 1991 along the Andaman coast of Thailand was correlated to the elevated seawater temperatures of 1-3 °C above the mean summer ambient (28.76°C). The solar irradiance seem to be a contributory factor for bleaching responses among bleached coral species. Reef cnidarians suffered by the bleaching included scleractinian corals, hydrocorals, octocorals, zooanthids, and sea anemones of which a total of 94 taxa were observed to have bleached. Among these acroporid corals were the most severely affected and subsequently died. Variation in bleaching observed among sites, ranging from 10% to 70% of live cover, was suspected to have dealt with differences in local community structures and susceptibility of the dominant corals at sites.

Bleaching and subsequent coral death are potential regulators of reef development which may also reduce the stability of coral reef ecosystems. Delayed and long term effects resulting from the bleaching have continued to the present. Evidently at the PMBC reef site, these have involved; (a). a shift in live coral cover dominance to extensive algal lawn, (b). invading of fouling and boring organisms onto dead coral frameworks, (c). changes in local fish assemblages, for instance disappearance of some apogonids and enlargement of territorial damselfish lawns, *Stegastes lividus*, (d). gradual changes in reef morphology which probably resulted from intense bioerosion relating physical damage and (e). recolonization of reef community via the recruitment mode of which believed to be a gradual process.

Tissue biomass characteristics of coral bleaching may be summarized as follows; (a). a reduction in number of zooxanthellae cm^{-1} (64% to 95%), (b). a reduction in chlorophyll-a cm^{-1} (89% to 99%) and

chlorophyll-a zooxanthellae⁻¹ (54% to 86%) with except for *M. elephantotus* and (d). a reduction in protein cm⁻² (43% to 74%). Subsequently, time-matched samples of coral tissue biomass analysis showed that recovery of a coral from bleaching is a gradual process which achieved within 17-27 weeks after the beginning of bleaching.

PLATE I

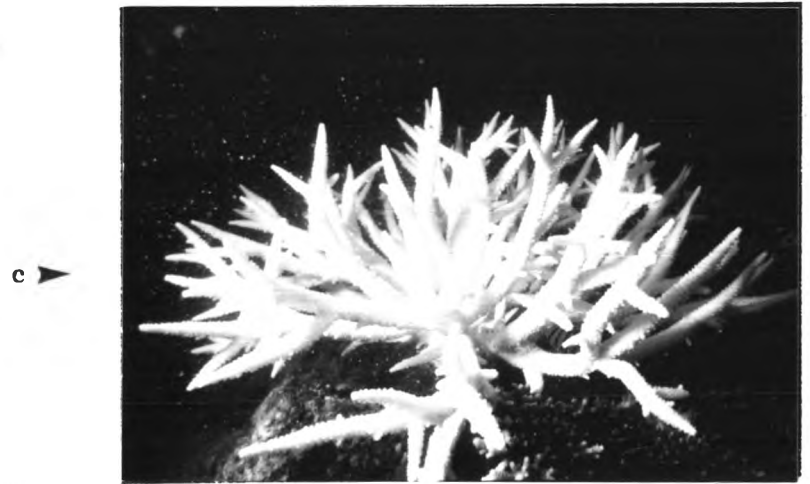
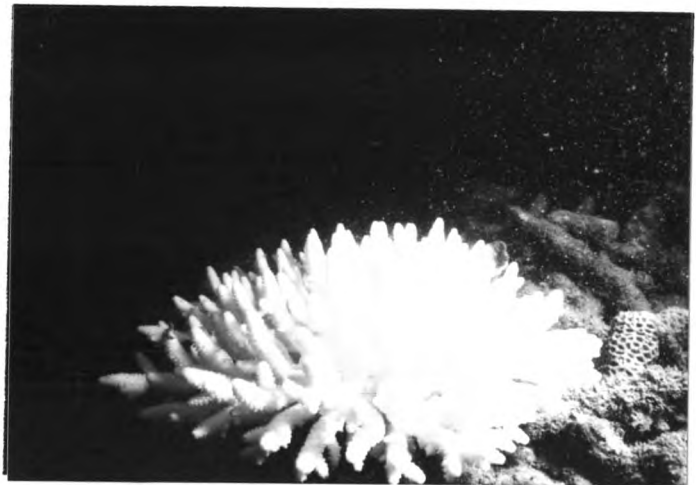


