CHAPTER 5

GROWTH HISTORY OF *MONTASTRAEA ANNULARIS* AT LOOE KEY NATIONAL MARINE SANCTUARY, FLORIDA

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Introduction

The main objective of this study is to produce a permanent and accurate record of vertical skeletal growth in Looe Key *Montastraea annularis* that extends back in time a minimum of 100 years. A secondary goal is to analyze these data for possible clues to past environmental perturbations that may have influenced health and growth of not only *M. annularis* but the entire Looe Key reef ecosystem as well. In addition, long-term growth rate trends of Looe Key *M. annularis* will be compared with those from the Key Largo Coral Reef Marine Sanctuary to determine if patterns of coral growth observed at Looe Key can be seen in those *M. annularis* growing off Key Largo. Also reported here are results of a new method developed by the author for sealing core sample holes in *M. annularis* with plugs of live coral. Data for this report were compiled from measurements of yearly growth bands revealed in x-radiographs of *M. annularis* core slabs. This sclerochronology technique is based on the work of Knutson *et al.,* (1972), who used autoradiograpby and x-radiography to prove the annual nature of density bands in several species of Pacific (Enevetak Atoll) massive corals.

In addition to being used as precise indicators of age and growth rate, the various characteristics of *M. annularis* density bands have also been evaluated by numerous workers for use as indicators of past changes in ocean environment. Among these are studies by Dodge *et al.* (1974), Hudson *et al.* (1976), Druffel and Linick (1978), Emiliani *et al.* (1978), Fairbanks and Dodge (1979), Highsmith (1979), Hudson (1981a, 1981b), and Druffel (1982). Of these, only the work of Hudson *et al.* (1976), Druffel and Linick (1978), Emiliani *et al.* (1978), Hudson (1981a, 1981b), and Druffel (1982) focus an *M. annularis* from Florida reefs. Their Investigations, however, were restricted to areas in the middle and upper portions of the Florida reef tract. Except for a limited survey by Landon (1975) of *M. annularis* growth rates on reefs off Key West (Figure 5.1), to this author's knowledge, there have been no previous sclerochronology studies of this species in the vicinity of the lower Keys Looe Key reef area (Figure 5.1).

Area description

Shinn *et al.* (1981) divided Looe Key reef into four major ecological zones: grass flat, reef flat, spur and groove. and deep-reef spur and groove. Although some *M. annularis* can be found in all areas of the reef, it is estimated that at least 90% of the Looe Key *M. annularis* population is concentrated in the spur and groove zone. Within this area, most of the *M. annularis*, including those specimens selected for sampling, are situated along the seaward half of prominent reef spurs (Figure 5.2) in water depths ranging from 3 to 8 m (Figure 5.3).

Methods

Core samples were collected from 12 *M. annularis* colonies at Looe Key National Marine Sanctuary during August 27 - 30, 1980. An additional eight corals were cored there during July 14 - 18, 1983. During the 1983 sampling period, a short (20-cm long) core was also taken adjacent to the sealed core hole of each coral sampled in 1980, so that chronologies of these previously collected corals could be extended to 1983. Underwater coring techniques and x-ray processing were identical to those used by the author in a similar study of *M. annularis* in the Key Largo Coral Reef Marine Sanctuary (Hudson, 1981a) with one exception. A new method of sealing core sample holes with plugs of live coral was tested on the eight Looe Key *M. annularis* sampled in 1983. The remaining core holes were filled with pre-cast cement plugs of the type used by the author in the Key Largo study. Both methods perform the same function, that of closing off the lesion to the outside environment, but, whereas four years or more are required for surrounding tissue and skeletal elements to completely cover the cement plug (pers. observation), it is anticipated that live core plugs will require only 12 - 18 months to achieve the same results (Figures 5.4 A-B, 5.5 A-B, and 5.5 C-D).

Procedures used to collect and install live tissue core plugs are as follows. A specially constructed 10.75-cm diameter x 20-cm long core plug barrel was used to obtain short cylinders of live coral from the base of each *M. annularis* subjected to core sampling. To reduce possibility of tissue rejection, plugs were only used on the corals from which they were taken. Since the plug barrel is slightly larger in diameter (0.7 cm) than the barrel used to collect the core samples, a plug is produced that fits snugly into the core hole. In order to maintain plugs flush with the top of the coral colony and to prevent their removal by divers, a shimming material of fiberglass reinforced packaging tape was wrapped around each plug's base to create a wedging effect so that plugs had to be forcibly inserted. The hole left at the coral's base by removal of the live core plug was sealed with a coded pre-cast cement plug to prevent infection and bioerosion, as described in Hudson (1981a), and to maintain identity of individual corals. Closeup color photographs are being taken of all core plugs at intervals of approximately two months so that healing times of coring lesions can be determined (Figures 5.4, 5.5). Average water depth over the 12 corals selected for study was 5.0 m, with a range of 3.8 to 6.4 m. Depth measurements were made by divers from the water surface to the top of each core plug.

Results

Growth history records of 20 *M. annularis* were constructed and analyzed from x-radiographs of core material collected at Looe Key reef during 1980 and 1983. Of these, eight were de-selected on the basis of having insufficient growth records or indistinct annual density bands. Annual growth rates of the 12 remaining corals were tabulated and each coral's yearly growth rate averaged at 5-year intervals (Figures 5.6 - 5.9). This allowed a direct comparison with published growth history data of this species from a similar study (Hudson, 1981a) in the Key Largo Coral Reef Marine Sanctuary (Figure 5.10). The youngest coral in the present study is 105 years of age, while the oldest has a density band chronology that dates back to 1793, a span of 190 years. Since ages of corals varied greatly (as much as 85 years), it was decided that only those growth rate data that are represented in growth records of all 12 corals would be used for comparative analysis.

Averaged growth rates of each colony together with maximum-minimum growth deviations were plotted as line graphs at 5-year intervals, so that significant changes in growth of individual corals could be recognized. In addition, growth rate data from all corals were combined into a single graph (Figure 5.9) to illustrate long-term trends in growth within the *M. annularis* community at Looe Key reef.

Individual growth history graphs reveal that 10 of 12 Looe Key *M. annularis* studied have a 60- to 75-year history of declining annual growth, a condition that was apparently initiated between 1908 and 1923. This trend, characterized by a gradual decrease in skeletal accretion rates, is even more evident when growth data of all Looe Key *M. annularis* are combined (Figure 5.9). Of particular interest is that during the most recent 5-year growth period (1978 - 1983), only two colonies (shown as E4' and D1' in Figure 5.9) increased their rate of vertical growth. Since determinate growth (reduction of growth rate with age) is generally not thought to be operational in reef-building corals (Highsmith, 1979), it appears that a gradual deterioration in some aspect of the reef environment is most likely responsible for the observed long-term decline.

Coincident with the decline of *M. annularis* growth rates at Looe Key reef in 1908 was the construction of Henry Flagler's Overseas Railway from Miami to Key West, Florida. Begun in 1904 and completed in 1916 (Corliss, 1953), this southernmost extension of the Florida East Coast Railroad Line was in operation until 1935. That year a disastrous; storm, the infamous "Labor Day Hurricane," struck the Florida Keys, severely damaging many miles of railway embankments there (Corliss, 1953). This catastrophic event, together with worsening economic conditions brought about by the great depression, forced owners of the railroad to abandon the Florida Keys segment of the line. The company sold this portion of the railway to the State of Florida, which in turn eventually converted it into a road for automobile traffic (today's Overseas Highway) by building a roadbed directly on top of the original railway.

Except for the recent building of new and wider bridges and widening of existing fills and embankments to accommodate more vehicular traffic, most of the modifications to land and water made by the building of the Overseas Railway remain unchanged today. Of these alterations, the most profound was the construction of permanent earthen causeways to bridge shoal areas between islands. This cost effective technique was used most extensively in the middle Keys area between Marathon and Upper Matecumbe Key (Figure 5.11). Here, tidal passes that had previously permitted water exchange between Florida Bay and the Atlantic Ocean were partially blocked by manmade embankments. According to Corliss (1953), about 20 miles (32 km) of the 106-mile (170-km) route between Jewfish Creek and Key West (Figure 5.11) were bridged by fills or embankments. Materials for these elevated causeways of mud, sand and rock were dredged and blasted from the surrounding Bay bottom and islands along the railway's path.

In order to determine if these perturbations could have contributed to the, observed decline in growth of Looe Key *M. annularis*, natural tidal openings and the manmade causeways that partially block them were both measured from modern navigational charts issued by the National Ocean Service. Copies of the US Coast and Geodetic Survey maps of the Florida Keys that were issued between 1895 and 1900 were obtained from the National Archives and used in conjunction with those charts previously mentioned to establish where natural land ended and manmade landfill began. Measurements taken by the author from National Ocean Service chart #11449 (Matecumbe to Grassy Key) indicate that, due to causeway construction, the effective tidal opening between Grassy Key and Long Key was reduced from 8.7 km to 4.0 km, while open water from Long Key to Lower Matecumbe Key was reduced from 5.8 km to 2.0 km. Similarly, the tidal exchange area separating Lower Matecumbe Key from Upper Matecumbe Key was reduced from 3.5 km to only 1.0 km (Figure 5.11).

Of the 18 km of natural tidal passes that existed between Grassy Key and Upper Matecumbe Key prior to building of the railway extension, 11 km (61%) were lost as a direct result of causeway construction there. In contrast, causeways were used only sparingly to bridge large tidal passes below Grassy Key (National Ocean Service charts #11445 and #11449). Of these, the opening spanned by the Seven Mile Bridge is by far the largest tidal pass in the entire Florida Keys. Prior to construction, it was approximately 10.5 km across. Space now occupied by embankments, together with Pigeon Key (a small island over which the bridge passes), amount to about 1.0 km, leaving a post-construction opening of 9.5 km. Tidal passes at both Bahia Honda Channel and Spanish Harbor Channel were each about 1.6 km across before building of the railway. Loss of tidal opening at Bahia Honda Channel from embankment building was only about 0.1 km, leaving a 1.5 km opening. Spanish Harbor Channel, however, was reduced nearly 0.5 km, leaving only about 1.1 km for tidal relief there.

Other tidal channels that could conceivably effect Looe Key reef are: Pine, Wiles, Kemp and Bow Channels (Figure 5.11). Before alterations by railway construction, the combined openings of these four channels amounted to approximately 4.5 km. Embankment building blocked off about 2.1 km of these passes, leaving about 2.4 km of tidal openings. Although these passes are directly inshore of the study area, they are considerably narrower and much shallower than those previously described. Average water depth of less than 2 m prevails over large areas in all four channels, whereas depths in excess of 3 m are common along both the Gulf and Atlantic Ocean sides of Spanish Harbor Channel, Bahia Honda Channel and Moser Channel (spanned by Seven Mile Bridge). Bahia Honda Channel with depths of 7 - 8 m at the bridge span is the deepest tidal pass between Key West and Miami.

Ginsburg and Shinn (1964) suggested that the absence of living reefs opposite major tidal passes in the Florida Keys is the result of chilled turbid water from Florida Bay and the Gulf of Mexico flowing out these tidal openings onto the reef tract during periods of severe winter storms. A recent study by Hudson (1981b) indicated that growth and survival of *M. annularis* on Florida reefs are strongly influenced by both heated and chilled waters that are generated in the Gulf of Mexico and Florida Bay. A landmark study by Roberts *et al.* (1982) proved conclusively that outbreaks of severe winter weather (cold fronts) that periodically impinge on the Florida Keys are capable of lowering inshore water temperatures to levels that have been proven lethal to major reef-building corals, including *M. annularis* (Mayor, 1914). In addition, Roberts *et al.* (1982) documented transport of these chilled water masses to offshore reef areas through major tidal passes in the middle and lower Florida Keys.

Based upon evidence presented earlier in this report, it is clear that passage of tidal waters through major breaches in the Florida Keys has been moderately to severely restricted as a result of embankment construction across tidal openings. It is this author's contention that extensive use of landfill embankments between Grassy Key and Upper Matecumbe Key between 1905 and 1908 created a barrier of sufficient magnitude that a substantial portion of tidal waters normally exiting there is now being diverted westward to deeper less restricted openings such as Moser Channel, Bahia Honda Channel and Spanish Harbor Channel. If this is true, then the added discharge of unsuitable water from this portion of Florida Bay could conceivably account for the decline in coral growth rate at Looe Key.

It in interesting to note that average growth of 10 *M. annularis* (Figure 5.10) an inshore patch reef in the Key Largo Coral Reef Marine Sanctuary (Figure 5.1) began to increase following completion of Flagler's railway. Farther offshore in an environment similar to that of Looe Key reef, 10 *M. annularis* at Molasses reef (Station L) also registered a slight increase in their rate of growth (Figure 5.10). During this same time period, 10 *M. annularis* at nearby Station K (Red Num Buoy 4DS) increased their average rate of vertical growth (Figure 5.10). Although circumstantial, timing of these growth rate increases does coincide with extensive construction of embankments in tidal passes of the middle Keys. It seems reasonable to assume that growth of *M. annularis* would be enhanced in those areas where tidal water discharge detrimental to their growth was reduced. The abrupt drop in growth rate at Station D is presumed to have been caused by cold water stress during the winter of 1941 - 1942. Cause of the 1918 - 1923 growth decline on the two outer reefs is unknown.

Discussion and conclusions

Critical examination of 1,550 yearly growth bands revealed few instances of major growth interruptions in Looe Key *M. annularis*. Although detectable winter stress bands are visible in some corals, particularly at the 1941-42 and 1969-70 horizons, there is little evidence to suggest an environmental trauma, such as the cold-water catastrophe at Hen and Chickens Reef, that could have inflicted severe damage to these corals. Proximity of Looe Key reef to warm clear waters of the Florida Current undoubtedly enable this ecosystem to survive periodic insults of unsuitable tidal waters from the Gulf of Mexico and Florida Bay. Partial shielding by the lower Florida Keys land masses has also played a vital role in maintaining this reef's vitality. A virtual absence of large flourishing reefs directly opposite major tidal passes is convincing evidence of protection by land masses. Whether or not reefs in the middle Keys have responded favorably to the reduction in tidal outflow has yet to be investigated. There is still considerable tidal exchange in the middle Keys area, particularly through the viaduct at Long Key.

In conclusion, this study indicates a 60- to 75-year suppression in vertical skeletal accretion rates of Looe Key reef's most prominent reef-building coral. Whether or not the observed reduction in growth rate is primarily attributable to building of the Overseas Railway or to a such broader based ecological perturbation remains to be proven. Although there were brief periods of a slight overall growth resurgence in the *M. annularis* community in 1953 and 1978, the long-term trend in most specimens examined has been one of gradual decline. Future periodic examination of growth rate trends in *M. annularis* at Looe Key reef will provide a continuing and valuable index of this sanctuary's vitality.

Acknowledgments

The author gratefully acknowledges the invaluable assistance of Captain Roy Gaensslen of the charter vessel SEA ANGEL and William Zempolich during field operations. Daniel M. Robbin is especially thanked for his field assistance and for technical aid in photography and drafting. Acknowledgment and appreciation are also due the following institutions and persons who contributed ideas and information on the history of the Overseas Railway to Key West: Cartographic and Architectural Branch, National Archives Records Service; Mr. F. R. Williams of the Florida Department of Natural Resources, Division of State Lands; Becky Smith, Historical Association of South Florida; Mr. Wright Langley, Key West Historic Preservation Board; Henry M. Flagler Museum; Seth Branson, Ms. Leslie Mami, Mr. Richard McCallister and John Roberts of the State of Florida Department of Transportation; Mr. William Krome, son of the engineer who completed construction of the Overseas Highway; Michael Slayton, US Army Corps of Engineers; Ms. Betty Bruce, Director of Archives and Records, Key West Public Library. Thanks are due to Eugene A. Shinn who provided encouragement and helpful suggestions throughout the study. Barbara Lidz is especially thanked for her untiring efforts in critically reviewing and typing of the manuscript. Her many helpful suggestions and unselfish aid are gratefully acknowledged.

This research was funded in part by the National Oceanic and Atmospheric Administration Sanctuary Programs Office, Office of Coastal Zone Management, and is part of a comprehensive study on the Looe Key National Marine Sanctuary. Dr. Nancy Foster and Carroll Curtis were responsible for administration of the study and its coordination with Dr. James Bohnsack (National Marine Fisheries Service). Billy Causey, Manager of the Looe Key National Marine Sanctuary (Florida Department of Natural Resources, Bureau of Land Management) and Rangers of the Florida Marine Patrol are thanked for their cooperation during the survey.

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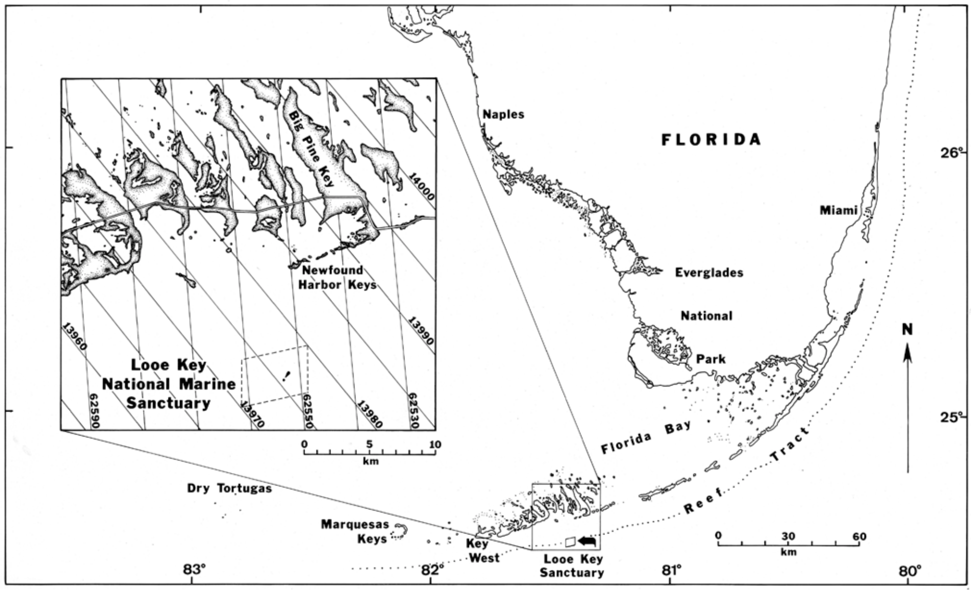

Figure 5.1. Index map for Looe Key National Marine Sanctuary. Loran C lines of position for Stations 1 (13900 µsec) and 4 (62500 µsec) for the Gulf of Mexico were reproduced from National Ocean Service chart #11442. Coast Guard Marker 24 within sanctuary (dashed lines on inset) indicated by standard nautical chart symbol for position of lighted fixed marker.

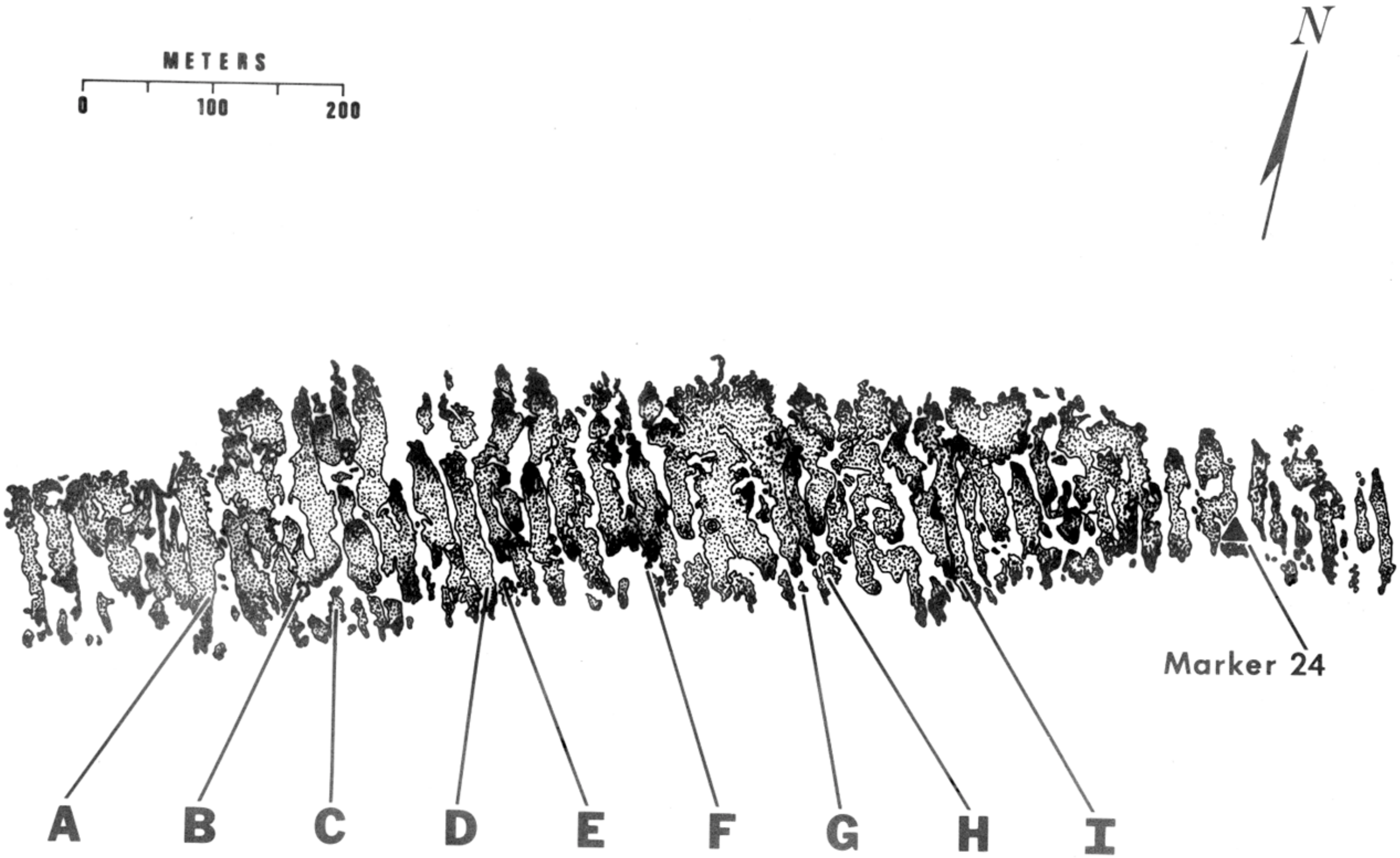

Figure 5.2. Map of core area in Looe Key National Marine Sanctuary showing spur and groove system of coral buttresses.

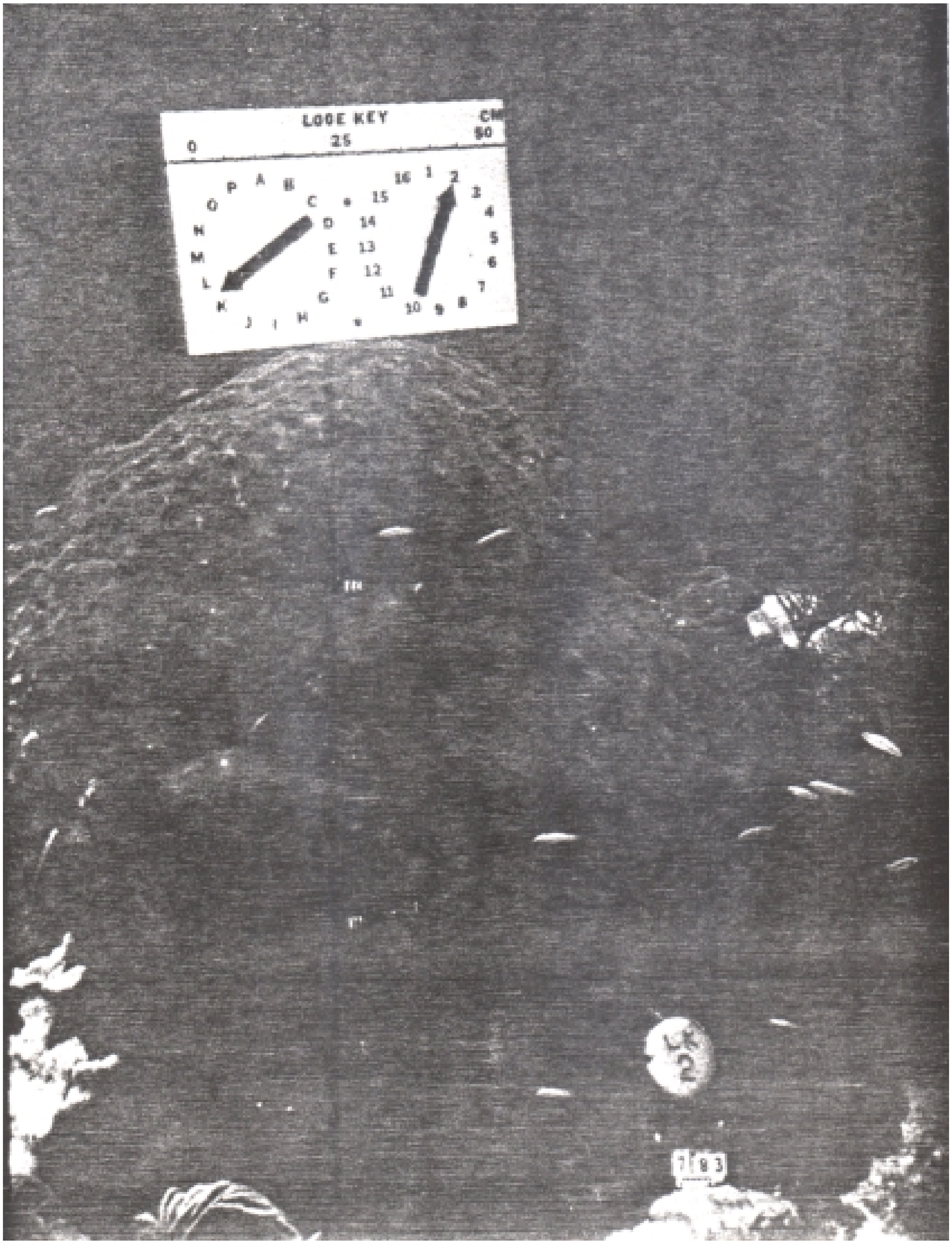

Figure 5.3. Panoramic view of 2-m high *Montastraea annularis* on seaward tip of spur buttress at Looe Key reef. Cement plug in foreground seals hole left by removal of live core plug.

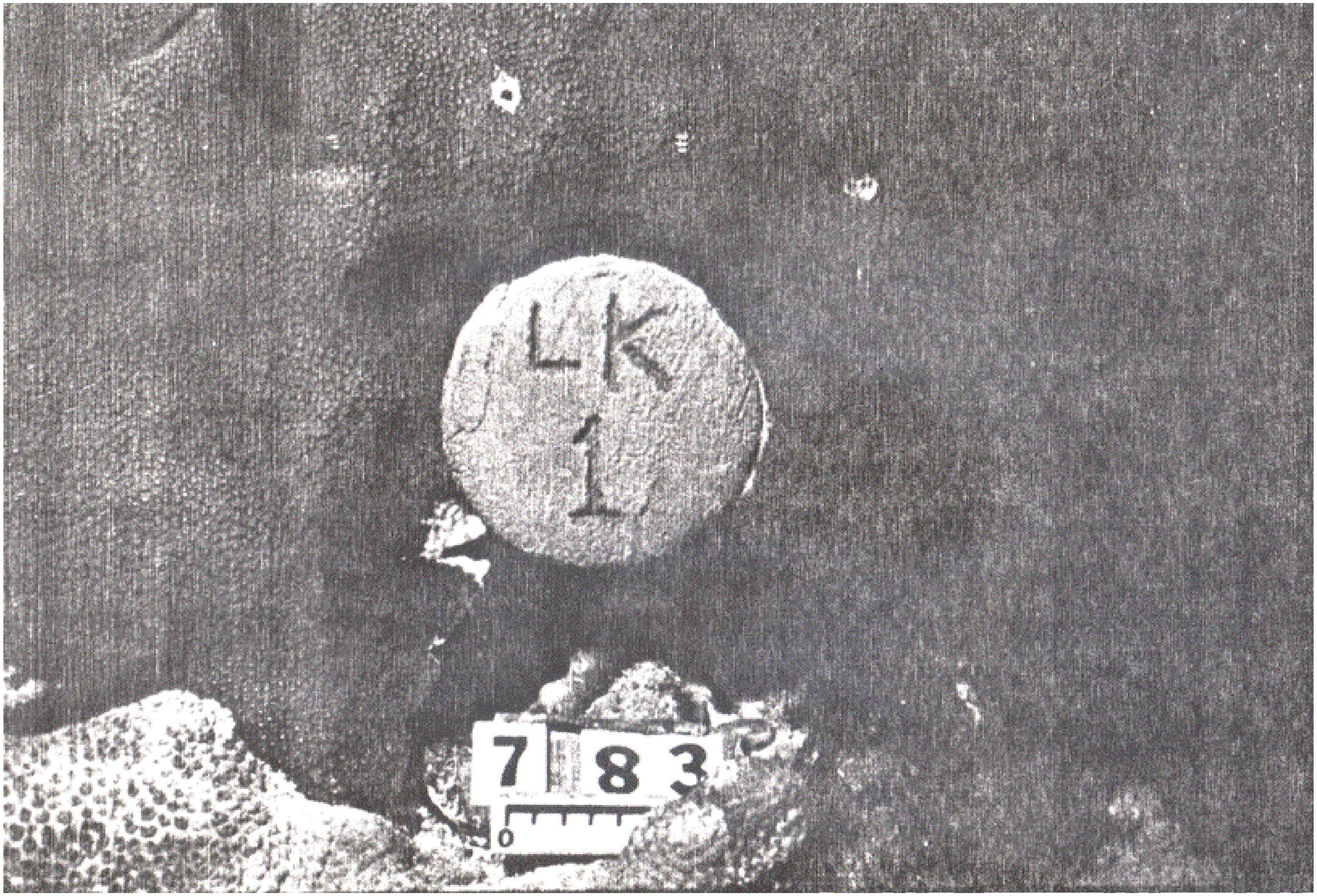

Figure 5.4A. Newly installed pre cast cement plug (LK1) fills hole left by removal of live core plug. Note two small nail holes above cement plug from installation of coring template. Scale bar is in centimeters.

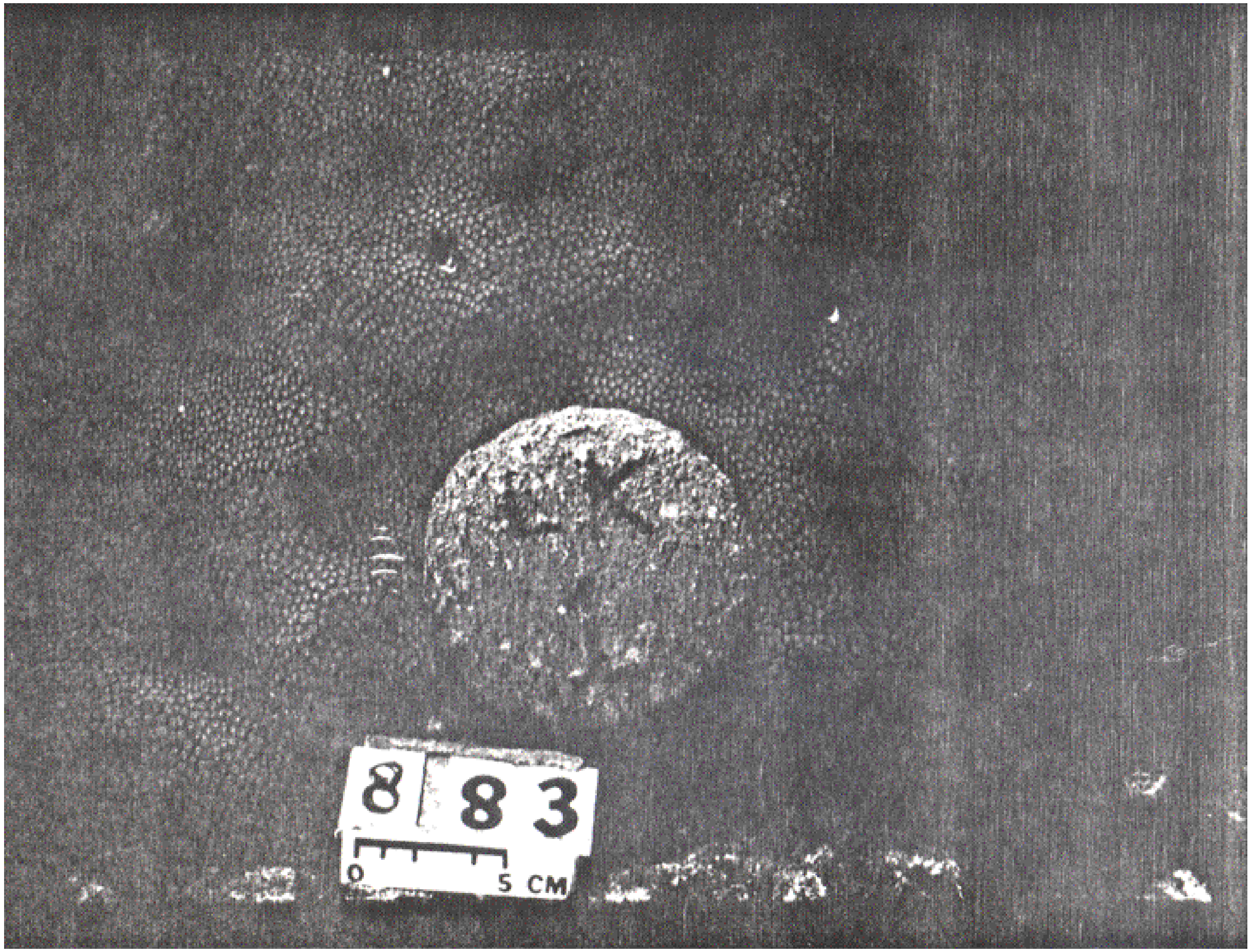

Figure 5.4B. Cement plug (LK1) rephotographed one month after installation. Note that lesions have been covered with new tissue. Also note that most of the lesions associated with coring have healed.

