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CHAPTER 4

SPECIES COMPOSITION AND ABUNDANCE OF CORALS AND OTHER INVERTEBRATES ON THE REEFS OF THE SEYCHELLES ISLANDS

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INTRODUCTION

Coral reefs of the Seychelles Islands are not as well studied as those of Kenya, Madagascar and the Chagos Archipelago. Present knowledge is based on the collections of J. Stanley Gardiner made at the beginning of this century and on several later investigations performed on the reefs of Mahé Island and Aldabra Atoll (Gardiner 1936, Levi 1961, Lewis 1968, Rosen 1971, 1979). This study deals with the distributional patterns of corals, molluscs, sponges and other common macrobenthic invertebrates of the Seychelles Islands coastal zones.

METHODS AND MATERIALS

The investigation of species composition and distributions of macroinvertebrates was conducted from the R/V Akademik A. Nesmeyanov (January - March 1989) down to a depth of 30 m using a combination of frame-quadrats and transects (Maragos and Jokiel 1976, Bouchon 1981) depending on the extent and morphology of a given reef. When a reef extended for hundreds of meters offshore (e.g., Desroches, Farquhar, St. Joseph and Cerf Islands), the distribution of organisms was analyzed at a number of widespread stations 200-500 m from each other. In the coastal zones of the granitic islands (Mahé, Praslin, La Digue) and also on Cöetivy Island, a 100 m-transect marked at each meter was used. The animal populations and cover of corals were estimated using a 1.0 m^2 frame divided into 100 equal squares. At most sites, subtidal stations continued on seaward from intertidal transects.

Altogether, 33 profile sections (transects) in 13 localities were studied and the species composition of corals was determined for an additional 5 localities (Table 1), while the species composition of sponges was determined for 12 sites (Table 2). Representative collections were archived at the USSR Academy of Sciences, Far East Branch, Vladivostok.

RESULTS AND DISCUSSION

An analysis of the species composition and distributional patterns of the floristic and faunistic populations of reefs of the Seychelles showed that major upper subtidal communities in all areas

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studied are dominated by either scleractinian and alcyonarian corals, algae or seagrasses (for more detailed information on the flora of coastal waters of the Seychelles see Ch. 5, Gutnik et al., on alcyonarians - Ch. 3, Malyutin, of the present ARB issue). Abundances and the ratio of floristic and faunistic complexes substantially change from one island to another and even within one island area. This paper follows the descriptive scheme of reef classification for the Seychelles suggested by Stoddart (1984), who follows convention by dividing the reefs into three groups: fringing, platform and atoll reefs.

Fringing reefs were most typically found on Mahé Island. Near the northeast Point, at a distance of 120-130 m offshore, beds of the seagrass *Thalassodendron ciliatum* are replaced by a badly damaged reef built mainly by colonies of branched *Stylophora pistillata*, *Pocillopora verrucosa* and rarely by smaller colonies of massive *Porites*, which combined develop up to 3% cover of the calcareous or bedrock primary substrata. Considerable area here is covered with members of the order Corallimorpharia (subclass Hexacorallia). At a distance of 160-170 m offshore, the reef flat changes in slope inclining at about 25-30° down to 8-12 m in depth. Concomitantly, Scleractinia decrease in number and development (substratum area coverage no more than 1-2%); separate corallagenous blocks and landslips occur frequently. The gastropods *Cypraea histrio*, *Conus distans*, *Lambis chiragra*, the sea urchin *Diadema* as well as single individuals of the bivalve molluscs *Tridacna maxima* and *Pinctada margaritifera* can be found between scattered blocks. Farther seaward the sandy bottom is populated by massive, columnar and lamellar corals form at 12-15 m in depth. *Goniastrea*, *Favia*, *Favites*, *Galaxea*, *Montipora* and sponges of the genus *Spirastrella* are characteristic of this part of the reef. Single colonies of branched *Acropora*, which otherwise are well developed on reef slopes, are rare. Overall, coral cover reaches 80%. Similar compositions and vertical distributions of scleractinians were found near Anonim Island on the eastern coast of Mahé Island; however the coral cover on the reef slope is about 40%, and *Acropora*, *Pocillopora* and *Millepora* are more abundant here.