Fig. a. Bleaching of corals on the reef flat of the PMBC reef, southern site (25 June 1991).
Fig. b. Completely bleached Acropora humilis (PMBC reef, southern site, 25 June 1991).
Fig. c. Completely bleached Acropora formosa (PMBC reef, southern site, 25 June 1991).
Fig. d. Completely bleached Acropora nobilis and partially bleached Porites lutea, below right, (Ko Khai Nok, 28 June 1991)

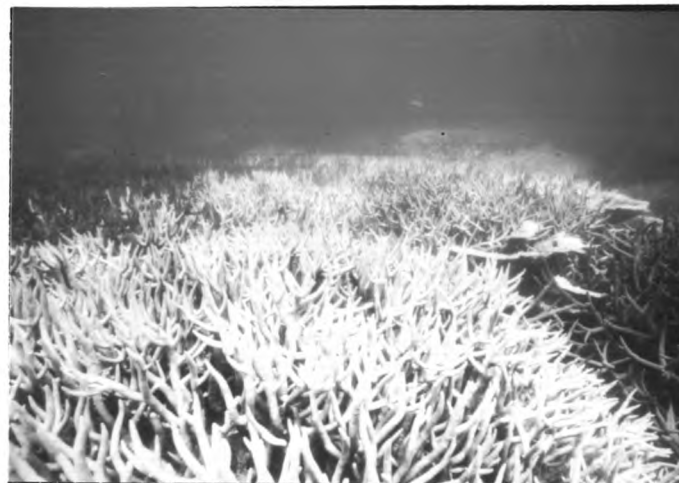


PLATE II

a ▶



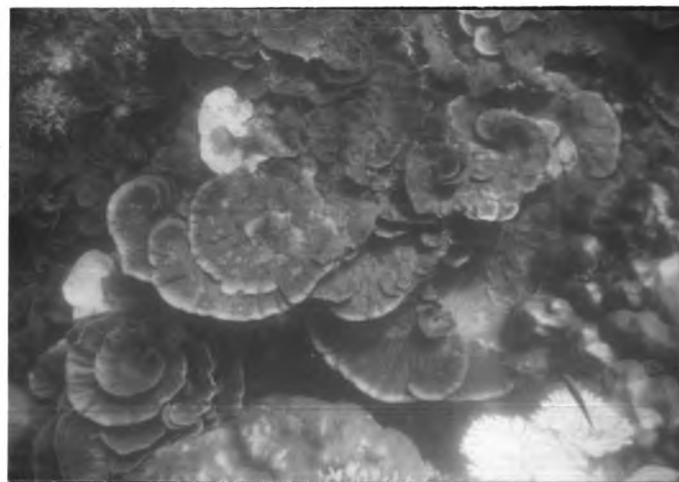
◀ b



c ▶



◀ d



- Fig. a. Patchy bleaching of Pocillopora verrucosa at Ko Racha Yai (5 July 1991).
Fig. b. Extensive bleaching of Acropora nobilis at Ko Hae (25 June 1991).
Fig. c. Bleaching of large stands of Acropora hyacinthus at Ko Khai Nok (28 June 1991).
Fig. d. Colonies of Montipora sp. with major part remaining normal pigmentation (Ko Loan, 25 June 1991).

PLATE III

a ▶



◀ b



c ▶



◀ d



Fig. a. Completely bleached Symphyllia sp. (Ko Hae, 26 June 1991).

Fig. b. Completely bleached Platygyra sp. (Ko Maithon, 28 June 1991).

Fig. c. Completely bleached Hydnophora rigida (Ko Maithon, 28 June 1991).

Fig. d. Completely bleached Hydnophora exesa with fully expanded polyps (Ko Dokmai, 28 June 1991).

PLATE IV

a ▶



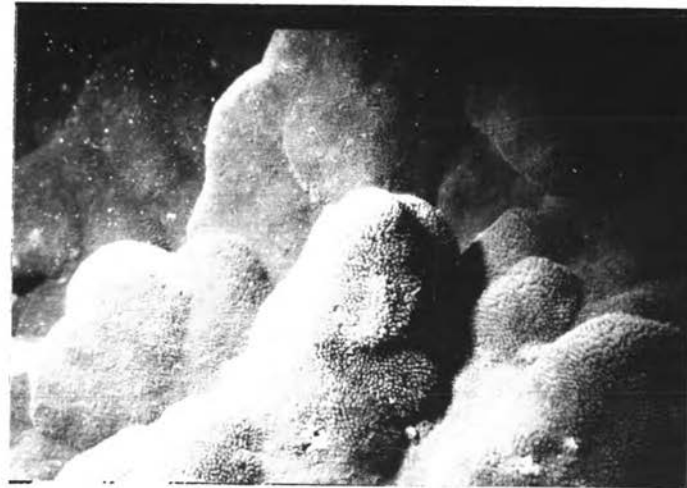
◀ b



c ▶



◀ d



- Fig. a. Completely bleached Fungia sp. (PMBC reef, southern site, 25 June 1991).
Fig. b. Completely bleached Goniopora sp. with expansion of polyps (Ko Dokmai, 28 June 1991).
Fig. c. Partially bleached of the massive coral Porites lutea (Ko Maithon, 28 June 1991).
Fig. d. Unbleached Porites lobata (Ko Maithon, 28 June 1991).

