ROB W. M. VAN SOEST
Instituut voor Taxonomische Zoologie
Zoölogisch Museum Amsterdam, Mauritskade 57
P.O. Box 4766, Amsterdam, The Netherlands

Shallow-Water Reef Sponges of Eastern Indonesia

Abstract

In a preliminary study of coral reef sponges collected during the Indonesian-Dutch Snellius II Expedition (1984–1985) in the eastern part of the Indonesian Archipelago, 56 species (out of 300–400 collected) were found to be common in this area. Other findings include a novel symbiotic association between the octocoral *Tubipora* and a *Mycale* and the first sclerosponge ever to be recorded from Indonesia (i.e., *Astrosclera willeyana*). Literature reveals that some of the common reef sponges of Indonesia are also common in other parts of the Indo-Pacific area: 26 appear to be common in Northeast Australian reefs, 37 in Central Pacific reefs, and 24 in Western Indian Ocean reefs. From the overall distribution of sponges in these four areas it is tentatively concluded that Indonesia is the distributional center of Indo-Pacific reef sponges. At the same time, species vary locally, and only 10 species (out of an estimated total of 204) may be common throughout the Indo-Pacific area. In addition, Indo-Pacific reefs seem highly dissimilar to those of the tropical Atlantic with respect to the generic composition of the common species of sponges.

Surprisingly little is known about the sponge fauna of Indonesia, supposedly the richest of the world's oceans. The most recent publication containing taxonomic descriptions of original material dates back to before World War II (Brøndsted, 1934). There are only a few earlier major publications on the Indonesian sponge fauna: Topsent (1897), Kieschnick (1896, 1900), Thiele (1899, 1903), and Hentschel (1912). The collections on which these works were based have not been revised, with the exception of Topsent's (1897; see Desqueyroux, 1981). One reason for this dearth of information is that the sponges in the large collections made by major expeditions in Indonesian waters (namely, the Siboga Expedition, 1898–1899, and the Snellius Expedition, 1925) were never described, with the exception of the Siboga Calcarea (Burton, 1930) and the genera *Placospongia* (Vosmaer and Vernhout, 1902) and *Spirastrella* (Vosmaer, 1911).

The Indonesian-Dutch Snellius II Expedition 1984–

1985 was organized around five principle projects in the fields of physical oceanography, marine geology, and marine biology, the last of which comprised a pelagic and a coral reef program. I joined the team interested in in exploring the coral reefs aboard the R/V *Tyro*, which traveled from Ambon (Amboina) to various locations around the Band and Savu seas, ending in Sulawesi (Figure 1). The eight localities visited were chosen for their divergent physical environment, namely, sheltered and exposed lagoons, deep lagoons, sea grass beds, coastal reef, exposed reef flats, drowned atolls, and exposed outer reefs.

Methods

During the cruise, these eight areas were systematically sampled by diving, snorkeling, and wading. Sponges were removed from the substrate, taken aboard, characterized briefly, labeled, and preserved in ethanol. Many specimens were photographed. Whenever possible, sampling in each location progressed as follows: dive 10–15 m, dive 4–10 m, snorkeling 1–4 m, intertidal wading. Now and then material was collected from depths exceeding 15 m. In addition, many specimens were obtained from deep-reef habitats by dredging and trawling.

Results

DEPTH AND HABITAT DISTRIBUTION

Approximately 1,200 specimens belonging to 300–400 species at 67 stations spread over Eastern Indonesia were collected. Fifty-six species were found to be common in more than three of the eight localities visited; many of these were common throughout the area. These common species and their depth distribution are listed in Table 1. Some identification problems still exist, and all identifications have yet to be checked against the type specimens.

On the basis of rough estimation of relative sediment cover, prevailing wave action, and current strength, the sampled stations were categorized as "sheltered" and "exposed." Although this is admittedly an oversimplification, it nevertheless provides some indication of the ecological preferences of many of the common sponges. The characteristic species found at different depths in sheltered and exposed habitats are listed in Table 2.