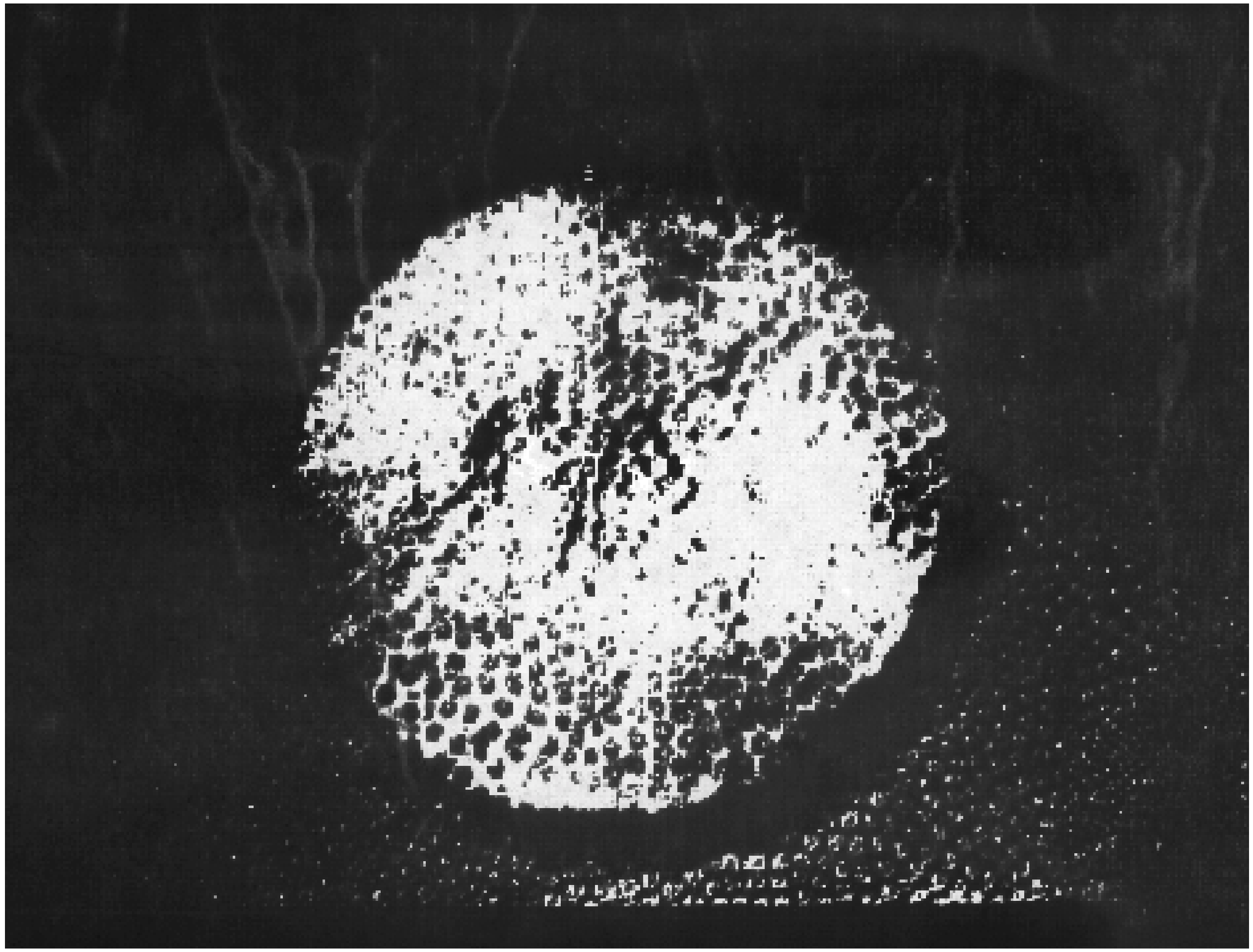

Figure 5.5A. Closeup photograph of live core plug (LK6) three months after being implanted. White appearance of coral tissue is due to expulsion of zooxanthella and is probably the result of transplant stress. Plug diameter is approximately 10.5 cm.

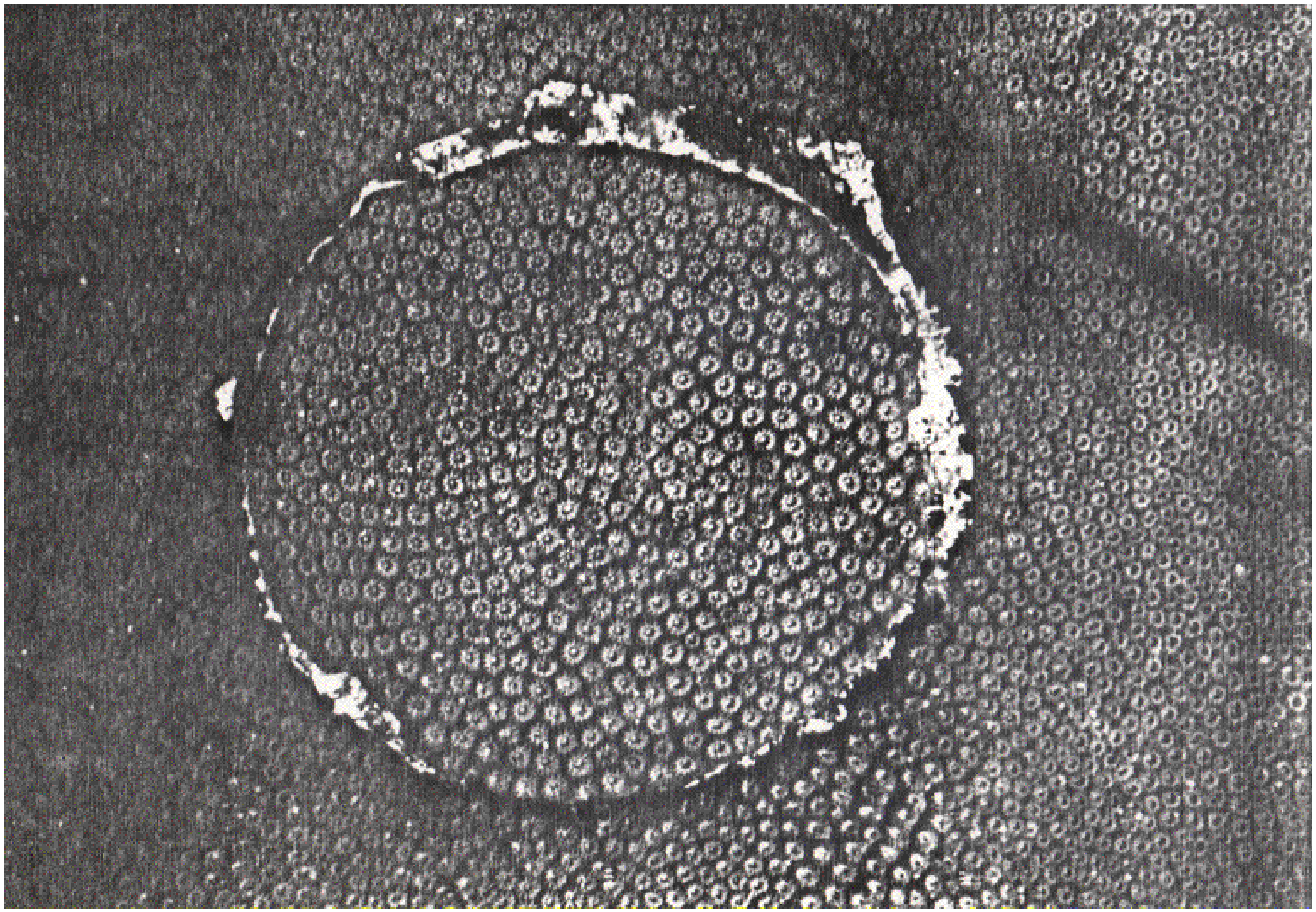

Figure 5.5B. Closeup photograph of live core plug (LK6) six months after being implanted. Note that plug color has returned to normal and surfaces of both core hole and core plug have healed over. Plug diameter is approximately 10.5 cm.

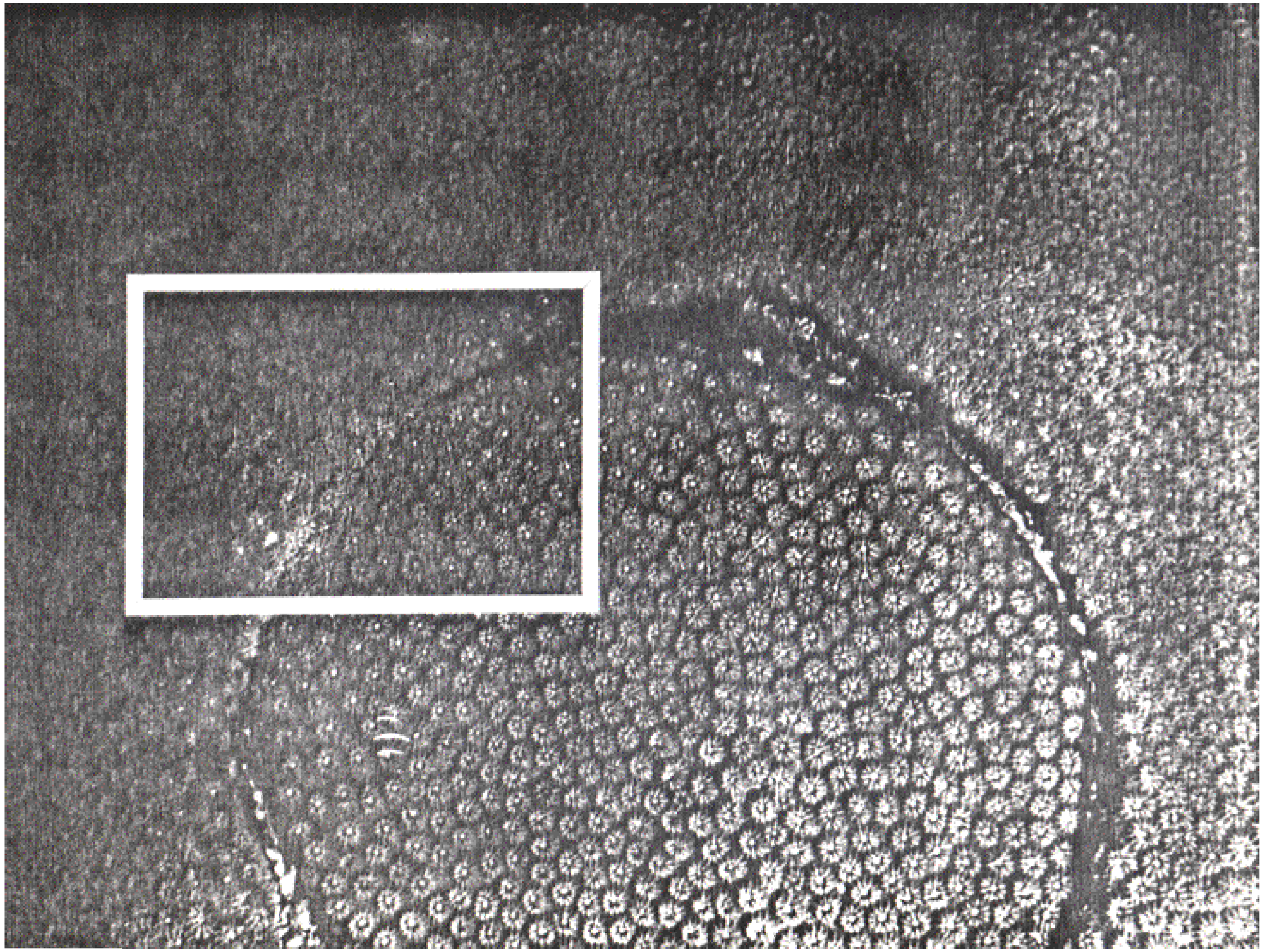

Figure 5.5C. Closeup of live core plug (LK1) nine months after implanting. Note fusion of polyps between parent coral and implanted plug. Plug diameter is approximately 10.5 cm.

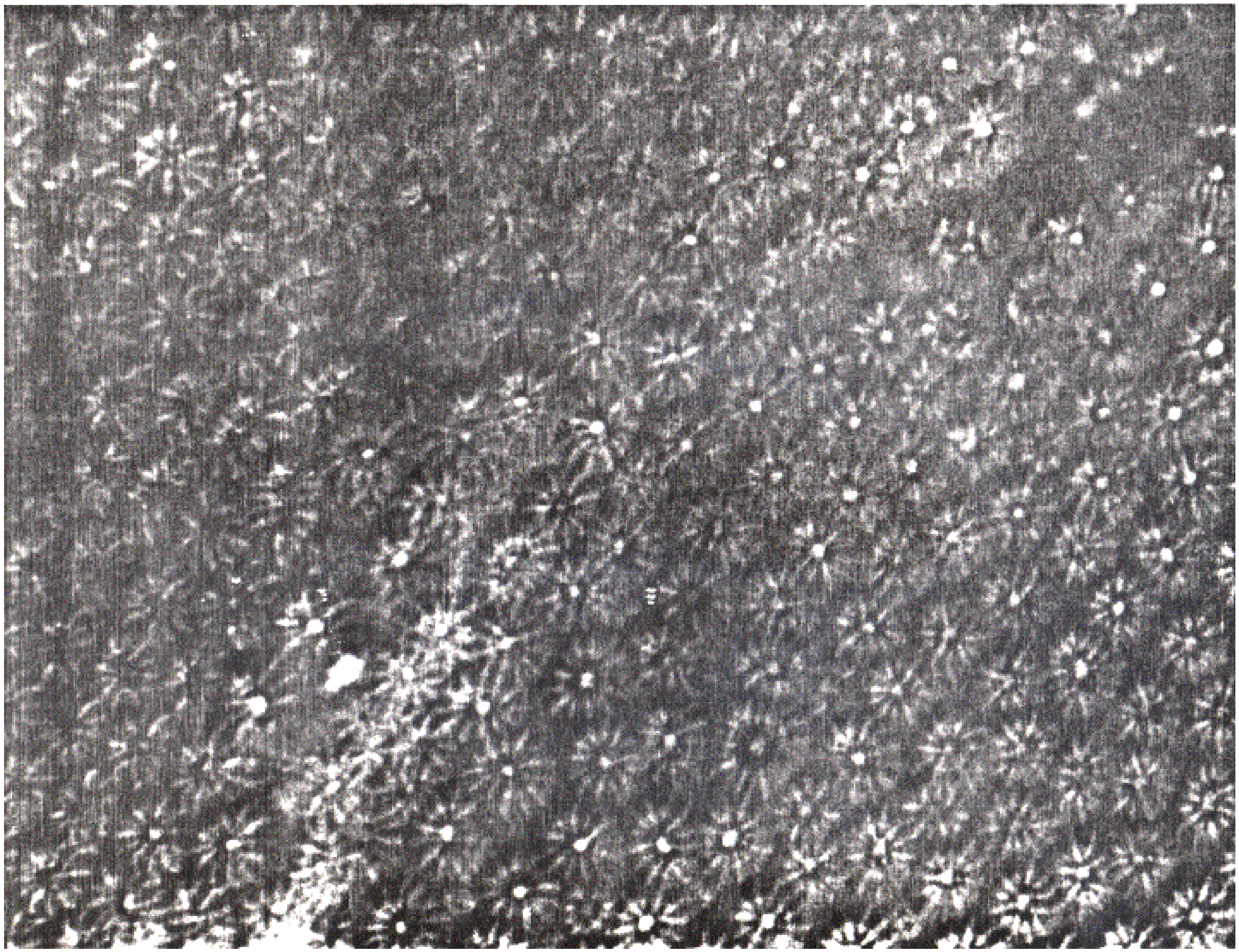

Figure 5.5D. Magnification (x 5) of inset in Figure 5.5C. Note closure and partial overlap of core plug suture line by newly formed polyps.

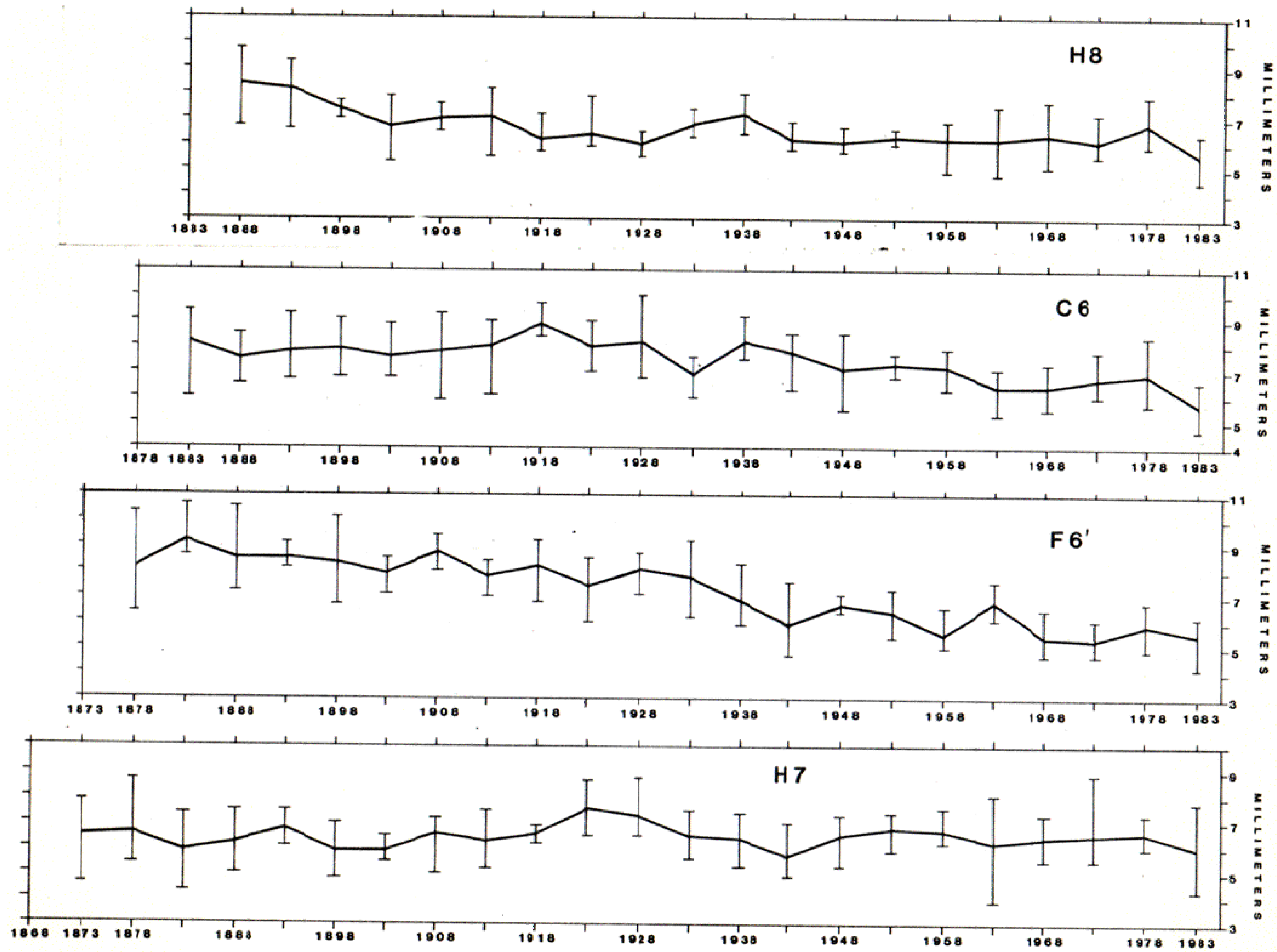

Figure 5.6. Growth history graphs of individual Looe Key *Montastraea annularis* plotted at 5-year intervals. Solid line indicates growth rate average. Vertical bars indicate maximum-minimum growth rates. Letter/number code identifies individual corals. Use this code to find location of specific corals in Figure 5.2.

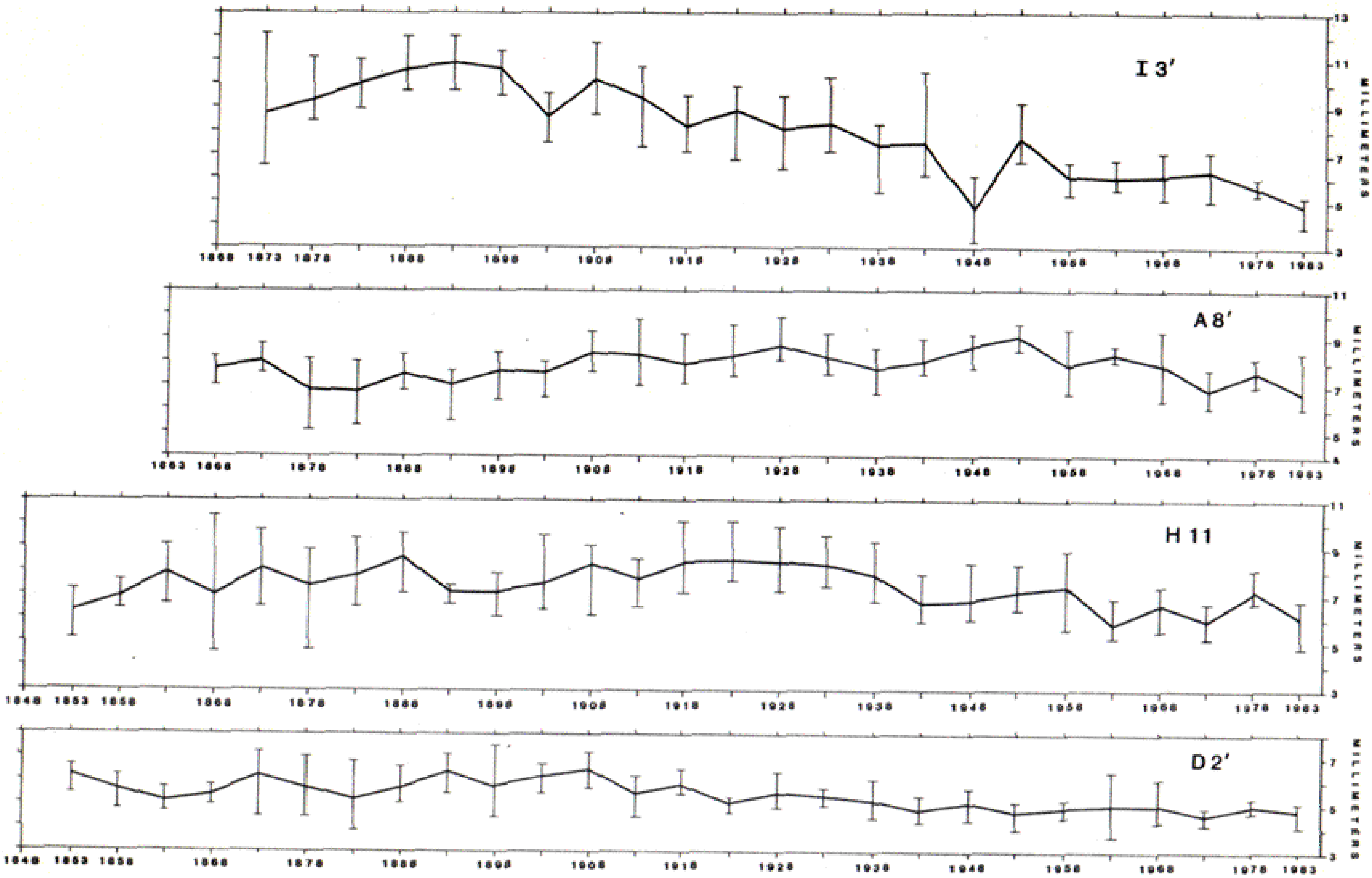

Figure 5.7. Growth history graphs of individual Looe Key *Montastraea annularis* plotted at 5-year intervals. Solid line indicates growth rate average. Vertical bars indicate maximum-minimum growth rates. Letter/number code identifies individual corals. Use this code to find location of specific corals in Figure 2.

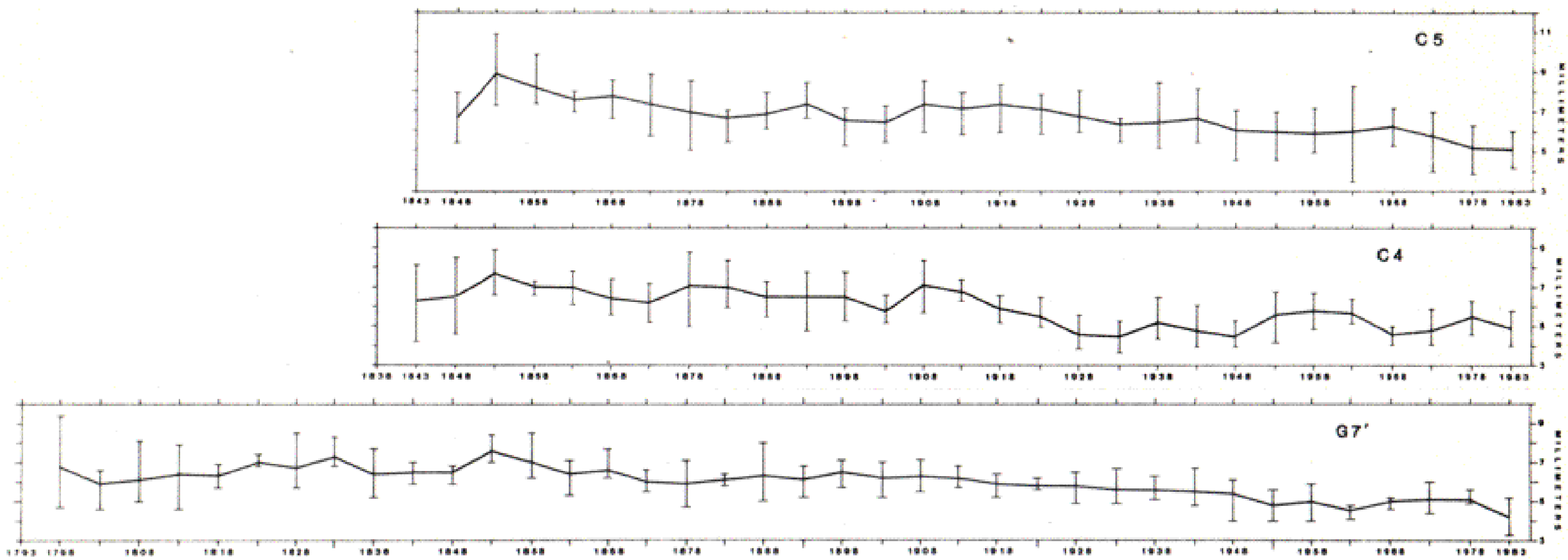

Figure 5.8. Growth history graphs of individual Looe Key *Montastraea annularis* plotted at 5-year intervals. Solid line indicates growth rate average. Vertical bars indicate maximum-minimum growth rates. Letter/number code identifies individual corals. Use this code to find location of specific corals in Figure 5.2. Note that GV is the oldest coral cored in this study.

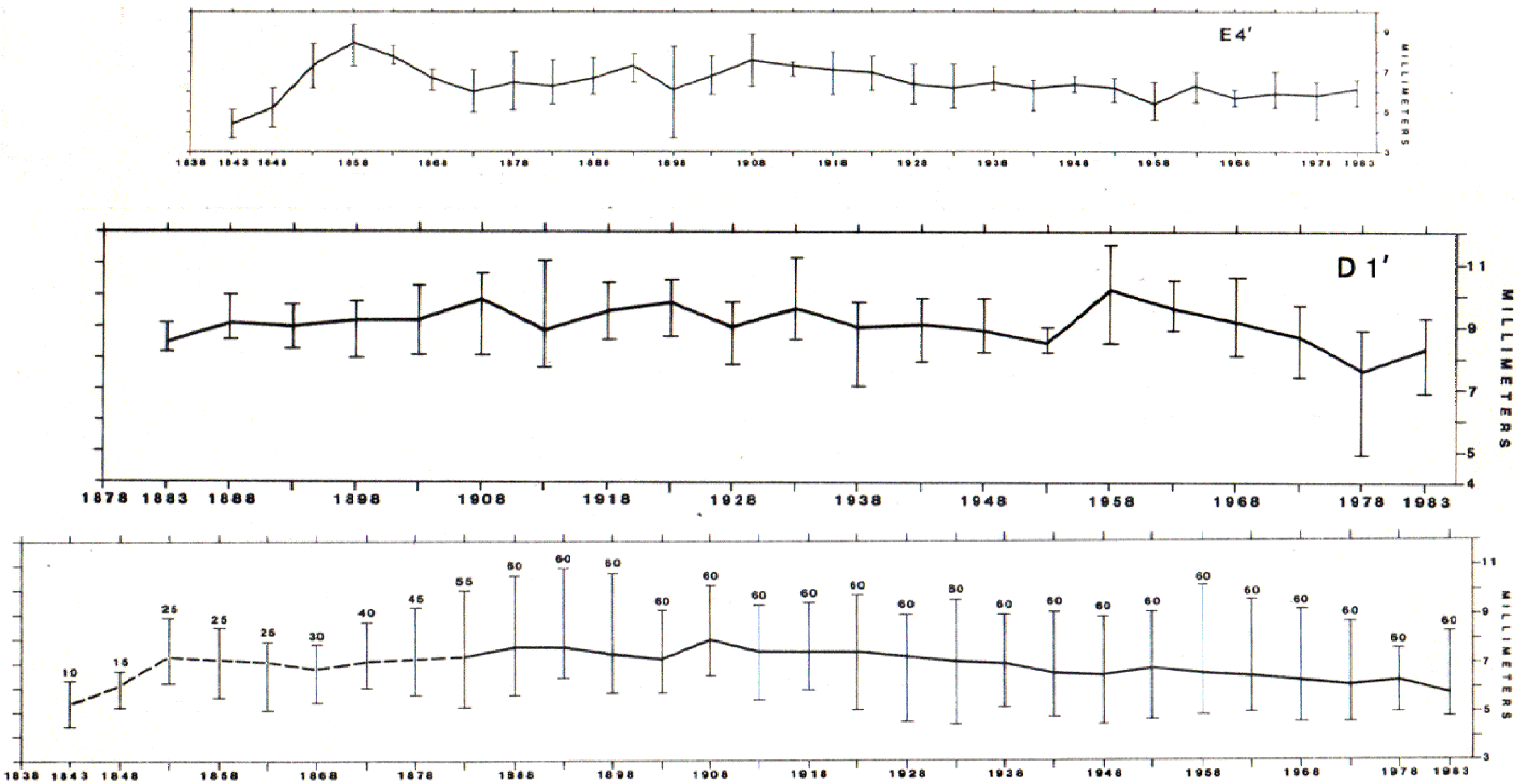

Figure 5.9. Growth history graphs of individual Looe Key *Montastraea annularis* plotted at 5-year intervals. Solid line indicates growth rate average. Vertical bars indicate maximum-minimum growth rates. Letter-number code identifies individual corals. Use this code to find location of specific corals in Figure 5.2. Corals EV and DI are the individuals that show a growth rate increase during 1978 - 1983. Graph at bottom shows combined growth rate average, for all corals at Looe Key reef. Note growth decline from 1908 to present.