PLATE V

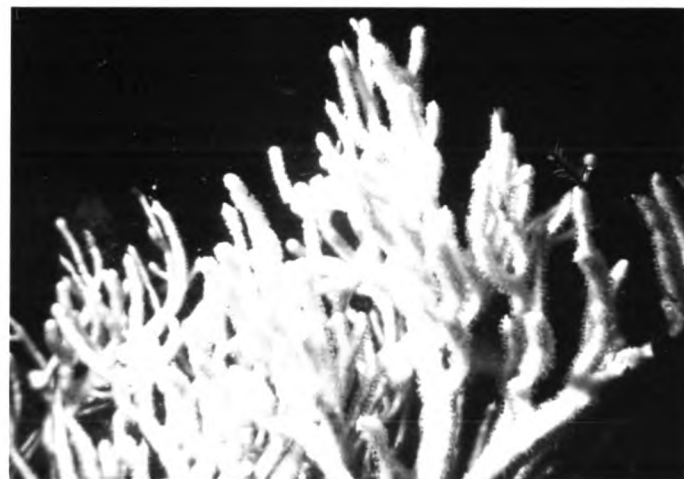
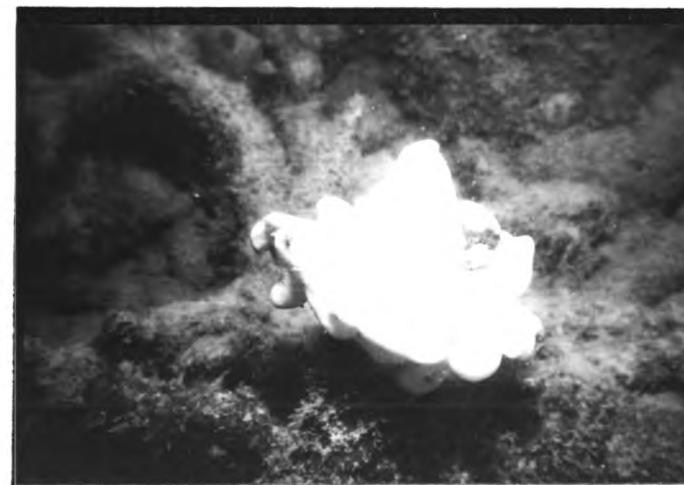


Fig. a. Completely bleached Sarcophyton sp. with fully expanded polyps (Ko Maithon, 28 June 1991).

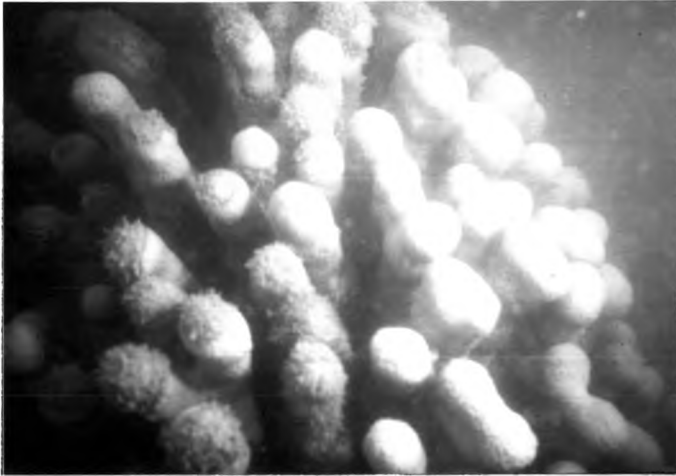
Fig. b. Completely bleached colony of Sarcophyton sp. in contracted condition (PMBC reef, western site, 19 July 1991).

Fig. c. Completely bleached of a monospecific carpet colonies of Sinularia sp. (Ko Maithon, 28 June 1991).

Fig. d. Bleaching of the gorgonian coral Rhumphella sp. (Ko Ell, 26 June 1991).