Granitic islands (Praslin, La Digue, Mahé) have fringing reefs in their coastal zones, which are characterized by a well developed reef flat and rather steep slopes extending down to 13-23 m in depth. The shallowest protions of reef flats and reef fronts are dominated by calcareous algae and encrusting scleractinians which are replaced by *Acropora* and *Pocillopora* (covering about 20-40%) at 2-3 m in depth. *Goniastrea* and *Favites* are common on large boulders and rocks. At 12 m in depth, the reef slope forms a platform inhabited by massive *Porites, Favia* and foliaceous *Pachyseris* (covering up to 30%). Among the other invertebrates, the gastropods *Lambis truncata* (1 individual·m^{-2}), *Chicoreus ramosus* (1·m^{-2}), *Lambis crocata* and smaller species are common.

At a distance of 2-3 km from Praslin Island, at 20-30 m in depth, the reef platform is populated by colonies of branched *Acropora* and *Turbinaria* as well as solitary *Heteropsammia cochlea*. At La Digue Island, coastal zone rock promontories 400-500 m offshore support isolated colonies of scleractinians, chiefly of the genera *Pocillopora* and *Favia*. In addition to corals, large settlements of the bivalve *Lopha cristagalli* (about 30·m^{-2}) and *Pinctada margaritifera* (up to 20·m^{-2}) are found.

According to Stoddart's (1984) classification, reefs of the African Banks, as well as reefs of Cöetivy, D'Arros, Cerf and Desroches, are indicative of platform reefs. Characteristic features of such reefs are a very slow increase in depth with increasing distance off shore, a long reef slope stretching over hundreds or even thousands meters, and extremely homogeneous compositions and distributions of organisms. The most salient features are given below, without describing each island in detail.

Reefs of Cerf Island and African Banks extend over several kilometers offshore and are 40-60% covered by 40-90% the seagrass *Thalassodendron ciliatum*. Of the scleractinians, branched *Stylophora pistillata*, *Porites cylindrica*, massive *Porites lutea* and *Favia* spp. are of most frequent

occurrence. There is no distinct zonation in the vertical distributional patterns of scleractinias in contrast to the typical fringing reefs of Mahé, Praslin and La Digue Islands. Coral colonies are not large (*Porites lutea* - < 20-30 cm in diameter), and total cover does not exceed 20%. Associated fauna includes the sea star *Protoreaster lincki* (to $2 \cdot m^{-2}$) and the bivalve mollusc *Pinctada margaritifera* (about $1 \cdot m^{-2}$).

In contrast to the reefs of the African Banks and Cerf Islands, the reef of the southeastern coast of D'Arros Island is smaller, with a more pronounced reef slope and scleractinian zonational pattern. Zonal alternation of monospecific populations is an interesting feature of this reef, the upper parts of which as a whole are similar in composition and development to the reefs described above. For example, the blue octocoral *Heliopora coerulea* is responsible for 100% cover at 17-25 m in depth. At 25-27 m (350-400 m from the reef front), separate juveniles of *Acropora*, *Heliopora* and the hydrocoral *Millepora* (about 50% cover) are replaced by monospecific populations of *Millepora platyphyllya*, whereas at 27-30 m almost 100% of the substratum is occupied by *Acropora*. *Porites* and *Favia* become more common at greater depths where sand plains occur. On the reef as a whole, the gastropods *Lambis truncata*, *Lambis arhtritica*, *Bursa bubo* and the holothurian *Telenota ananasare* are of frequent occurrence, but they do not form large concentrations.

The pattern of coral distribution in the coastal waters of Cöetivy Island represents an obvious case of local variability in vertical scleractinian distribution for the upper subtidal of the Seychelles. Abundant growths of the seagrass *Thalassodendron ciliatum* (90-100% cover) begin from the waterline along the northeastern coast of this island, and extend throughout the reef flat and gentle slope over 800-1000 m. With increased distance off shore, the abundance of *T. ciliatum* gradually decreases (about 50% at 7 m in depth and about 10% at 17 m in depth) whereas scleractinians and alcyonarians increase somewhat. At a distance of 400-500 m, coral cover reaches 30-35%, consisting of small colonies of branched *Acropora digitifera*, *Pocillopora verrucosa*, *Stylophora pistillata*, *Millepora platyphylla*, representatives of *Platygyra*, *Galaxea*, *Favia* and several smaller species usually inhabiting sites that are free of seagrasses, but sometimes co-occurring with these macrophytes.