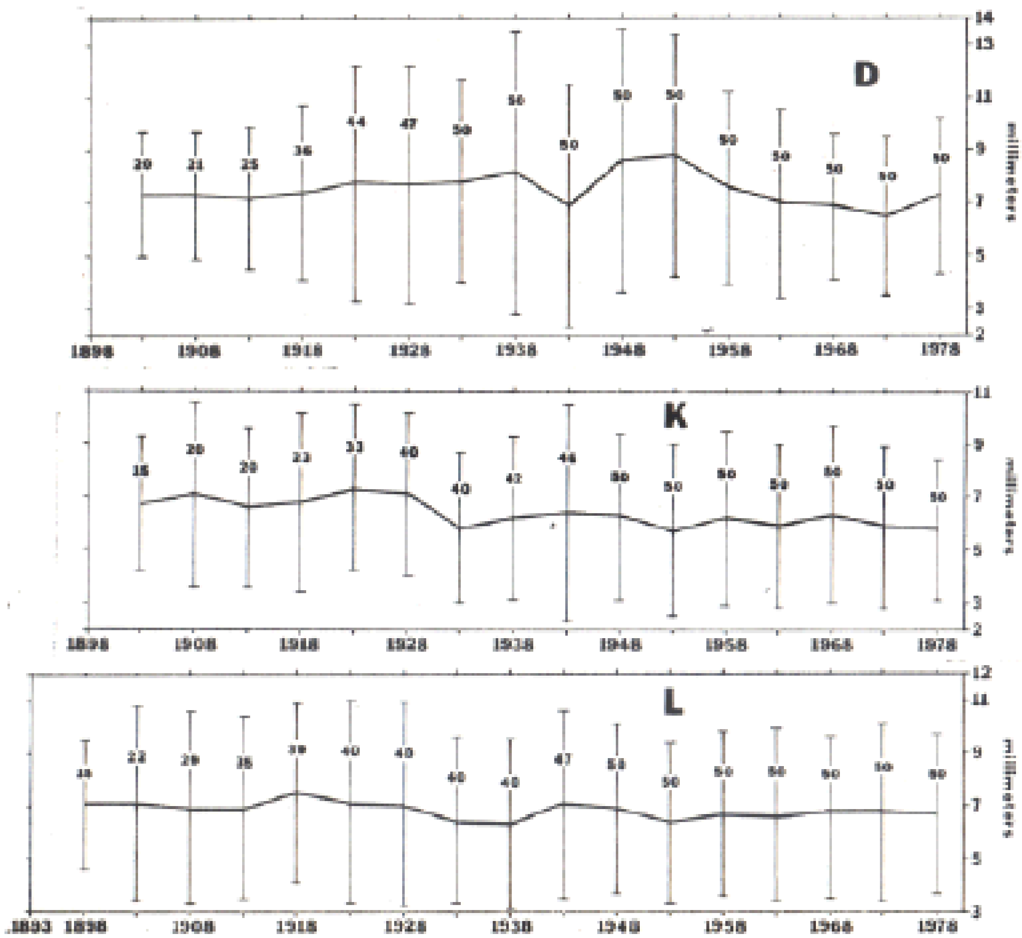

Figure 5.10. Composite growth history graphs showing average growth rate of 10 *Montastraea annularis* from the Key Largo Coral Reef Marine Sanctuary. Vertical bars represent maximum-minimum growth at the 65% level. Solid line represents average growth rate. Numbers in vertical bars represent total number of yearly measurements for each 5-year period. Station D is Basin Hill Shoal; Station L is Molasses Reef; Station K is Red Num Buoy ADS.

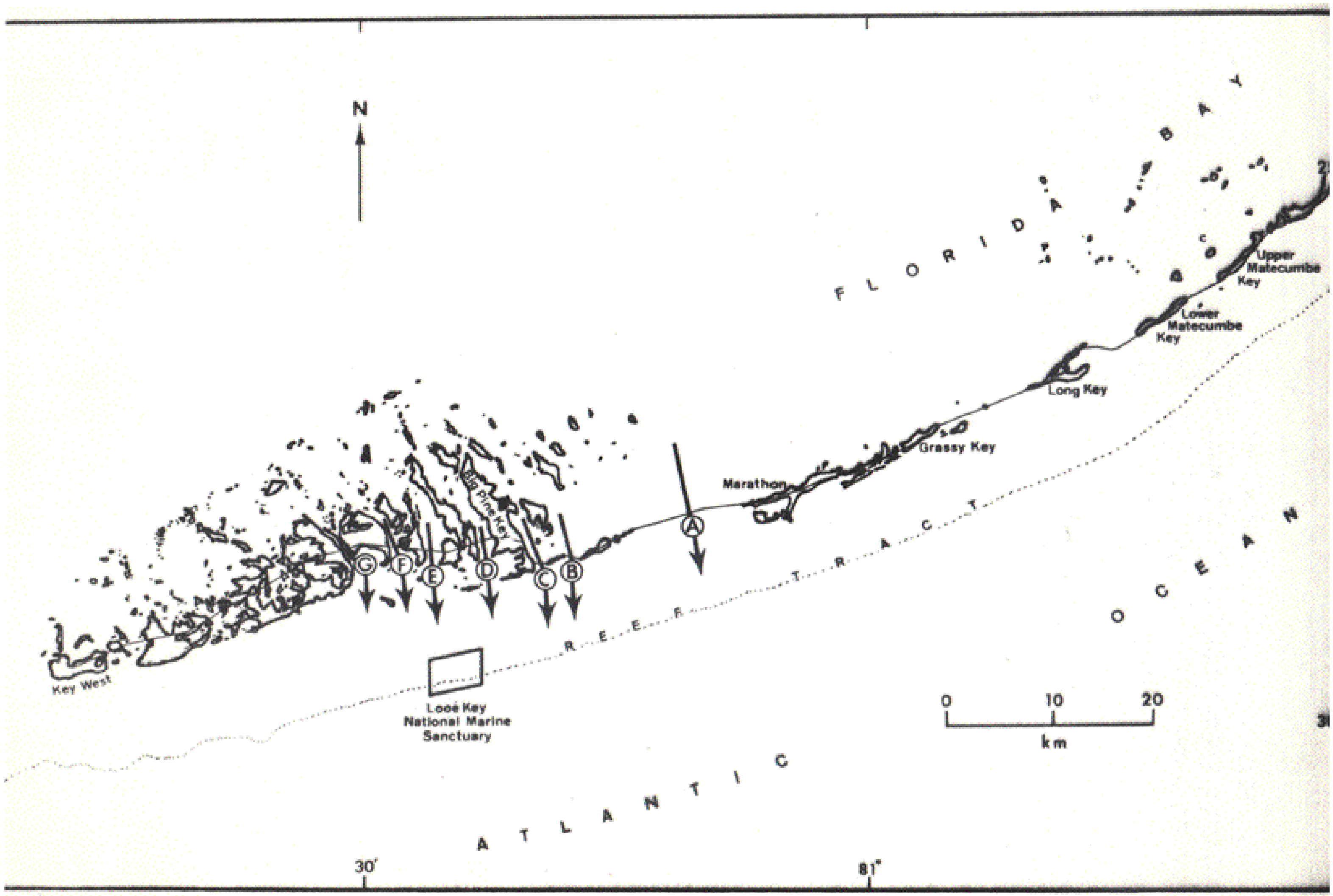

Figure 5.11. Map of Florida Keys from Upper Matecumbe Key to Key West. Lettered arrows A through G indicate: A) Moser Channel, 3) Bahia Honda Channel, C) Spanish Harbor Channel, D) Pine Channel, E) Niles Channel, F) Kemp Channel, and G) Bow Channel.

CHAPTER 6

LOOE KEY NATIONAL MARINE SANCTUARY RESOURCE SURVEY: CORALS AND OTHER MAJOR BENTHIC CNIDARIA

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Introduction

The HMS Looe, a 44-gun British frigate, wrecked on a Florida Keys reef in February 1744 (Peterson, 1955). The small emergent rubble island on the reef flat was named Looe Key. Cannons and other artifacts of the Looe were removed long ago and the island has since disappeared, but evidence of the wreck still can be seen in the eastern fore reef.

Looe Key reef is a bank reef located 12.9 km, 200° off the SW tip of Big Pine Key, Florida (24° 37' N, 81° 24' W) (Figure 6.1a). The reef and adjacent coral and seagrass communities, encompassing a 5.3 nmi^2 area, were designated as Looe Key National Marine Sanctuary (LKNMS) in January 1981.

Agassiz (1852) in his early studies of Florida reefs, described Looe Key reef as a "series of submarine elongate hillocks rising above sealevel in the form of islands or boulders in a few places". Recently published research on Looe Key reef is scarce. Antonius *et al.* (1978) conducted a pre-sanctuary resource survey. An environmental impact statement was provided by NOAA (1980) in due process of Implementing the sanctuary status. A study by Shinn *et al.* (1981) provided Information on the reef's age and Its spur and groove development.

Consistent with the main goal of the national marine sanctuary program to "...promote and coordinate research to expand scientific knowledge of significant marine resources and improve management decision making," NOAA's Sanctuary Programs Division funded a multi-disciplinary survey at LKNMS coordinated through National Marine Fisheries Service Southeast Fisheries Center. The survey's main purpose was to develop a resource map of sanctuary coral, sponge and reef fish resources through in situ observations and measurements of physical features. The following work provides baseline information an corals and other benthic Cnidaria that are major faunal components.

Methods and materials

A snorkeling /SCUBA reconnaissance of Looe Key reef was conducted in June 1983. Reef fish and coral scientists and management personnel made preliminary site selections based on low level, high resolution aerial photographs. Areas designated for quantitative coral sampling included sites in the eastern, middle and western spur and groove formation, a forereef community (to 11 m maximum depth) and livebottom communities WNW and N of the main spur and groove tract.

In August 1983, six sites (Figure 6.2) were quantitatively sampled along traverses using 1-m^2 plots and a matrix of transects at each site (Table 6.1). Site I was located adjacent to navigational marker "24" at the eastern fringe of the spur and groove tract (Figure 2). A small spur was sampled with eight 1-m^2 quadrats at random meter numbers along a 100 m traverse generally bisecting the spur from north to south. Sites II and III were in the middle and western spur and groove tract, respectively (Figure 6.2). A 200-m traverse was established at both sites extending from the seaward southern tip bisecting the finger over the reef flat into the rubble zone. East and west transects were set at randomly selected meter numbers within habitat zones along the 200-m traverse. Quadrats were sampled at odd or even numbers along east or west laid transects, respectively. Fifty-six 1-m^2 quadrats were censused at middle spur and groove site II; 55 at western spur and groove site III (Table 6.1). Depths were taken at 10-m intervals on top and at the base of the spurs (Table 6.2).

An area seaward of western spur and groove site III dominated by *Montastraea* buttresses was selected as site IV (Figure 6.2). Sixteen 1-m^2 quadrats were censused at random meter numbers along a 100-m traverse run due west through the habitat (Table 6.1). Site V was an intermediate depth livebottom community WNW of the main spur and groove tract (Figure 6.2, insert). A traverse was established through the approximate center of the community and extended 83 m into sand with sparse gorgonians. Data were gathered from 18 1-m^2 quadrats at random meter numbers along the traverse (Table 6.1). Site VI was located in a shallow livebotton community extending east to west inshore of the main spur and groove tract (Figure 6.2, insert). Two traverses, 50 and 82 m long, were established here. A total of 19 1-m^2 quadrats were sampled at random meter numbers (Table 6.1).

Data acquisition followed Weinberg's (1981) drawn map technique which included species identification and abundance of octocorals, stony corals (Milleporina and Scleractinia) and per cent stony coral cover within each 1-m^2 quadrat. Sampling adequacy was determined by asymptote of stony and octocoral species area curves. The common zoanthids, *Palythoa caribbea* and *Zoanthus sociatus*, and the corallimorph, *Ricordea florida*, were also censused.

Vouchers were collected for laboratory confirmation of questionable identifications. Qualitative photographs were taken to document habitats and zones therein.

Analyses of data included calculation of species composition, frequency, abundance, density/m^2 ($\bar{x} \pm s$), diversity (H') $\log_2$, and evenness (J').

The ORDANA benthic analysis IBM 360/370 program (Bloom *et al.,* 1977) was used to compute intersite faunal similarities. Classification analyses were based on cnidarian species abundance data. Data were transformed to presence-absence for qualitative species co-occurrence (Czekanowski's Qualitative Coefficient) and to 4th root $x^{1/4}$ (Field *et al.,* 1981) for quantitative analyses [Czekanowski's Quantitative (Bray-Curtis) Community Coefficient] (Bloom, 1981). The octocoral and stony coral faunas were analyzed independently for all six sites and for all zones within sites II and Ill. Analyses were then repeated for all Cnidaria combined. Values were rounded to two decimal points. Results are presented on habitat maps.

Results and Discussion

Looe Key National Marine Sanctuary encompasses a mosaic of seagrass, sedimentary, reef and livebottom communities. The last two are the subject of the present study.

The outer Florida reef platform is composed of three topographic types: (1) flourishing reefs displaying coral zonation, (2) barren outer reef flats, and (3) outer reef rubble mounds (Hulter, 1971). Looe Key reef is in the first category and exhibits only minor differences from other bank-barrier reefs in the Florida reef tract. Distinctive features of these reefs include vertical zonation of coral off the reef front, the presence of spur and groove formations, and the presence of *Acropora palmata*.

Geologically, *Acropora palmata* formed the reef flats of many Florida outer reefs as colonies grew in place to sea level and died from overcrowding (Shinn, 1963). *Acropora palmata* was not responsible for Looe Key reef flat formation which is essentially consolidated rubble overlying a sediment filled bedrock depression, but the species was Looe Key's primary spur builder 800 - 1,000 years ago (Shinn *et al.,* 1981). At present, *A. palmata* is scarce on shallow parts but more common on deeper parts of the spur and groove system. Although overall abundance is low compared to that at other reefs, *A. palmata* is present on more than 70% of the spurs (Bohnsack, this volume). The species often attains large size and provides important habitat for schools of snappers, grunts, and other fishes which seek refuge beneath its branches. *Acropora palmata* grows rapidly and uses fragmentation recruitment to exploit spatial resources; broken branches form new colonies in a relatively short time.

Inshore of the main spur and groove, the back-reef is comprised of seagrasses (*Thalassia* and *Syringodium*) and sand-filled blowouts several meters in diameter. Thick mats of seagrass rhizomes and roots form ledges overhanging the deeper holes. Isolated coral colonies *Diplora clivosa*, *Montastraea annularis*, *Acropora palmata*, *Gorgonia ventalina* and *Pterogorgia anceps*), some washed from more seaward zones, survive here with the queen conch (*Strombus gigas*) and other typical grass flat organisms. Water depths rarely exceed 3 - 4 m.

Spur and groove systems generally are aligned to prevailing waves and swells, i.e., perpendicular to the platform margin; some form at a slight angle to the prevailing sea. Looe Key spurs deviate slightly from a perpendicular orientation (Shinn *et al.,* 1981), with their axes projecting SSE-NNW (Figures 6.1b, 6.2). The spur and groove system at Looe Key (Figure 6.3) extends roughly 1200 m east to west with Individual spurs attaining a length of about 200 m. A band of rubble separates the landward seagrasses from the reef flat. The shallowest portion of the spur and groove system is emergent at low tide. The shallow zone of the spur and groove habitat is characterized by expansive golden mats of *Palythoa* and dense clusters of the bladed firecoral, *Millepora complanata*, both adapted to the environmental. unpredictability of the zone. The few stony coral and octocoral species encountered here represent the hardiest, most successful and abundant species in the adjacent seaward zone.

As relief of the spurs increases in the transition from a relatively flat, high energy shallow reef to an elevated (to 4 m) three dimensional benthic profile, the increased depth and spatial heterogeneity provide numerous niches for octocoral and stony coral exploitation. *Acropora palmata* occurs on top and the lettuce coral, *Agaricia agaricites*, proliferates on the vertical faces of the spurs in this zone. Octocorals become more common, with twice as many species as in the preceding shallower zone. Expansive sheets of *Palythoa* are replaced by small isolated mats. *Millepora complanata* is still moderately abundant.

Octocorals proliferate on top of the spurs as relief of the spurs diminishes toward their termination in about 9 in depth. Colonies of *Montastraea*, *Diploria*, *Colpophyllia*, and *Siderastrea* reach massive proportions and often are excavated on their undersides, creating cavernous Interiors. Increased biotic complexity in this zone can be attributed partially to increased cryptic habitat. These hollow corals are a favorite refuge for spiny lobster (*Panulirus argus*) and other reef organisms.

Slightly offshore of the main spur and groove system, a buttress forereef community reaches its greatest expansion toward the west. Shinn *et al.* (1981) described this as "...an Intermediate reef accumulation with vague, low amplitude, imperfectly-formed spurs." The visual perspective of the area is dominated by massive mounds of *Montastraea annularis*. Smaller stony coral species and numerous octocorals occupy the low relief rocky platform, which is frequently interrupted by wide sedimentary areas.

Expansive livebottom areas occur within the Sanctuary, east, west and inshore (north) of the main Looe Key reef. These areas of relatively low relief are dominated by octocorals and sponges, with small colonies of stony corals. Generally their margins fade into patchy sand with sparse octocoral growth and then to an entirely sedimentary community. Livebottom communities differ from the typical patch reefs which have areas of high relief formed by large stony coral colonies and fairly well defined boundaries surrounded by sand halos.

Spur and groove community

Site I consisted of a small, low relief, somewhat homogeneous spur (Figure 6.2) with a cnidarian fauna dominated by octocorals. *Plexaura flexosa* was most abundant and four other species, *Eunicea succinea*, *Pseudopterogorgia americana*, *Muricea atlantica*, and *Gorgonia ventalina* were common. These five comprised nearly 70% of all octocorals encountered (Table 6.3). Six species of stony corals were censused (Table 6.4). *Millepora complanata* contributed about 45% and *Favia fragum* 22% to the stony coral population. The golden sea mat anemone, *Palythoa caribbea*, represented about 11% of all cnidarians sampled (Tables 6.3, 6.4, 6.5).

The shallow rubble zone (Table 6.1) at sites II and III (Figure 6.2) extended 40 - 50 m from the seagrass beds (Plate 6.1) seaward to the reef flat. Although this zone is characterized by a comparative lack of macrobenthos, whole and fragmented colonies of *Acropora palmata* and *A. cervicornis* live here, likely transported inshore by storm waves from deeper spur and groove zones. Some large colonies are overturned and generating new growth (Plate 6.2). These isolated colonies provide shelter for dense populations of *Diadema antillarum* (urchin) and small fish. *Porites astreoides* (Plate 6.3), the most abundant stony coral in this zone, forms thin veneers on the rubble. Seafans (*Gorgonia ventalina*) (Plate 6.4) are abundant, but few other octocoral species were observed. Sparsely scattered colonies of *Plexaura flexosa*, *Eunicea tourneforti* and *Pterogorgia citrina* were attached to the reef limestone or unstable rubble. *Eunicea succinea* was the only octocoral in quantitative samples.

Coalesced spurs seaward of the rubble zone form a discontinuous barrier or platform sometimes awash at low tide. The spurs emerge as distinct relief features 20 - 30 m seaward of the rubble zone (Table 6.2). Overall their relief ranges from 0.3 - 3.9 m. Their width is as great as 21 m adjacent to the reef flat and narrows to 3 - 6 m at their termination where maximum water depth is nearly 9 m (Table 6.2). The generally continuous spur at site II measures 168 m from origin to seaward termination. At site III, the 174 m long spur is broken into two segments by a small cleft about 74 m seaward of the rubble zone.

Four zones are distinctly recognizable at sites II and III. Although the rubble zone is basically barren, the three remaining zones are characterized by changes in species abundance patterns within the cnidarian fauna.

Fauna of the shallow spur and groove (Table 6.1) live in a physically controlled environment. Heavy wave surge, intense solar radiation, wide range of temperature fluctuation, and occasional desiccation during spring low tides limit habitation in this zone. Horizontal surfaces of the spurs are covered almost entirely by *Millepora complanata* (Plate 6.5) and *Palythoa caribbea*, therefore the area is referred to as the *Millepora*/*Palythoa* zone. *Ricordea florida*, a corallimorph, and *Zoanthus sociatus*, another zoanthid anemone, are interspersed among the *Palythoa* mats (Plate 6.6) and *Millepora* colonies.

Millepora complanata, *Agaricia agaricites* and *Porites astreoides* comprised the majority of the stony coral fauna sampled at both sites (Tables 6.6, 6.7). Only four species of octocorals occurred in shallow spur and groove samples, and their relative abundances varied widely (Tables 6.8, 6.9). *Gorgonia ventalina* dominated at site II but was scarce in this zone at site III. *Plexaura flexosa* was most abundant at site III but occurred in few site II samples. *Plexaura* *homomalla* and *Eunicea succinea* were the only other octocorals sampled in this shallow zone at either site.

The *Acropora*/transition zone (Plate 6.7) begins about 70 - 110 m seaward of the rubble zone (Table 6.1). Depths range from 2.4 to 7.0 m on top of the spurs to a maximum of 8.2 m down the vertical sides to the sand channels (Table 6.2). This zone extends 55 m seaward in these depths at site II and 40 m seaward at site III. *Palythoa* occurred in fewer, more isolated sate, but .14. complanata was still relatively abundant. (Tables 6.10, 6.11).

The number of stony coral species was more than twice that of the adjacent shallower zone. The three species most abundant in the shallow spur zone, *M. complanata*, *A. agaricites* and *P. astreoides*, together with *Acropora cervicornis* and *Porites porites*, comprised the bulk of the stony coral population (Tables 6.10, 6.11). *Agaricia agaricites* surpassed *M. complanata* as the single most abundant stony coral species, proliferating in this zone due to its morphology and microbabitat preferences. In the shallow spur zone, *A. agaricites* forms thumb-sized colonies in small pockets and depressions, whereas in this high relief zone, it forms leaf or plate-like colonies on vertical faces of the spurs, in some ewes virtually excluding all other stony corals (Plate 6.8). Tall stands of *Acropora palmata* (Plate 6.9) occurred in about one third of the samples at site II (Table 6.10). The species was not present in quantitative samples at the western spur site III, although colonies were observed within the *Acropora*/transition zone at several other locations there. *Acropora palmata* occurs in aggregated thickets resulting from fragmentation recruitment. Propagules are only transported a limited distance from parent colonies. Consequently, the importance of *A. palmata* was not reflected in quantitative sampling at site Ill.

Even though there were nearly twice as many stony coral species as octocoral species in the *Acropora*/transition zone, the number of octocoral species was still nearly twice that of the previous zone. The four species that occurred in the shallow spur zone were the most abundant species here (Tables 6.12, 6.13). *Plexaura flexosa* comprised nearly half the octocoral population at both sites. *Palythoa* also occurred in about half of the samples (Table 6.5).

The most seaward zone (Table 6.1) of the spur and groove habitat extends 25 - 45 m from the previous zone to the spur's termination onto a level sedimentary plain (Table 6.2). This *Montastraea*/octocoral zone (Plate 10) is characterized at its beginning by high relief with steep vertical overhangs diminishing rapidly as the spur terminates. Much of the relief Is attributable to massive colonies of *M. annularis* growing on the spurs or standing free beside them.

The dominant stony coral species of this zone differed between sites II and III (Tables 6.14, 6.15). *Montastraea cavernosa*, *A. cervicornis* and *A. palmata* constituted 60% of the stony coral population at the middle spur (II), whereas *Siderastrea siderea*, *Mycetophyllia lamarckiana*, *M. annularis*, *A. agaricites*, *Millepora alcicornis*, and *A. cervicornis* comprised 62.1% of the stony coral population at the western spur (III). *Montastraea cavernosa* was the most abundant stony coral species at site II, comprising 30.3% of all individuals. *Siderastrea siderea* was most abundant at site III, representing 11.4% of all stony coral species. A total of 25 stony coral species were censused in the *Montastraea*/octocoral zone (22 at site II, 20 at site III). Species found at site II but not at site III included *A. palmata*, *Diploria labyrinthiformis*, *Diploria strigosa*, *Manicina areolata*, and *Dendrogyra cylindrus*. The last species, commonly known as pillar coral (Plate 6.11), is rare throughout the Caribbean and was present in only one sample during our survey. *Acropora prolifera*, *Eusmilia fastigiata, Mycetophyllia ferox*, and *Oculina diffusa* were limited to site III.

Although the greatest number of octocoral species occurred in this zone (Tables 6.16, 6.17), *Plexaura flexosa* still dominated the fauna. Numerically, the species comprised about half of all octocoral colonies censused, and it occurred in more then three fourths of the samples. *Plexaura homomalla* constituted about one fourth of all colonies censused but also was represented in about half of the samples. *Eunicea succinea* still occurred frequently. *Pseudoplexaura porosa* became one of the four most abundant octocorals, in this zone (Plate 6.12), replacing *Gorgonia ventalina*. The zoanthild *Palythoa* was recorded in about half of the cnidarian samples, but *Zoanthus* and *Ricordea* were rare (Table 6.5).

Montastraea buttress community

Due south of the seaward boundary of the western spur site III in 9 m depth (Figure 6.2), the area of generally uniform relief Is broken by "haystacks" of *Montastraea annularis* (Plate 6.13) greater than 2 m high and 3 m in diameter. This community of coral and sponge aggregations interrupted by large expanses of sand was designated site IV. Nearly equal numbers of stony coral and octocoral species were encountered. *Montastraea cavernosa*, *M. annularis*, *A. cervicornis*, *M. alcicornis*, and *S. siderea* were the most abundant stony corals (Table 6.18). Although *A. cervicornis* was relatively abundant in some samples, it occurred infrequently. Each of the eleven remaining species contributed less than 5% to the population.

Plexaura flexosa and *P. homomalla* comprised about half of the octocoral population. *Eunicea succinea* and *Eunicea calyculata* were next in abundance, and the 11 remaining octocoral species each contributed less than 7% (Table 6.19). Stony corals and octocorals occurred in about the same density, each with averages of about seven colonies and four species/m^2.

Ricordea and *Zoanthus* were not recorded, but *Palythoa* was represented in about one third of the samples (Table 6.5).

Livebottom community

The composition of coral communities in two areas outside the reef proper (sites V and VI) differed from others encountered at Looe Key. Site V was in about 9 a depth WNW of the main spur and groove formation (Figure 6.2). Only a vestige of spur and groove development was observed in this area of generally uniform low relief.

Octocorals were slightly more abundant and diverse than were stony corals in this complex reef limestone habitat (Tables 6.20, 6.21). *Plexaura flexosa* did not exhibit such strong dominance as at previous sites; seven other species (*E. succinea*, *E. tourneforti*, *Plexaurella fusifera*, *Muriceopsis flavida*, *Muricea atlantica*, *Pseudopterogorgia americana*, and *calyculata*) occurred in at least half of the samples. *Eunicea succinea* was most abundant but contributed little more to the population than did *P. flexosa* (Table 6.20).

Porites astreoides, *A. agaricites*, *A. cervicornis*, *M. alcicornis*, and *S. siderea* were encountered in at least half of the samples; their abundances in the stony coral population were fairly equally represented (Table 6.21). None of the eleven other species contributed more then about 52 to the population.

Site VI was in a linear band inshore and parallel to the major east-west axis of the reef proper (Figure 6.2). Two segments were sampled in a maximum depth of 6 m. These shallow reef limestone hard grounds were pocketed with sediment-filled depressions and dominated by octocoral and sponge growth (Plate 6.14). *Plexaura flexosa* and *E. succinea* were again the most abundant octocorals. The first occurred in all samples and was accompanied in high frequency by its co-dominant, as wall as by *P. homomalla*, *G. ventalina*, *M. atlantica*, and *P. porosa.* Four other species, *E. tourneforti*, *B. asbestinum, P. americana, and M. flavida*, occurred in more than half of the samples (Table 6.22).

Numerically, there were about half as many stony corals as there were octocorals at site VI (Table 6.23). *Millepora alcicornis* attained Its greatest abundance in the shallow livebottom, and *Siderastrea siderea* and *S. michelini* were also common. Although *P. astreoides*, and *A. agaricites* occurred in more than half of the samples, each contributed numerically slightly less than 7% to the stony coral population. The remaining 16 species were even less common, and all but one occurred in a third or fewer of the samples (Table 6.23).

Palythoa was least common in the livebottom communities and was found in only 11 and 16% of the samples at sites V and VI, respectively (Table 6.5).

Summary

Three major types of reef communities (spur and groove, buttress and livebottom) were censused during the surveys The spur and groove tract Included sites I through III; site IV was in the buttress community, and sites V and VI were in the livebottom areas outside the main reef. Generally, octocorals were most prominent in livebottom communities, whereas stony corals were most successful in the spur and groove formation (Tables 6.24, 6.25). Milleporids and zoanthids effectively dominated the reef flat/shallow spur and groove zone of the main reef. Stony coral species richness (22) was greatest in the *Montastraea*/octocoral zone of the middle spur (Table 6.25), and a survey maximum of 26 species was recorded at site II (Table 6.26). Estimated stony coral cover was likewise greatest at site II (middle spur) in the *Montastraea*/octocoral zone. Although overall site diversity (3.49) was highest at this site, the *Montastraea*/octocoral zone at the western spur site III had a slightly greater (3.87) zonal diversity. Highest average numbers of stony coral colonies were about 10/m^2 at both middle and western spur and groove sites. Reduced stony coral colony density (i.e., lower numbers of colonies per unit area) within the *Montastraea*/octocoral zone (Table 25) resulted from larger colonies of *Montastraea*, *Diploria*, *Colpophylia* and *Siderastrea* monopolizing spatial resources, thereby limiting the number of colonies occurring within a samples, in extreme cases, a single colony filled the 1-m^2 quadrat.

The greatest number of octocoral species (15) in the spur and groove tract occurred et the middle spur site II (Table 6.27). Like the stony corals, they were more successful in the deeper *Montastraea*/octocoral zones. Diversity (3.26) and mean numbers of colonies/m^2 (10) were greatest at the eastern fringe spur (site I). Disregarding the *Millepora*/*Palythoa* zones, mean numbers of colonies/m^2 were 6 and 9 at the two zones of the western spur but only 2 and 6 at the respective middle spur zones (Table 6.24).

The *Montastraea*/buttress community (site IV) of the fore-reef was apparently equally favorable to stony corals and octocorals, which were represented by nearly equal numbers of species (16; 15), species density/m^2 (3.88; 4.19), colony density/m^2 (7.63; 7.56), species diversity (3.01; 3.12) and evenness (0.75; 0.80) (Tables 24, 25).

Octocorals were more abundant than stony corals in the deeper livebottom area (site V) and were markedly more dominant in the Inshore shallow livebottom area (site VI). Although numbers of species of stony corals (21) and octocorals (22) were about the same, there were nearly twice as many octocoral as stony coral colonies/m^2 (20.58 vs. 11.53). Octocoral diversity (3.72) and evenness (0.83) were highest in this community and were greater than stony coral diversity (3.44) and evenness (0.78) (Tables 6.24, 6.25).

Quantitatively and qualitatively, intersite similarity was high for comparisons of all sampled Cnidaria (Milleporina, Octocorallia, Zoanthidae, Scleractinia) among the two livebottom habitats (sites V and VI) and the *Montastraea*/buttress community (Figure 6.4a and b). Middle and western spur and groove tract sites II and III also showed high similarity, whereas the eastern fringe spur site I was least similar to other sites by both comparisons. Classification based on quantitative (relative abundance) analyses resulted in generally lower similarity values between sites than did those based on qualitative (species presence/absence) analyses (Figures 6.4, 6.5, 6.6). Because many species were broadly distributed among the sites, qualitative analyses imply generally high intersite similarity. Quantitative analyses detect variability of the relative abundance or species dominance between sites and therefore may provide a better view of community structure.

Overall, the octocoral fauna was quantitatively more similar among sites than was the stony coral fauna. Seven of 15 octocoral Intersite comparisons resulted in similarity values greater than 0.50, whereas only 2 of 15 comparisons yielded values greater than 0.50 for stony corals (Figures 6.5, 6.6). As with the combined Cnidaria, greatest octocoral and stony coral intersite similarities were between livebottom sites V and VI and between spur and groove sites II and III (Figures 6.5, 6.6). A greater disparity existed between qualitative and quantitative values for stony coral Intersite comparisons than for octocorals. Occurrences of similar species with significantly different abundances likely caused the disparity; generally low similarity values reflect differences in species abundance and dominance between sites.