PLATE VI

a ▶



◀ b



c ▶



◀ d



Fig. a-d. Photographic records on 26 October 1991, PMBC reef (western site), showing some corals which undergoing recovery. a. partially dead colony of Psammocora digitata, b. Symphyllia sp. colony with superficial death, c. Lobophyllia sp. with death of the major part of colony, and d. soft coral (Sinularia sp.) colony with the dead part of cemented sclerites still remain.

PLATE VII

a

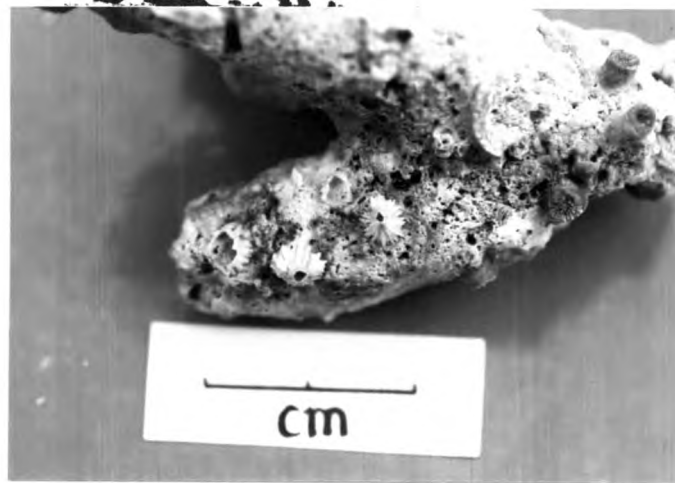


b



Fig. a. A specimen of Stegastes lividus (subadult, 9.2 cm total length), PMBC reef, western site, 15 October 1991.

Fig. b. An adult S. lividus (about 15cm total length) territory on dead stands of branching Acropora resulting from the 1991 bleaching event, 2 m depth, PMBC reef site, 26 April 1992. An extensive lawn of filamentous algae was maintained within its territory.



a



b



c

Fig. a-c. The fouling organisms attached on dead Acropora surface; a. barnacles, b. bryozoa and c. sponge

