CHAPTER 3

GENERAL HABITAT DESCRIPTION AND MAPPING

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Introduction

An important goal of the resource inventory is to qualitatively describe and map the major habitats within the Sanctuary. Accurate maps are necessary to relocate important features in the Sanctuary and to monitor changes resulting from natural or human induced perturbations. Detailed large scale maps of the forereef habitat are particularly desirable because it receives the most intense use.

Methods

Horizontal aerial photographs taken 22 November 1974 by NOAA (NOS 8284 to 8287) were used to map gross habitat features in the Sanctuary (Plate 3.1). Major features were identified by photointerpretation with groundtruth based on verification by divers or surface observations. Large scale maps of the forereef were made (Figs. 3.1, 3.2, Appendix 3.A). from low altitude aerial photographs taken of the forereef and shallow hardbottom habitats at a 200 ft/in (24.4 m/cm) scale. Diver surveys were used to identify and generally characterize the various habitats to a depth of 40 ft (12 m). Deeper depths were not surveyed due to budget and diving safety constraints.

Based on the initial survey, three forereef spur formations were selected for detailed coral, fish, and geological surveys (Figure 3.3).

Two spurs were selected to represent the middle portions of the forereef and one was selected to represent the edge of the forereef. Using the same sites insured that survey results by different specialists would be as comparable as possible. The actual detailed survey results will be reported in separate chapters.

Results

Eight basic habitat types were identified in the Sanctuary although four habitats were subdivided into other classifications (Figure 3.4, Plate 3.1). A general map of the Sanctuary with a transect showing horizontal habitat characteristics and the vertical depth profile was produced from general survey results (Figure 3.5). Below we qualitatively describe general habitat characteristics for each habitat. More detailed descriptions and quantitative analyses of sediments, corals, and fishes are provided in later chapters.

1. Live Bottom. This habitat, sometimes called hardbottom (Marszlek, 1983), is characterized by solid calcium carbonate substrate dominated by scattered sponges, soft corals and isolated hard corals. This habitat has low vertical relief and less hard coral coverage when compared to most true reef habitats (Plate 3.2). Shallow and deep live bottoms were distinguished based on the depth of occurrence and proximity inshore or offshore. Deep live bottom habitat (Plate 3.3) occurs mostly on the eastern and western areas of the sanctuary near the Straits of Florida at depths of 8 to 12 m (25 to 40 ft). The shallow live bottom habitat (Plate 3.4) occurs mostly in

a narrow zone along the northern areas of the sanctuary near the edge of Hawk Channel at depths of 6 to 9 m (18 to 30 ft).

2. Deep Reef. This habitat was not surveyed in this study due to budget and safety constraints. A general description of this habitat was provided in the Draft Environmental Impact Statement (US Department of Commerce, 1980).

3. Buttress. This zone, dominated by hard corals (Plate 3.2), occurs south and west of the forereef spur and groove tract in a depth range of 10 to 12 m (30 to 40 ft). It is characterized by large colonies of the mountainous star coral *Montastraea annularis* although much of this habitat is covered by sponges and soft corals.

4. Forereef. This zone, also called the spur and grove tract, is characterized by high relief coral formations known as spurs separated by sand channels known as grooves (Plate 3.1). The spurs extend seaward from the reef crest, the shallowest portion of the reef. Spur formations are often called "fingers" because their structure and orientation looks from above like giant fingers of a hand resting on the bottom. Shinn *et al.* (1981) cored several of the spurs and found they were composed mainly of elkhorn coral *Acropora palmata*. Sand composes the substrate underneath the forereef, unlike other reefs examined in the Florida Keys which had foundations on solid calcium carbonate platforms (Shinn, *et al.*, 1981).

The forereef can be divided into three zones. The deepest portion of the forereef is the *Montastraea*/octocoral zone or the deep spur and groove zone. It is characterized by a high diversity of coral species but relatively low vertical relief (Figure 3.6, Plate 3.5). The middle zone, known as the *Acropora* transition zone, has the highest species diversity for corals (Figure 3.7, Plates 3.6 and 3.7). It is characterized by the occurrence of *Acropora palmata* (Plate 3.8) although this species in not necessarily present on every spur. The shallowest forereef zone is the *Millepora*/*Palythoa* zone (Figure 3.8, Plates 3.8, 3.9) which is dominated by firecoral (*Millepora complanata*) and the zoanthid (*Palythoa caribaeorum*). This zone is considered a high energy zone because it receives the most wave energy. Damage from wave action is believed to limit the presence of most corals in this zone. The shallowest portion of this zone, the reef crest, is where corals exist near the surface and may be partially exposed during the lowest tides.

5. Rubble. Rubble from dead and broken corals composes two features known as the rubble zone and the rubble horns. The rubble zone occurs immediately shoreward of the forereef reef crest. This zone is composed of broken coral fragments thrown behind the reef by wave action from storms. In parts of the rubble zone nearest the reef, the rubble has been cemented together to form a solid substrate and may have small attached colonies of soft or hard corals (Plate 3.10). Isolated living corals, especially *Acropora palmata*, exist in various areas of the rubble zone (Plate 3.10). The rubble horns (Plate 3.11) are composed of unconsolidated rubble cobble thrown up on the east and west sides of the lagoon by refracted wave patterns and occasional storms (Kissling, 1975). The rubble zone and the rubble horns enclose the lagoon habitat.

6. Lagoon. The lagoon, also called the reef flat (US Department of Commerce, 1983), is a shallow triangular-shaped area bounded by rubble habitat. The base of the triangle is the rubble zone immediately behind the forereef and the other two sides are the rubble horns discussed above. The depths of the lagoon extend from the surface to approximately 3 m (10 ft). The middle of the lagoon is a mixed sand and rubble bottom covered by sand and seagrass beds with occasional isolated coral heads (Plate 3.12). Seagrasses nearest the rubble zone are generally heavily grazed by fishes and sea urchins.

7. Sand Flats. This is generally a uniformly flat, featureless habitat distinguished by sand cover of variable depth (Plate 3.13). Isolated protrusions of coral or a calcium carbonate platform

occur occasionally. This habitat covers the most area in the sanctuary and surrounds most other reef, seagrass, and hard bottom habitats.

8. Seagrass Flats. Much of the Sanctuary is covered by beds of seagrasses dominated by the angiosperms turtle grass, (*Thalassia testudinum*) and eel grass (*Syringodium filliforme*) (Plates 3.12, 1.13, 3.14). Other algae, especially *Halimeda* spp. are scattered throughout the seagrass beds. The edges of these beds may be quite distinct or may gradually taper into sand.

Discussion

General qualitative descriptions of the different zones are basically similar to the descriptions provided in the DEIS proposal (US Department of Commerce, 1980) and will not be repeated here. Quantitative descriptions of species present are given in appropriate later chapters.

Results from this general survey differ in several respects from previous descriptions of the Sanctuary. In particular, the area described as a patch reef zone (US Department of Commerce, 1980) is actually a mixture of seagrasses, sand flats, and live bottom. True "patch reefs" occur near the Newfound Harbor Keys, north of the Sanctuary. Pillar coral (*Dendrogyra cylindrus*) were reported on "patch reefs" (what we call hard bottom) in the Draft Environmental Impact Statement (US Department of Commerce, 1980). Our survey did not find any colonies of pillar coral in the Sanctuary outside the forereef, despite intensive searches along the inshore strip of live bottom. Conversations with local divers indicate that at least one area exists with pillar corals but it is apparently inshore of the Sanctuary boundaries.

Results reported here also differ from the Florida Reef Tract Marine Habitats and Ecosystems (MHE) Maps (Marszlek, 1983) which were based on interpretation of high altitude aerial photographs. The MHE maps do not distinguish between our livebottom and reef classifications. However, the MHE description of hardbottom corresponds to our classification of live bottom. The rubble horns (Figure 3.4) are erroneously listed as coral bottom on the MHE maps. Also, the shallow live bottom band we show near Hawk Channel (Figure 3.4) is not shown on the MHE maps, although it should appear as limestone bedrock. We also observed more coverage by sea grass beds near the eastern Sanctuary boundary than indicated in the MHE maps. The differences between our maps and the MHE maps show the importance of groundtruth verification when interpreting aerial photography.

Literature cited

Kissling, D. L. 1975. Coral reefs in the lower Florida Keys: A preliminary report. Pages 103E-K in H. G. Multer, ed. Field guide to some carbonate rock environments: Florida Keys and western Bahamas. Contribution No. 40. Dept. Earth Sciences, Fairleigh Dickinson University, Madison, NJ.

Marszalek, D. S. 1983. Florida Reef Tract Marine Habitats and Ecosystems. (Maps). Rosenstiel School of Marine and Atmospheric Science, University of Miami, Miami, FL.

Shinn, E. A. 1976. Coral reef recovery in Florida and the Persian Gulf. Environ. Geol., 1:241-254.

U. S. Department of Commerce. 1980. Draft environmental impact statement, proposed Looe Key National Marine Sanctuary, April 1980. Natl. Oceanic Atmospheric Admin., Office Coastal Zone Mgmt. 128 pp.

U. S. Department of Commerce. 1983. Looe Key National Marine Sanctuary Management Plan. Natl. Oceanic Atmospheric Admin., Office Coastal Zone Mgmt. 58 pp.

Appendix 3.A

Large scale section maps of the Looe Key Reef forereef spur formations.