NEW RECORDS AND OBSERVATIONS

FIRST INDONESIAN SCLEROSPONGE. In view of other reports of *Astrosclera willeyana* Lister from Polynesia, Christ-

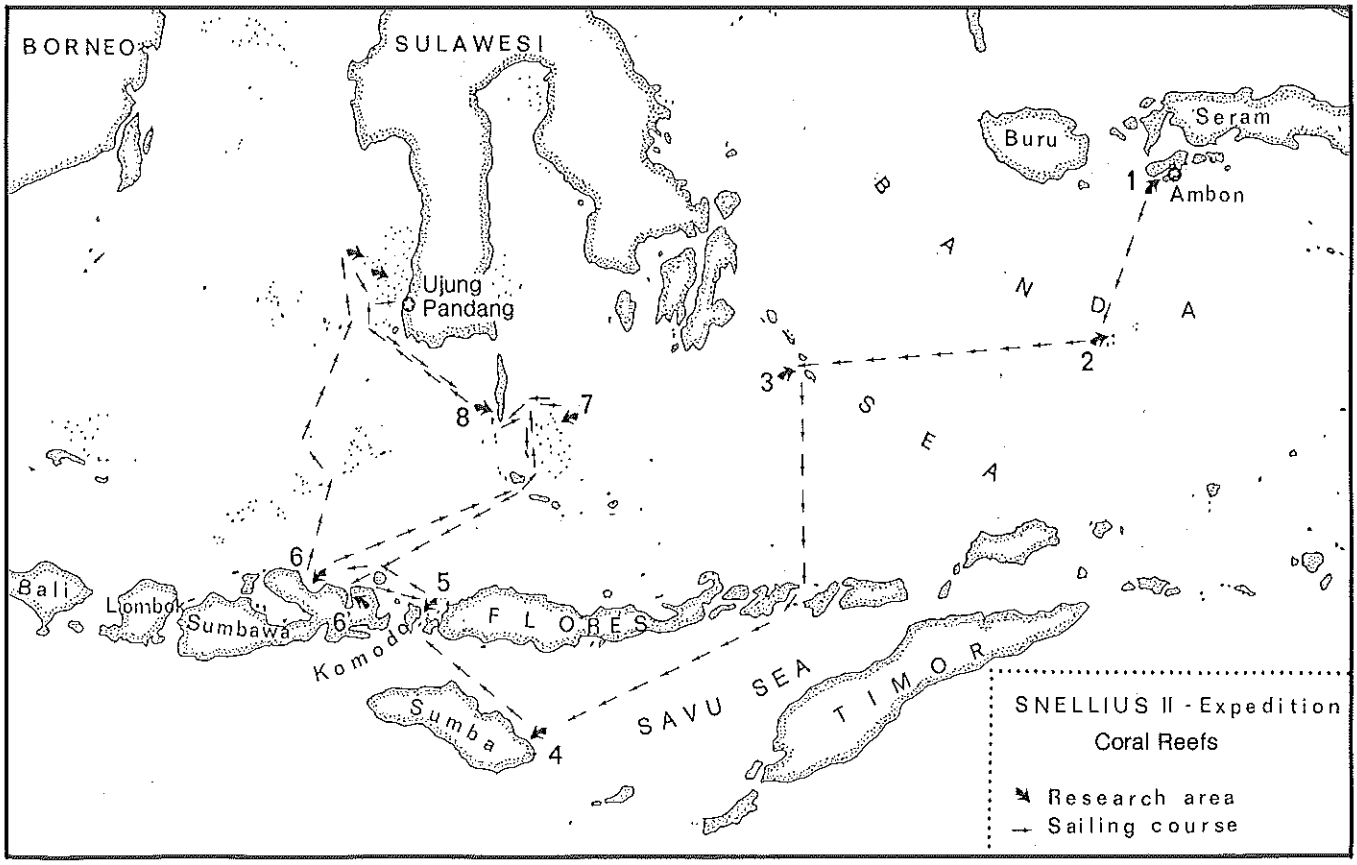

Figure 1. Map of eastern Indonesia showing cruise track of R/V *Tyro* and coral reef sampling stations of Snellius II expedition: *1*, Ambon; *2*, Pulau 2 Maisel; *3*, Tukangbesi; *4*, Sumba; *5*, Komodo; *6*, Sumbawa; *7*, Taka Bone Rate; *8*, Selayar; *9*, Ujung Pandang.