PLATE XIII

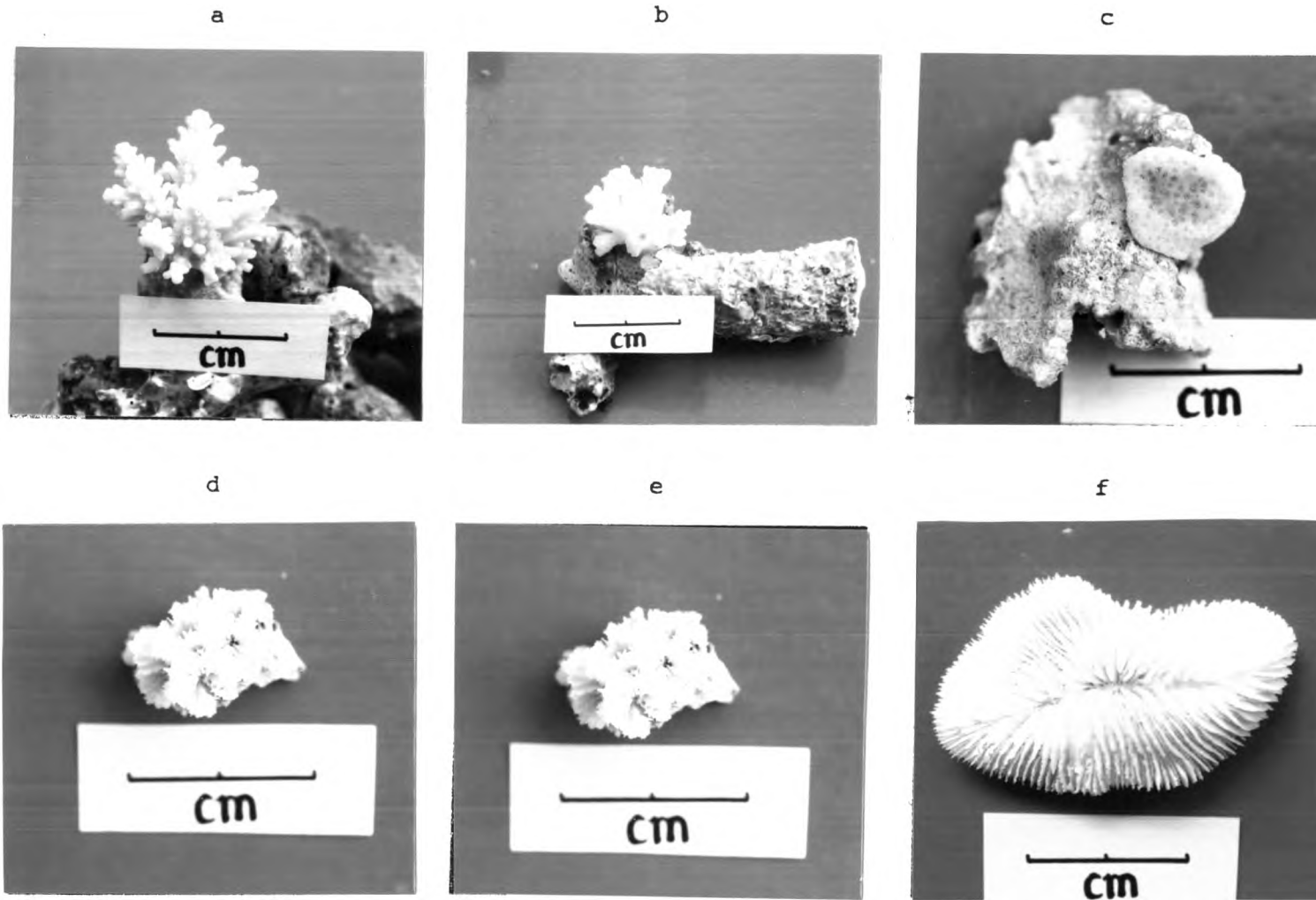


Fig. a-f. Illustrations of some coral recruits collected from the PMBC reef site on 3 July 1992.
a. *Acropora formosa*, b. *Pocillopora damicornis*, c. *Porites (Synaraea) rus*,
d. *Platygyra sinensis*, e. *Pectinia* sp., and f. *Fungia* sp.

PLATE IX

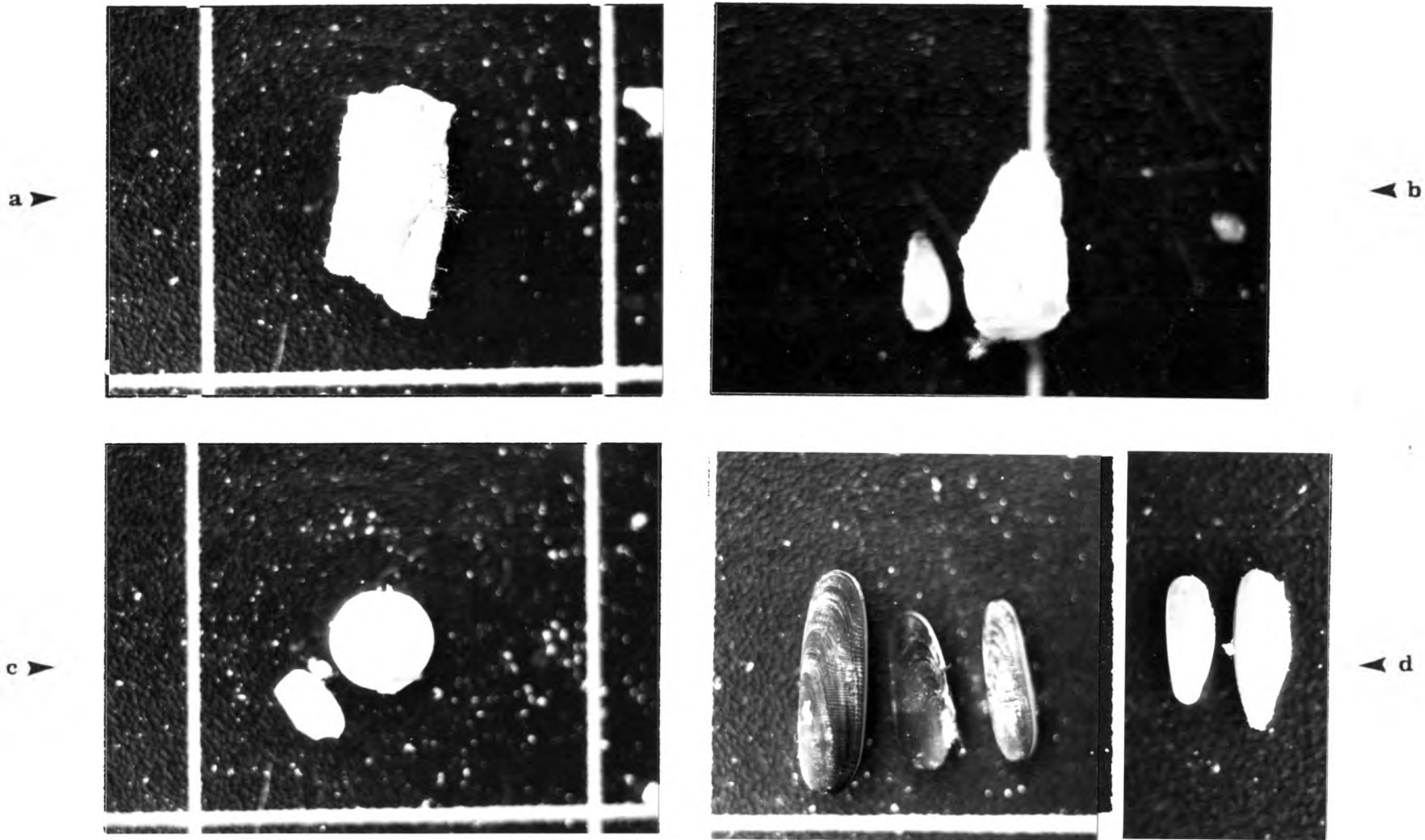
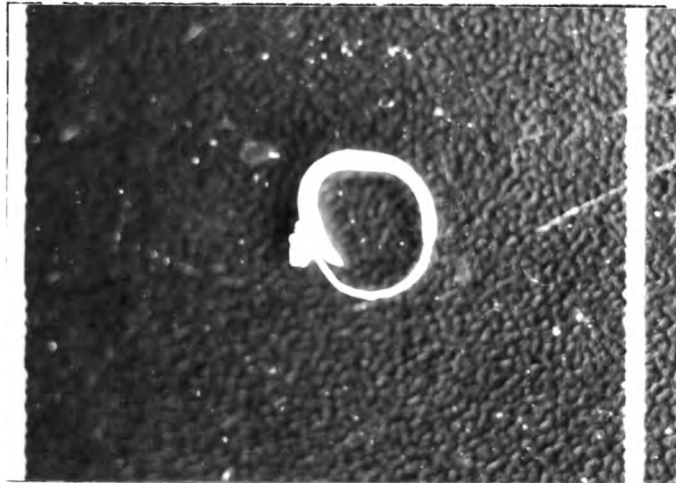