Generally, corresponding zones within middle and western sites II and III in the spur and groove tract harbored a more similar fauna, both quantitatively and qualitatively, than did adjacent zones on the same spur (Figures 6.7, 6.8). An exception occurred within the octocoral fauna and was correspondingly reflected in analyses for combined Cnidaria. Quantitatively and qualitatively, the octocoral fauna at the site III *Montastraea*/octocoral zone bore greater similarity to that of the adjacent *Acropora*/transition zone than to the more distant site II *Montastraea*/octocoral zone (Figures 6.7a, c; 6.8a, c).

Generally, *Acropora*/transition zones within both sites were more similar to adjacent, seaward *Montastraea*/octocoral zones than to adjacent inshore *Millepora*/*Palythoa* zones. Only the combined Cnidaria and stony coral comparisons at the western spur site III showed similarity greater than 0.50 between the shallow *Millepora*/*Palythoa* and the seaward *Montastraea*/octocoral zones.

A total of 59 cnidarian species was censused during this survey (Table 6.28). Anthozoans obviously dominated the macrobenthic community. Members of the family Plexauridae (16 species) were the most abundant of the 23 octocoral species which together comprised 1317 colonies (Table 6.29). Three species (*Plexaura flexosa*, *Eunicea succinea* and *Plexaura homomalla*) comprised almost 55% of the octocoral fauna. The 31 scleractinian species (1278 colonies) were distributed among ten families, of which the Faviidae and Mussidae had the most species (Table 6.28). *Agaricia agaricites*, and *Porites astreoides* were most abundant (Table 6.30). The two hydrozoan milleporids (292 colonies; Table 6.30) were both relatively abundant; however, *Millepora complanata* was restricted to the spur and groove formation. Only one "false" coral (Scleractinia: Corallimorpharia) and two zoanthid species were censused (Table 6.31).

Previous coral surveys at Looe Key were conducted by Antonius *et al.* (1978) and by the Florida Department of Natural Resources (FDNR) in 1980. Differences in reported species (Tables 6.32, 6.33) can be attributed to differences in sampling methods, depths, reef locations and possible field identification errors. Antonius *et al.* used a line point intersect (one piece of Information collected each meter) method of data acquisition; their deepest observations were to 45 m, although 6 - 18 transect sampling was limited to depths less than 35 m. The majority of the 1980 work by FDNR involved a survey along 2 traverses using continuous line transects to 10.7 m depth in the spur and groove formation, with qualitative observations at 18 - 30 m and an additional transect at 27.4 m; only 18 1-m^2 quadrats were sampled. A total of 24 octocoral and 32 stony coral species were recorded in 1980, of which only 14 octocoral and 20 stony coral species were sampled in the shallow reef areas. *Plexaura flexosa*, *Plexaura* *homomalla*, *Gorgonia ventalina*, *Porites astreoides*, *Millepora complanata*, and *Agaricia agaricites* were the three most abundant octocorals and stony corals, respectively, during this cursory survey.

The three surveys had twelve octocoral species in common from reef flat and shallow reef records to 11 m depths; nine additional species were common to two of the three surveys. Records of *Eunicea asperula, Plexaurella dichotoma, Muricea muricata*, and *Pseudopterogorgia bipinnata* by Antonius *et al.* (1978) from the shallow reef were not substantiated in our current survey nor in the 1980 work (which included a deep reef *P. bipinnata* record). All shallow reef species recorded in 1980 were previously listed by Antonius *et al.* and again in our 1983 work. *Pseudoplexaura crucis* was the only 1983 species not previously reported by Antonius *et al.* They did not include *Briareum asbestinum, Erythropodium caribaeorum* and *Eunicea succinea* among their shallow reef records, although they did report those species from patch reefs. Deep water records for *Eunicea clavigera, Eunicea pinta, Muricea laxa*, *Pseudopterogorgia elisabethae* (FDNR, 1980), *Iciligorgia schrammi*, and *Ellisella barbadensis* (Antonius *et al.,* 1978; FDNR, 1980) add these species to the Looe Key faunal list (Table 6.32).

Twenty-two stony coral species were recorded at shallow reef stations (<11 m) during all three surveys, and six others were recorded during two of the three surveys (Table 6.33). Two additional species, *Scolymia lacera* and *Isophyllastrea rigida*, were recorded at reef shallows only during the present survey. Three of four other stony coral taxa reported from the shallow reef by Antonius *et al.* are problematical and will be discussed elsewhere. Antonius *et al.* reported 14 taxa of stony corals from the deep reef; none of those appear on our list among taxa recorded at the shallow reef (Table 6.33), although three appear to be other names for shallow reef taxa. Two of the deep reef species reported by Antonius *et al.* were also recorded in our 1980 survey. Species of Agariciidae were reported to be common on the deep ridge (Antonius *et al.,* 1978). They reported the agariciids *Agaricia undata, A. lamarcki*, and *A. fragilis*, and the mussids *Mycetophyllia dansana* and *M. aliciae* in the text, but their habitats were not delimited in the tables. These five species were not recorded during our 1980 nor our 1983 surveys, but all are species which typically occur at depths greater than those we sampled and whose occurrence at the deep reef seaward of Looe Key would seem reasonable.

Antonius *et al.* (1978) and the FDNR 1983 survey included sites outside the main reef tract. Patch reefs surveyed by Antonius *et al.* and our inshore (6 m) livebottom site VI are somewhat comparable. Twenty octocoral species were common to both (Table 6.32). Six octocorals (*Eunicea mammosa, Eunicea fusca, Eunicea asperula, Plexaurella dichotoma, Muricea muricata*, and *Pterogorgia guadalupensis*) reported by Antonius *et al.* were not recorded at the inshore livebotton site during our 1983 study. *Pseudoplexaura crucis* and *Plexaurella grises* were added to the list from 1983 records. Likewise, nineteen stony coral species were common to both. Antonius *et al.* reported nine taxa from patch reefs (*Millepora complanata*, *M. squamosa*, *Agaricia danai, Diploria clivosa*, *Diploria strigosa*, *Solenastrea hyades*, *Oculina varicosa*, *Dendrogyra cylindrus*, and *Mussa angulosa*) which were not recorded at the inshore livebottom site during our 1983 survey. *Scolymia lacera* and *Eusmilia fastigiata* were added to the list from that habitat during our 1983 work.

Antonius *et al.* (1978) reported 55 stony coral taxa (3 hydrocoral species and 52 scleractinian taxa comprising 47 species) (Table 6.33). Discounting the deep reef species previously discussed, thirteen other taxa were not recorded by us in either 1980 or 1983. Four of these names supposedly represent varieties or ecophenotypes (formae) of *Agaricia agaricites* (*A. a. danai, carinata, purpurea*, and *humilis*). Additionally, *Porites divaricata* and *P. furcata* are standardly accepted as varieties or Peophenotypes of *P. Porites* (fide Squires, 1958; Brakel, 1977). Such distinctions were not utilized during our 1980 and 1983 studies. *Millepora squarrosa* is synonymous with *M. complanata* (fide Stearn and Riding, 19713; DeWeert, 1981). Thus, seven taxonomic designations used by Antonius *et al.* were not deemed appropriate for our use. Four of the remaining six species are not typically dwellers of south Florida reefs. *Oculina varicosa* commonly constructs bank reefs in more temperate areas (Reed, 1980); the Antonius *et al.* record is more likely of *Oculina diffusa*. *Madracis asperula* is typically an ahermatype; *M. mirabilis* is the typical reef species. *Tubastrea aurea* is a rare photophobic cave dweller. *Sphenotrochus auritus* is an Ahermatypic solitary coral described from Cape Frio, Brazil (Pourtales, 1874) and not otherwise reported from Florida. Its presence at Looe Key requires verification. *Agaricia tenuifolia* and *A. grahamae* are also tropical species not previously reported from Florida reefs. Goreau and Wells (1967) reported what *A. tenuifolia*, was restricted to depths less than 18 m, where it commonly builds spur formations in the western Caribbean (Carrie Bow Cay, Belize; Roatan, Bay Islands, Honduras). The record (Antonius *et al.,* 1978: p. 22) of *A. tenuifolia* from 45 m depth on the deep ridge is thus questionable. A revised list of corals from the three Looe Key surveys would include 36 octocorals, 39 scleractinians and 2 hydrocoral species.

Acknowledgments

This project was supported by the National Oceanic and Atmospheric Administration Sanctuary Programs Office. Dr. Nancy Foster and Carroll Curtis were responsible for its administration and coordination with Dr. James Bohnsack (National Marine fisheries Service), the project leader. We expressly thank Dr. Bohnsack for the invitation to participate in the survey, for providing Mr. Mike Schmale (University of Miami) as an adept field assistant and for efficient management of the survey.

Billy Causey, the Looe Key National Marine Sanctuary manager (Florida Department of Natural Resources, Bureau of Environmental Land Management), cooperated in all phases of the survey and provided excellent logistical support. FDNR Bureau of Recreation and Parks provided Rangers Tom Markey and Bill Green for support of on site boat operations. Technical assistance of several FDNR Bureau of Marine Research colleagues included electronic data processing by Frank S. Kennedy, Jr., manuscript preparation by Marjorie Myers and Vivien Lipscombe, and editorial assistance by William G. Lyons. All are gratefully acknowledged.

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Table 6.1. Synopsis of quantitative coral sampling sites, Looe Key, August 1983.

Site	Reef Locale	Depth (m)	Traverse length (m)	Number of 1-m^2 Quadrats	Characteristics
I	Eastern spur and groove tract	2-6	100	8	Homogeneous low relief spur
II	Middle spur and groove tract	0-9	200*	56*	Well developed spur with distinct zonation
	Rubble zone	1	32	0	"Barren" zone
	Shallow spur and groove zone	0 - 5	68	17	*Millepora*/ *Palythoa*
	Intermediate depth spur and groove	2 - 7	55	19	*Acropora*/ transition
	Deep spur and groove zone	5 - 9	45	20	*Montastraea*/ octocoral
III	Western spur and groove tract	1 - 9	200*	55*	Well developed spur with distinct zonation
	Rubble zone	1	26	1	Barren zone
	Shallow spur and groove zone	1 - 7	109	15	*Millepora*/ *Palythoa*
	Intermediate depth spur and groove	4 - 8	40	22	*Acropora*/ transition
	Deep spur and groove zone	7 - 9	25	17	*Montastraea*/ octocoral
IV	Western fore-reef	9	100	16	*Montastraea* buttress
V	Livebottom WNW of spur and groove	9 - 11	83	18	Low relief hard grounds
VI	Inshore (north) livebottom parallel to spur and groove tract	6	132	19	Low relief hard grounds

* Represents total sampling effort at the middle and western spurs.

Table 6.2. Morphological characteristics, depths, and zones at sites II and III, spur and groove tract, Looe Key, August 1983.

A. Middle Spur II Traverse distance (m) from shallow to deep*	Spur width (m)	Spur height (relief) (m)	Water depth top of spur (m)	Water depth in groove (m)	Zone
0	na	na	1.4	na	Barren
10	na	na	1.4	na	
20	na	na	1.4	1.4	
30	coalesced	0	1.5	1.5	*Millepora/*
40	coalesced	0	1.5	1.5	*Palythoa*
50	coalesced	0	0.3	1.5	
60	3.0	1.2	0.6	1.8	
70	coalesced	0.9	2.1	3.0	
80	coalesced	1.6	2.1	3.7	
90	17.5	2.8	2.1	4.9	
100	5.5	2.8	2.4	5.2	*Acropora/*
110	8.0	3.4	2.4	5.8	transition
120	15.5	3.1	3.0	6.1	
130	13.0	3.6	3.7	7.3	
140	8.0	2.7	4.6	7.3	
150	12.0	2.4	5.2	7.6	
160	12.5	2.1	5.8	7.9	*Montastraea/*
170	11.0	2.4	5.8	8.2	octocoral
180	12.0	2.1	6.1	8.2	
190	13.3	1.2	7.3	8.5	
200	3.3	0.3	8.5	8.8	

Table 6.2. Morphological characteristics, depths, and zones at sites II and III, spur and groove tract, Looe Key, August 1983 (cont.)

B. Middle Spur III Traverse distance (m) from shallow to deep*	Spur width (m)	Spur height (relief) (m)	Water depth top of spur (m)	Water depth in groove (m)	Zone
0	na	na	1.4	1.4	Barren
10	na	na	1.4	1.4	
20	na	na	1.4	1.4	
30	9.5	0.5	0.6	1.1	*Millepora/*
40	16.5	0.5	0.6	1.1	*Palythoa*
50	15.0	0.7	0.8	1.5	
60	18.0	1.3	0.8	2.1	
70	21.0	1.5	0.9	2.4	
80	15.5	2.8	1.2	4.0	
90	8.5	3.4	1.2	4.6	
100	6.5	2.6	2.3	4.9	*Acropora/*
110	13.0	3.5	2.3	5.8	transition
120	16.0	3.7	3.0	6.7	
130	15.0	3.9	3.4	7.3	
140	13.5	3.3	4.0	7.3	
150	11.0	3.0	4.6	7.6	
160	15.5	1.8	5.8	7.6	*Montastraea/*
170	4.0	1.2	7.0	8.2	octocoral
180	14.0	1.8	6.7	8.5	
190	10.0	1.5	7.3	8.8	
200	6.0	0.3	8.5	8.8	

Traverses at site II and III were not fully extended through the barren rubble zone into the back-reef seagrass beds.

Table 6.3. Abundance of octocorals, site I (east spur), Looe Key, August 1983.

Species	Abundance	Percent abundance	Frequency
Plexaura flexosa	16	20.00	0.75
Eunicea succinea	12	15.00	0.75
Pseudopterogorgia americana	10	12.50	0.37
Muricea atlantica	9	11.25	0.62
Gorgonia ventalina	8	10.00	0.62
Pterogorgia citrina	7	8.75	0.25
Plexaura homomalla	6	7.50	0.50
Eunicea tourneforti	4	5.00	0.37
Plexaurella fusifera	3	3.75	0.37
Eunicea calyculata	2	2.50	0.25
Pseudoplexaura flagellosa	2	2.50	0.12
Plexaurella grisea	1	1.25	0.12
Total: species 12	colonies 80		

Table 6.4. Abundance of stony corals, site I (east spur), Looe Key, August 1983.

Species	Abundance	Percent abundance	Frequency	Density $\bar{x}$	Density S
Millepora complanata	8	44.44	0.38	1.00	1.77
Favia fragum	4	22.22	0.13	0.50	1.41
Siderastrea radians	2	11.11	0.13	0.25	0.71
Porites astreoides	2	11.11	0.25	0.25	0.46
Diploria clivosa	1	5.56	0.13	0.13	0.35
Millepora alcicornis	1	5.56	0.13	0.13	0.35
Total: species 6	colonies 18				

Table 6.5. Abundance of Zoanthidae and coral limorpharia at six sites, Looe Key, August 1983.

Site	Species	Abundance	Percent abundance	Frequency	Density/m^2 $\bar{x}$	Density/m^2 S	Estimated cover $\bar{x}$	Estimated cover S
I	*Palythoa caribbea*	12	100	0.55	1.50	1.60	4.69	7.13
II_1	*Palythoa caribbea*	25	78.13	0.53	1.47	1.81	3.56	24.45
	Ricordea florida	7	21.88	0.25	0.41	0.87		
II_2	*Ricordea florida*	42	58.33	0.89	2.21	1.51	13.55	16.25
	Palythoa caribbea	30	41.67	0.68	1.58	1.35		
II_3	*Palythoa caribbea*	17	80.95	0.55	0.85	1.04	1.84	2.01
	Ricordea florida	3	14.29	0.10	0.15	0.49		
	Zoanthus sociatus	1	4.76	0.05	0.05	0.22		
III_1	*Palythoa caribbea*	30	56.60	0.73	2.00	1.69	21.41	15.00
	Ricordea florida	23	43.40	0.60	1.53	1.96		
III_2	*Palythoa caribbea*	16	61.54	0.32	0.73	1.32	3.75	7.86
	Ricordea florida	9	34.62	0.28	0.41	0.80		
	Zoanthus sociatus	1	3.85	0.05	0.05	0.21		
III_3	*Palythoa caribbea*	30	88.24	0.53	0.88	1.05	6.32	6.56
	Ricordea florida	4	11.76	0.24	0.24	0.44		
IV	*Palythoa caribbea*	10	100	0.38	0.63	0.96	1.09	2.58
V	*Palythoa caribbea*	2	100	0.11	0.11	0.32	0.28	0.81
VI	*Palythoa caribbea*	3	60.00	0.16	0.16	0.37	0.53	1.34
	Ricordea florida	2	40.00	0.11	0.11	0.32		

[1]*Millepora*/*Palythoa* zone.
[2]*Acropora*/transition zone.
[3]*Montastraea*/octocoral zone.

Table 6.6. Abundance of stony corals, site II (middle spur), *Millepora/Palythoa* zone, Looe Key, August 1983.

Species	Abundance	Percent abundance	Frequency	Density $\bar{x}$	Density S
Porites astreoides	72	44.44	0.88	4.24	3.80
Agaricia agaricites	39	24.07	0.59	2.29	3.62
Millepora complanata	34	20.99	0.82	2.00	1.54
Favia fragum	17	10.49	0.35	1.00	1.73
Total: species 4	colonies 162				

Table 6.7. Abundance of stony corals, site III (western spur), *Millepora/Palythoa* zone, Looe Key, August 1983.

Species	Abundance	Percent abundance	Frequency	Density $\bar{x}$	Density S
Millepora complanata	47	41.23	0.93	3.13	1.77
Agaricia agaricites	28	24.56	0.60	1.87	2.39
Porites astreoides	26	22.81	0.53	1.73	2.22
Porites porites	7	6.14	0.27	0.47	0.92
Mycetophyllia lamarckiana	2	1.75	0.13	0.13	0.35
Siderastrea siderea	2	1.75	0.13	0.13	0.35
Montastraea cavernosa	2	1.75	0.13	0.13	0.33
Total: species 7	colonies 114				

Table 6.8. Abundance of octocorals, site II (middle spur), *Millepora/Palythoa* zone, Looe Key, August 1983.

Species	Abundance	Percent abundance	Frequency
Gorgonia ventalina	15	75.00	0.41
Eunicea succinea	2	10.00	0.05
Plexaura flexosa	2	10.00	0.11
Plexaura homomalla	1	5.00	0.05
Total: species 4	colonies 20		

Table 6.9. Abundance of octocorals, site III (western spur), *Millepora/Palythoa* zone, Looe Key, August 1983.

Species	Abundance	Percent abundance	Frequency
Plexaura flexosa	12	60.00	0.46
Eunicea succinea	4	20.00	0.26
Plexaura homomalla	3	15.00	0.13
Gorgonia ventalina	1	5.00	0.06
Total: species 4	colonies 20		

Table 6.10. Abundance of stony corals, site II (saddle spur), *Acropora* transition zone, Looe Key, August 1983.

Species	Abundance	Percent abundance	Frequency	Density $\bar{x}$	Density S
Agaricia agaricites	39	20.31	0.68	2.05	2.30
Millepora complanata	35	18.23	0.57	1.58	2.50
Porites astreoides	28	14.58	0.68	1.47	1.93
Acropora cervicornis	20	10.42	0.26	1.05	2.53
Acropora palmata	17	8.85	0.32	0.89	1.89
Porites porites	13	6.77	0.36	0.68	1.00
Montastraea cavernosa	9	4.69	0.21	0.47	1.07
Favia fragum	8	4.17	0.21	0.42	1.02
Montastraea annularis	7	3.65	0.11	0.37	1.21
Millepora alcicornis	3	1.56	0.16	0.16	0.37
Mycetophyllia lamarckiana	3	1.56	0.11	0.16	0.50
Siderastrea siderea	2	1.04	0.11	0.11	0.32
Stephanocoenia michelini	2	1.04	0.11	0.11	0.32
Colpophyllia natans	2	1.04	0.11	0.11	0.32
Eusmilia fastigiata	1	0.52	0.05	0.05	0.32
Isophyllastrea rigida	1	0.52	0.05	0.05	0.32
Isophyllia sinuosa	1	0.52	0.05	0.05	0.32
Mycetophyllia ferox	1	0.52	0.05	0.05	0.32
Total: species 18	colonies 192				

Table 6.11. Abundance of stony corals, site III (western spur), *Acropora*/transition zone, Looe Key, August 1983.

Species	Abundance	Percent abundance	Frequency	Density $\bar{x}$	Density S
Agaricia agaricites	78	34.98	0.68	3.55	4.03
Millepora complanata	37	16.59	0.50	1.68	2.10
Porites astreoides	27	12.11	0.64	1.23.	1.27
Porites porites	25	11.21	0.45	1.14	1.70
Montastraea annularis	14	6.28	0.41	0.64	0.95
Mycetophyllia lamarckiana	13	5.83	0.41	0.59	0.85
Stephanocoenia michelini	9	4.04	0.23	0.41	0.96
Millepora alcicornis	5	2.24	0.14	0.23	0.69
Siderastrea siderea	5	2.24	0.23	0.23	0.43
Favia fragum	2	0.90	0.09	0.09	0.29
Dichocoenia stokesi	2	0.90	0.05	0.09	0.43
Eusmilia fastigiata	2	0.90	0.09	0.09	0.29
Montastraea cavernosa	1	0.45	0.05	0.05	0.21
Mycetophyllia ferox	1	0.45	0.05	0.05	0.21
Meandrina meandrites	1	0.45	0.05	0.05	0.21
Siderastrea radians	1	0.45	0.05	0.05	0.21
Total: species 16	colonies 223				

Table 6.12. Abundance of octocorals, site II (middle spur), *Acropora*/transition zone, Looe Key, August 1983.

Species	Abundance	Percent abundance	Frequency
Plexaura flexosa	17	41.46	0.36
Gorgonia ventalina	8	19.51	0.21
Eunicea succinea	6	14.63	0.26
Plexaura homomalla	5	12.20	0.21
Pseudoplexaura porosa	3	7.32	0.15
Pseudopterogorgia americana	1	2.44	0.05
Pseudoplexaura flagellosa	1	2.44	0.05
Total: species 7	colonies 41		

Table 6.13. Abundance of octocorals, site III (western spur), *Acropora*/transition zone, Looe Key, August 1983.

Species	Abundance	Percent abundance	Frequency
Plexaura flexosa	58	43.61	0.86
Plexaura homomalla	22	16.54	0.50
Eunicea succinea	20	15.04	0.63
Gorgonia ventalina	12	9.02	0.40
Pseudoplexaura porosa	9	6.77	0.27
Pseudopterogorgia americana	4	3.01	0.18
Briareum asbestinum	3	2.26	0.13
Pseudoplexaura flagellosa	2	1.50	0.09
Muricea atlantica	1	0.75	0.04
Muriceopsis flavida	1	0.75	0.04
Eunicea tourneforti	1	0.75	0.04

Total: species 11 colonies 133

Table 6.14. Abundance of stony corals, site II (middle spur), *Montastraea*/octocoral zone, Looe Key, August 1983.

Species	Abundance	Percent abundance	Frequency	Density $\bar{x}$	Density S
Montastraea cavernosa	59	30.26	0.65	2.95	5.12
Acropora cervicornis	33	16.92	0.40	1.65	2.70
Acropora palmata	25	12.82	0.25	1.25	2.94
Montastraea annularis	24	12.31	0.40	1.20	2.57
Millepora alcicornis	11	5.64	0.40	0.55	0.76
Siderastrea siderea	8	4.10	0.40	0.40	0.50
Millepora complanata	7	3.59	0.20	0.35	0.81
Porites porites	3	1.54	0.10	0.15	0.49
Mycetophyllia lamarckiana	3	1.54	0.15	0.15	0.37
Agaricia agaricites	3	1.54	0.15	0.15	0.37
Dichocoenia stellaris	3	1.54	0.15	0.15	0.37
Meandrina meandrites	2	1.03	0.10	0.10	0.31
Stephanocoenia michelini	2	1.03	0.10	0.10	0.31
Dendrogyra cylindrus	2	1.03	0.05	0.10	0.45
Favia fragum	2	1.03	0.05	0.10	0.45
Porites astreoides	2	1.03	0.10	0.10	0.31
Diploria labyrinthiformis	1	0.51	0.05	0.05	0.22
Diploria strigosa	1	0.51	0.05	0.05	0.22
Diploria clivosa	1	0.51	0.05	0.05	0.22
Manicina areolata	1	0.51	0.05	0.05	0.22
Colcophyllia natans	1	0.51	0.05	0.05	0.22
Mycetophyllia sp.	1	0.51	0.05	0.05	0.22
Total: species 22	colonies 195				

Table 6.15. Abundance of stony corals, site III (western spur), *Montastraea*/octocoral zone, Looe Key, August 1983.

Species	Abundance	Percent abundance	Frequency	Density $\bar{x}$	Density S
Siderastrea siderea	15	11.36	0.53	0.88	1.05
Mycetophyllia lamarckiana	14	10.61	0.41	0.82	1.13
Montastraea annularis	14	10.61	0.41	0.82	1.13
Agaricia agaricites	14	10.61	0.41	0.82	1.24
Millepora alcicornis	13	9.85	0.47	0.76	1.03
Acropora cervicornis	12	9.09	0.24	0.71	1.36
Porites porites	10	7.58	0.41	0.59	1.00
Millepora complanata	7	5.30	0.18	0.41	1.06
Porites astreoides	6	4.55	0.29	0.35	0.61
Montastraea cavernosa	5	3.79	0.24	0.29	0.59
Eusmilia fastigiata	5	3.79	0.29	0.29	0.99
Colpophyllia natans	3	2.27	0.12	0.18	0.53
Diploria clivosa	3	2.27	0.12	0.18	0.53
Mycetophyllia ferox	2	1.52	0.12	0.12	0.33
Acropora prolifera	2	1.52	0.12	0.12	0.49
Oculina diffusa	2	1.52	0.12	0.12	0.33
Stephanocoenia michelini	2	1.52	0.12	0.12	0.33
Favia fragum	1	0.76	0.06	0.06	0.24
Meandrina meandrites	1	0.76	0.06	0.06	0.24
Dichocoenia stellaris	1	0.76	0.06	0.06	0.24
Total: species 20	colonies 132				

Table 6.16. Abundance of octocorals, site 11 (middle spur), *Montastraea*/octocoral zone, Looe Key, August 1983.

Species	Abundance	Percent abundance	Frequency
Plexaura flexosa	60	48.78	0.85
Plexaura homomalla	24	19.51	0.50
Eunicea succinea	9	7.32	0.40
Pseudoplexaura porosa	8	6.50	0.25
Eunicea tourneforti	4	3.25	0.20
Plexaurella fusifera	3	2.44	0.10
Briareum asbestinum	3	2.44	0.10
Gorgonia ventalina	2	1.63	0.10
Pseudopterogorgia americana	2	1.63	0.10
Eunicea calyculata	2	1.63	0.10
Pseudoplexaura crucis	2	1.63	0.10
Plexaurella grisea	1	0.81	0.05
Muriceopsis flavida	1	0.81	0.05
Eunicea laciniata	1	0.81	0.05
Pseudoplexaura flagellosa	1	0.81	0.05
Total: species 15	colonies 123		

Table 6.17. Abundance of octocorals, site III (western spur), *Montastraea*/octocoral zone, Looe Key, August 1983.

Species	Abundance	Percent abundance	Frequency
Plexaura flexosa	64	42.11	0.88
Plexaura homomalla	26	17.11	0.76
Pseudoplexaura porosa	17	11.18	0.64
Briareum asbestinum	16	10.53	0.05
Eunicea succinea	12	7.89	0.41
Gorgonia ventalina	5	3.29	0.23
Pseudoplexaura flagellosa	3	1.97	0.17
Pseudopterogorgia americana	2	1.32	0.11
Plexaura fusifera	2	1.32	0.11
Muricea atlantica	1	0.66	0.05
Muriceopsis flavida	1	0.66	0.05
Eunicea calyculata	1	0.66	0.05
Eunicea tourneforti	1	0.66	0.05
Erythropodium caribaeorum	1	0.66	0.05
total: species 14		colonies 152	

Table 6.18. Abundance of stony corals, site IV, *Montastraea* buttress community, Looe Key, August 1983.

Species	Abundance	Percent abundance	Frequency	Density $\bar{x}$	Density S
Montastraea cavernosa	52	42.62	0.69	3.25	3.61
Montastraea annularis	10	8.20	0.50	0.63	0.72
Acropora cervicornis	10	8.20	0.19	0.63	1.54
Millepora alcicornis	9	7.38	0.44	0.56	0.73
Siderastrea siderea	9	7.38	0.44	0.56	0.81
Porites porites	6	4.92	0.38	0.38	0.50
Siderastrea radians	6	4.92	0.06	0.38	1.50
Mycetophyllia lamarckiana	5	4.10	0.25	0.31	0.60
Dichocoenia stellaris	3	2.46	0.19	0.19	0.40
Porites astreoides	3	2.46	0.19	0.19	0.40
Agaricia agaricites	2	1.64	0.13	0.13	0.34
Diploria labyrinthiformis	2	1.64	0.13	0.13	0.34
Meandrina meandrites	2	1.64	0.13	0.13	0.34
Manicina areolata	1	0.82	0.06	0.06	0.25
Solenastrea bournoni	1	0.82	0.06	0.06	0.25
Stephanocoenia michelini	1	0.82	0.06	0.06	0.25
Total: species 16	colonies 122				

Table 6.19. Abundance of octocorals, site IV, *Montastraea* buttress community, Looe Key, August 1983.

Species	Abundance	Percent abundance	Frequency
Plexaura flexosa	37	30.58	0.75
Plexaura homomalla	23	19.01	0.56
Eunicea succinea	12	9.92	0.37
Eunicea calyculata	11	9.09	0.50
Pseudopterogorgia americana	8	6.61	0.31
Gorgonia ventalina	7	5.79	0.37
Muricea atlantica	5	4.13	0.31
Eunicea tourneforti	5	4.13	0.18
Plexaurella fusifera	4	3.31	0.25
Pseudoplexaura flagellosa	3	2.48	0.18
Muricea elongata	2	1.65	0.12
Muriceopsis flavida	1	0.83	0.06
Pseudoplexaura crucis	1	0.83	0.06
Pseudoplexaura porosa	1	0.83	0.06
Briareum asbestinum	1	0.83	0.06
Total: species 15	colonies 121		

Table 6.20. Abundance of octocorals, site V, 9 m livebottom community, Looe Key, August 1983.

Species	Abundance	Percent abundance	Frequency
Eunicea succinea	47	20.00	0.88
Plexaura flexosa	33	14.04	0.83
Eunicea tourneforti	22	9.36	0.55
Plexaurella fusifera	21	8.94	0.72
Muriceopsis flavida	21	8.94	0.61
Muricea atlantica	20	8.51	0.66
Pseudopterogorgia americana	18	7.66	0.50
Eunicea calyculata	14	5.96	0.61
Plexaurella grisea	8	3.40	0.33
Plexaura homomalla	7	2.98	0.38
Gorgonia ventalina	6	2.55	0'33
Plexaurella nutans	6	2.55	0:27
Muricea elongata	3	1.28	0.11
Briareum asbestinum	3	1.28	0.16
Eunicea laciniata	2	0.85	0.11
Pseudoplexaura crucis	2	0.85	0.11
Pseudopterogorgia acerosa	1	0.43	0.05
Pseudoplexaura porosa	1	0.43	0.05
Total: species 18	colonies 235		

Table 6.21. Abundance of stony corals, site V, 9 m livebottom community, Looe Key, August 1983.

Species	Abundance	Percent abundance	Frequency	Density $\bar{x}$	Density S
Porites astreoides	31	16.06	0.78	1.72	1.36
Agaricia agaricites	30	15.54	0.67	1.67	1.71
Acropora cervicornis	28	14.51	0.56	1.56	1.82
Millepora alcicornis	25	12.95	0.72	1.39	1.24
Siderastrea siderea	23	11.92	0.83	1.28	1.07
Porites porites	11	5.70	0.44	0.61	0.98
Montastraea cavernosa	8	4.15	0.39	0.44	0.62
Dichocoenia stellaris	8	4.15	0.39	0.44	0.62
Dichocoenia stokesi	7	3.36	0.17	0.39	1.04
Stephanocoenia michelini	6	3.11	0.22	0.33	0.69
Solenastrea bournoni	6	3.11	0.28	0.33	0.59
Meandrina meandrites	3	1.55	0.17	0.17	0.38
Manicina areolata	2	1.04	0.11	0.11	0.32
Montastraea annularis	2	1.04	0.11	0.11	0.32
Diploria labyrinthiformis	2	1.04	0.11	0.11	0.32
Scolymia lacera	1	0.52	0.06	0.06	0.24
Total: species 16	colonies 193				

Table 6.22. Abundance of octocorals, site VI, inshore (6 m) live bottom community, Looe Key, August 1983.