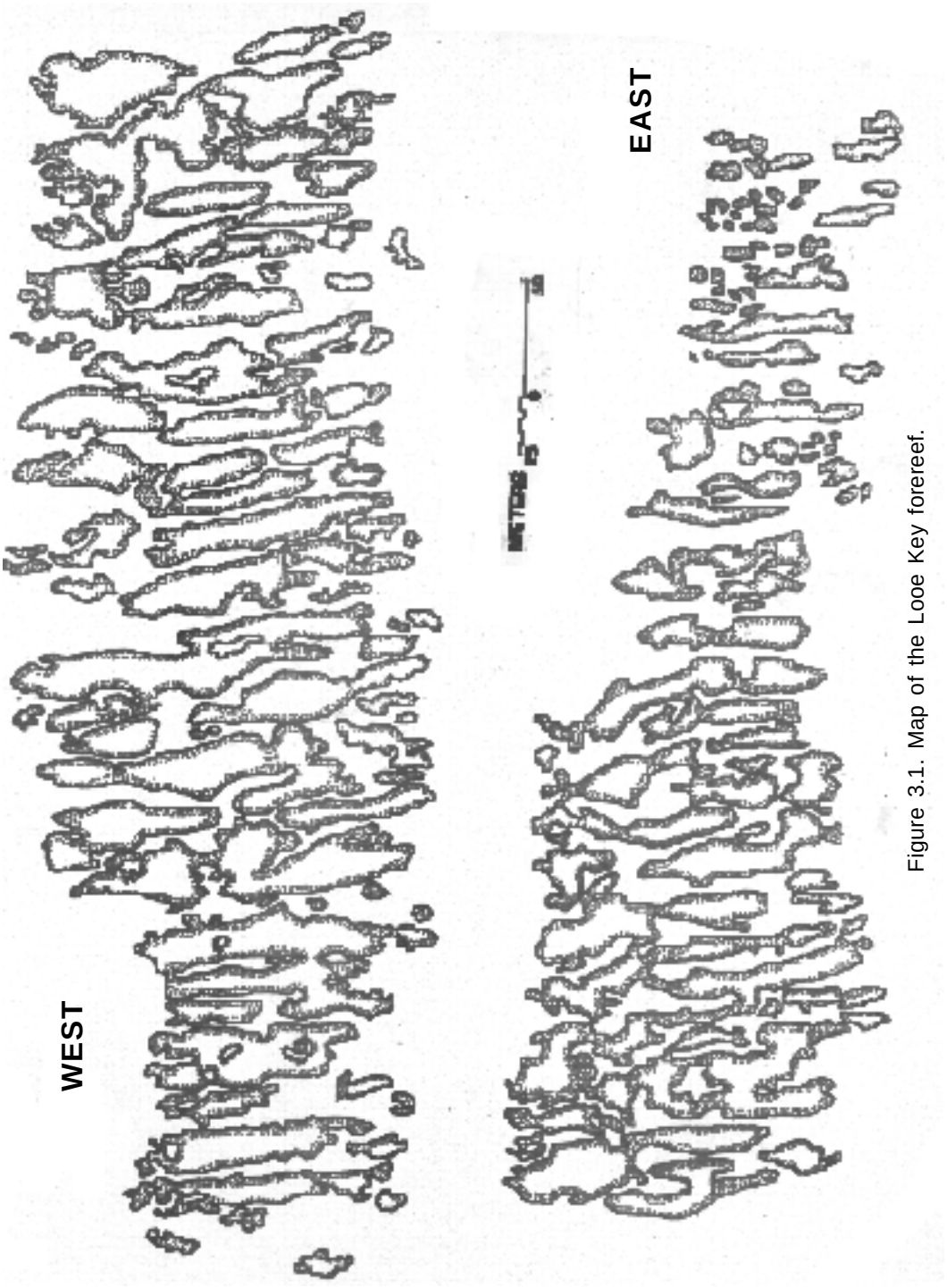


Figure 3.1. Map of the Looe Key forereef.

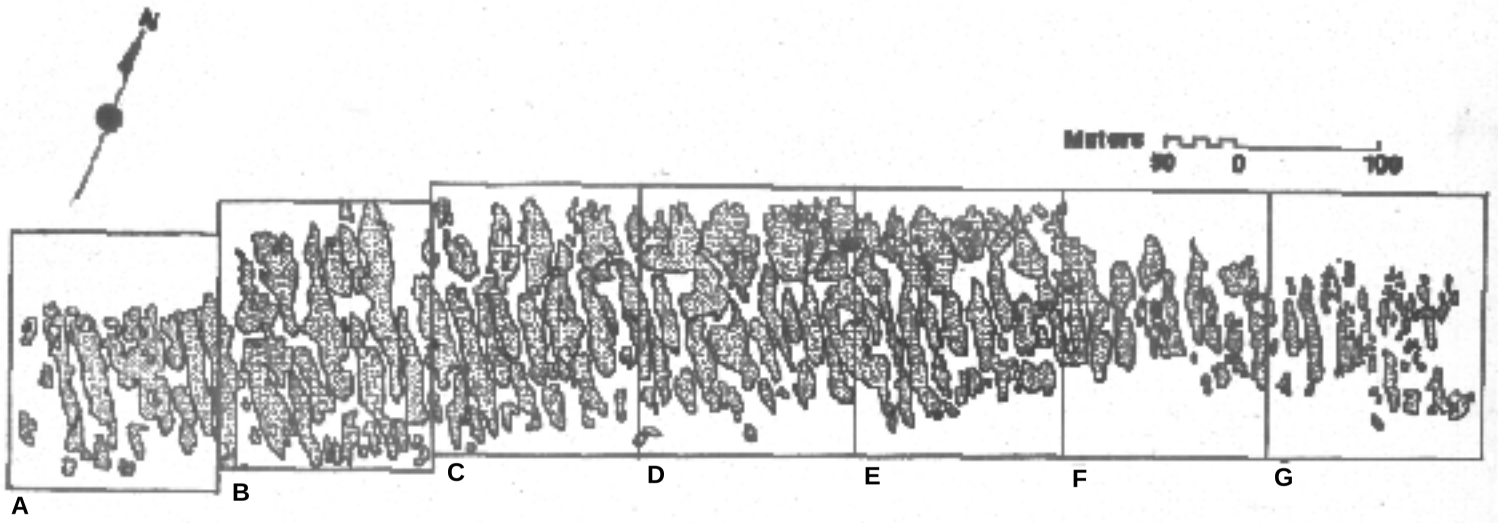


Figure 3.2. Section maps of Looe Key Reef. Stippled portions show spur formations of the forereef zone, the major portion of the reef. This is a key to the section maps on following pages.

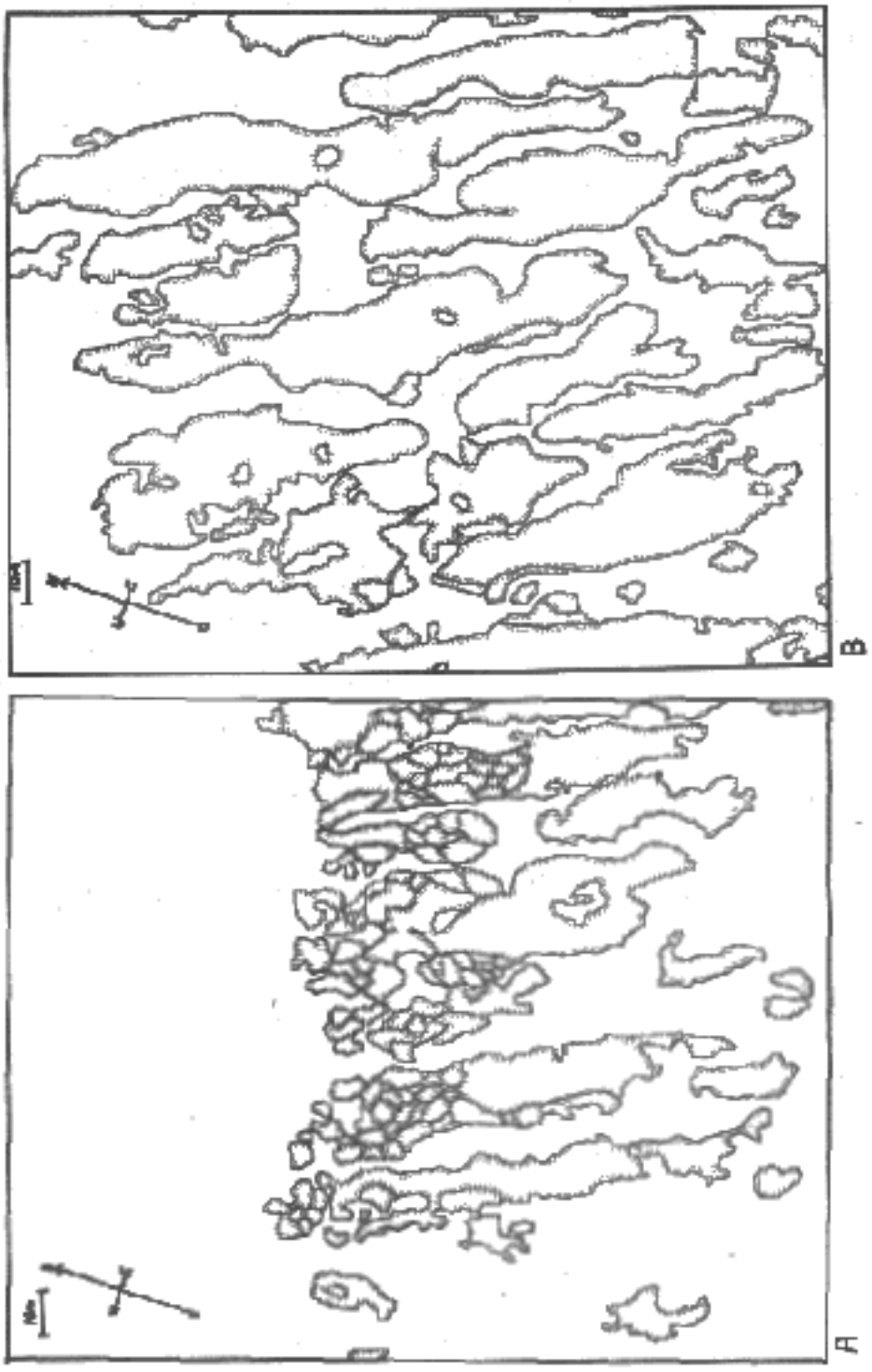


Figure 3.2. Section maps of Looe Key Reef (cont.)

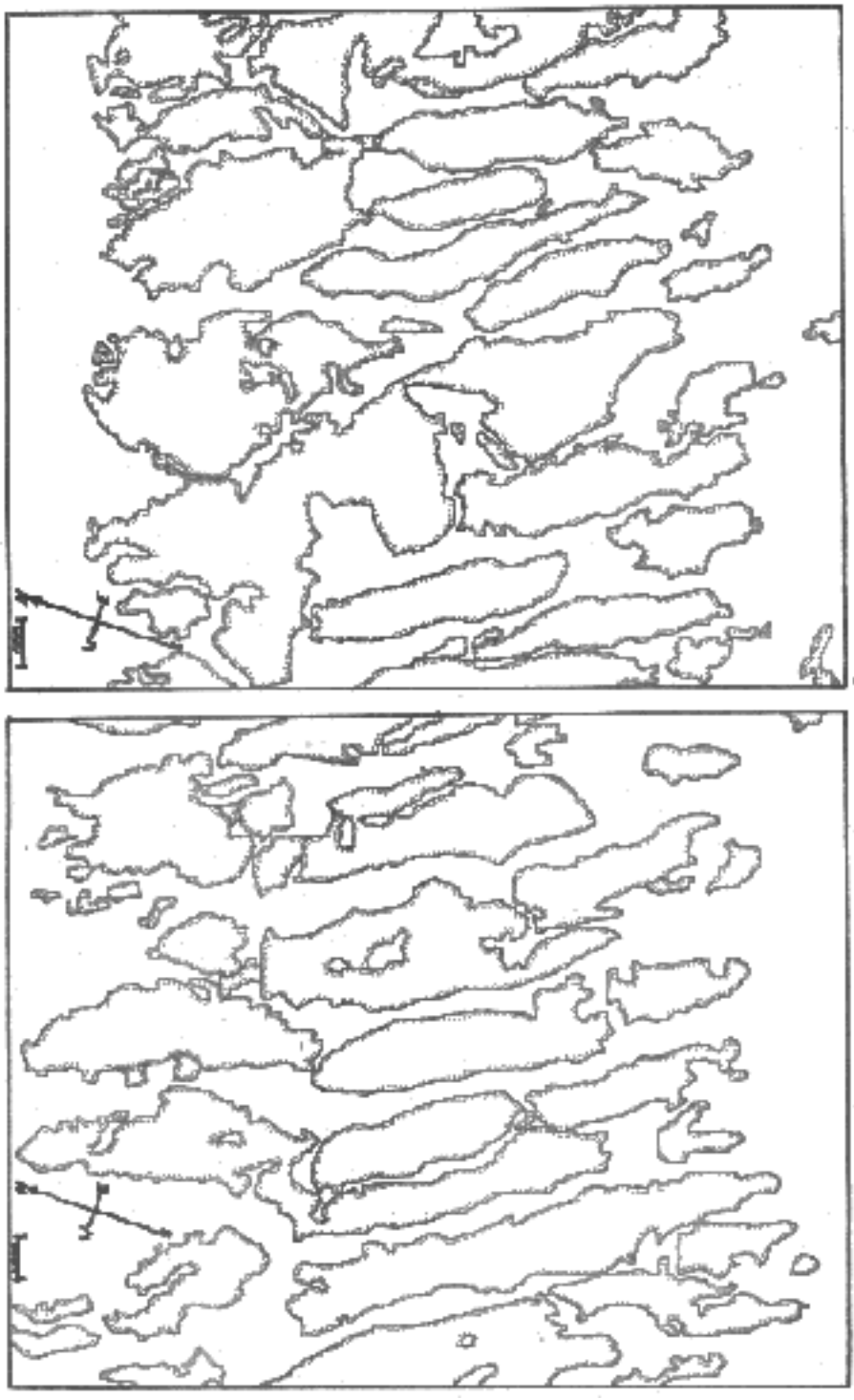


Figure 3.2. Section maps of Looe Key Reef (cont.)