Fig. a-d. The common borers penetrated in dead Acropora corals

- a. Boring sponge.
- b. Boring bivalves, Family Gastrochaenidae; Gastrochaena sp.
- c. Boring bivalves, Family Pholadidae; Jounnetia sp.
- d. Boring bivalves, Family Mytilidae; Lithophaga spp.

PLATE X

a



b

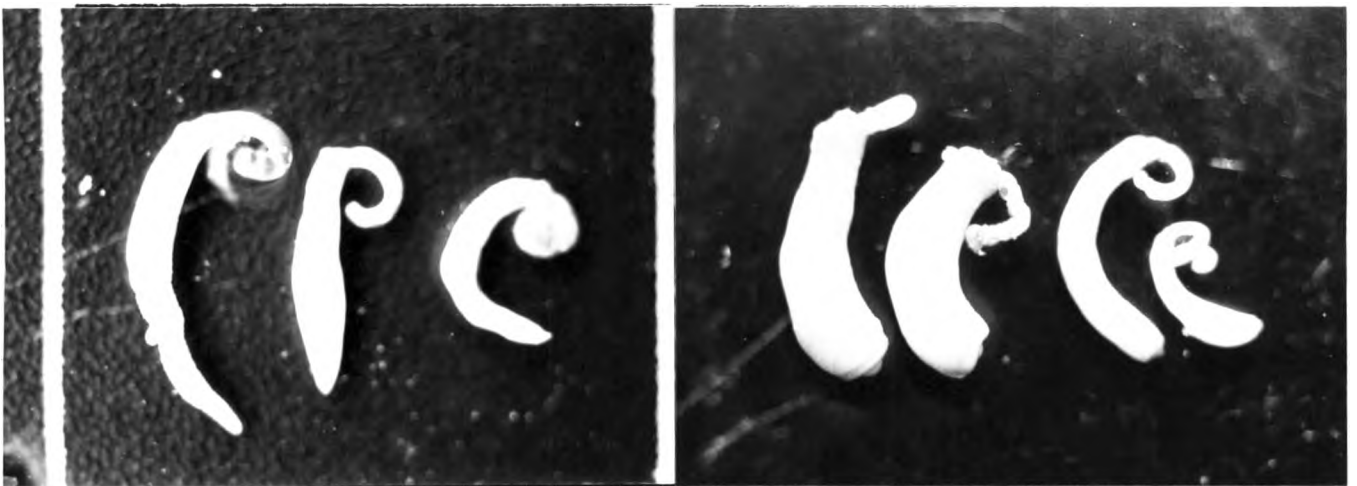
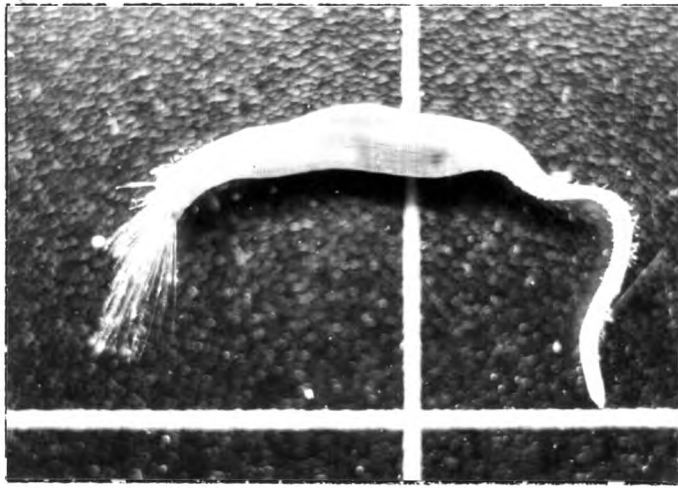