Species	Abundance	Percent abundance	Frequency
Plexaura flexosa	90	23.02	1.00
Eunicea succinea	63	16.11	0.89
Plexaura homomalla	26	6.65	0.78
Gorgonia ventalina	23	5.88	0.78
Muricea atlantica	23	5.88	0.78
Eunicea tourneforti	21	5.37	0.52
Briareum asbestinum	20	5.12	0.52
Pseudopterogorgia americana	19	4.86	0.57
Muriceopsis flavida	19	4.86	0.57
Pseudoplexaura porosa	19	4.86	0.73
Eunicea calyculata	17	4.35	0.42
Plexaurella fusifera	14	3.58	0.36
Pseudoplexaura crucis	9	2.30	0.26
Pseudopterogorgia acerosa	6	1.53	0.21
Pterogorgia anceps	4	1.02	0.15
Pseudoplexaura flagellosa	4	1.02	0.21
Muricea elongata	3	0.77	0.15
Plexaurella grisea	3	0.77	0.10
Pseudoplexaura wagenaari	3	0.77	0.15
Plexaurella nutans	2	0.51	0.10
Eunicea laciniata	2	0.51	0.05
Erythropodium caribaeorum	1	0.26	0.05
Total: species 22	colonies 391		

Table 6.23. Abundance of stony corals, site VI, inshore (6 m) livebottom community, Looe Key, August 1983.

Species	Abundance	Percent abundance	Frequency	Density $\bar{x}$	Density S
Porites astreoides	31	16.06	0.78	1.72	1.36
Millepora alcicornis	50	22.83	0.74	2.63	2.22
Siderastrea siderea	49	22.37	0.79	2.58	2.43
Stephanocoenia michelini	27	12.33	0.68	1.42	1.35
Porites astreoides	15	6.85	0.58	0.79	0.79
Agaricia agaricites	15	6.85	0.53	0.79	0.92
Porites porites	10	4.57	0.42	0.53	0.70
Dichocoenia stellaris	9	4.11	0.32	0.47	0.77
Montastraea cavernosa	7	3.20	0.32	0.37	0.60
Siderastrea radians	7	3.20	0.21	0.37	0.76
Dichocoenia stokesi	6	2.74	0.16	0.32	0.82
Meandrina meandrites	3	1.37	0.11	0.16	0.50
Solenastrea bournoni	3	1.37	0.16	0.16	0.37
Oculina diffusa	3	1.37	0.16	0.16	0.37
Acropora cervicornis	3	1.37	0.05	0.16	0.69
Colcophyllia natans	2	0.91	0.11	0.11	0.32
Favia fragum	2	0.91	0.11	0.11	0.32
Montastraea annularis	2	0.91	0.05	0.11	0.46
Diploria labyrinthiformis	2	0.91	0.05	0.11	0.46
Scolymia sp.	2	0.91	0.11	0.11	0.32
Manicina areolata	1	0.46	0.05	0.05	0.23
Eusmilia fastigiata	1	0.46	0.05	0.05	0.23
Total: species 21	colonies 219				

Table 6.24. Summary, octocoral analyses, Looe Key, August 1983.

Site	No. of 1-m^2 Quadrats	Total no. Species	Species/m^2 Range	Species/m^2 $\bar{x}$	Species/m^2 S	Total no. Colonies	Colonies/m^2 Range	Colonies/m^2 $\bar{x}$	Colonies/m^2 S	H'	J'
I	8	12	0-9	5.13	3.00	80	0-24	10.00	8.42	3.26	0.91
II_1	17	4	0-2	0.65	0.79	20	0-4	1.18	1.47	1.19	0.60
II_2	19	7	0-5	1.32	1.70	41	0-9	2.16	3.00	2.30	0.82
II_3	20	15	0-6	3.00	1.81	123	0-15	6.15	4.20	2.53	0.65
II_T	56	15	0-6	1.71	1.81	184	0-15	3.29	3.80	2.65	0.68
III_R	1	1	1	-	-	1	1	-	-	-	-
III_1	15	4	0-3	0.93	1.22	20	0-6	1.33	2.02	1.53	0.77
III_2	22	11	0-7	3.23	1.72	133	0-15	6.05	4.41	2.46	0.71
III_3	17	14	1-7	4.18	1.91	152	1-18	8.94	4.63	2.62	0.69
III_T	54	14	0-7	2.89	2.08	306	0-18	5.65	4.91	2.56	0.67
IV	16	15	0-9	4.19	2.43	121	0-16	7.56	4.53	3.12	0.80
V	18	18	3-11	7.33	2.17	235	3-24	13.06	5.99	3.56	0.86
VI	19	22	5-13	9.47	2.46	391	10-30	20.58	4.79	3.72	0.83
TOTAL	172	23	0-13	3.91	3.33	1317	0-30	7.66	7.24	3.49	0.77

R - Rubble zone.
1 - *Millepora*/*Palythoa* zone, spur and groove formation.
2 - *Acropora*/transition zone, spur and groove formation.
3 - *Montastraea*/octocoral zone, spur and groove formation.
T - Intrasite totals for combined zones, sites II and III, respectively.

Table 6.25. Summary, stony coral (Milleporina, Scleractinia less Corallimorpharia) analyses, Looe Key, August 1983.

	No. of $1\text{-}m^2$	Total no.	Species/m^2			Total no.	Colonies/m^2					Stony coral cover Estimate percemt	
Site	Quadrats	Species	Range	$\bar{x}$	S	Colonies	Range	$\bar{x}$	S	H'	J'	$\bar{x}$	S
I	8	6	0-2	1.13	1.13	18	0-9	2.25	3.11	2.17	0.84	1.56	1.29
II_1	17	4	1-4	2.53	1.23	162	1-24	9.59	6.36	1.83	0.91	5.88	4.41
II_2	19	18	2-6	4.00	1.89	192	2-17	10.11	5.77	3.36	0.80	18.55	12.95
II_3	20	22	0-8	4.16	1.95	195	0-19	9.75	6.09	3.25	0.73	28.50	21.39
II_T	56	26	0-8	3.54	1.90	549	0-24	9.82	5.96	3.49	0.74	-	-
II_R	1	0		-	-	-	0	-	-	-	-	-	-
III_1	15	7	1-5	2.73	1.62	114	2-14	7.60	4.40	2.07	0.73	15.63	17.48
III_2	22	16	1-10	4.14	2.47	223	1-24	10.18	6.88	2.93	0.73	11.25	9.41
III_3	17	20	3-7	4.59	1.37	132	4-14	7.65	3.44	3.87	0.90	21.76	18.43
III_T	54	22	1-10	3.59	2.05	469	1-24	8.76	5.39	3.34	0.75	-	-
IV	16	16	0-7	3.88	1.96	122	0-15	7.63	4.76	3.01	0.75	21.41	23.56
V	18	16	1-9	6.00	2.17	193	1-20	10.83	5.22	3.43	0.86	8.89	6.20
VI	19	21	3-8	5.74	1.24	219	5-17	11.53	4.11	3.44	0.78	9.87	6.74
TOTAL	171	32	0-10	3.89	1.47	1570	0-24	9.71	2.61	3.89	0.79	14.33	8.29

R - Rubble zone
1 - *Millepora*/*Palythoa* zone, spur and groove formation.
2 - *Acropora*/transition zone, spur and groove formation.
3 - *Montastraea*/octocoral zone, spur and groove formation.
T - Intrasite totals for combined zones, sites II and III, respectively.

Table 6.26. Stony corals, site II (middle spur), Looe Key, August 1983.

Species	Abundance	Percent abundance	Frequency	Density $\bar{x}$	Density S
Porites astreoides	102	18.58	0.54	1.82	2.89
Agaricia agaricites	81	14.75	0.46	1.45	2.56
Millepora complanata	76	13.84	0.52	1.36	1.88
Montastraea cavernosa	68	12.39	0.29	1.20	3.35
Acropora cervicornis	53	9.65	0.29	0.95	2.25
Acropora palmata	42	7.65	0.20	0.75	2.08
Montastraea annularis	31	5.65	0.18	0.55	1.74
Favia fragum	27	4.92	0.20	0.48	1.19
Porites porites	16	2.91	0.16	0.29	0.71
Millepora alcicornis	14	2.53	0.20	0.25	0.55
Siderastrea siderea	10	1.82	0.18	0.18	0.39
Mycetophyllia lamarckiana	6	1.09	0.09	0.11	0.37
Stephanocoenia michelini	4	0.73	0.07	0.07	0.26
Dichocoenia stellaris	3	0.55	0.05	0.05	0.23
Colpophyllia natans	3	0.55	0.05	0.05	0.23
Meandrina meandrites	2	0.36	0.04	0.04	0.19
Dendrogyra cylindrus	2	0.36	0.02	0.04	0.27
Diploria labyrinthiformis	1	0.18	0.02	0.02	0.13
Diploria strigosa	1	0.18	0.02	0.02	0.13
Diploria clivosa	1	0.18	0.02	0.02	0.13
Manicina areolata	1	0.18	0.02	0.02	0.13
Eusmilia fastigiata	1	0.18	0.02	0.02	0.13
Isophyllastrea rigida	1	0.18	0.02	0.02	0.13
Isophyllia sinuosa	1	0.02	0.02	0.02	0.13
Mycetophyllia ferox	1	0.02	0.02	0.02	0.13
Mycetophyllia sp.	1	0.02	0.02	0.02	0.13
Total: species 26	colonies 549				

Table 6.27. Abundance of octocorals, site II (middle spur), Looe Key, August 1983.

Species	Abundance	Percent abundance	Frequency
Plexaura flexosa	79	42.93	0.46
Plexaura homomalla	30	16.30	0.26
Gorgonia ventalina	25	13.59	0.23
Eunicea succinea	17	9.24	0.25
Pseudoplexaura porosa	11	5.98	0.14
Eunicea tourneforti	4	2.17	0.07
Pseudopterogorgia americana	3	1.63	0.05
Plexaurella fusifera	3	1.63	0.03
Briareum asbestinum	3	1.63	0.03
Eunicea calyculata	2	1.09	0.03
Pseudoplexaura crucis	2	1.09	0.03
Pseudoplexaura flagellosa	2	1.09	0.03
Plexaurella grisea	1	0.54	0.01
Muriceopsis flavida	1	0.54	0.01
Eunicea laciniata	1	0.54	0.01
Total: species 15	colonies 184		

Table 6.28. Systematic listing of Cnidaria sampled at six sites, Looe Key, August 1983.

Phylum CNIDARIA (Hatschek, 1888)
- Class HYDROZOA Owen, 1843
  - Order MILLEPORINA Hickson, 1901
    - Family MILLEPORIDAE Fleming, 1828
      - *Millepora alcicornis* Linné, 1758
      - *M. complanata* Lamarck, 1816
- Class ANTHOZUA Ehrenberg, 1834
- *Subclass OCTOCORALLIA Haeckel, 1866
  - Order ALCYONACEA Lamouroux, 1816 (emended Verrill, 1866; Bayer, 1981)
    - Family BRIAREIDAE Gray, 1840
      - *Briareum asbestinum* (Pallas, 1766)
    - Family ANTHOTHELIDAE Broch, 1916
      - *Erythropodium caribaeorum* (Duchassaing and Michelotti, 1860)
    - Family PLEXAURIDAE Gray, 1859
      - *Plexaura homomalla* Esper, 1792
      - *P. flexosa* Lamouroux, 1821
      - *Eunicea succinea* (Pallas, 1766)
      - *Eunicea laciniata* Duchassaing and Michelotti, 1860
      - *E. tourneforti* Milne Edwards and Haime, 1857
      - *E. calyculata* Ellis and Solander, 1786
      - *Muriceopsis flavida* (Lamarck, 1815)
      - *Plexaurella nutans* (Duchassaing and Michelotti, 1860)
      - *P. grisea* Kunze, 1916
      - *P. fusifera* Kunze, 1916
      - *Muricea atlantica* (Kukenthal, 1919)
      - *M. elongata* Lamouroux, 1821
      - *Pseudoplexaura porosa* (Houttuyn, 1772)
      - *P. flagellosa* (Houttuyn, 1772)
      - *P. wagenaari* (Stiasny, 1941)
      - *P. crucis* Bayer, 1961
    - Family GORGONIIDAE Lamouroux, 1812
      - *Pseudopterogorgia acerosa* (Pallas, 1766)
      - *P. americana* (Gmelin, 1791)
      - *Gorgonia ventalina* Linné, 1758
      - *Pterogorgia citrina* (Esper, 1792)
      - *P. anceps* Pallas, 1766)
- Subclass ZOANTHARIA de Blainville, 1830
  - Order ZOANTHINIARIA van Beneden, 1898
    - Family ZOANTHIDAE Gray, 1840
      - *Palythoa caribbea* Duchassaing and Michelotti, 1860
      - *Zoanthus sociatus* Le Sueur, 1817
  - Order SCLERACTINIA
  - Suborder ASTROCOENIINA Vaughan and Wells, 1943
    - Family ASTROCOENIIDAE Koby, 1890
      - *Stephanocoenia michelini* Milne Edwards and Haime, 1848
    - Family ACROPORIDAE Verrill, 1902
      - *Acropora palmata* (Lamarck, 1816)
      - *A. cervicornis* (Lamarck, 1816)
      - *A. prolifera* (Lamarck, 1816)

Table 6.28. Systematic listing of Cnidaria sampled at six sites, Looe Key, August 1983 (cont.).

Suborder FUNGIINA Verrill, 1865
- Family AGARICIIDAE Gray, 1847
  - *Agaricia agaricites* (Linné, 1758)
- Family SIDERASTREIDAE Vaughan and Wells, 1943
  - *Siderastrea radians* (Pallas, 1766)
  - *S. siderea* (Ellis and Solander, 1786)
- Superfamily PORITICAE Gray, 1842
- Family PORITIDAE Gray, 1842
  - *Porites astreoides* Lamarck, 1816
  - *P. Porites* (Pallas, 1766)

Suborder FAVIINA Vaughan and Wells, 1943
- Superfamily FAVIICAE Gregory, 1900
- Family FAVIIDAE Gregory, 1900
  - *Favia fragum* (Esper, 1795)
  - *Diploria labyrinthiformis* (Linné, 1758)
  - *D. clivosa* (Ellis and Solander, 1786)
  - *D. strigosa* (Dana, 1846)
  - *Manicina areolata* (Linné, 1758)
  - *Colpophyllia natans* (Houttuyn, 1772)
  - *Montastraea cavernosa* (Linné, 1767)
  - *M. annularis* (Ellis and Solander, 1786)
  - *Solenastrea bournoni* Milne Edwards and Haime, 1850
- Family OCULINIDAE Gray, 1847
  - *Oculina diffusa* Lamarck, 1816
- Family MEANDRINAE Gray, 1847
  - *Meandrina meandrites* (Linné, 1758)
  - *Dichocoenia stellaris* Milne Edwards and Haime, 1849
  - *D. stokesi* Milne Edwards and Haime, 1849
  - *Dendrogyra cylindrus* Ehrenberg, 1834
- Family MUSSIDAE Ortmann, 1890
  - *Scolymia lacera* (Pallas, 1766)
  - *Scolymia* sp.
  - *Isophyllia sinuosa* (Ellis and Solander, 1786)
  - *Isophyllastrea rigida* (Dana, 1846)
  - *Mycetophyllia lamarckiana* Milne Edwards and Haime, 1849
  - *M. ferox* Wells, 1973
  - *Mycetophyllia* sp.

Suborder MYOPHINA Vaughan and Wells, 1943
- Superfamily CARYOPHYLLIICAE Gray, 1847
- Family CARYOPHYLLIIDAE Gray, 1847
  - *Eusmilia fastigiata* (Pallas, 1766)

**Suborder CORALLIMORPHARIA Carlgren, 1940
- Family RICORDEIDAE Watzl, 1922
  - *Ricordea florida* Duchassaing and Michelotti, 1860

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* According to most recent revision (Beyer, 1981).
** According to Den Hartog, 1980.

Table 6.29. Abundance of octocorals at six sites, Looe Key, August 1983.

Species	Abundance	Percent abundance
Plexaura flexosa	389	29.54
Eunicea succinea	188	14.27
Plexaura homomalla	143	10.86
Gorgonia ventalina	87	6.61
Pseudopterogorgia americana	64	4.86
Muricea atlantica	59	4.48
Eunicea tourneforti	58	4.40
Pseudoplexaura porosa	58	4.40
Plexaurella fusifera	47	3.57
Eunicea calyculata	47	3.57
Briareum asbestinum	46	3.49
Muriceopsis flavida	44	3.34
Pseudoplexaura flagellosa	16	1.21
Pseudoplexaura crucis	14	1.06
Plexaurella grisea	13	0.99
Muricea elongata	8	0.61
Plexaurella nutans	8	0.61
Pterogorgia citrina	7	0.53
Pseudopterogorgia acerosa	7	0.53
Eunicea laciniata	5	0.38
Pterogorgia anceps	4	0.30
Pseudoplexaura wagenaari	3	0.23
Erythropodium caribaeorum	2	0.15
Total: species 23	colonies 1317	

Table 6.30. Abundance of stony corals (Milleporina, Scleractinia◊) at six sites, Looe Key, August 1983.

Species	Abundance	Percent abundance	Frequency∆
Agaricia agaricites	248	13.50	0.80
Porites astreoides	212	11.54	1.00
*Millepora complanata**	175	9.53	0.70
Montastraea cavernosa	143	7.78	0.80
*Millepora alcicornis**	117	6.37	0.80
Siderastrea siderea	113	6.15	0.80
Acropora cervicornis	106	5.77	0.60
Porites porites	85	4.63	0.80
Montastraea annularis	73	3.97	0.70
Stephanocoenia michelini	49	2.67	0.70
Acropora palmata	42	2.29	0.20
Mycetophyllia lamarckiana	40	2.18	0.60
Favia fragum	36	1.96	0.70
Dichocoenia stellaris	24	1.31	0.50
Siderastrea radians	16	0.87	0.40
Dichocoenia stokesi	15	0.82	0.30
Meandrina meandrites	12	0.65	0.60
Solenastrea bournoni	10	0.54	0.30
Eusmilia fastigiata	9	0.49	0.40
Colpophyllia natans	8	0.44	0.40
Diploria labyrinthiformis	7	0.38	0.40
Diploria clivosa	5	0.27	0.30
Oculina diffusa	5	0.27	0.20
Manicina areolata	5	0.27	0.40
Mycetophyllia ferox	4	0.22	0.30
Acropora prolifera	2	0.11	0.10
Dendrogyra cylindrus	2	0.11	0.10
Scolymia sp.	2	0.11	0.10
Diploria strigosa	1	0.05	0.10
Scolymia lacera	1	0.05	0.10
Isophyllia sinuosa	1	0.05	0.10
Isophyllastrea rigida	1	0.05	0.10
Mycetophyllia sp.	1	0.05	0.10
Total: species 33	colonies 1570		

◊ Corallimorpharia excluded.

∆ Frequency expressed as presence or absence of a species within sampling sites or zones, N = 10 attributes.

* Milleporina.

Table 6.31. Abundance of non-coral Cnidaria at six sites, Looe Key, August 1983.

Species	Abundance	Percent abundance	Frequency
Palythoa caribbea	175	9.53	1.00
Zoanthus sociatus	2	0.11	0.20
Ricordea florida[Δ]	90	4.90	0.70
Total: species 3	colonies 267		

[Δ] Zoanthidae, Corallimorpharia.

Table 6.32. Comparison of Looe Key Octocorallia records.

Coral Surveys*

Species	Antonius *et al.* 1978	FDNR 1980	FDNR 1983
Briareum asbestinum	P D		L S
Erythropodium caribaeorum	P D	S	L S
Iciligorgia schrammi	D R	D	
Plexaura flexosa	P S D	S D	L S
Plexaura homomalla	P S D	S	L S
Pseudoplexaura porosa	P S D	S D	L S
Pseudoplexaura flagellosa	P S D	S D	L S
Pseudoplexaura wagenaari	P S D	S	L S
Pseudoplexaura crucis			L S
Eunicea asperula	P S D		
Eunicea calyculata	P S D	S D	L S
Eunicea fusca	P D		
Eunicea laciniata	P S D		L S
Eunicea mammosa	P S D	S	
Eunicea succinea	P D	S	L S
Eunicea tourneforti	P S D		L S
Eunicea clavigera		D	
Eunicea pinta		D	
Plexaurella dichotoma	P S D		
Plexaurella fusifera	P S D	S D	L S
Plexaurella grisea	S		L S
Plexaurella nutans	P S D	D	L S
Muricea atlantica	PS	S D	L S
Muricea muricata	P S D		
Muricea elongata	P S D		L S
Muricea laxa		D	
Muriceopsis flavida	P S D	D	L S
Gorgonia ventalina	P S D	S D	L S
Pseudopterogorgia bipinnata	S D	D	
Pseudopterogorgia acerosa	P S D	S D	L S
Pseudopterogorgia americana	P S D	S D	L S
Pseudopterogorgia elisabethae		D	
Pterogorgia citrina	S	S	S
Pterogorgia anceps	P		L S
Pterogorgia guadalupensis	P		
Ellisella barbadensis	D R	D	

L - livebottom.
P - patch reef.
S - shallow reef (0 - 11 m depth).
D - plateau (10 - 18 m depth); drop off (25 - 35 m depth).
R - ridge (45 m depth).

* Only portions of above depths were sampled in any one survey.

Table 6.33. Comparison of Looe Key stony coral (Milleporina and Scleractinia) records.

Coral Surveys*

Species	Antonius *et al.* 1978	FDNR 1980	FDNR 1983
Millepora alcicornis	P S D	S D	L S
Millepora complanata	P S D	S	S
Millepora squarrosa[1]	P S		
Stephanocoenia michelini[2]	P S D	S D	L S
Madracis decactis	D	D	
Madracis mirabilis	D	Q	
Madracis asperula	D		
Acropora palmata	S	S	S
Acropora cervicornis	P S D	S	L S
Acropora prolifera	S		S
Agaricia agaricites	P S D	S D	L S
Agaricia agaricites forma *danai*	P S D		
Agaricia agaricites forma *carinata*	*		
Agaricia agaricites forma *purpurea*	D		
Agaricia agaricites forma *humilis*	*		
Agaricia tenuifolia	D		
Agaricia undata	D		
Agaricia lamarcki	D		
Agaricia grahamae	D		
Agaricia fragilis	D		
Helioseris cucullata	D	D	
Siderastrea siderea	P S D	S D	L S
Siderastrea radians	P S	S	L S
Porites astreoides	P S D	S	L S
Porites porites	P S D	S	L S
Porites divaricata[3]	D		
Porites furcata[3]	D		
Favia fragum	P S	S	L S
Diploria clivosa	P S	Q	S
Diploria labyrinthiformis	P S D	D	L S
Diploria strigosa	P S D	S D	S
Manicina areolata	P S	Q	L S
Colpophyllia natans	P S D	S	L S
Montastraea annularis	P S D	S D	L S
Montastraea cavernosa	P S D R	S	L S
Solenastrea hyades	P S D		
Solenastrea buornoni	P S D	Q	L S
Oculina diffusa	P S D	S	L S
Meandrina varicosa	P S D		
Meandrina meandrites	P S D	S	L S
Dichocoenia stokesi	P S D	Q	L S
Dichocoenia stellaris	P S D	D	L S
Dendrogyra cylindrus	P S	Q	S
Mussa angulosa	P S D	Q	
Scolymia lacera	D		L S

Table 6.33. Comparison of Looe Key stony coral (Milleporina and Scleractinia) records (cont.).

Coral Surveys*

Species	Antonius *et al.* 1978	FDNR 1980	FDNR 1983
Isophyllia sinuosa	D	Q	S
Isophyllastrea rigida	D		S
Mycetophyllia lamarckiana	D	S D	S
Mycetophyllia daniana	D		S
Mycetophyllia ferox	D	S	S
Mycetophyllia aliciae	D		
Eusmilia fastigiata	D	S D	L S
Sphenotrochus auritus	*		
Tubastrea aurea	*		

L - livebottom.
P - patch reef.
S - shallow reef (0 - 11 m depth).
D - plateau (10-18 m depth); drop off (25 - 35 m depth).
R - ridge (45 m depth).
Q - qualitative observation.
* Included in a systematic list of species (Appendix) by Antonius *et al.* (1978); not discussed in text nor reported in the tables.
[1] *Millepora squarrosa* is a synonym of *Millepora complanata* (*fide* Stearn and Riding, 1973).
[2] *Stephanocoenia michelini* was reported as *S. intersepta* by Antonius *et al.* (1978).
[3] Varieties of *Porites porites* (*fide* Squires, 1958).

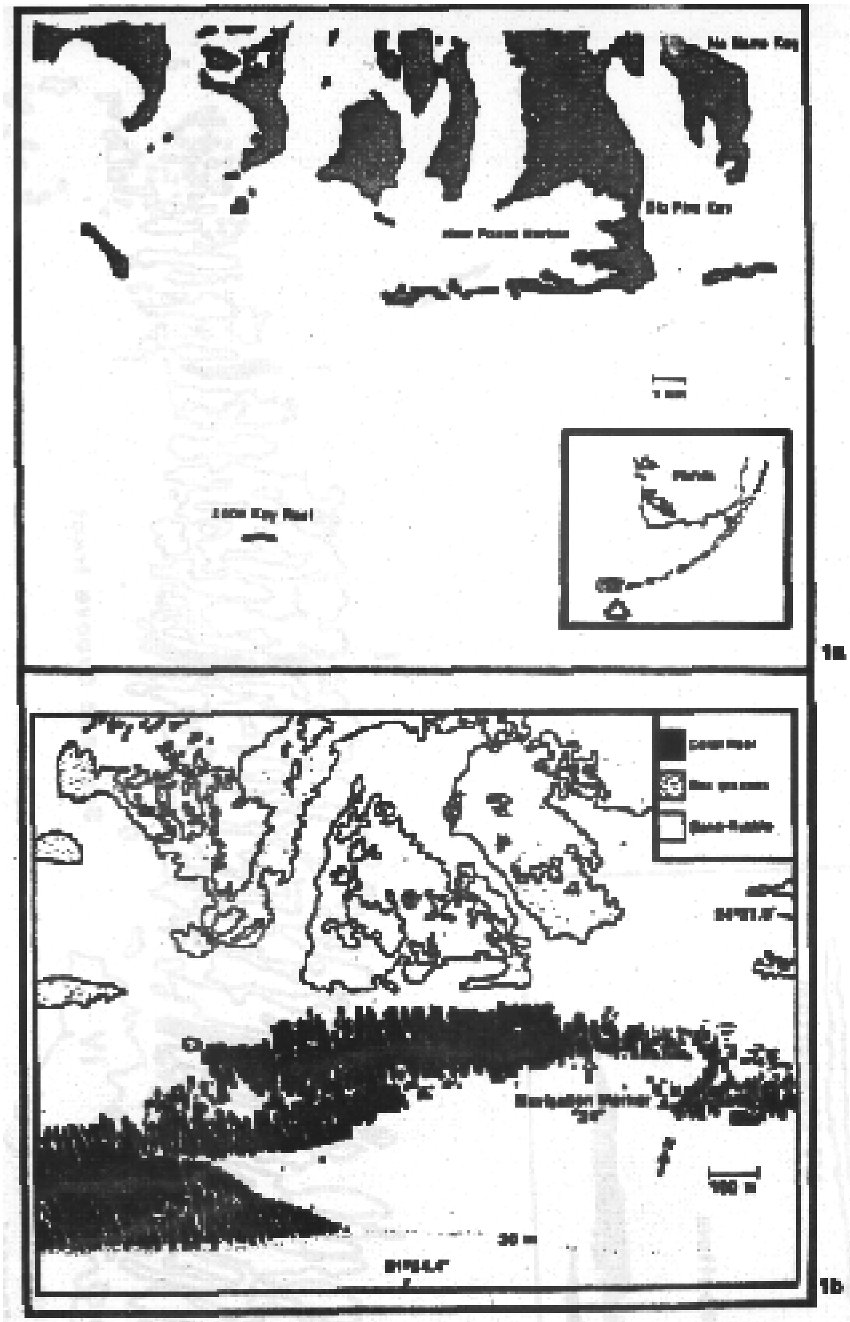


Figure 6.1. a. Geographic location of Looe Key, Florida. b. Orientation of main spur and groove tract, Looe Key reef.

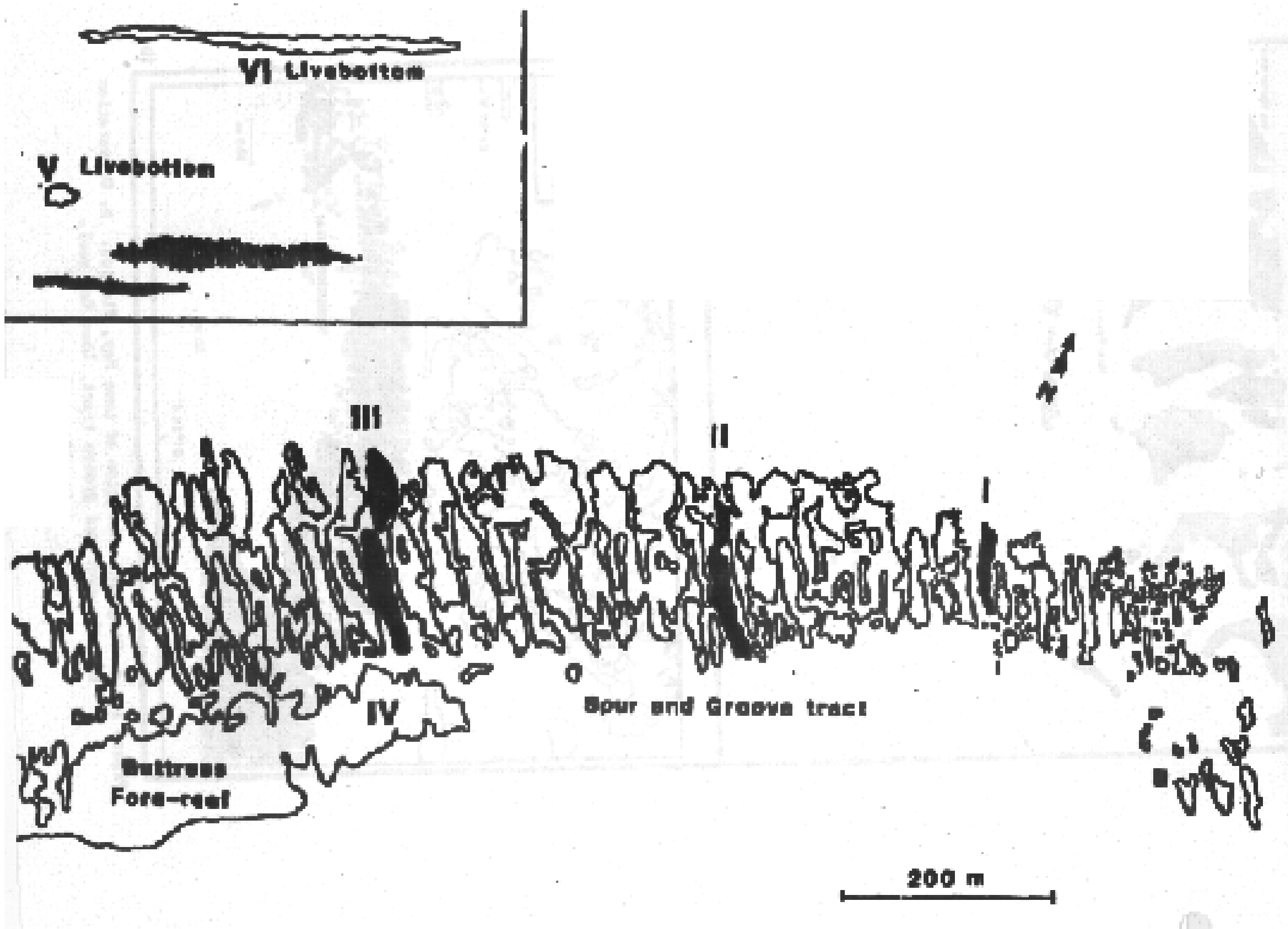


Figure 6.2. Looe Key quantitative coral sampling sites, August 1983.