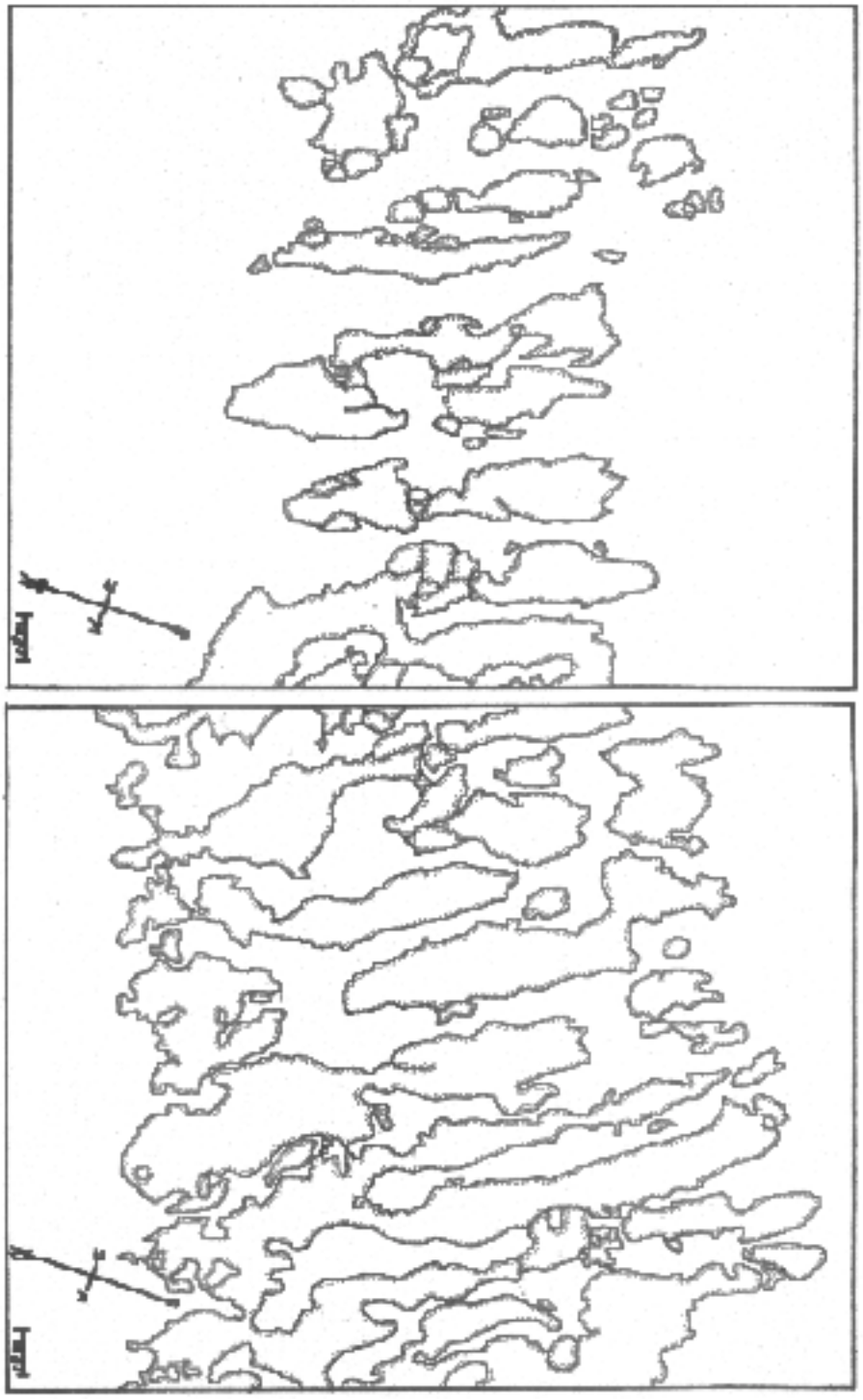


Figure 3.2. Section maps of Looe Key Reef (cont.)

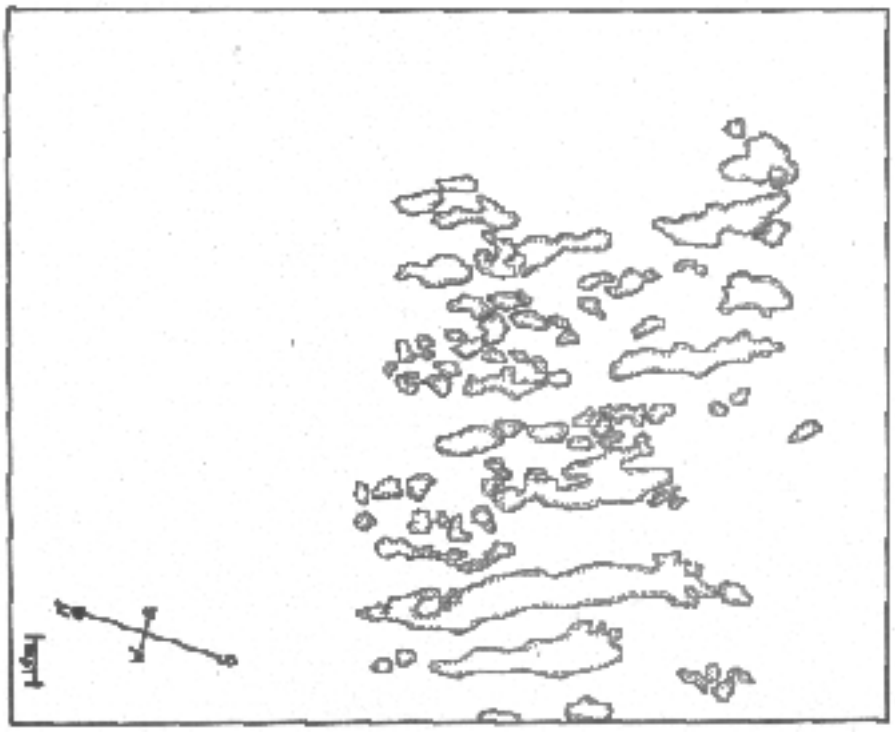


Figure 3.2. Section maps of Looe Key Reef (cont.)

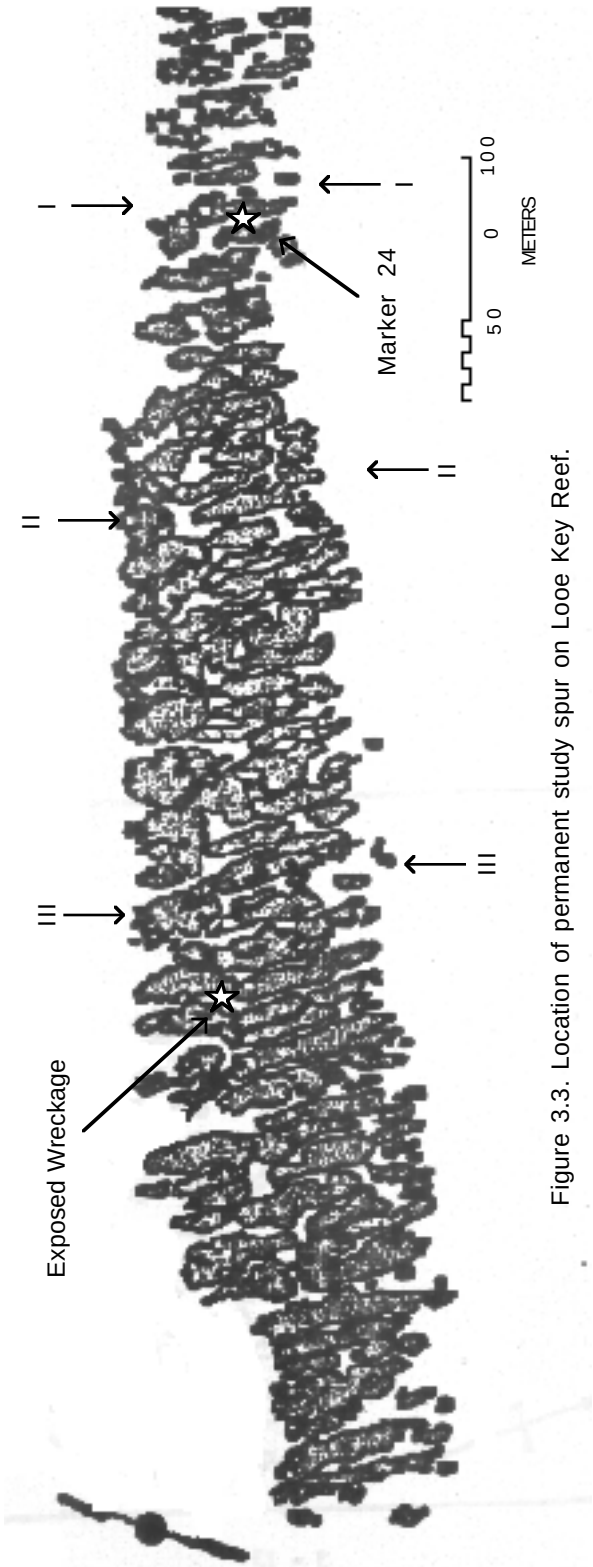


Figure 3.3. Location of permanent study spur on Looe Key Reef.