Table 1. Depth distribution of common shallow-water reef sponges of eastern Indonesia; abundance estimates are based on number of observations (long bar = abundant in three or more localities; medium bar = occasional in three or more localities; short bar = rare in three or more localities)

Species	Depth				
	0–1 m	1–4 m	4–10 m	10–15 m	> 15 m
Coelocarteria singaporense					
Haliclona cymaeformis					
Gelliodes pumilus					
Haliclona viola					
Hymenacidon conulosa					
Ircinia ramosa					
Cinachyra australiensis					
Xestospongia exigua					
Stelletta clavosa					
Clathria reinwardti					
Dysidea herbacea					
Spirastrella vagabunda					
Dactylospongia elegans					
Psammaplysilla purpurea					
Xestospongia cf. *carbonaria*					
Liosina paradoxa					
Haliclona cf. *nematifera*					
Tethya robusta					
Phyllospongia foliascens					
Phyllospongia papyracea					
Spirastrella solida					
Haliclona sp. red					
Aaptos cf. *suberitoides*					
Halichondria cartilaginea					
Gelliodes fibulatus					
Hyrtios erectus					
Haliclona amboinensis					
Dysidea granulosa					
Stelletta globostellata					
Axinella carteri					
Plakortis cf. *nigra*					
Petrosia contignata					
Theonella swinhoei					
Oceanapia amboinensis					
Agelas mauritiana					
Asteropus sarassinorum					
Placospongia melobesioides					
Acervochalina confusa					
Haliclona cf. *turqoisia*					
Ircinia cf. *irregularis*					
Spirastrella decumbens					
Petrosia nigricans					
Petrosia testudinaria					
Fascaplysinopsis reticulata					
Niphates olemda					
Callyspongia joubini					
Acanthella cavernosa					
Gelliodes petrosioides					
Callyspongia confoederata					
Dysidea cinerea					
Clathria basilana					
Liosina arenosa					
Myrmekioderma granulata					
Cliona sp. orange					
Theonella conica					
Agelas ceylonica					

Table 2. Vertical distribution of characteristic species of sheltered and exposed habitats in eastern Indonesia

Depth	Habitat type	
	Sheltered	Exposed
0–1 m	*Coelocarteria singaporense* *Gelliodes pumilis* *Haliclona cymaeformis* *Haliclona* cf. *viola* *Spirastrella vagabunda*	*Hymeniacidon conulosa* *Dysidea herbacea* *Stelleta clavosa* *Cinachyra australiensis* *Xestospongia exigua*
1–4 m	*Ircinia ramosa* *Clathria reinwardti* *Dactylospongia elegans* *Psammaplysilla purpurea* *Gelliodes fibulatus*	*Asteropus sarassinorum* *Phyllospongia foliascen* *Phyllospongia papyracea* *Hyrtios erectus* *Halichondria cartilaginea*
4–10 m	*Petrosia contignata* *Tethya robusta* *Spirastrella solida* *Axinella carteri* *Petrosia nigricans* *Spirastrella decumbens* *Myrmekioderma granulata*	*Liosina paradoxa* *Dysidea granulosa* *Stelleta globostellata* *Agelas mauritiana* *Petrosia testudinaria* *Theonella swinhoei* *Haliclona* cf. *turquoisia* *Fascaplysinopsis reticulata*
10–15 m	*Acervochalina confusa* *Clathria basilana* *Niphates olemda*	*Oceanapia amboinensis* *Gelliodes petrosioides* *Acanthella cavernosa* *Callyspongia confoederata* *Theonella conica*

mas Island, Madagascar, New Caledonia and Northeast Australia (Ayling, 1982), it is hardly surprising to find this species at depths of 10 m near Taka Karlarang (Taka Bone Rate).

"SOFT" LITHISTIDS. The lithistid *Theonella swinhoei* Gray is a common sponge in shallow, rather exposed reef habitats. It is compressible owing to the weakly developed lithistid skeleton, especially near the surface. A similar "soft" lithistid is found in West Indian coral reefs, namely, *Discodermia dissoluta* Schmidt.