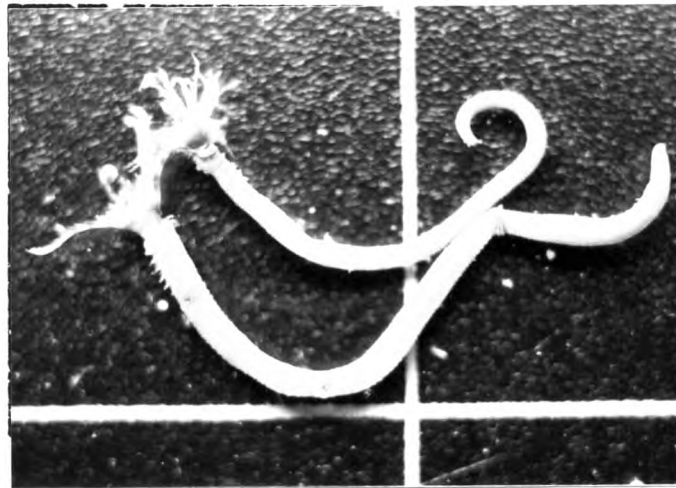
Fig. a,b. The sipunculid borers penetrated in dead Acropora coral.

a. Family Phascolosomatidae; Phascolosoma sp.

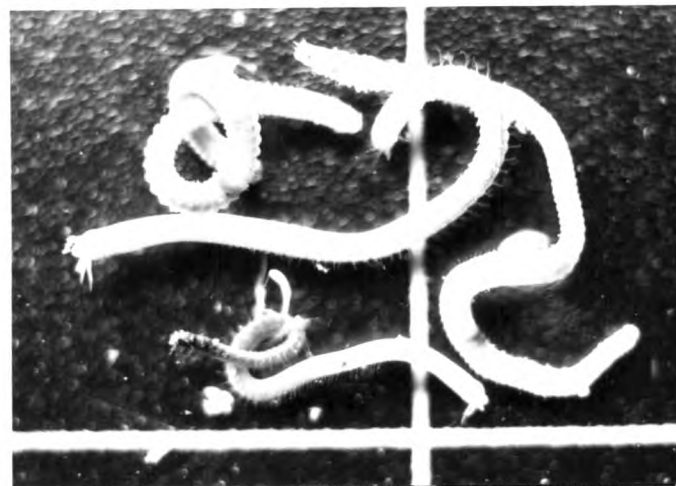
b. Family Aspidosiphonidae; Aspidosiphon spp.



a



b



c

Fig. a-c. The polychaete borers bored in dead Acropora corals

a. Family Flabelligeridae; Pherusa sp.

b. Family Sabellidae; Hypsicomus sp.

c. Family Eunicidae; Eunice sp.

PLATE XII

a



b



Fig. a,b. Illustrations of acroporid skeletons which were excavated by various boring organisms.

a. The samples were collected from the damselfish (Stegastes lividus) territories.

b. The samples were collected outside the damselfish territories.