Along the western coast of Cöetivy Island, *Thalassodendron ciliatum* occurs as a small belt between the coastline and the 1 m isobath. Immediately past the reef front, the scleractiian community begins with the dominant *Stylophora pistillata* densely covered with calcareous algae and *Acropora digitifera* (covering - 10-20%). Corals inhabit calcareous substrata together with the bivalves *Tridacna crocea* ($1\text{-}10 \cdot m^{-2}$) and *Cardina variegata* ($15\text{-}2 \cdot m^{-2}$). At 10-12 m in depth, the coral cover consists of mainly *Heliopora coerulea* and *Acropora digitifera*, similar to the rock promontories of Praslin and La Digue Islands. Deeper, patches of *Acropora* and some colonies of *Porites* can be found.

The third group of Seychelles reefs consists of the atolls Aldabra, Astove, Farquhar, Cosmoledo and St. Joseph. As a rule, atolls are characterized by platform reefs on the outer side and surround a shallow sandy lagoon. Considerable areas of the lagoons are often occupied by seagrasses, spreading into intertidal sites. Scleractinians are sparse here, with only small isolated colonies of *Stylophora*, *Favia* and *Montipora*. Cover does not exceed 5% in most areas. The associated fauna is represented by the gastropods *Monetaria moneta*, *Monetaria annulus* (to $50 \cdot m^{-2}$), *Cyprea tigris* ($0.2 \cdot m^{-2}$), and by the bivalves *Pinna* sp. and *Codakia* sp.

The outer reef slopes facing the open sea, are often very extensive. Near the southeastern coast of St. Joseph Island, at distance of 1 km from shore (depth of about 25 m) a well-developed coral community is present with many scleractinias such as *Pocillopora*, *Porites* and *Acropora* (covering about 35%). *Favia*, *Favites*, *Lobophyllia*, *Symphyllia* and gorgonians are of frequent occurrence. A similar situation is observed in the coastal waters of Farquhar and Cosmoledo Islands. Also, the reef slope at the eastern end of St. Joseph Atoll has an inclination of 45-70° (30-40 m from the shore and

at 7 m in depth) and consists of the blue octocoral *Heliopora coerulea* at its upper boundary (100% cover), and of massive and encrusting scleractinian species (*Porites*, *Pachyseris*) below 24 m where *Heliopora* cover is reduced to 20-40%. At 33 m, the reef changes to a sandy platform with isolated small colonies of *Porites cylindrica* and some other species.

A slope of similar geomorphology is characteristic of the reef at the southwestern coast of Astove Atoll, where the reef at 6-8 m in depth is dominated by a monospecific cover of *Porites cylindrica* (100%) until it declines abruptly (inclination angle of 50-90°) down to more than 40 m. Beginning from 17-18 m, coral cover decreases sharply and *Porites cylindrica* is replaced by small colonies of *Platygyra* and *Favia*. Deeper than 22 m, corals are not observed in this region and the reef slope is nearly 100% covered by algae.

In summary, the Seychelles reefs, especially those of the northern granitic islands (Mahé, Praslin, La Digue), show scleractinian compositions and distributional patterns that are very similar to most reefs of the Indo-West Pacific (for observations in Vietnam see Latypov, 1987). More or less distinct vertical zonational patterns are similar, dependent on succession of scleractinians from the same genera and life forms (e.g., branched and crustose *Stylophora* and *Montipora* on reef flats, branched *Stylophora*, *Pocillopora* and *Acropora* on reef slopes and massive, encrusting and isolated *Porites*, *Pachyseris* and *Fungia* at the bases of slopes and on platforms). The preliminary checklist of Scleractinia and *Millepora* corals of the Seychelles includes 51 genera. Earlier surveys of Aldabra and other granitic islands identified a total of 64 genera of hermatypic corals (Rosen 1971, 1979, Pillai et al. 1973, Wijsman-Best et al. 1980, Sheppard 1987). Further study of the voucher collections will reduce this difference.

In conclusion, it is important to note the absence of dense settlements of bivalve molluscs on Seychelles reefs. Bivalves play an important role in the function of coastal benthic communities of the tropical zones of other Indian and Pacific Ocean reefs. For example, *Tridacna crocea*, on reefs in the region of Townsville (Australia), forms populations with a density of up to $200 \cdot m^{-2}$ and is to a considerable degree responsible for the formation of micro atoll-like structures (Hamner and Jones 1976). In the coastal waters of Vietnam, this species along with other numerous and common Indo-Pacific molluscs, such as *Arca ventricosa* and *Beguina semiorbiculata*, seems to control important processes of bioerosion and biosedimentation. Only isolated individuals of these two species are also found on the Seychelles reefs. Bivalve molluscs are not as important for reef life in the Seychelles Islands as is the case on the Great Barrier Reef and in coastal zones of Vietnam, although their species diversity is comparatively high (Taylor 1968). The reasons for the differences in abundances of this invertebrate group in these regions is at present unclear.