SYMBIOTIC ASSOCIATIONS. Symbiotic relationships are generally more numerous and complex in Indo-Pacific reefs than in West Indian reefs. It is not at all unusual to find sponges in association with macroalgae. Two examples of such "compound" organisms are *Haliclona cymaeformis* and *Halichondria cartilaginea* (Esper, 1794). The former is relatively well known (Vacelet, 1981); it is intimately associated with the red alga *Ceratodictyon spongiosum*, and is known throughout the Indo-Pacific: particularly in North Australia (Bergquist and Tizard, 1967, as *Sigmadocia symbiotica*), Hong Kong (van Soest, 1980, as *S. symbiotica*) Madagascar (Vacelet and Vasseur, 1971, as *Gellius cymiformis*), Mozambique Channel (Thomas, 1979, as *Sigmadocia fibulata*), and New Caledonia (Vacelet, 1981, as *Gellius cymiformis*). It was earlier reported from Indonesia by Weber and Weber (1889, as *Reniera fibulata*), and the Siboga collections also hold several specimens.

Less well known is *Halichondria cartilaginea* (senior synonym of *Halichondria symbiotica* Lévi, 1961). It lives in intimate association with the green alga *Cladophoropsis vaucheriaeformis*, forming corrugated green mats that have branching projections. Weber and Weber (1889) reported this form from Indonesia as *Halichondria* spec. *Struvea delicatula* (see their Plate V, Figures 3–5).

An association that apparently has not yet been described is that of the red alga *Amphiroa* and a species of *Mycale* showing affinities with *M. cockburniana* Hentschel (1911). The association consists of yellow, tubelike forms; the alga is visible as red "veins" in the walls of these forms. It was found in three separate localities.

Much more spectacular is a novel *Mycale-Tubipora* association found exclusively around the island of Komodo. It forms quite characteristic groups of tubes, which are apparently the result of the sponge acting upon the growth form of the normally hemispherical or lobate octocoral. The compound organism was found to be quite common in shallow water around Komodo, but repeated attempts to find it elsewhere (for instance around nearby Sumbawa) have failed. The fact that in all discovered instances the same *Mycale* species was found growing over and between the red polyp tubes indicates that this may well be an obligatory relationship.

A further remarkable association is the only discovered case of a *Hyattella* species completely interwoven with a hydroid of the thecate family Haleciidae. The few hydroids reported to be living in association with sponges have been Athecata.

In contrast to the situation in the West Indian region, only a few zoanthids were found encrusting sponges; most of these examples are from caves or deep water.

Discussion

BIOGEOGRAPHIC DISTRIBUTIONAL CENTERS IN THE INDO-WEST PACIFIC

A major biogeographic issue in the Indo-Pacific is the alleged presence of a Western Indian Ocean coral reef distributional center which is thought to reflect the separate geological history of this area (see Rosen, 1971, 1975; Briggs, 1974). Following Rosen (1971), I attempted to establish whether such a distributional center in the Western Indian Ocean is also evident for reef sponges by comparing the lists of genera known from different coral reef areas of the western region of the Indo-Pacific. The numbers of genera of four separate areas (Indonesia, the Central Pacific, Northeast Australia, and Madagascar) are presented in Table 3. This information was gathered from recent articles dealing solely with reef sponges; all those containing data on dredged material were omitted. These reports were as follows: on Western Indian Ocean reefs, Vacelet and Vasseur (1965, 1971, 1977), Vacelet et al. (1976), Rützler (1972); on Central Pacific reefs, de Laubenfels (1954), Bergquist (1965), Bergquist et al.

Table 3. Comparisons of coral reef sponge faunas of four Indo–West Pacific areas and the West Indies region, using numbers of genera reported for each area and the numbers of species reported as "common" in each area. (– = not applicable; for further explanation, see text)

Compared areas	Genera				"Common" species			
A–B	Total A	Shared (W)	Total B	Cz %	Total A	Shared (W)	Total B	Cz %
Indonesia–Northeast Australia	189	66	79	49	98	26	54	34
Indonesia–Central Pacific	189	66	83	49	98	37	61	47
Central Pacific–Northeast Australia	83	31	79	38	61	16	54	28
W. Indian Ocean–Indonesia	121	85	189	55	79	24	98	27
W. Indian Ocean–Northeast Australia	121	32	79	32	79	15	54	24
W. Indian Ocean–Central Pacific	121	43	83	42	79	11	61	16
Indonesia–West Indies	189	82	117	53	–	–	–	–
Total Indo–Pacific–West Indies	244	94	117	52	–	–	–	–
"Common" genera: Total Indo–Pacific–West Indies	48	10	24	28	–	–	–	–