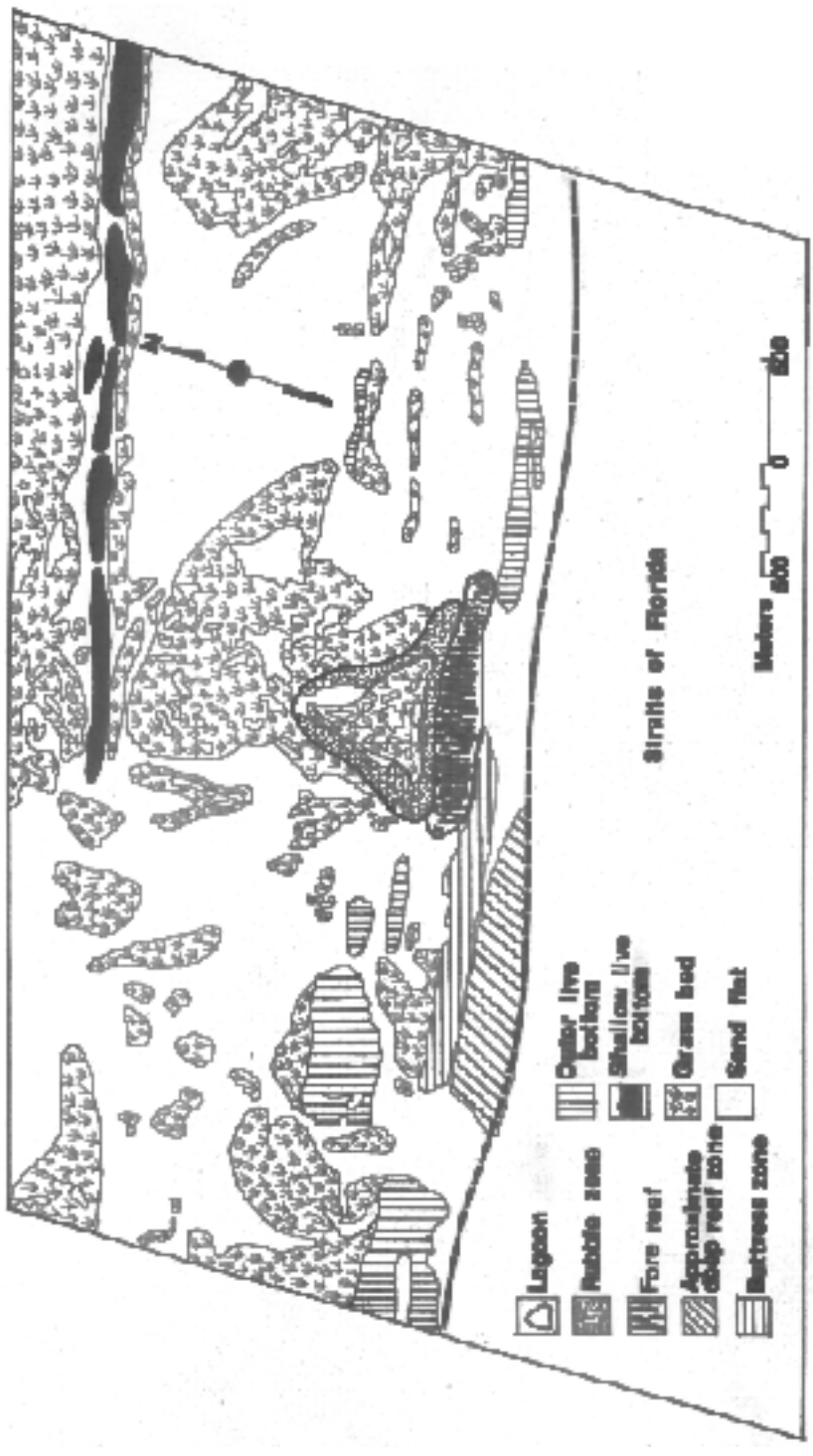


Figure 3.4. Habitat map of Looe Key National Marine Sanctuary.

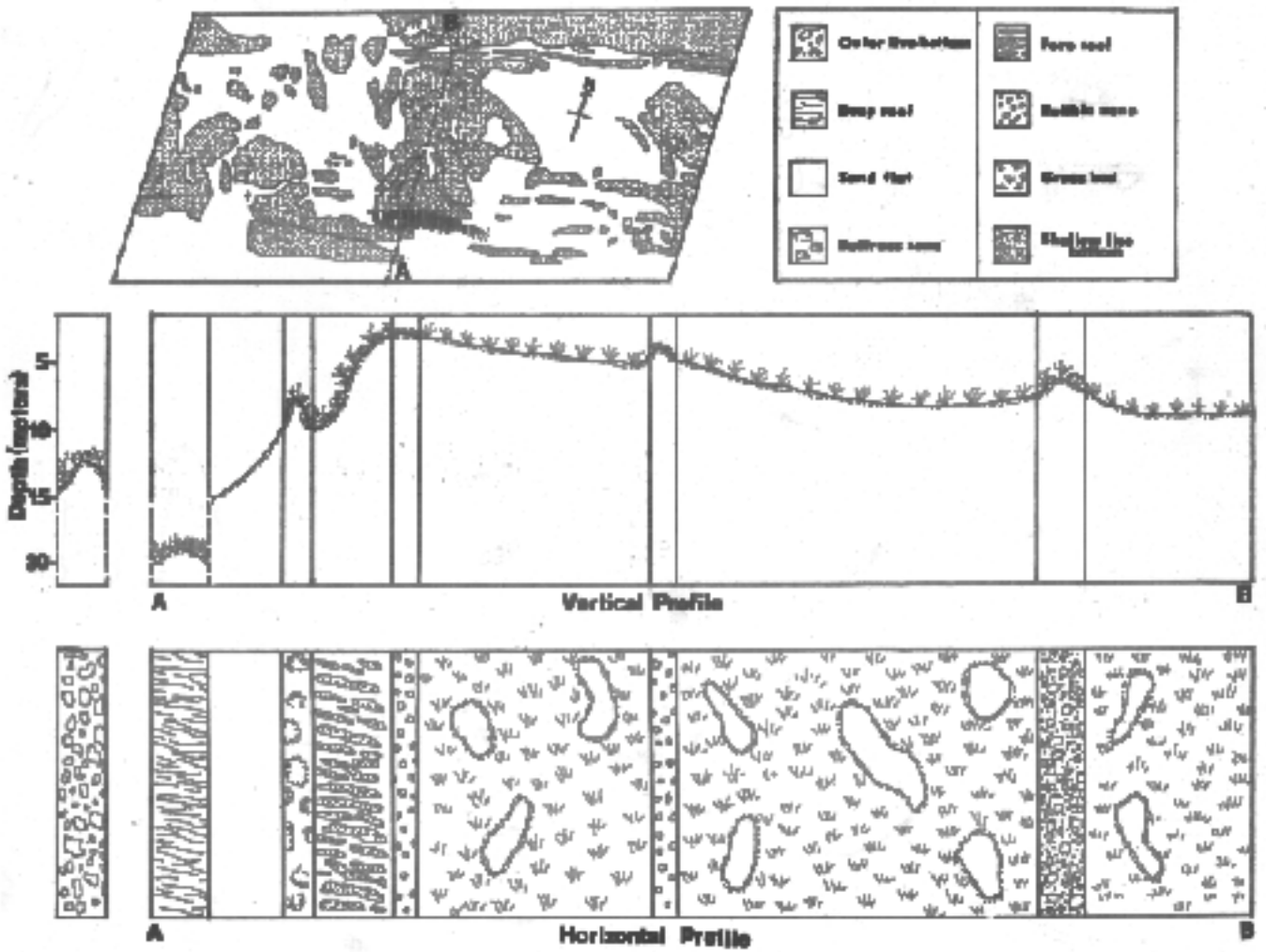


Figure 3.5. Vertical and horizontal profiles in Looe Key National Marine Sanctuary. The profile of deep live bottom habitat on left did not occur along the approximate transect between points A and B but occurs in western and eastern portions of the Sanctuary (see Figure 3.4).

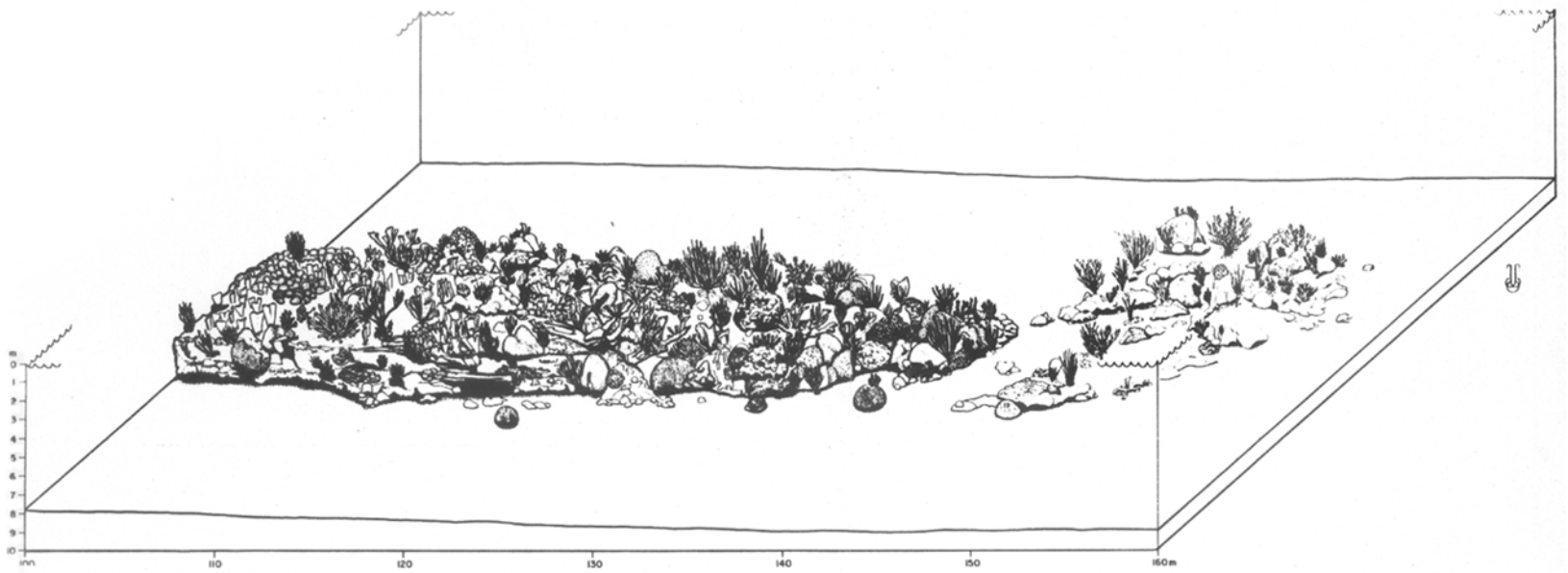


Figure 3.6. Representative view of Acropora transition zone. See Figure 3.9 for identification key.