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Table 1. Coral species from the coastal waters of the Seychelles Islands. M = Mahé, P = Praslin, Co = Cöetivy, F = Farquhar and D = Desroches

Species	Island				
	M	P	Co	F	D
1. *Pocillopora damicornis* (Linneus, 1758)	M	P			D
2. *Pocillopora eydouxi* Milne Edwards & Haime, 1860		P	Co		D
3. *Pocillopora meandrina* Dana, 1846					D
4. *Pocillopora verrucosa* (Ellis & Solander, 1786)	M	P	Co	F	D
5. *Pocillopora woodjonesi* Vaughan, 1918				F	
6. *Seriatopora hystrix* Dana, 1846			Co		D
7. *Stylophora pistillata* Esper, 1797	M	P	Co	F	D
8. *Montipora foveolata* (Dana, 1846)					D
9. *Montipora millepora* Crossland, 1952		P			
10. *Montipora spongodes* Bernard, 1897	M	P			
11. *Montipora venosa* (Ehrenberg, 1834)		P			
12. *Montipora verrucosa* (Lamarck, 1816)				F	
13. *Montipora* sp.1	M		Co	F	D
14. *Montipora* sp.2	M		Co	F	
15. *Anacropora* sp.		P			
16. *Acropora aculeus* (Dana, 1846)		P			
17. *Acropora anthocercis* (Brook, 1893)					D
18. *Acropora cerealis* (Dana, 1846)					D
19. *Acropora cytherea* (Dana, 1846)	M	P	Co		D
20. *Acropora digitifera* (Dana, 1846)	M	P	Co	F	
21. *Acropora divaricata* (Dana, 1846)	M	P		F	
22. *Acropora formosa* (Dana, 1846)	M	P			D
23. *Acropora grandis* (Brook, 1892)		P			D
24. *Acropora hyacinthus* (Dana, 1846)	M	P			D
25. *Acropora nasuta* (Dana, 1846)				F	D
26. *Acropora nobilis* (Dana, 1846)	M	P			
27. *Acropora palifera* (Lamarck, 1816)	M	P	Co		
28. *Acropora polystoma* (Brook, 1891)	M			F	
29. *Acropora robusta* (Dana, 1846)			Co		
30. *Acropora verweyi* Veron & Wallace, 1984			Co		
31. *Acropora* sp.1	M		Co	F	D
32. *Acropora* sp.2			Co		
33. *Astreopora explanata* Veron, 1985		P		F	
34. *Astreopora listeri* Bernard, 1896				F	
35. *Astreopora myriophthalma* (Lamarck, 1816)			Co		D
36. *Astreopora ocellata* Bernard, 1896		P			
37. *Astreopora* sp.				F	
38. *Porites annae* Crossland, 1952		P			
39. *Porites cylindrica* Dana, 1846			Co	F	
40. *Porites lobata* Dana, 1846	M	P	Co	F	D
41. *Porites lutea* Edwards & Haime, 1860	M			F	D
42. *Porites murrayensis* Vaughan, 1918					D
43. *Porites nigrescens* Dana, 1846					D
44. *Porites stephensoni* Crossland, 1952					D
45. *Porites* sp.				F	

Table 1. Continued.