PLATE XIV

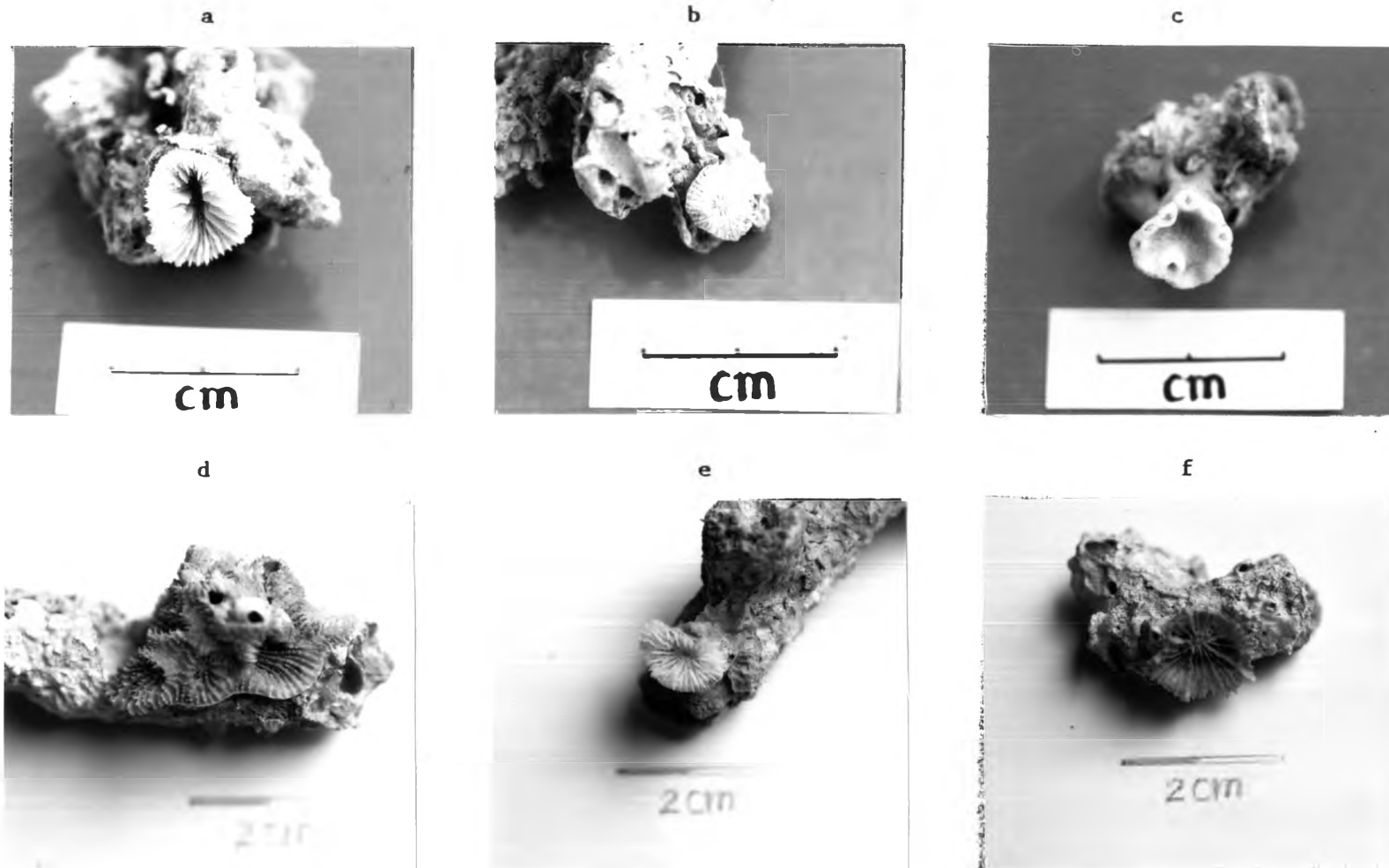


Fig. a-f. Illustrations of some coral recruits collected from the PMBC reef site on 3 July 1992. a. Fungia sp., b. Scolymia sp., c. Turbinaria sp., d. recently dead Favia pallida e. recently dead Fungia sp., and f. recently dead Pectinia sp. (resulting from breakage of substratum).

PLATE XV

a



b



Fig. a,b. An illustration for the present condition of the dead acroporid frameworks at the PMBC reef site (samples were collected on 27 August 1993 and photographed in an aquarium).

a. Sample collected from the damselfish territory showing high standing-crop of filamentous algae.

b. Samples collected outside the damselfish territory showing a role of grazers (particularly grazing fishes) for controlling the algal abundance.