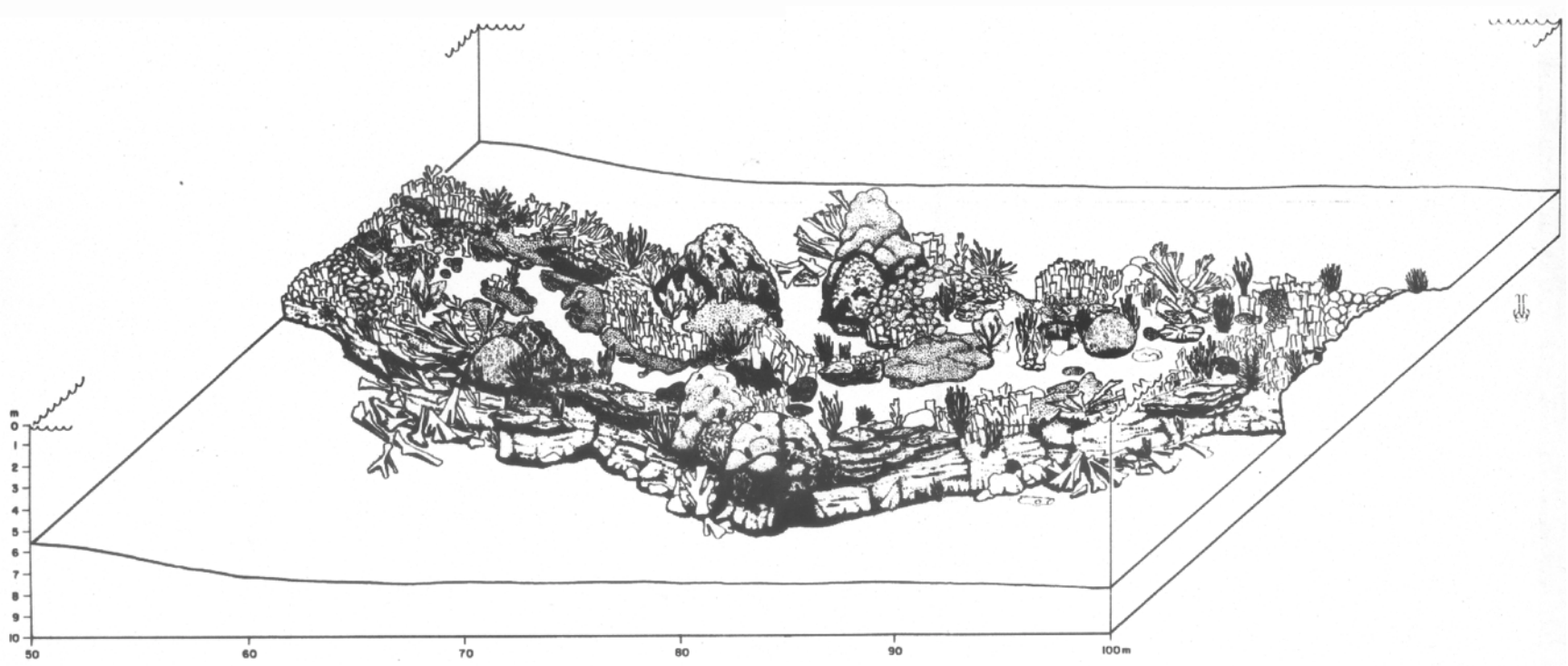


Figure 3.7. Representative view of Acropora transition zone. See Figure 3.9 for identification key.

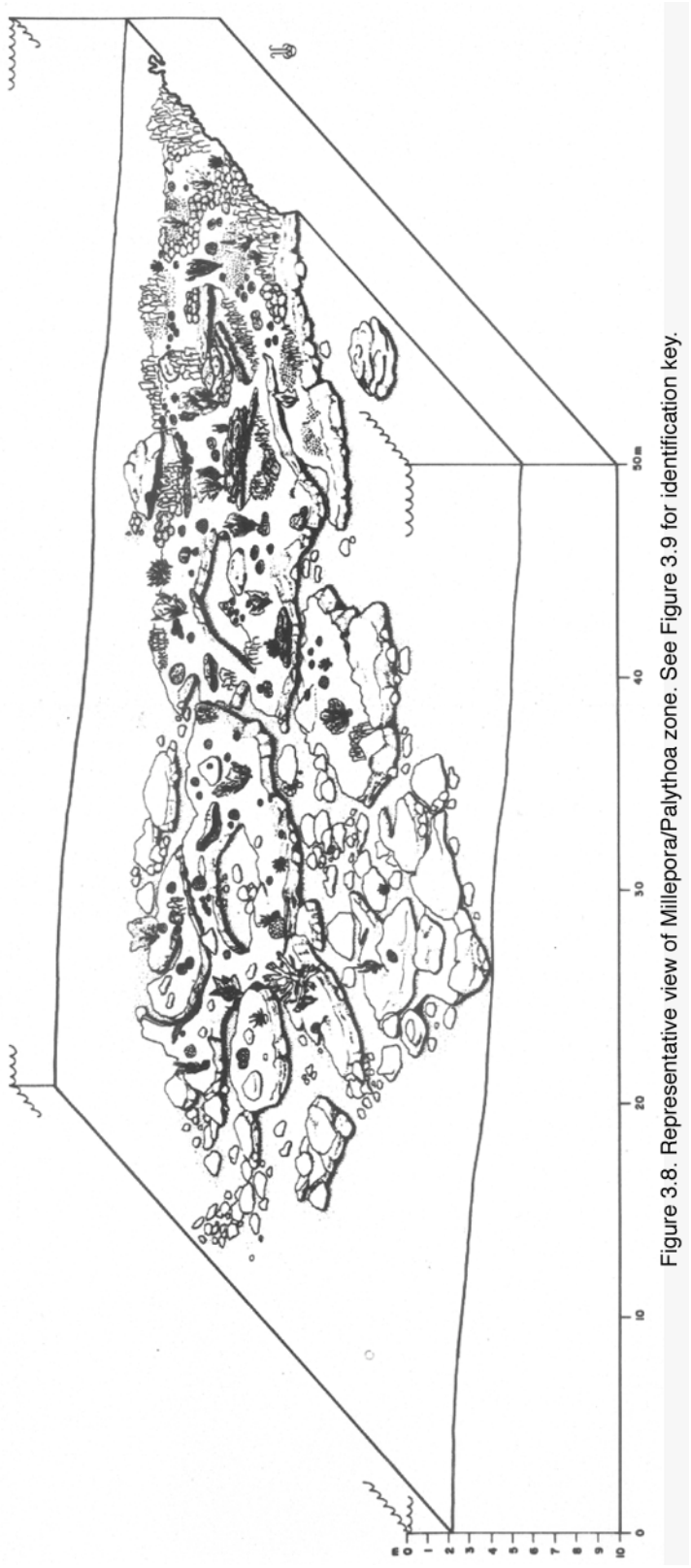


Figure 3.8. Representative view of Millepora/Palythoa zone. See Figure 3.9 for identification key.

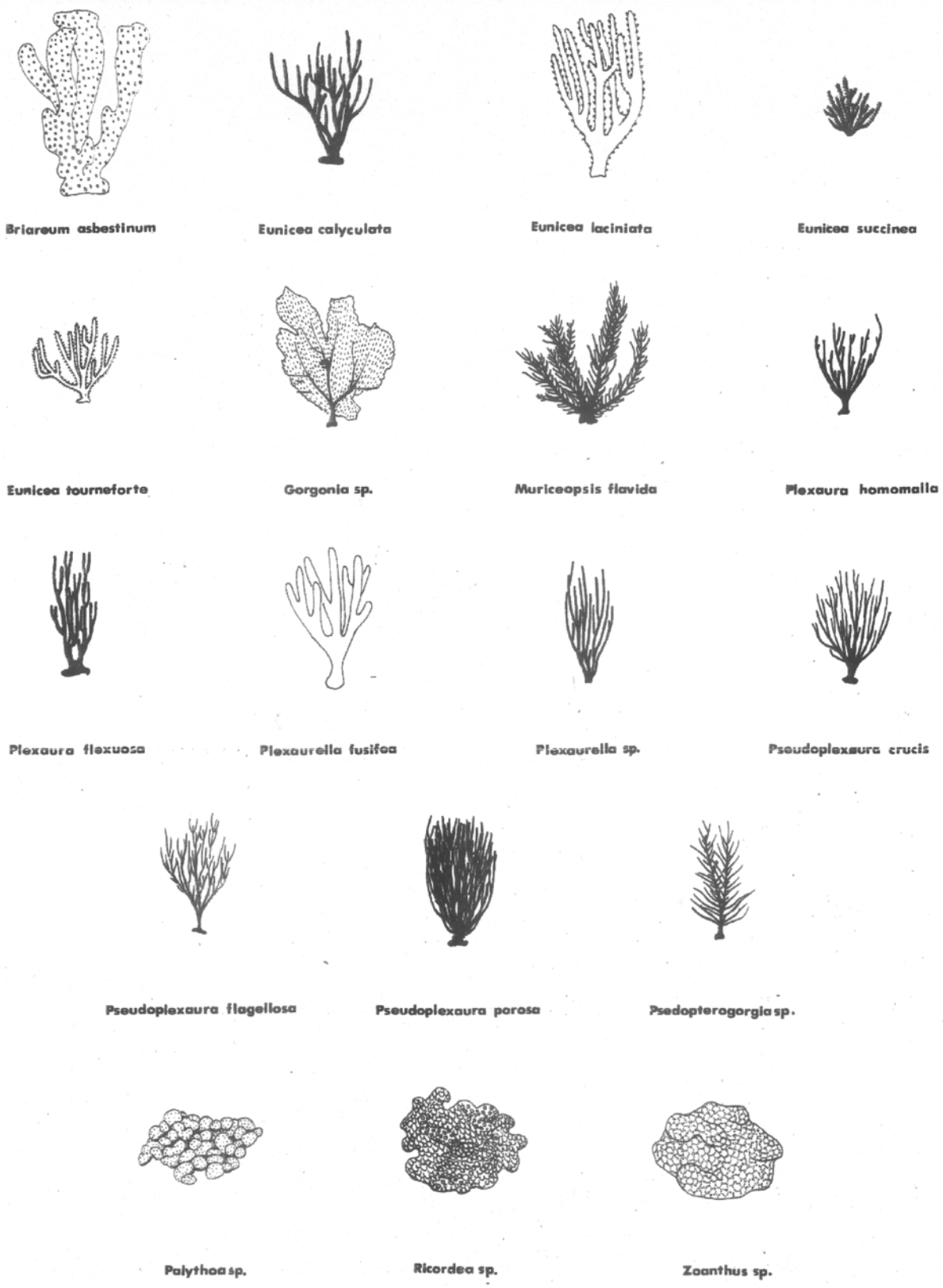


Figure 3.9. Key to coral identification for Figures 3.6, 3.7 and 3.8.