Species	Island				
	M	P	Co	F	D
46. *Goniopora lobata* Milne Edwards & Haime, 1860	M				D
47. *Goniopora* sp.1	M				
48. *Goniopora* sp.2	M				
49. *Alveopora* sp.	M				
50. *Pseudosiderastrea tayamai* Yabe & Sugiyama, 1935		P			
51. *Psammocora profundacella* Gardiner, 1898					D
52. *Psammocora superficialis* Gardiner, 1898					D
53. *Cosinaraea* sp.		P			
54. *Pavona clavus* (Dana, 1846)	M	P			D
55. *Pavona minuta* Wells, 1956	M	P		F	
56. *Pavona varians* Verrill, 1864		P			D
57. *Pavona* sp.				F	
58. *Leptoseris mycetoseroides* Wells, 1954				F	D
59. *Gardineroseris planulata* (Dana, 1846)		P		F	D
60. *Pachyseris* sp.	M	P			
61. *Cycloseris cyclolites* (Lamarck, 1801)			P		
62. *Diaseris* sp.		P			
63. *Fungia danai* Milne Edwards & Haime, 1851	M			F	
64. *Fungia granulosa* Klunzinger, 1879		P			
65. *Fungia repanda* Dana, 1846					D
66. *Fungia scutaria* Lamarck, 1801				F	
67. *Herpolitha limax* Houttuyn, 1772	M				D
68. *Herpolitha weberi* Van Der Horst, 1921					D
69. *Herpolitha* sp.					D
70. *Sandalolitha robusta* Quelch, 1886					D
71. *Galaxea astreata* (Lamarck, 1816)	M	P		F	
72. *Echinophyllia aspera* (Ellis & Solander, 1786)				F	D
73. *Mycedium elephantotus* (Pallas, 1766)		P			
74. *Pectinia lactuca* (Pallas, 1766)	M			F	
75. *Acanthastrea bowerbanki* Edwards & Haime, 1851				F	D
76. *Acanthastrea echinata* (Dana, 1846)				F	
77. *Acanthastrea hillae* Wells, 1955				F	
78. *Acanthastrea* sp.1	M				
79. *Lobophyllia* sp.	M				D
80. *Symphyllia* aff. *valenciennesii*	M				D
81. *Hydrophora microconos* (Lamarck, 1816)		P	Co	F	D
82. *Caulastrea* sp.		P			
83. *Favia maritima* (Nemenzo, 1971)	M		Co		D
84. *Favia maxima* Veron, Pichon & Wijsman-Best, 1977	M	P	Co		
85. *Favia pallida* (Dana, 1846)					D
86. *Favia speciosa* (Dana, 1846)	M	P	Co	F	D
87. *Favia stelligera* (Dana, 1846)		P	Co	F	
88. *Favia* sp.				F	
89. *Favites abdita* (Ellis & Solander, 1786)		P	Co	F	D
90. *Favites chinensis* (Verrill, 1866)	M			F	

Table 1. Continued.

Species	Island				
	M	P	Co	F	D
91. *Favites flexuosa* (Dana, 1846)	M	P	Co	F	D
92. *Favites* sp.			Co		
93. *Goniastrea aspera* Verrill, 1905		P			
94. *Goniastrea edwardsi* Chevalier, 1971	M	P			D
95. *Goniastrea pectinata* (Hemprich & Ehrenberg, 1834)	M	P	Co	F	D
96. *Goniastrea retiformis* (Lamarck, 1816)	M	P			D
97. *Platygyra daedalea* (Ellis & Solander, 1786)	M		Co	F	D
98. *Platygyra lamellina* (Hemprich & Ehrenberg, 1834)			Co	F	
99. *Platygyra pini* Chevalier, 1975	M			F	
100. *Platygyra sinensis* (Edwards & Haime, 1849)		P			
101. *Leptoria phrygia* (Ellis & Solander, 1786)			Co		
102. *Oulophyllia crispa* (Lamarck, 1816)	M			F	D
103. *Montastrea annuligera* (Edwards & Haime, 1849)		P		F	D
104. *Plesiastrea versipora* (Lamarck, 1816)			Co		D
105. *Diploastrea heliopora* (Lamarck, 1816)					D
106. *Leptastrea bewickensis* Veron, Pichon & Wijsman-Best, 1977					D
107. *Leptastrea purpurea* (Dana, 1846)	M	P			D
108. *Leptastrea transversa* Klunzinger, 1879	M				
109. *Cyphastrea serailia* (Forskål, 1775)		P	Co		
110. *Cyphastrea* sp.	M				
111. *Echinopora lamellosa* (Esper, 1795)	M				
112. *Moseleya latistellata* Quelch, 1884					D
113. *Turbinaria frondens* (Dana, 1846)	M	P	Co		D
114. *Turbinaria mesenterina* (Lamarck, 1816)	M	P			D
115. *Turbinaria peltata* (Esper, 1794)	M	P	Co		D
116. *Turbinaria reniformis* Bernard, 1896			Co		
117. *Heteropsammia cochlea* (Spengler, 1781)	M	P			
118. *Tubastraea micrantha* (Hemprich & Ehrenberg, 1834)					D
119. *Tubastraea* sp.	M				D
120. *Siderastrea radians* (Pallas, 1766)		P			
121. *Tubipora musica* Linaeus, 1758			Co		D
122. *Heliopora coerulea*(Pallas, 1766)		P	Co	F	D
123. *Millepora platyphylla* Hemprich & Ehrenberg, 1834	M	P	Co	F	D