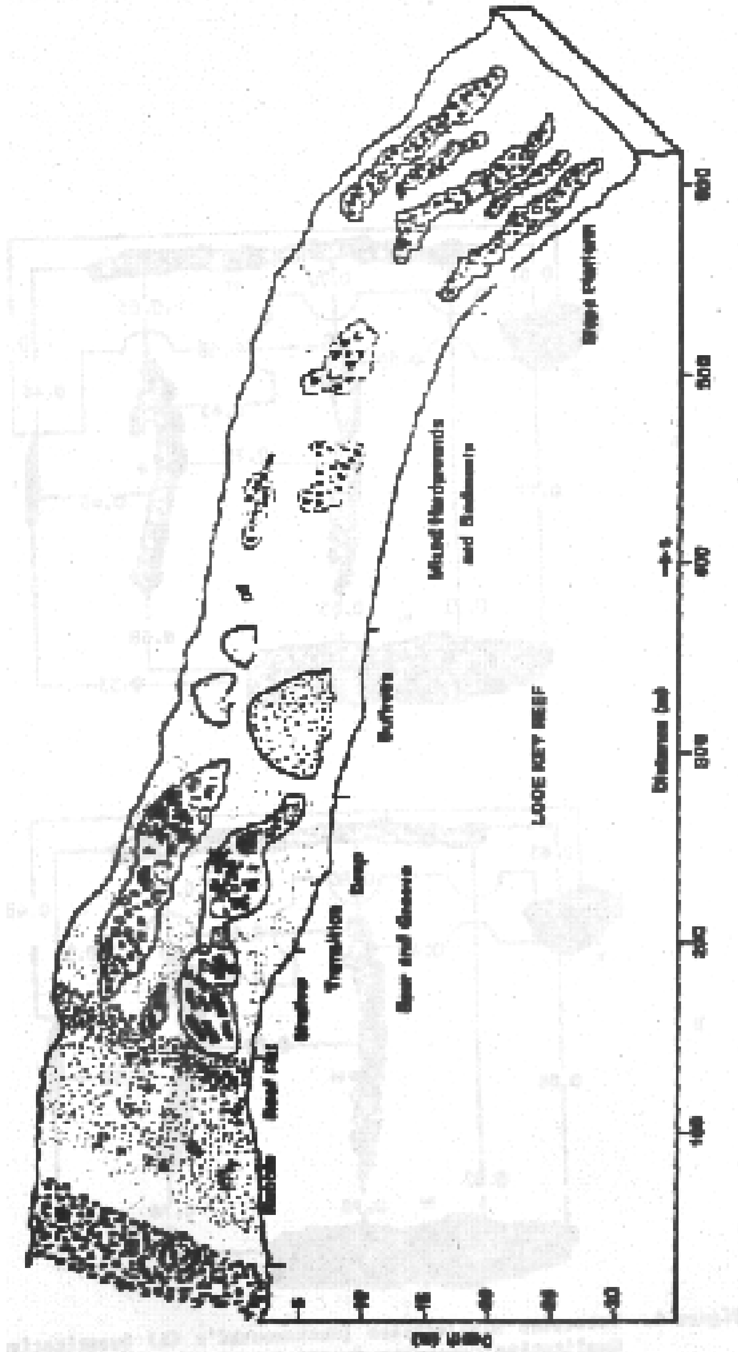
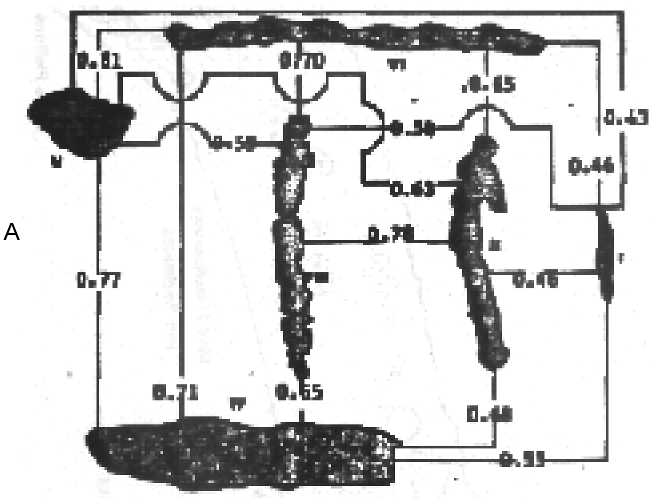


Figure 6.3. Looe Key reef, spur and groove tract, zonation patterns.

A



B

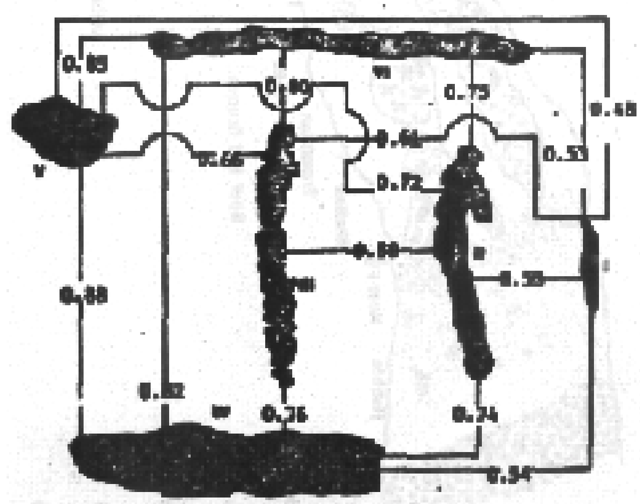


Figure 6.4. Intersite similarities [Czekanowski's (A) Quantitative and (B) Qualitative Community Coefficients] of cnidarian fauna sampled at six sites, Looe Key National Marine Sanctuary, August 1983.

A

B

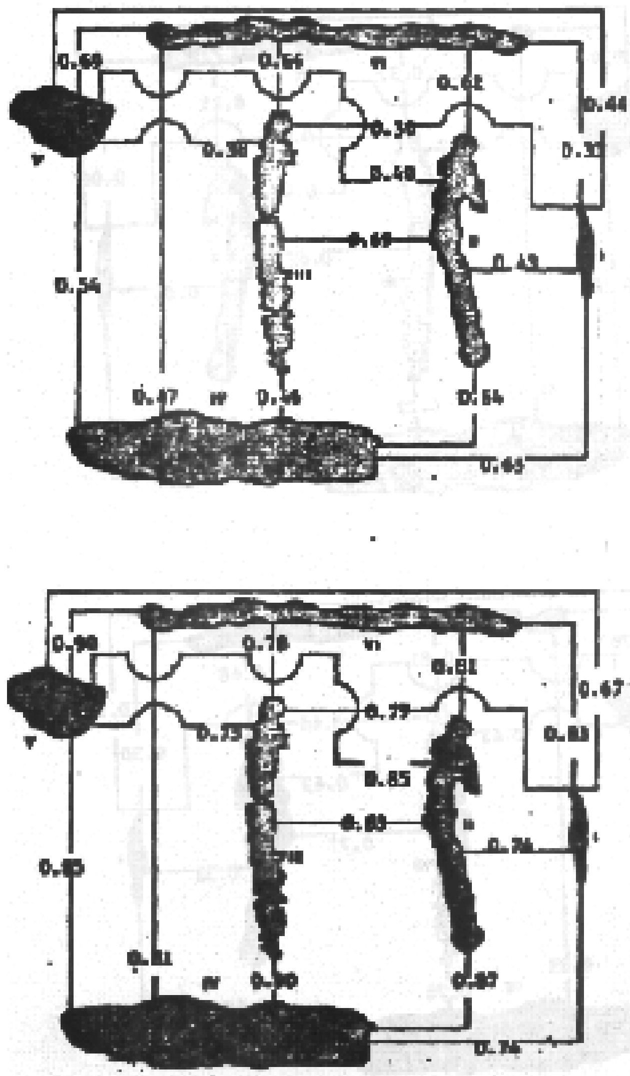


Figure 6.5. Intersite similarities [Czekanowski's (A) Quantitative and (B) Qualitative Community Coefficients] of octocoral fauna sampled at six sites, Looe Key National Marine Sanctuary, August 1983.

A

B

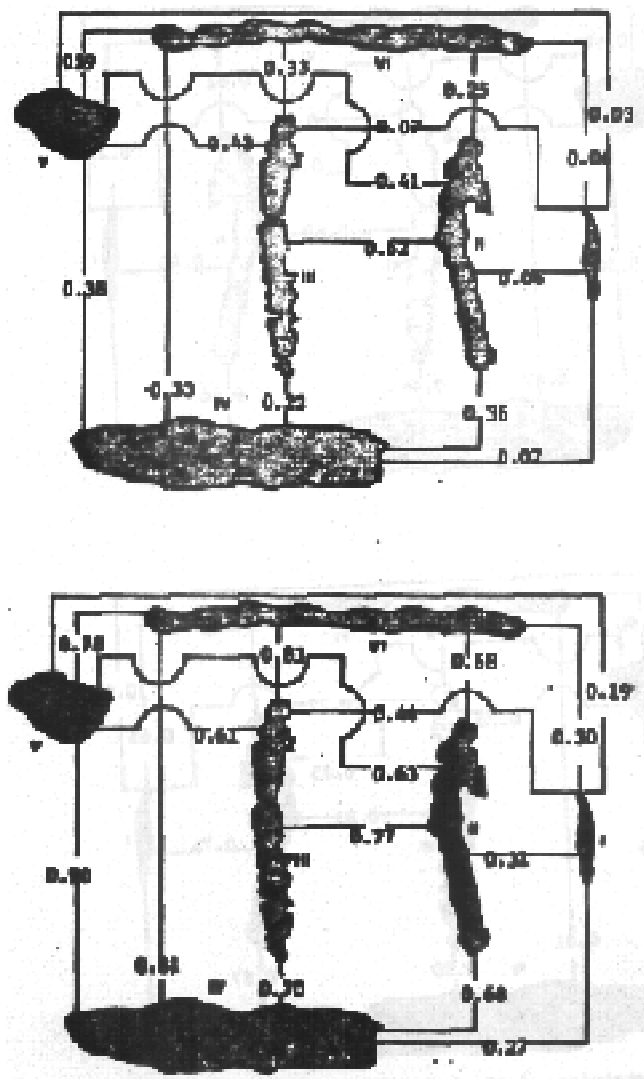


Figure 6.6. Intersite similarities [Czekanowski's (A) Quantitative and (B) Qualitative Community Coefficients] of stony coral fauna sampled at six sites, Looe Key National Marine Sanctuary, August 1983.

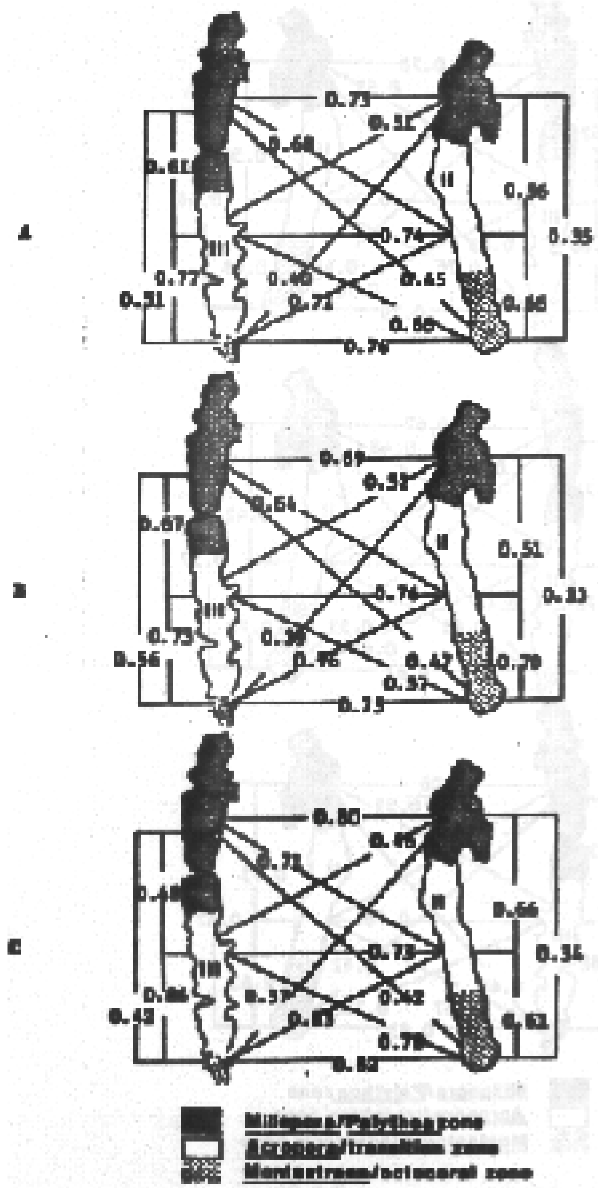


Figure 6.7. Intersite similarities Czekanowski's Quantitative Community Coefficients for (A) all sampled Cnidaria, (B) stony corals, (C) octocorals at sites II and III, Looe Key National Marine Sanctuary, August 1983.

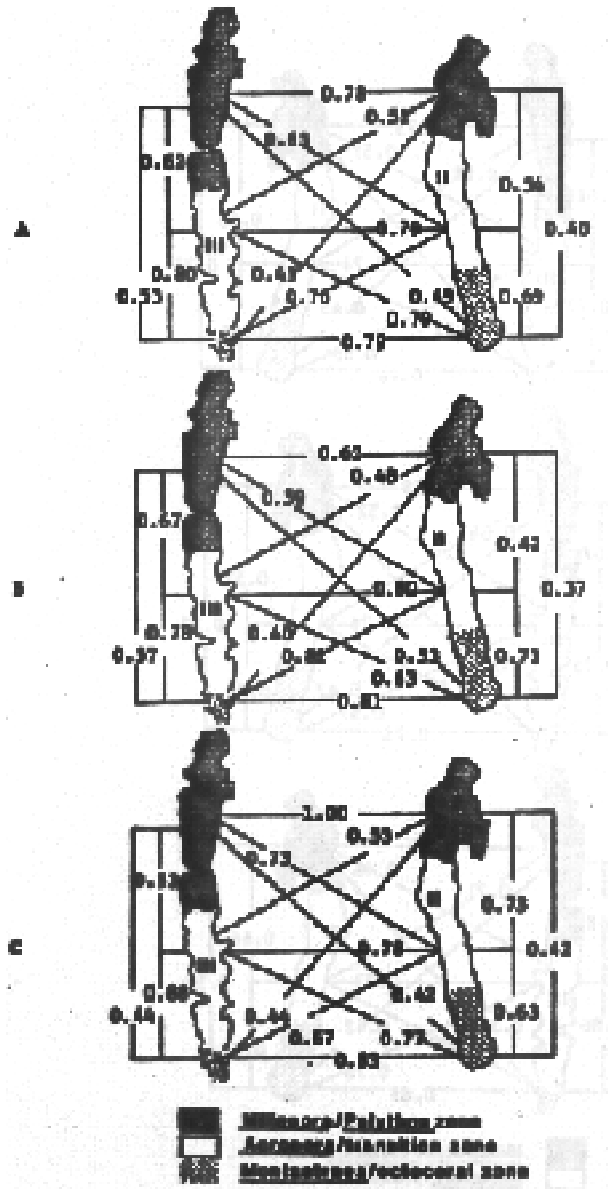
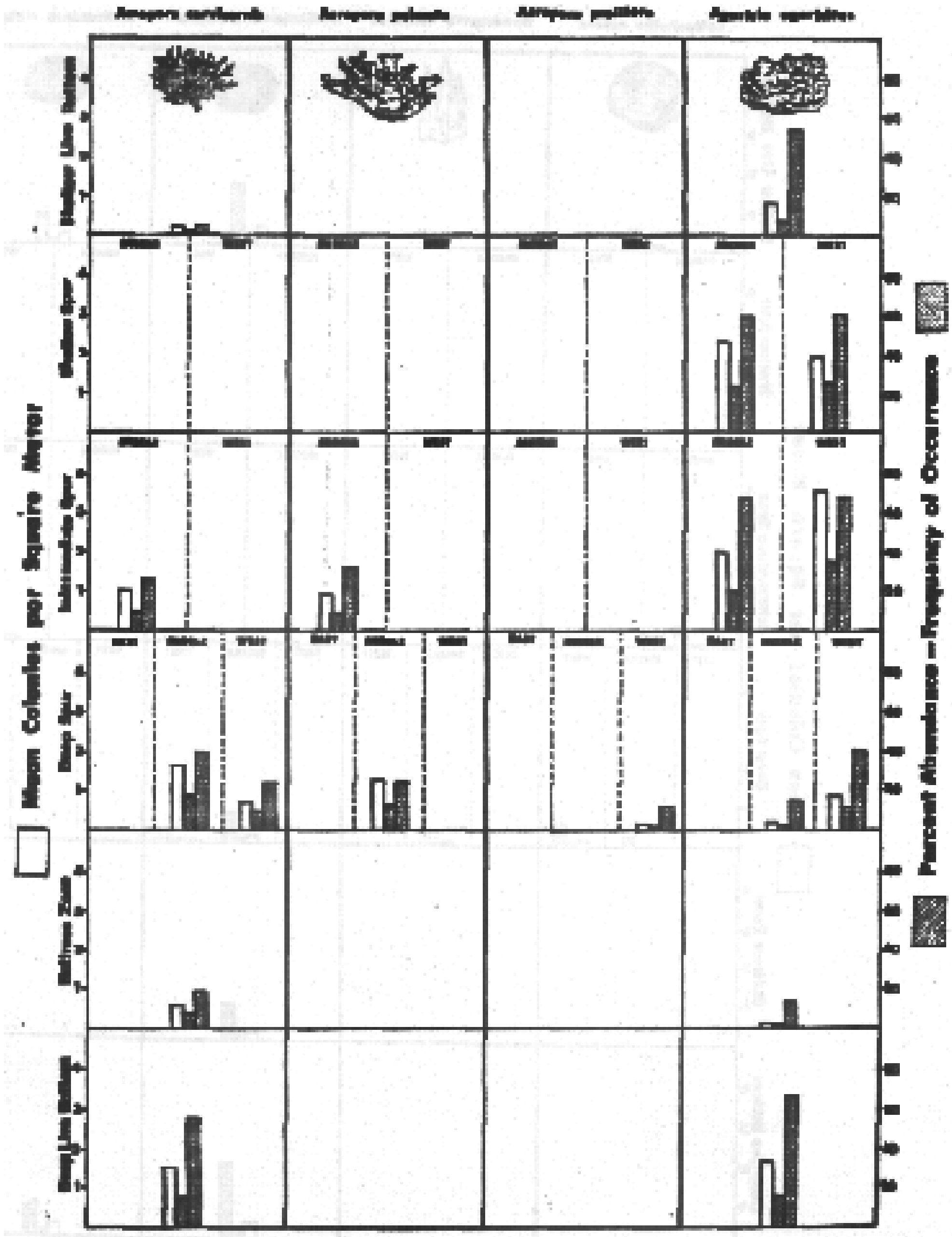
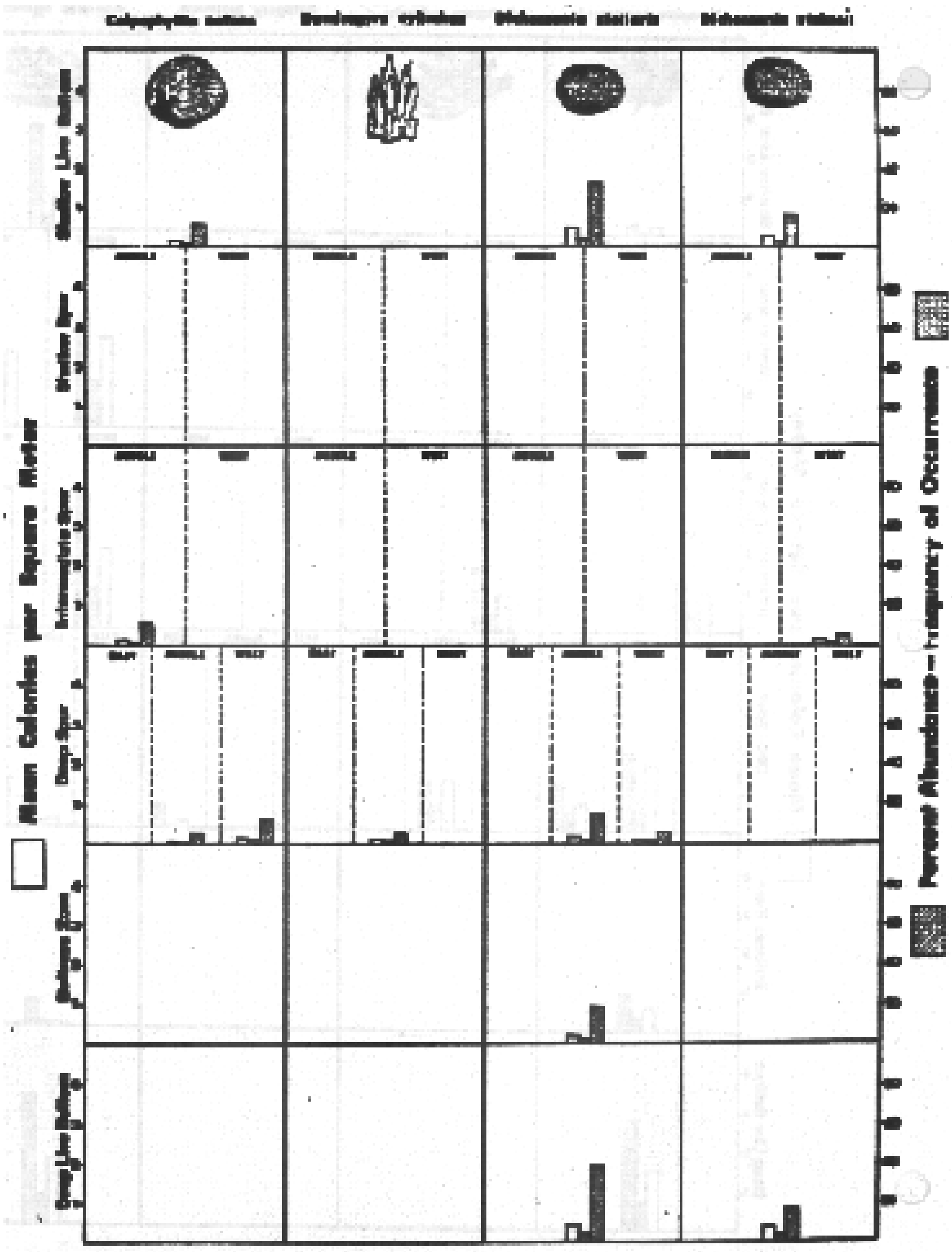
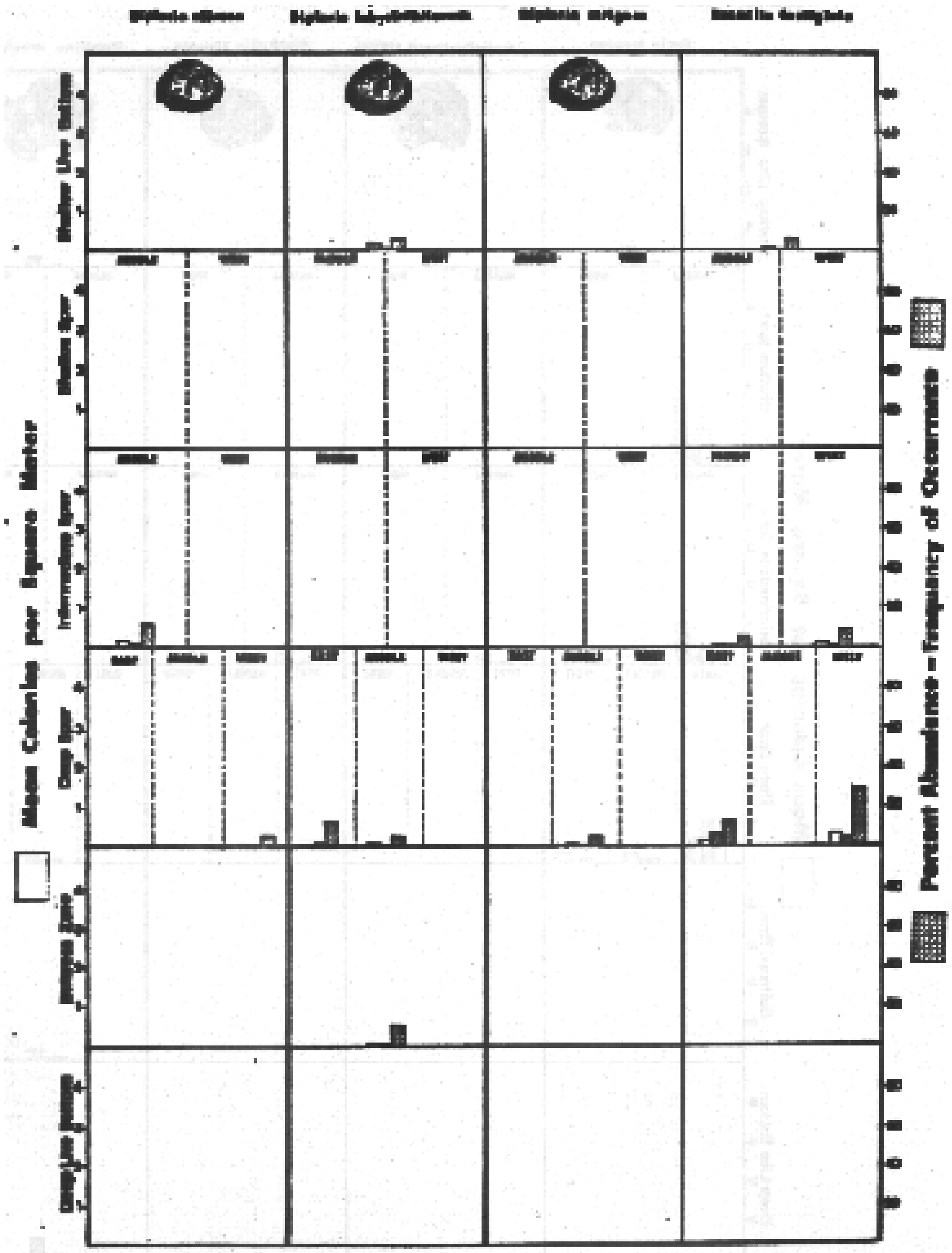


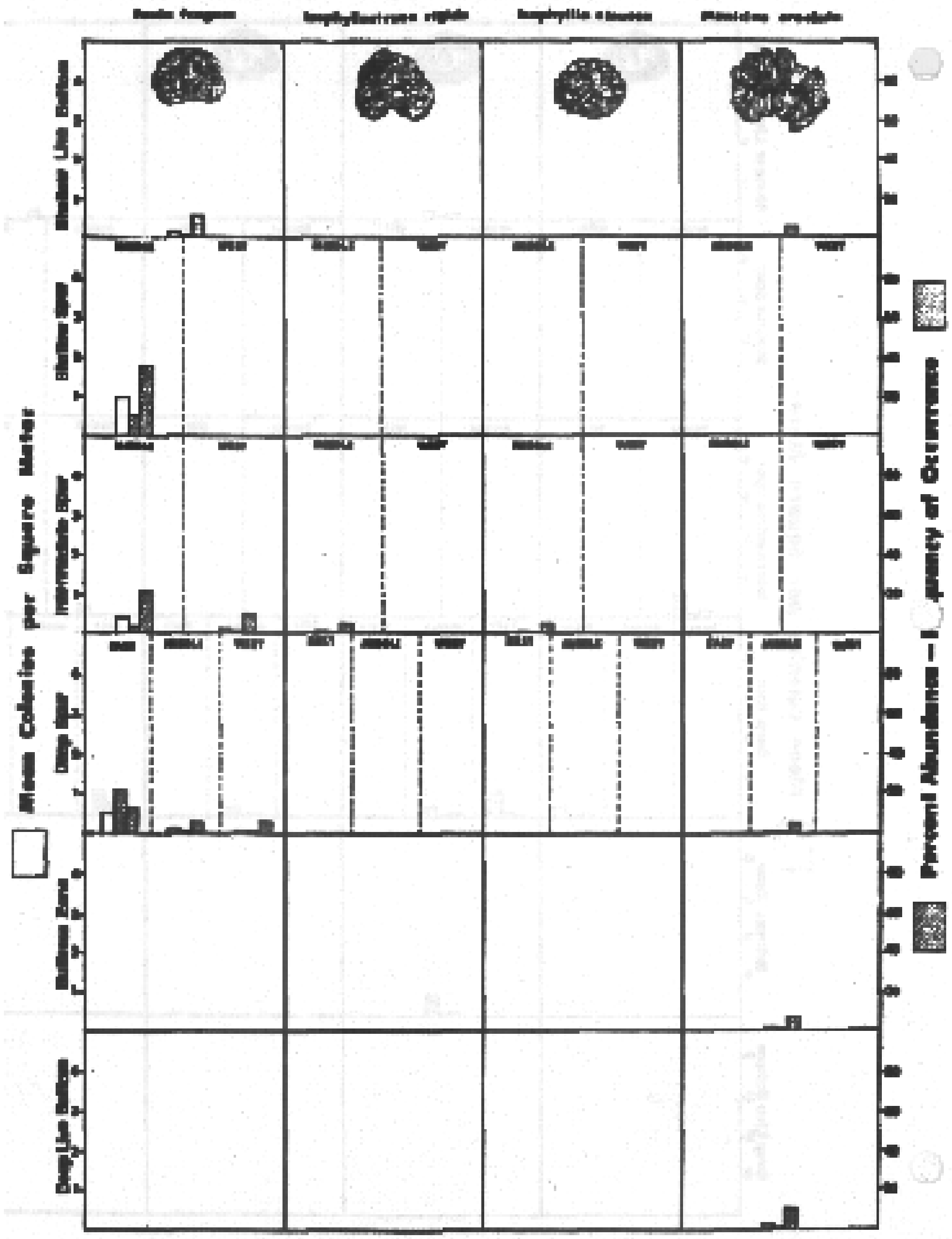
Figure 6.8. Intersite similarities Czekanowski's Quantitative Community Coefficients for (A) all sampled Cnidaria, (B) stony corals, (C) octocorals at sites II and III, Looe Key National Marine Sanctuary, August 1983.

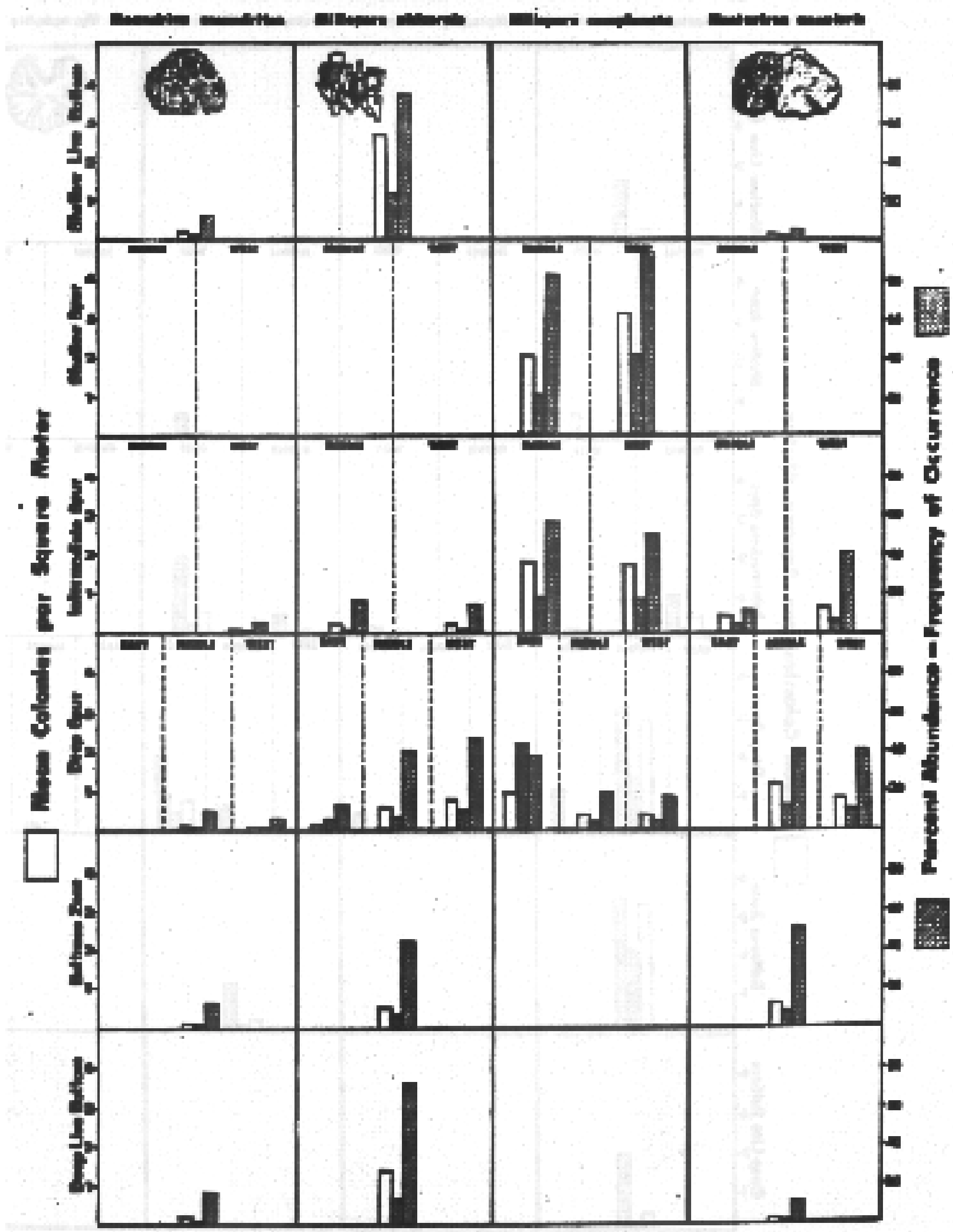
Appendix 6.A. Stony coral abundance and distribution, Looe Key Reef.