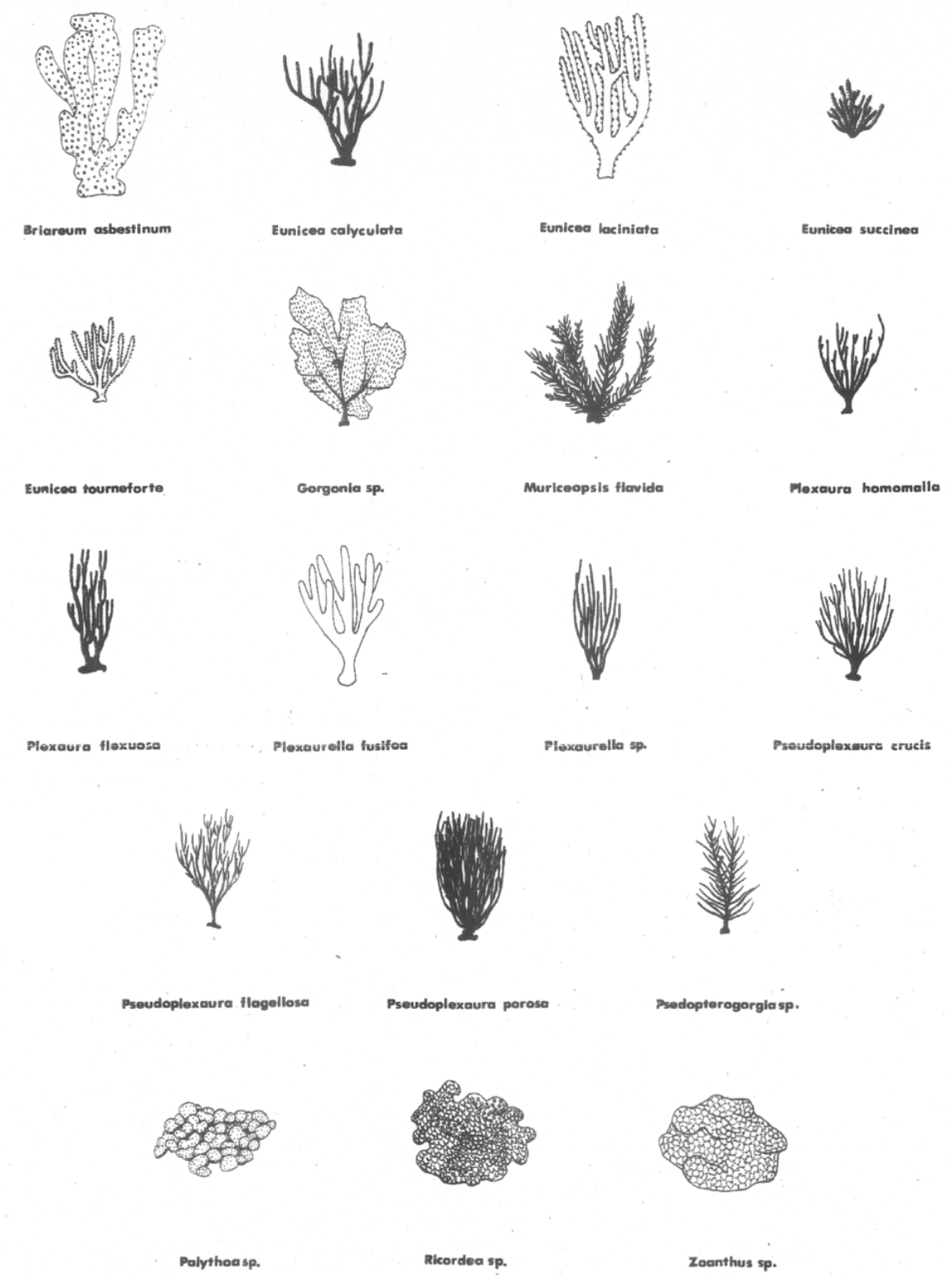
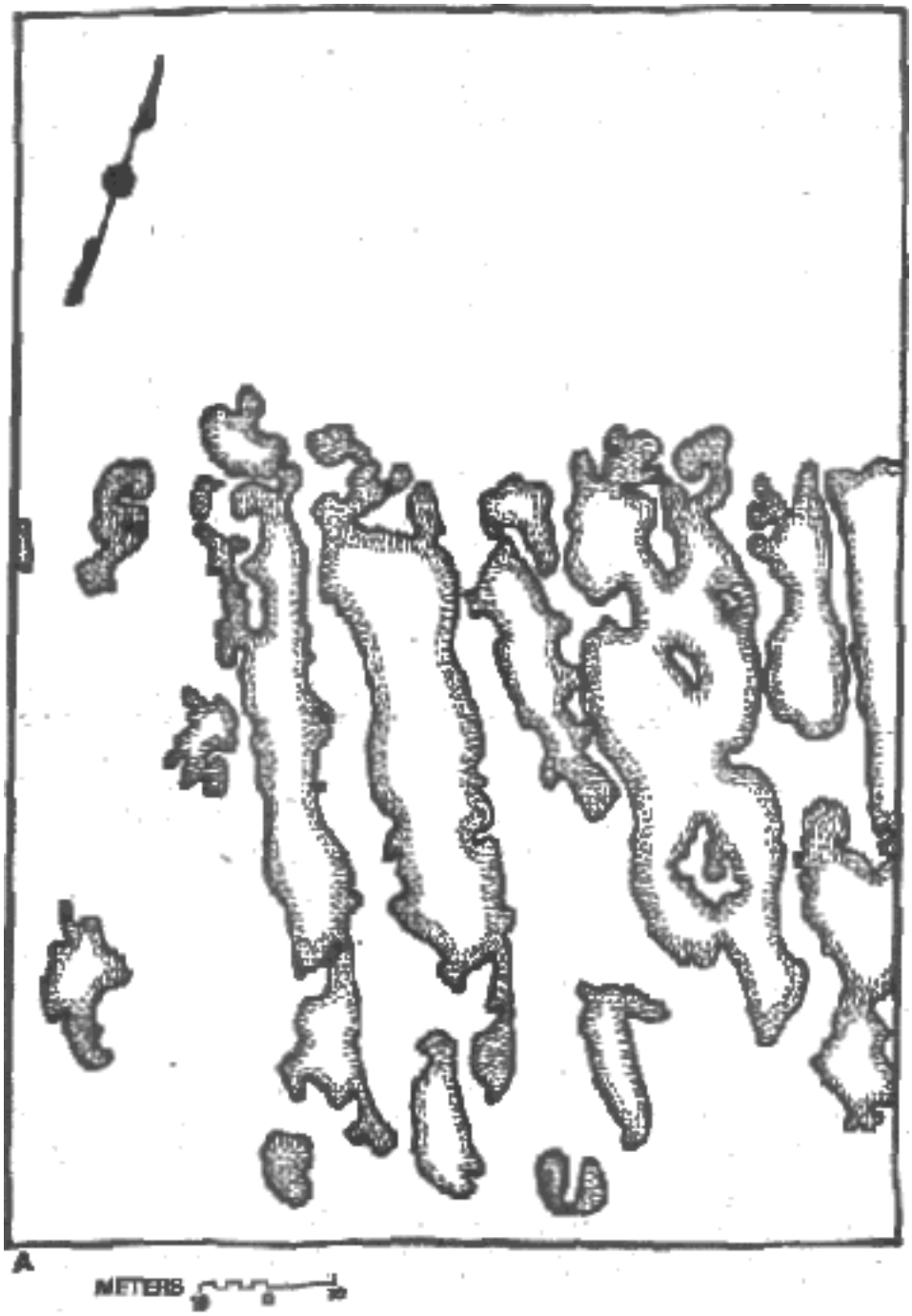
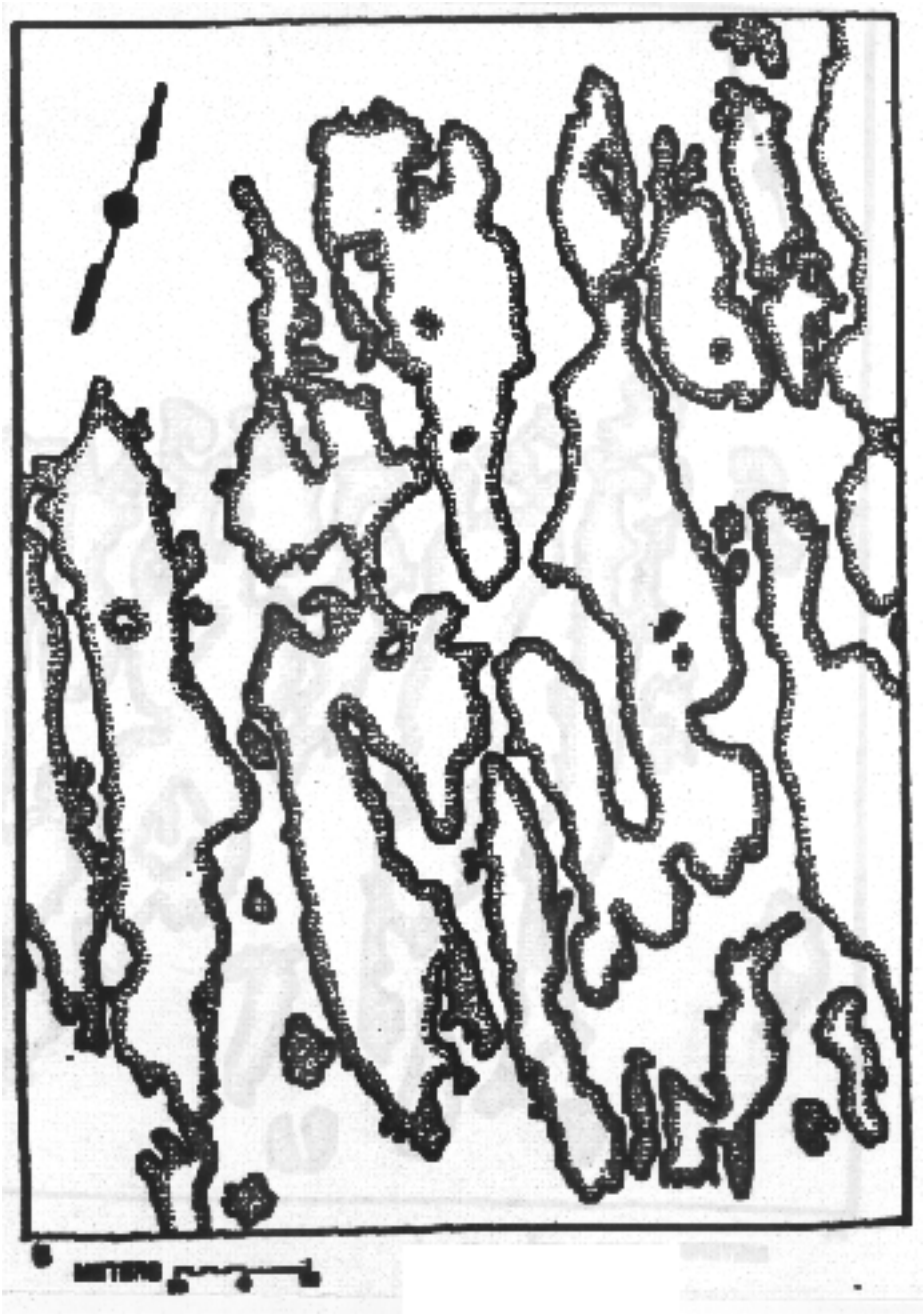
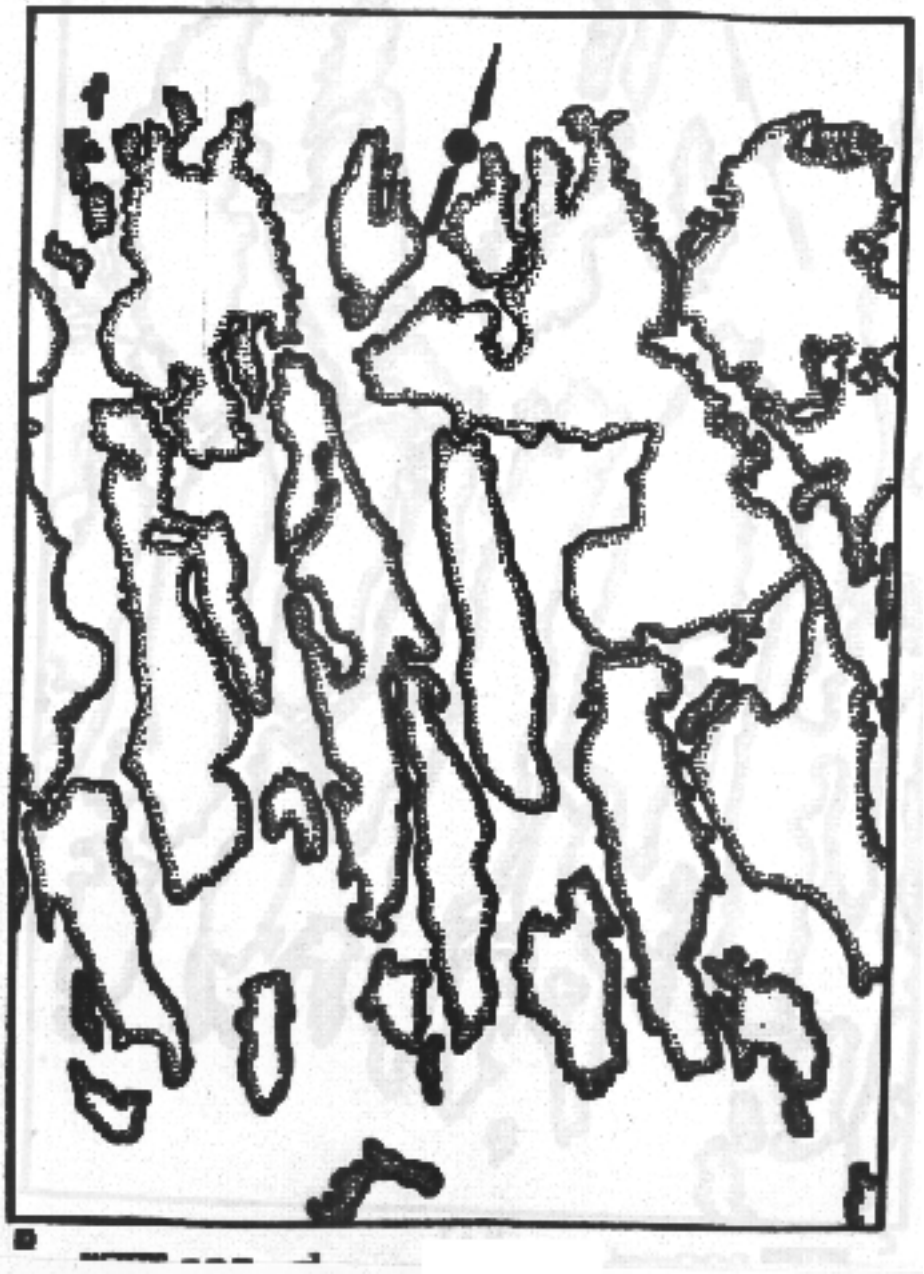