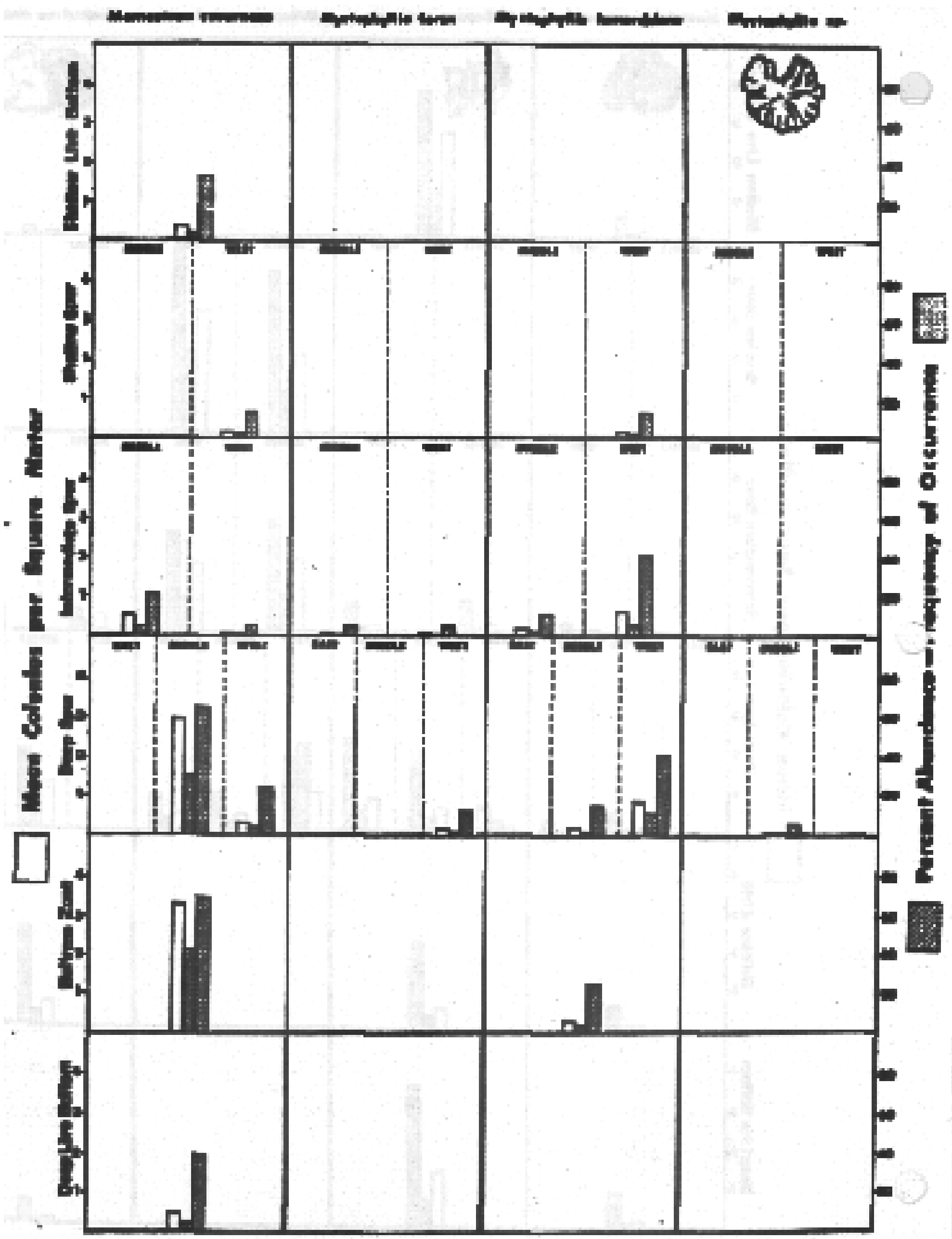



Mean Colonies per Square Meter
Percent Abundance – Frequency of Occurrence

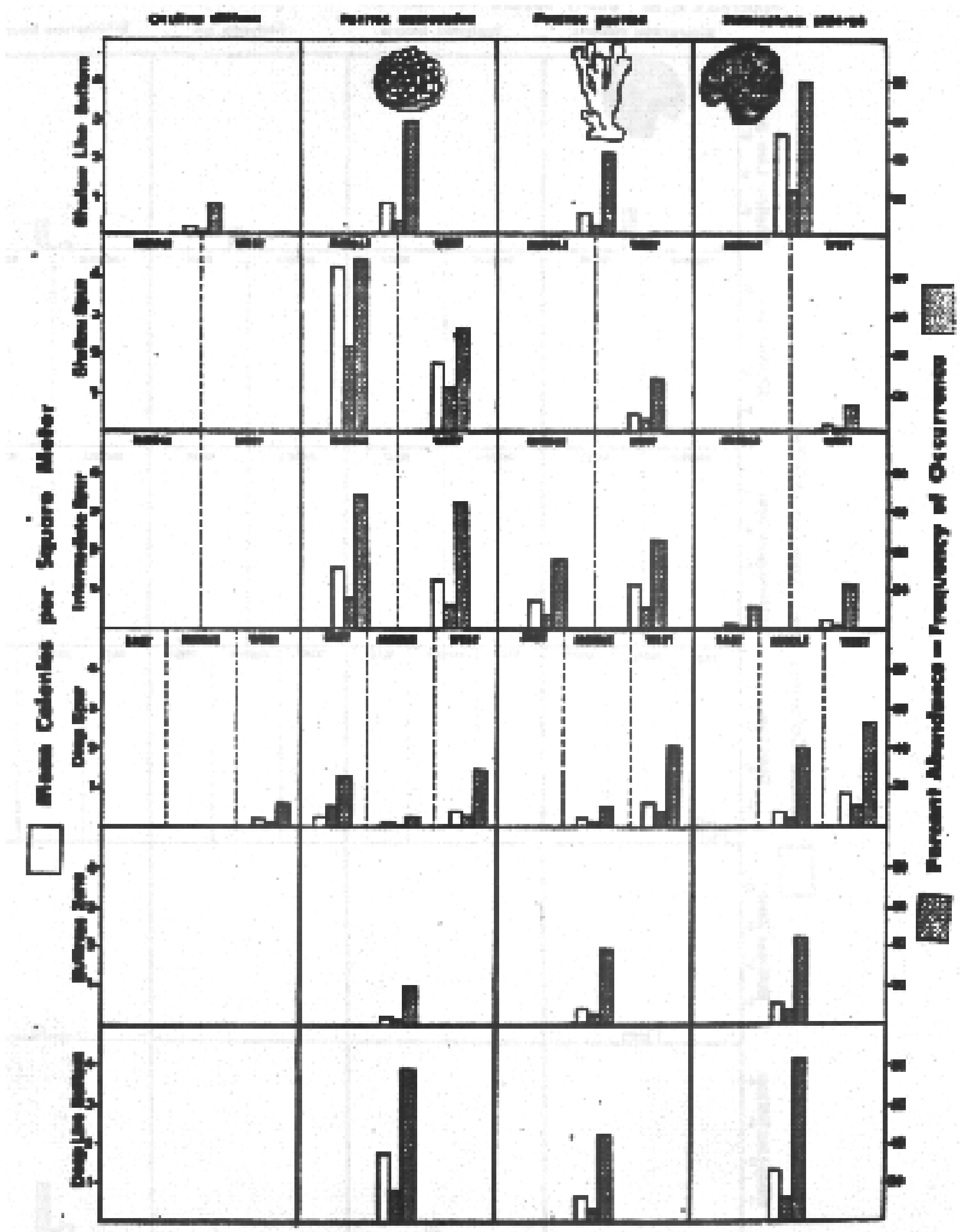

Mean Colonies per Square Meter
Percent Abundance - Frequency of Occurrence

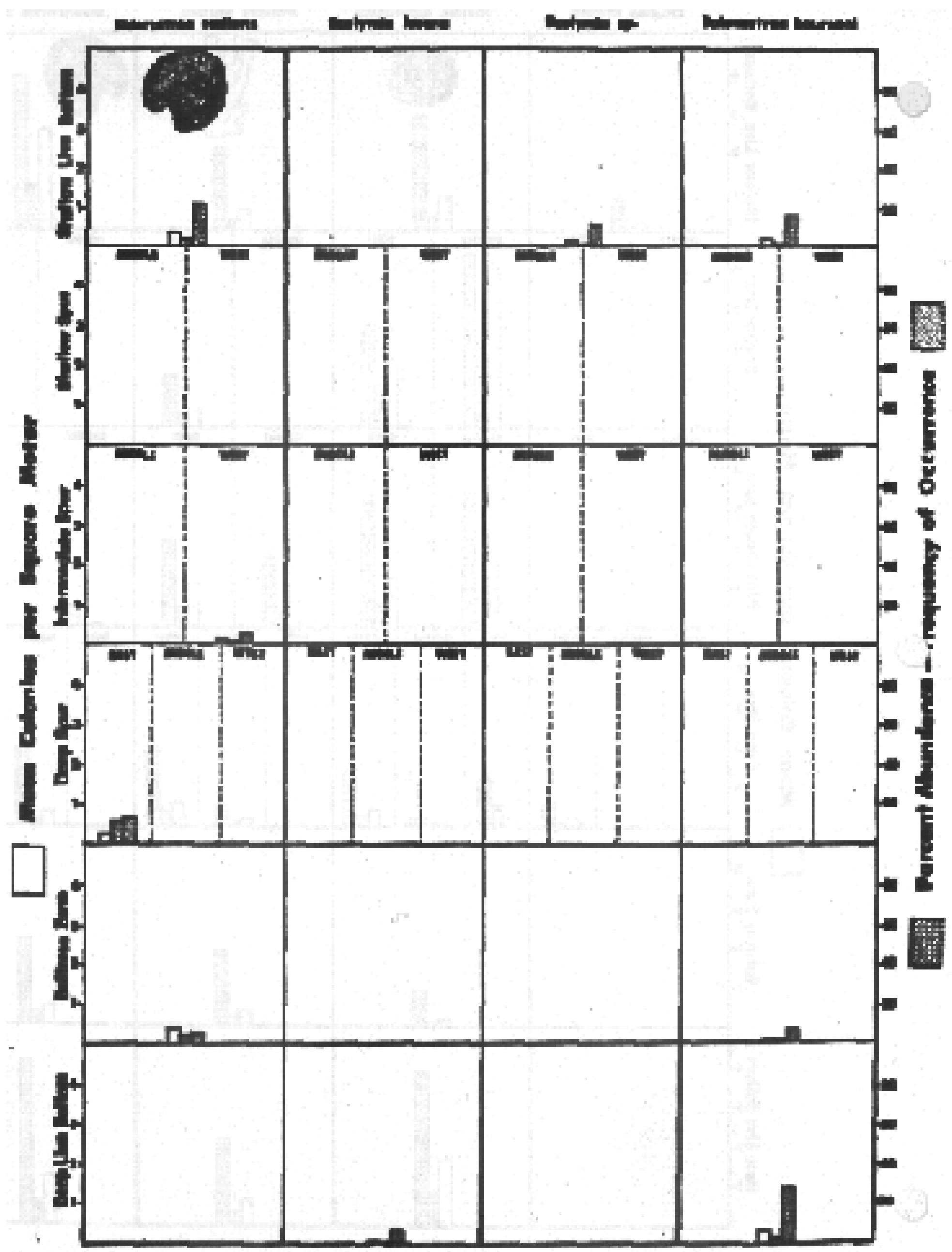

Mean Colonies per Square Meter

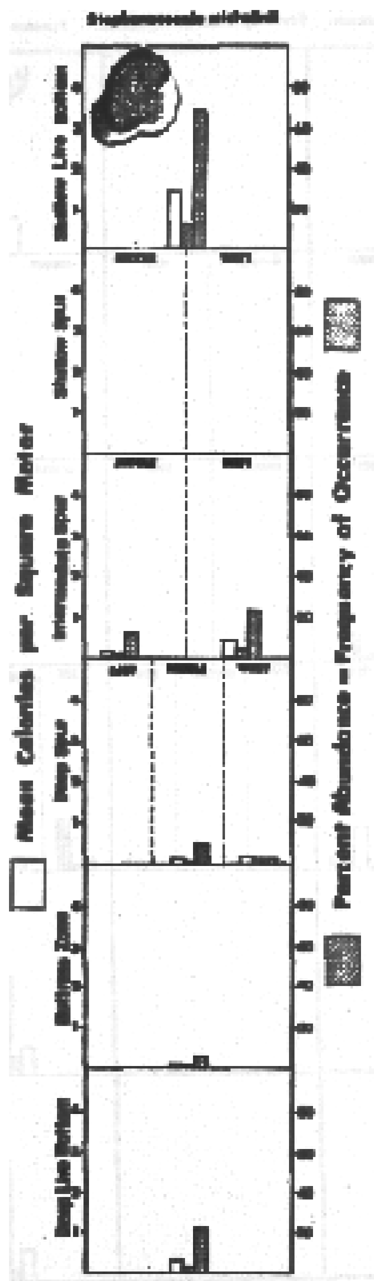

Mean Colonies per Square Meter
Percent Abundance – Frequency of Occurrence



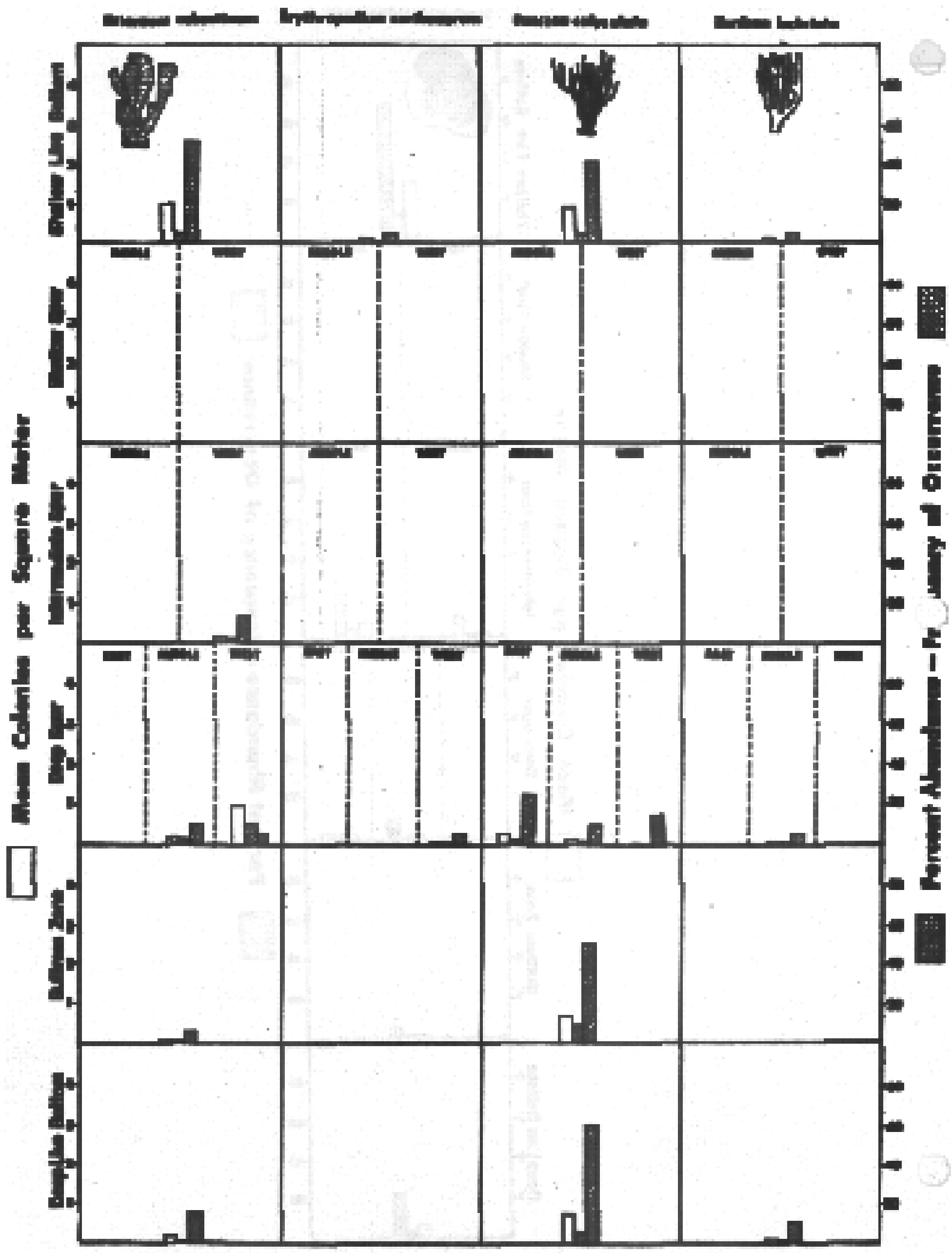
Mean Colonies per Square Meter
Percent Abundance — Frequency of Occurrence

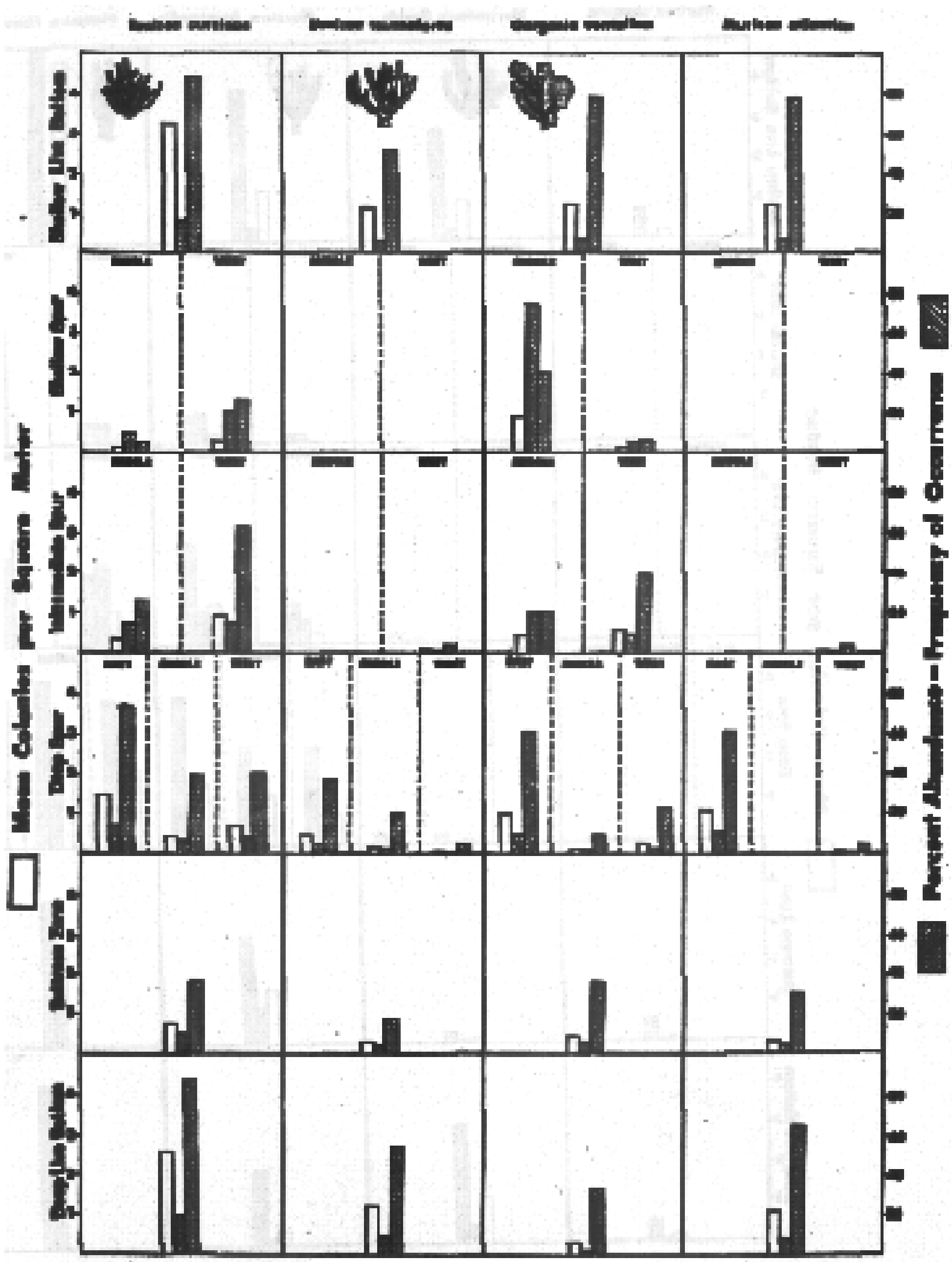

Mean Colonies per Square Meter
Percent Abundance – Frequency of Occurrence

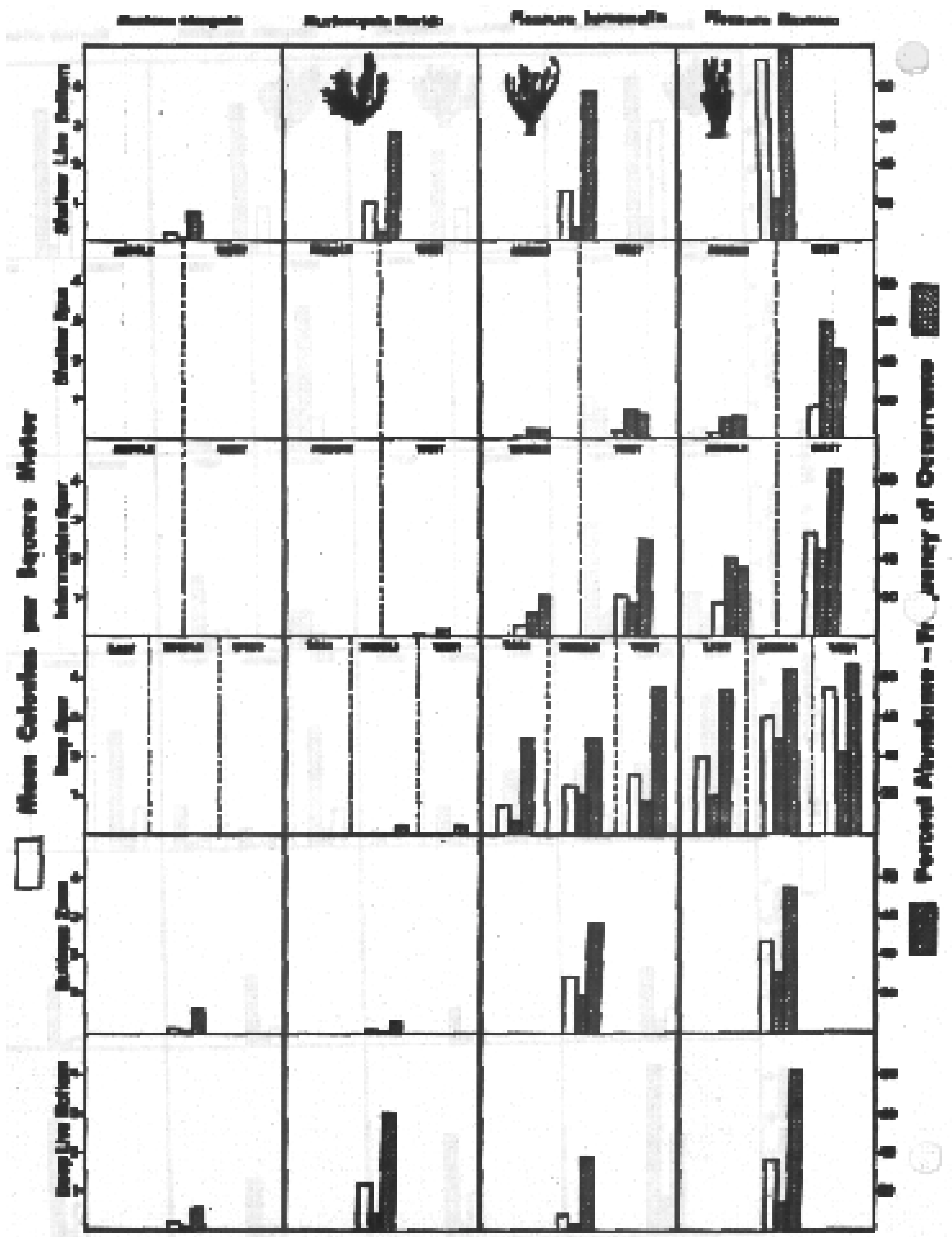

Mean Colonies per Square Meter
Percent Abundance — Frequency of Occurrence

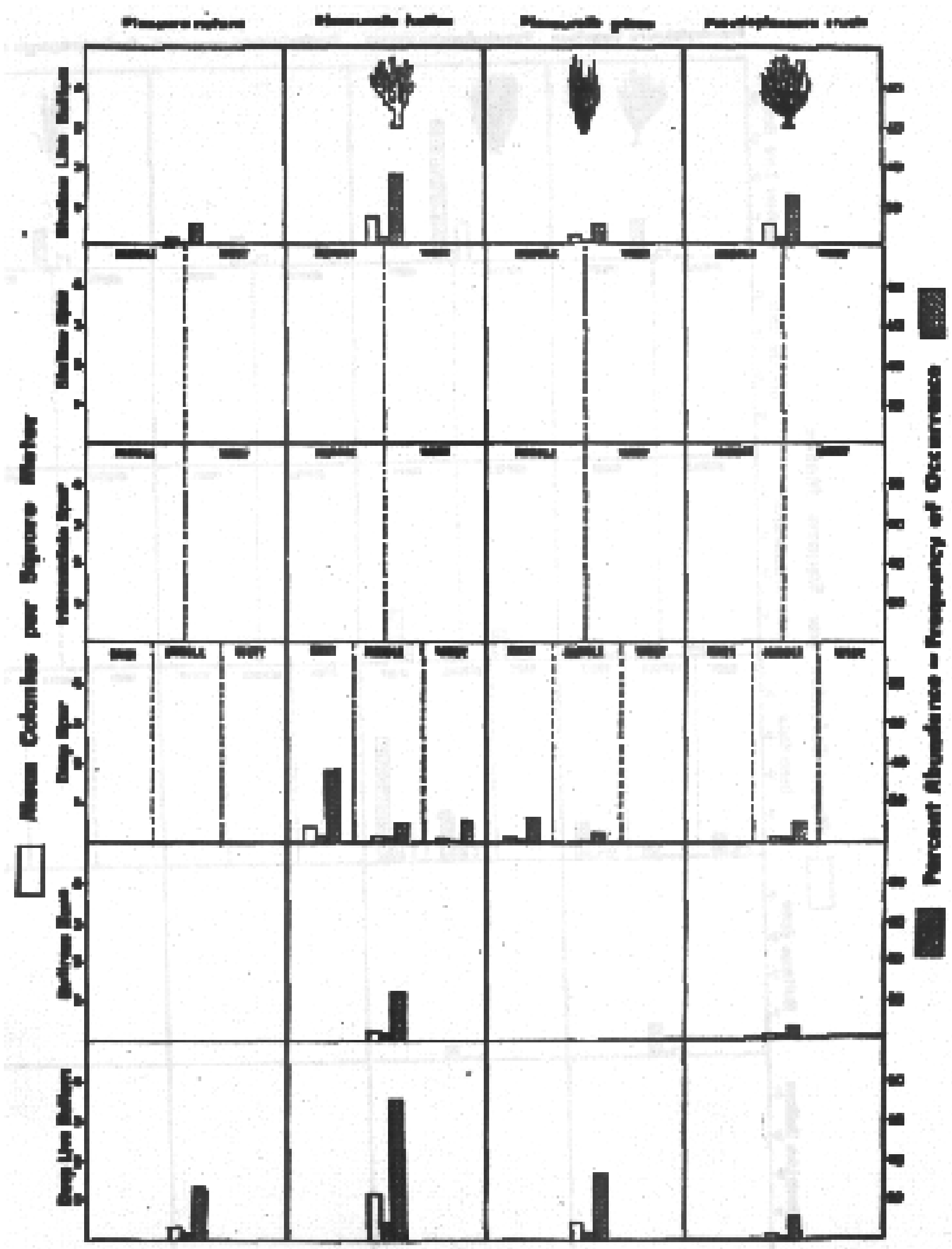


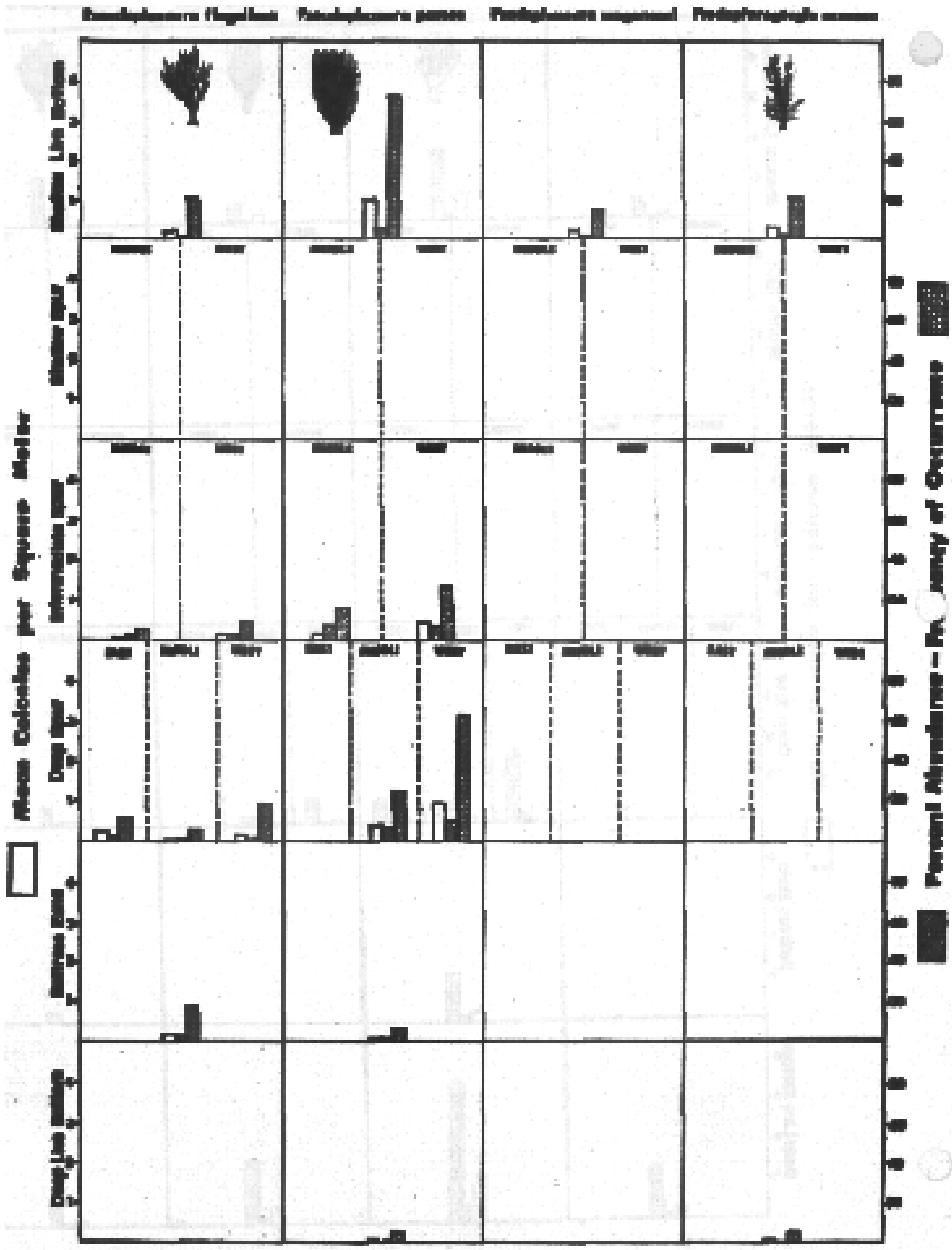
Mean Colonies per Square Meter
Percent Abundance – Frequency of Occurrence