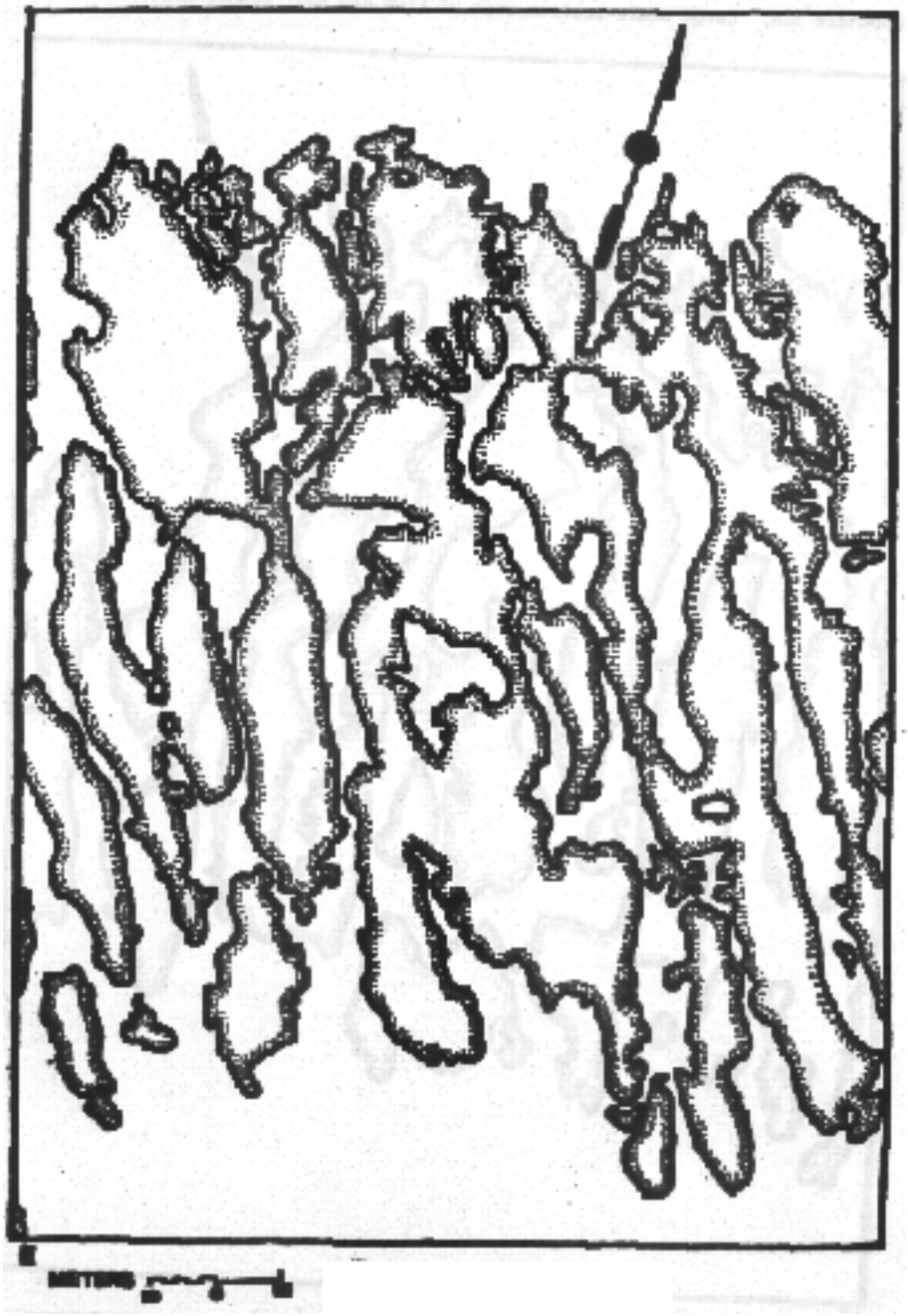
Figure 3.9. Key to coral identification for Figures 3.6, 3.7 and 3.8 (cont.).

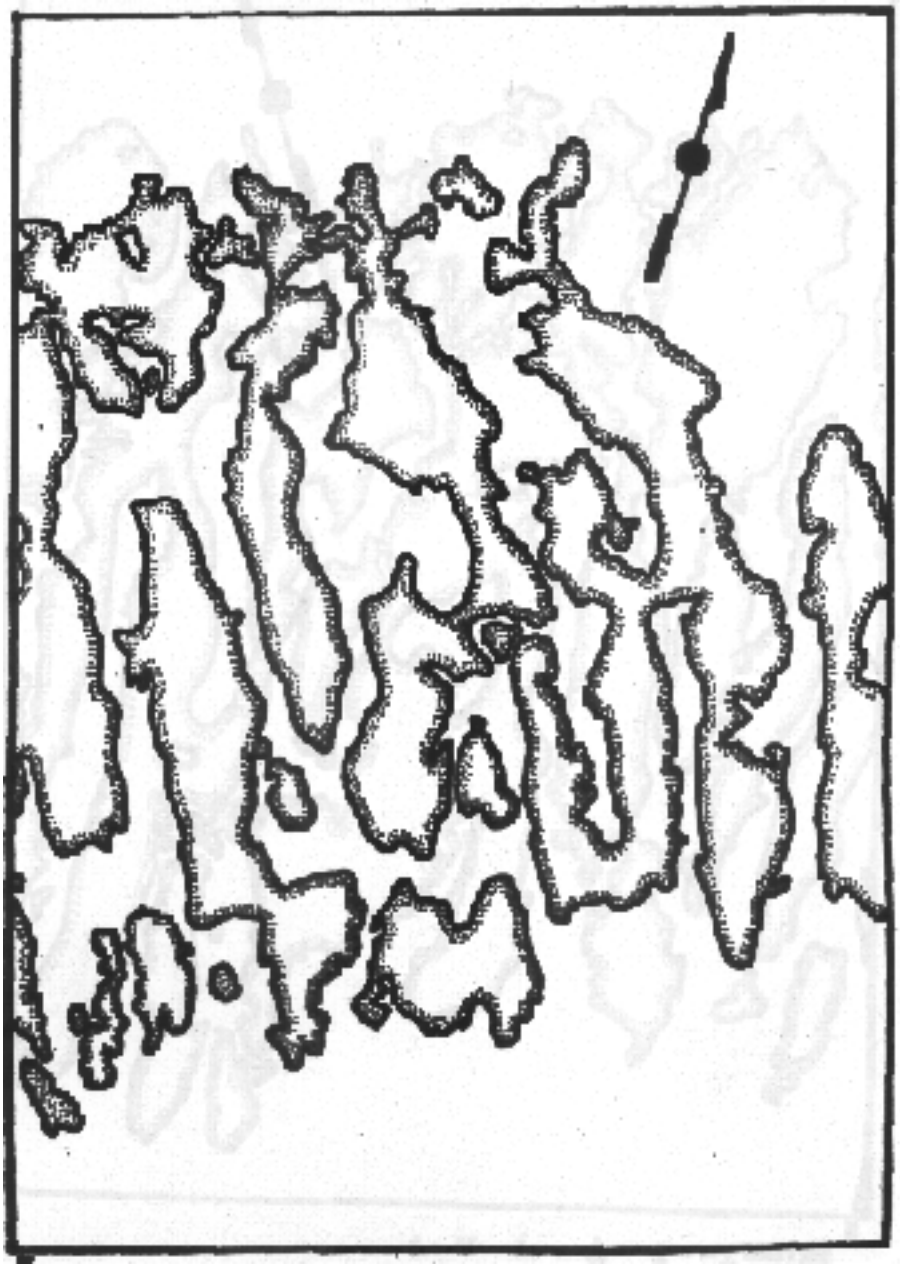
Appendix 3.A. Large scale section maps of the Looe Key Reef forereef spur formations. See Figure 3.2.