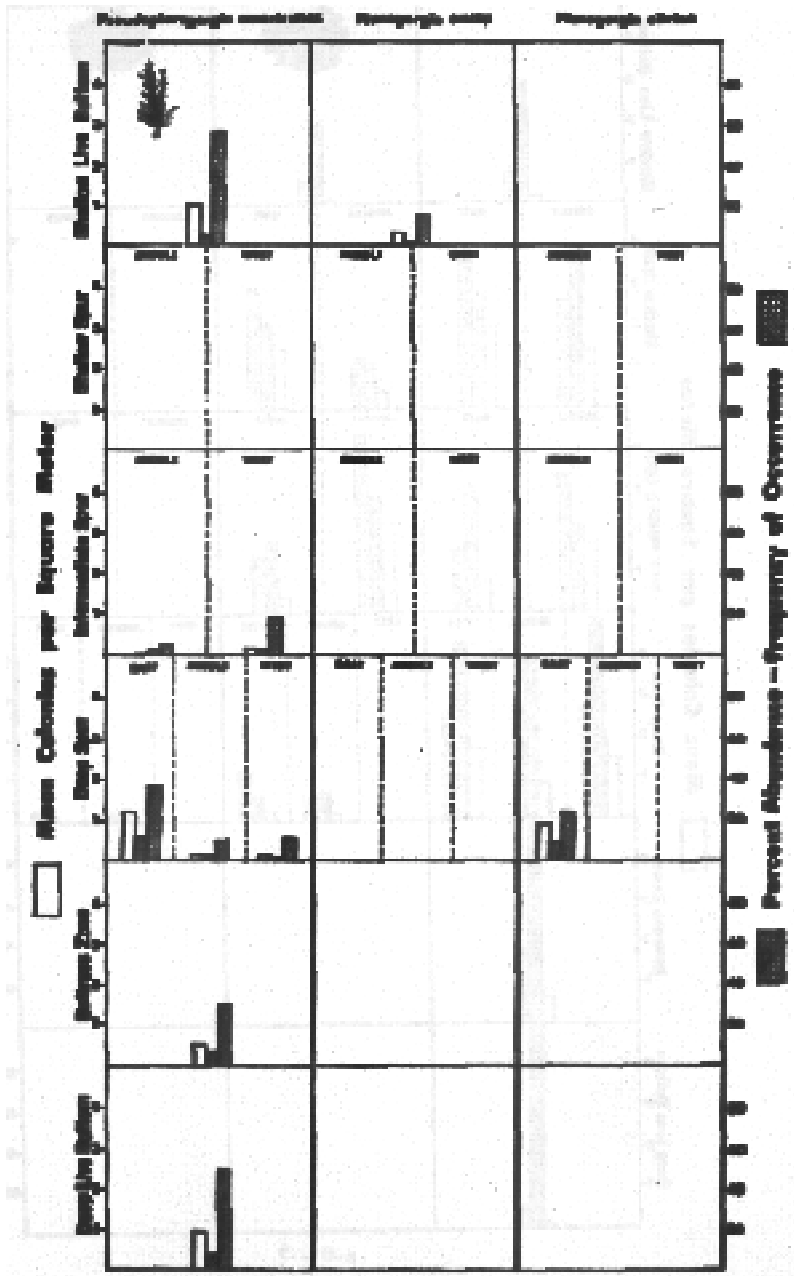

Mean Colonies per Square Meter

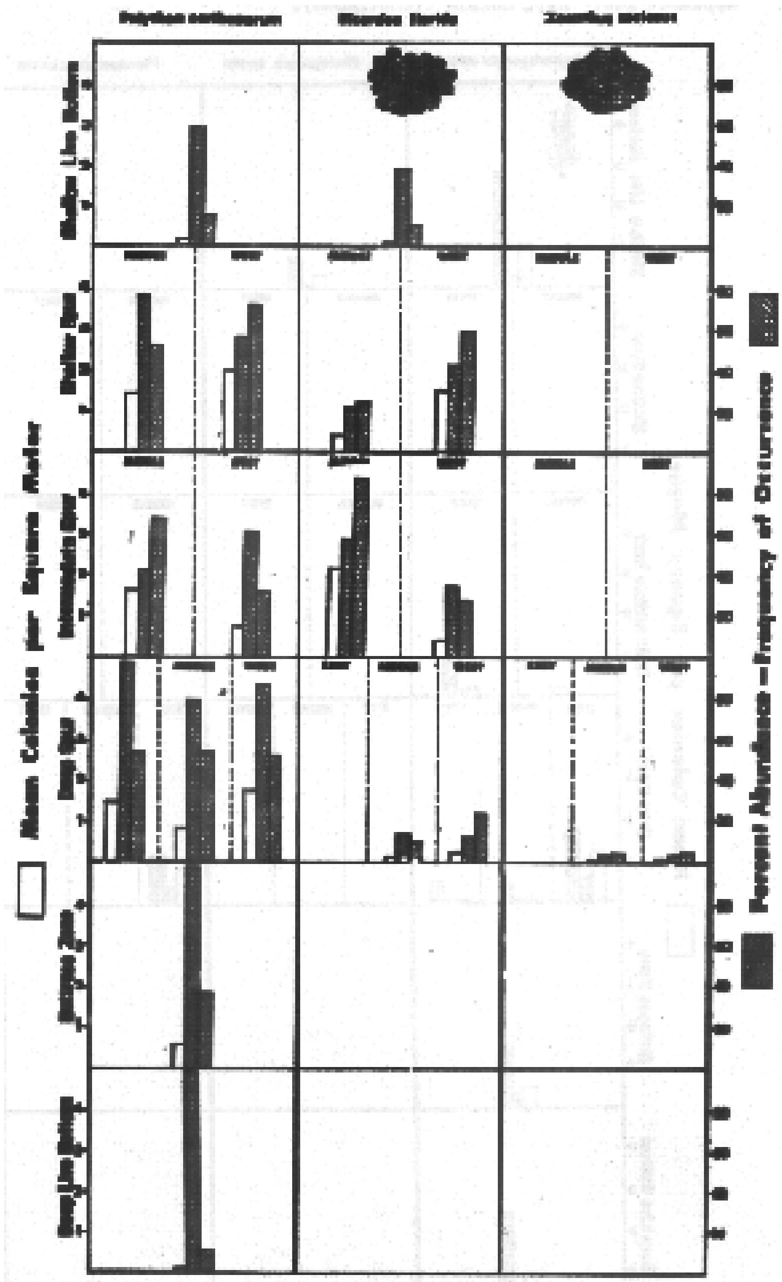

Mean Colonies per Square Meter
Percent Abundance - Frequency of Occurrence




Mean Colonies per Square Meter
Percent Abundance – Frequency of Occurrence


Mean Colonies per Square Meter


Mean Colonies per Square Meter
Percent Abundance – Frequency of Occurrence



Mean Colonies per Square Meter
Percent Abundance – Frequency of Occurrence

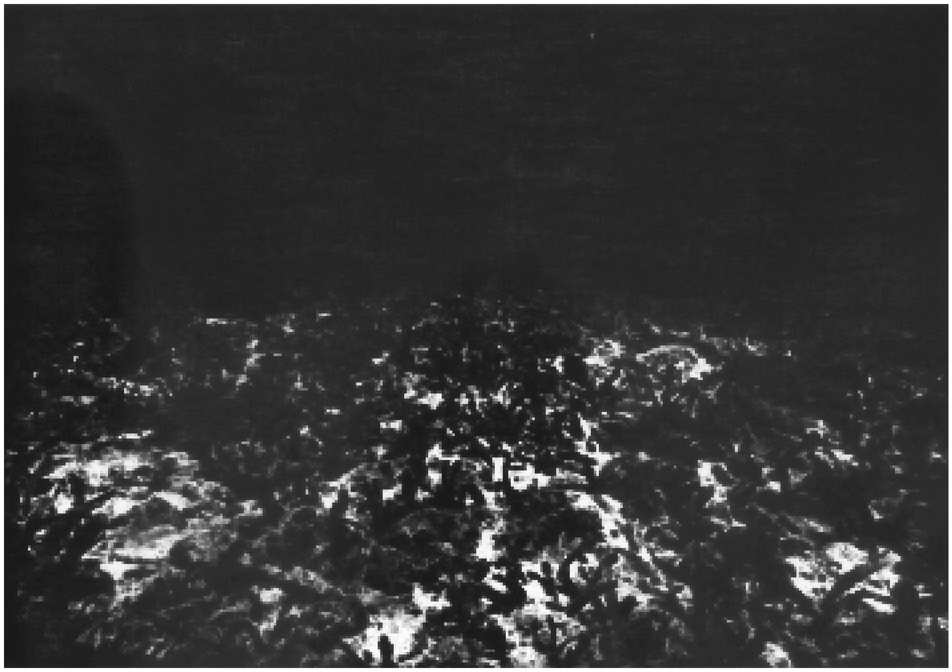


Plate 6.1. Sparse seagrass community inshore of rubble zone, Looe Key, August 1983.

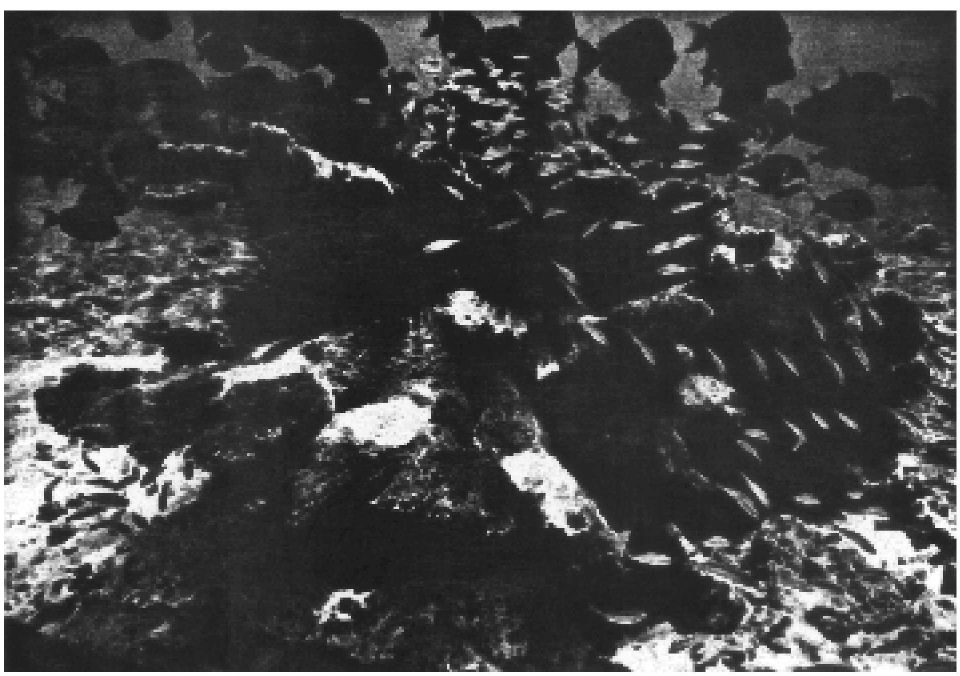


Plate 6.2. Rubble zone, Looe Key, August 1983. *Diadema antillarum* (urchin) sheltered by overturned *Acropora palmata* with hovering reef fish.

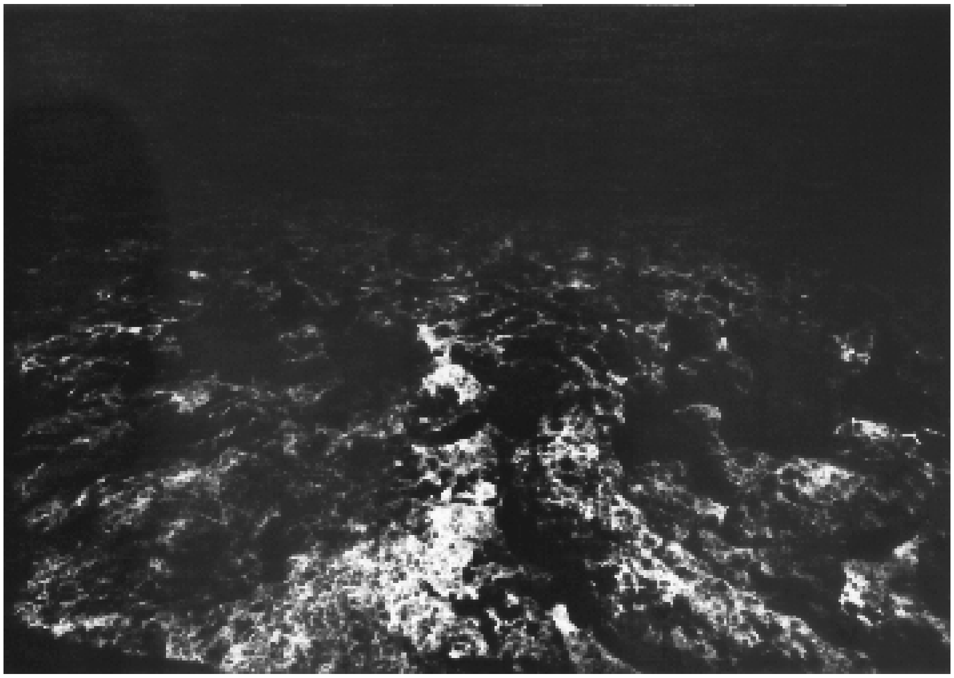


Plate 6.3. *Porite porites* on boulders in rubble zone, Looe Key, August 1983.

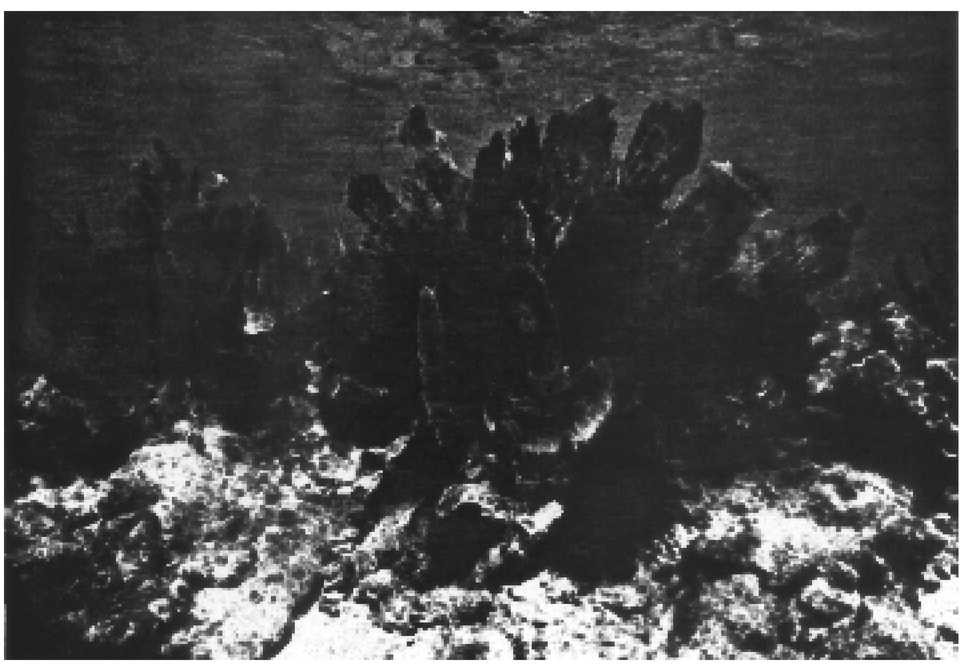


Plate 6.4. *Gorgonia ventalina* (seafan) cluster, rubble zone, Looe Key, August 1983.

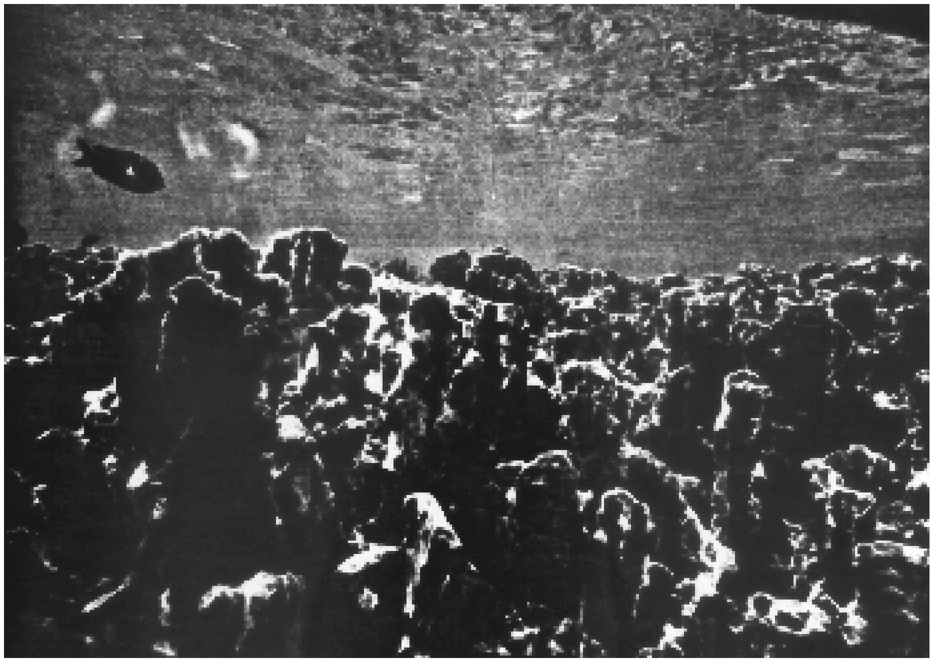


Plate 6.5. *Millepora complanata*, shallow spur and groove, Looe Key, August 1983.

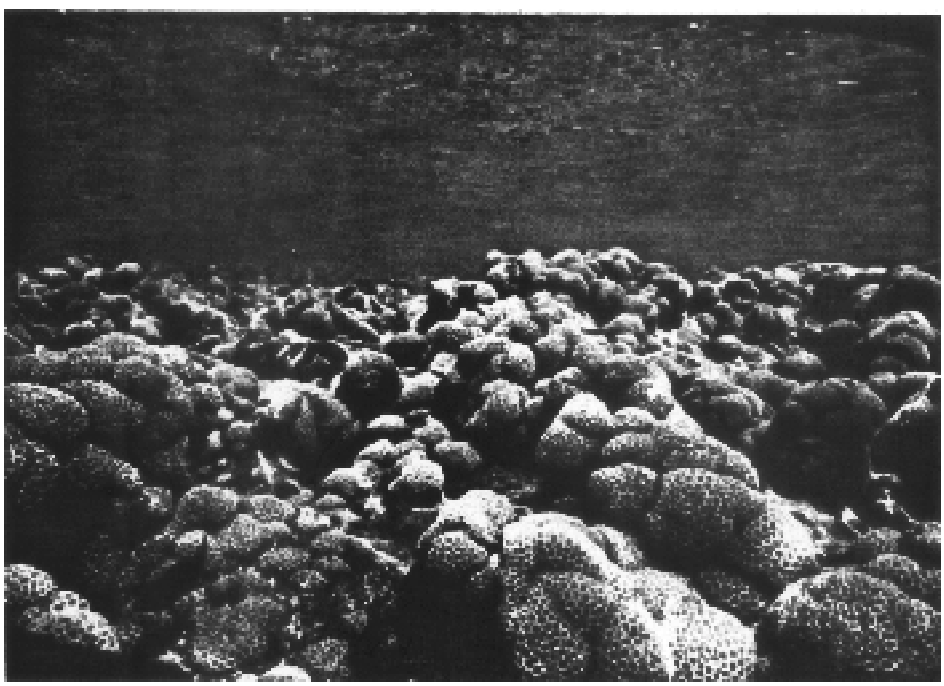


Plate 6.6. *Palythoa caribaerum* (golden sea mat) with *Zoanthus soriatus* (green zoanthid), shallow spur and groove, Looe Key, August 1983.

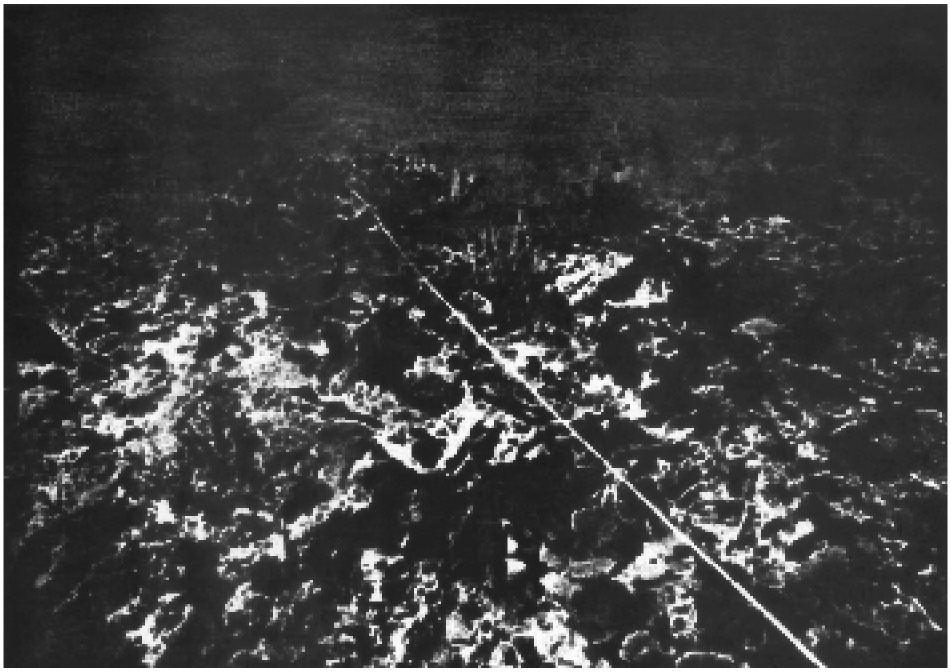


Plate 6.7. Colonies of *Acropora palmata*, top of spur, *Acropora*/transition zone, Looe Key, August 1983.

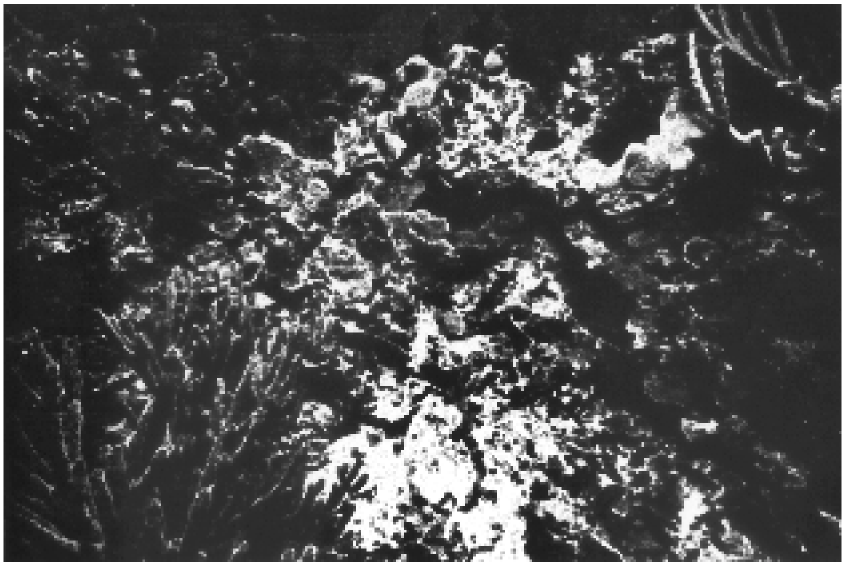


Plate 6.8. *Agaricea agaricites* (lettuce coral) and *Plexaura homomalla* (lower left), *Acropora*/transition zone, Looe Key, August 1983.

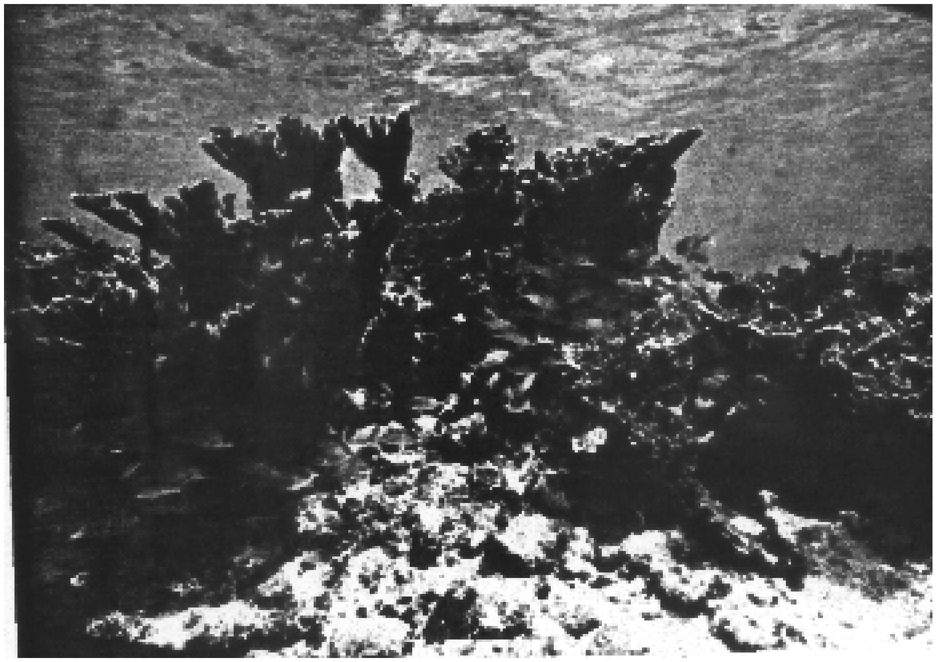


Plate 6.9. Stands of *Acropora palmata* with schools of reef fish, *Acropora*/transition zone, Looe Key, August 1983.

Plate 6.10. *Montastraea*/octocoral zone, deep spur and groove zone, Looe Key, August 1983.

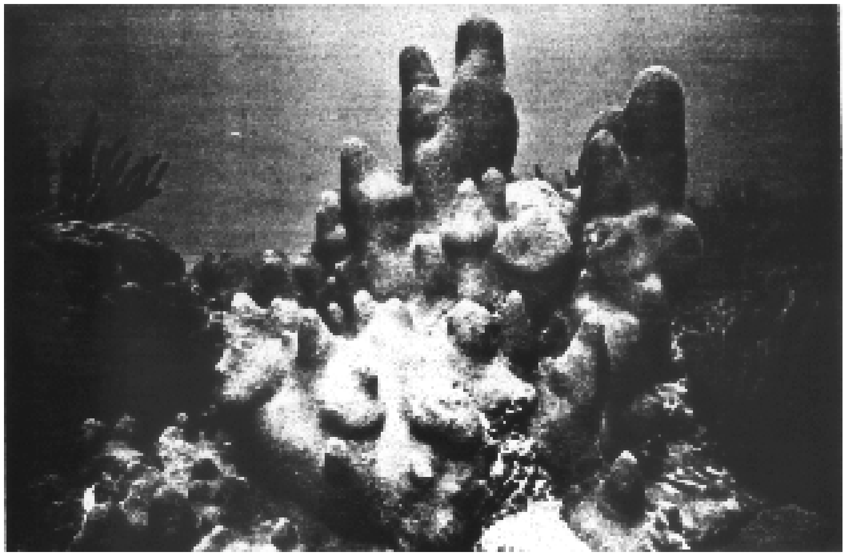


Plate 6.11. *Dendrogyra cylindricus* (pillar coral), *Montastraea*/octocoral zone, Looe Key, August 1983.

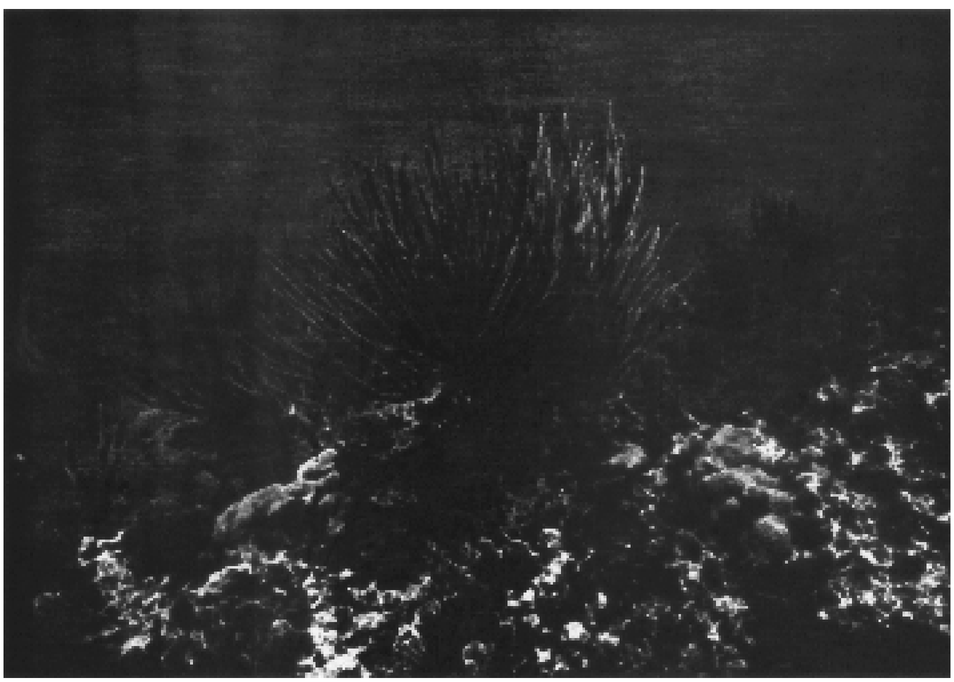


Plate 6.12. *Plexaura* sp., *Montastraea*/octocoral zone, Looe Key, August 1983.

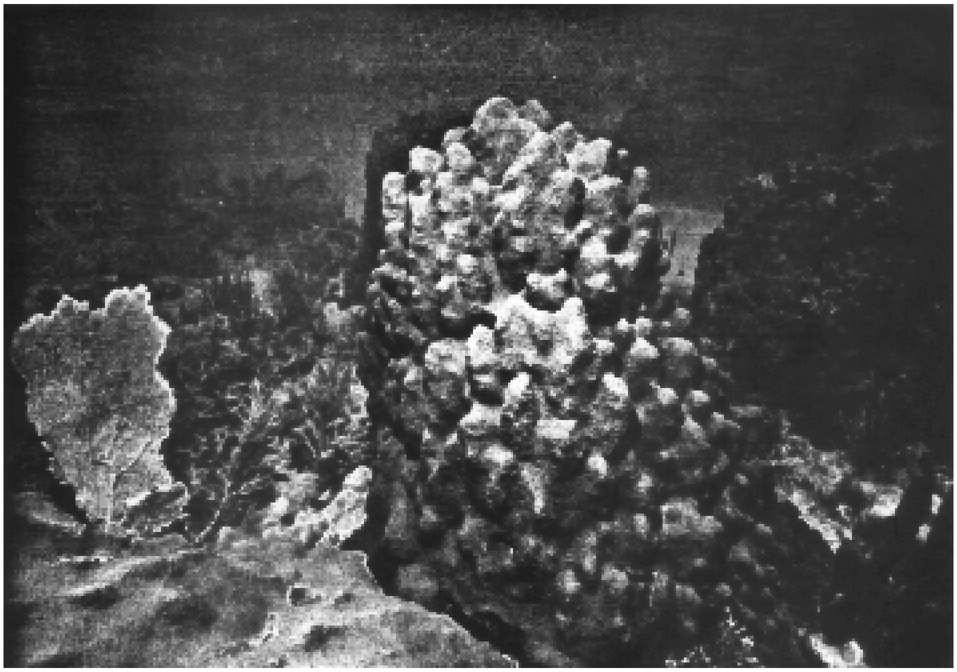


Plate 6.13. *Montastraea annularis, Montastraea*/buttress community, forereef, Looe Key, August 1983.

Plate 6.14. Shallow livebottom community, inshore of main spur and groove, Looe Key, August 1983.