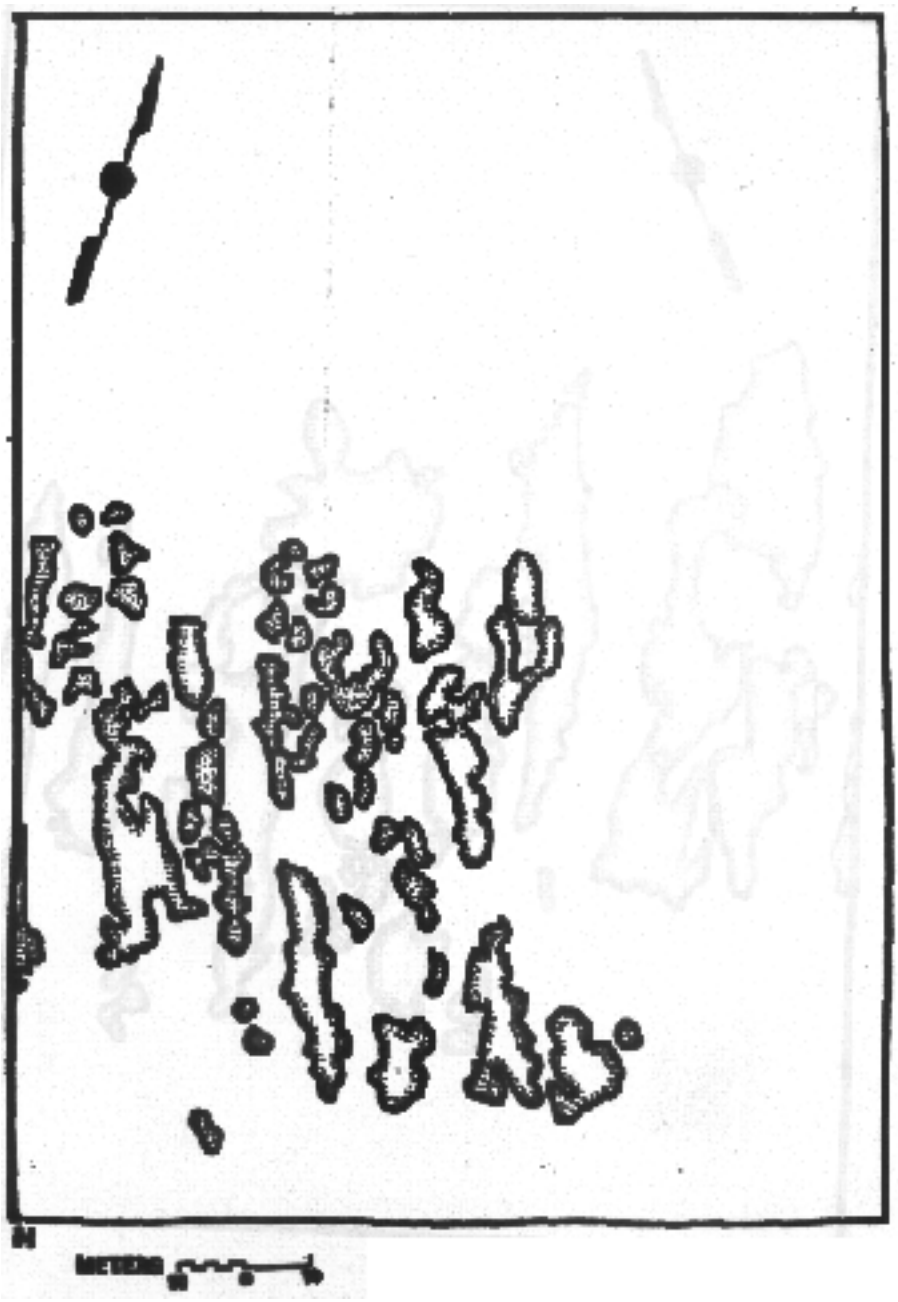












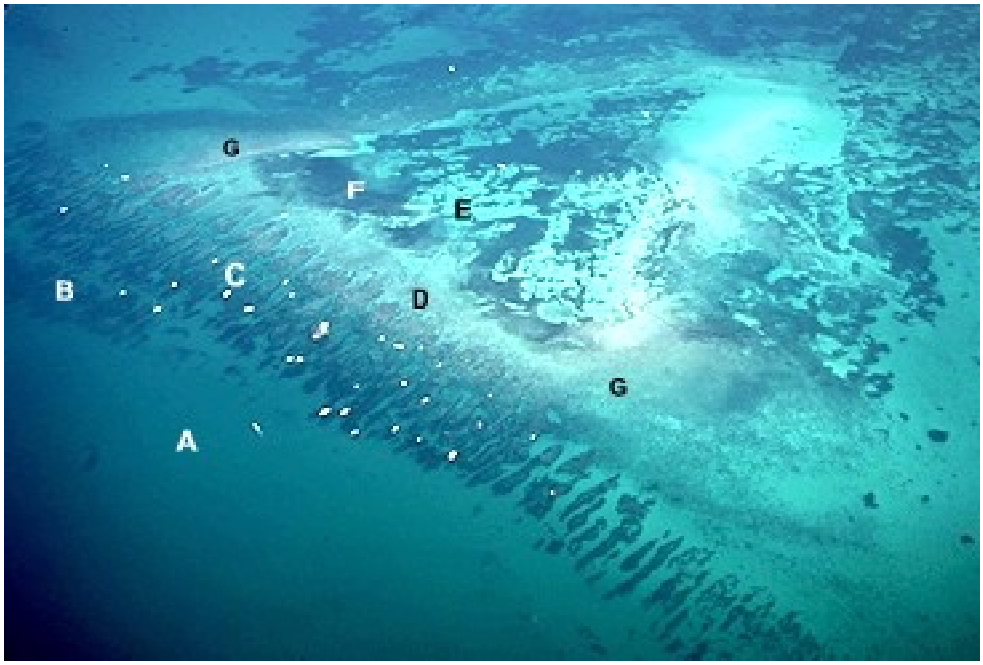


Plate 3.1. Oblique aerial photo of the forereef looking northwest. Letters show several reef Zones: Al deeper sand flats; 89 buttress zone; C, forereef (spur and groove formation); D, rubble zone; E, lagoon sand; F, lagoon grass beds; G, lagoon rubble horn on the west (left) and on the east (right).

Plate 3.2. Typical live bottom (left) and buttress zone coral reef formation (right). Live bottom is characterized by expanses of dead calcium carbonate substrate dominated by sponges and soft corals (Octocoralla) with occasional colonies of hard coral (Scleractinia). Coral reefs are characterized by a dominance of living hard corals. Live bottoms generally have low vertical relief relative to coral reefs.

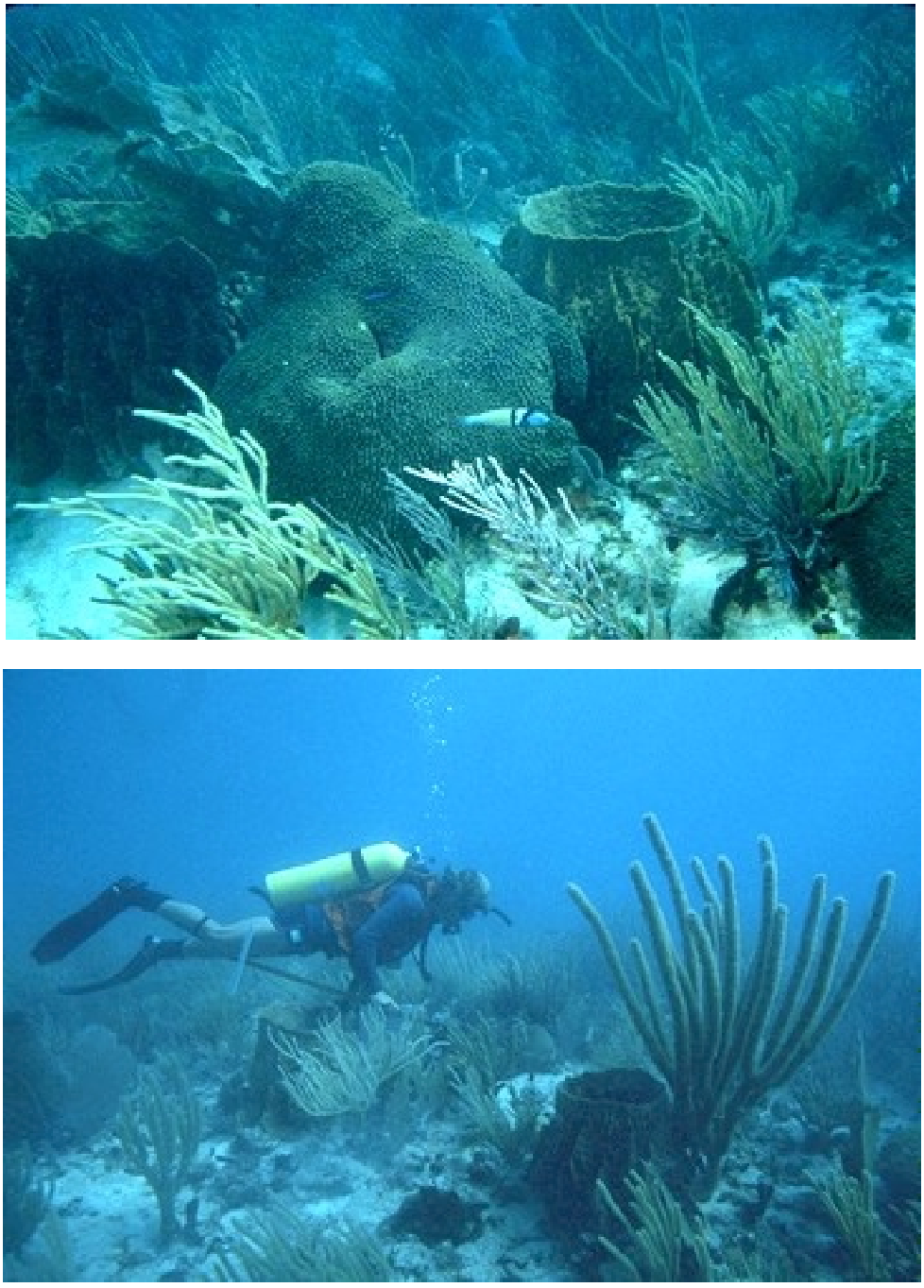


Plate 3.3. Representative deep live bottom (top) with sponges, soft corals, and isolated colonies of hard corals. A bluehead wrasse, *Thalassoma bifasciatum*, is swimming in the foreground. A diver (bottom) provides scale and shows the gene al low relief habitats typical of live bottoms.

Plate 3.4. Shallow live bottom habitats (top and bottom) exist in a narrow line along the northern boundary of the Sanctuary near the edge of Hawk Channel. Sponges, soft corals, and small hard coral colonies dominate the benthic fauna.

Plate 3.5. Spur and groove formation of the forereef habitat showing typical low relief formations on the seaward ends of spurs in closeup (top) and at a distance (bottom).

Plate 3.6. Representative views of middle spur formation showing a large colony of brain coral, *Colpophyllia natans*, (top) and two growth forms of mountainous star coral, *Montastrea annularis* (bottom).

Plate 3.7. The portions of many spurs form nearly vertical walls (top) which frequently have lush growths of soft coral (bottom).

Plate 3.8. Spurs formation has historically been based on elkhorn coral, *A. palmata*, which in some areas forms extensive stands (top) that provide shelter for many species of reef fish. In shallow water spurs are usually topped by firecoral (*Millepora complanata*) and the zoanthid *Palythoa caribaeorum* (bottom).

Plate 3.9. View looking seaward (top) showing the top of a typical shallow spur formation. The tops of spurs in shallow water are usually nearly flat and dominated by firecoral (*M. complanata*) and the zoanthid *Palythoa caribaeorum* (bottom).

Plate 3.10. Only isolated colonies of soft coral (top) and hard coral (bottom) occur in the rubble zone which is composed mostly of dead coral fragments thrown up behind the forereef after major storms.

Plate 3.11. Typical rubble (top) found on the rubble horns on the east and west sides of the lagoon. Isolated colonies of elkhorn coral (*Acropora palmata*) (bottom) frequently occur in the rubble zone just landward of the forereef crest.

Plate 3.12. A few isolated coral heads (top) are infrequently found in lagoonal grass beds. Typical grass beds (bottom) are dominated by turtle grass (*Thalassia testudinum*, wide blades) and eel grass (*Syringodium filiforme*, narrow rounded blades). In the lagoon the substrate is often a mixture of rubble and sand.

Plate 3.13. Sand flats (top) dominate much of the Sanctuary and have little relief except for occasional isolated coral patches. Sparse sea grasses (bottom) occur most commonly near hard bottom and reef areas.

Plate 3.14. Typical views of medium density (top) and high density (bottom) sea grass beds. These habitats are important sources of food for many reef organisms.