(1971); and on Northeast Australian reefs, Burton (1934), Bergquist (1969), Bergquist and Tizard (1967), Pulitzer-Finali (1982). Data on Indonesian reefs were obtained from both the Snellius II and the Siboga collections.

The lists of genera have been compared using Czekanowski's coefficient:

$$Cz = \frac{2W}{A+B} \times 100$$

in which W is the number of shared genera of area A and B, A is the number of genera in area A, B is the number of genera in area B (after Dauer and Simon, 1975). Czekanowski's values for the different areas are given in Table 3. Other coefficients used in biogeographic comparisons (e.g., Jaccard's or Simpson's, see Udvardy, 1969) yield comparable results. If Rosen's data on reef coral genera concur with those on reef sponge genera, the genera of Indonesia, the Central Pacific, and Northeast Australia can be expected to show a high degree of similarity and few differences compared to those of the Western Indian Ocean. Although generic endemism appears to be higher (25%) in the Western Indian Ocean than anywhere else (Indonesia 20%, Central Pacific 18%, and Northeast Australia 15%), the Cz values for the respective areas are quite similar, so no conclusion may be drawn concerning the existence of a separate Indian Ocean center. Also, note that closely studied cryptic habitats in Madagascar reefs have yielded several unusual genera, whereas this habitat has not been investigated or has been studied only cursorily in other areas. Moreover, the generic composition of all four areas is by no means equally well known.

If we extend our comparison to West Indies coral reef sponge genera described in the recent literature (Hechtel, 1965; Wiedenmayer, 1977; van Soest, 1981; Gómez López and Green, 1984; Zea, 1987; Alvarez et al., this volume), we find this fauna shows the same high similarity with Indonesia as the Western Indian Ocean. Compared to the Western Indo-Pacific as a whole, the Cz value remains equal. From these comparisons, crude and preliminary as they may be, it appears that reef sponge genera tend to have large, often cosmotropical, distributions, and, thus, that any differences between the areas under consideration must be based on a comparison of species. The present state of our knowledge makes such a comparison impossible. Very few regional studies have included comparisons of type specimens, so that many species identifications will obviously prove to be wrong. Furthermore, the different areas have by no means been studied with equal intensity, so the absence of species from the regional lists does not necessarily mean they do not occur in a particular area. At most, we are able to compare the distribution of the more common, relatively well-known species in the various parts of this huge area.

DISTRIBUTION OF "COMMON" REEF SPONGES

Reef sponges were judged to be common in the four areas studied on the basis of assessments and actual numbers reported in the literature. The numbers of species concerned and their comparison values (Cz values) are presented in Table 3. Although this procedure can only yield very preliminary results, some trends are already apparent: Local variations of sponge faunas are pronounced in different parts of the Indo-Pacific. Even closely adjoining areas such as Indonesia and Northeast Australia have a Cz value of only 34% (based on 26 shared species out of a total of 152 species considered common in both areas). The highest Cz value was for Indonesia and the Central Pacific (47% based on 37 species shared out of a total of 159 considered common in both areas); the lowest Cz value was for Madagascar and the Central Pacific (16% based on 11 species shared out of a total of 140 considered common in both areas). Only 10 species were found to be common in all four areas: *Spirastrella vagabunda, Tethya robusta, Myrmekioderma granulata, Iotrochota baculifera, Clathria reinwardti, Haliclona cymaeformis, Ircinia ramosa, Phyllospongia*

Table 4. Examples of morphologically similar, vicariant species in Indo–Pacific and West Indies reefs

Indo–Pacific	West Indies
Monanchora unguiculata	*M. unguifera*
Mycale sp.	*M. laevis*
Mycale euplectelloides	*M. laxissima*
Iotrochota baculifera	*I. birotulata*
Petrosia testudinaria	*Xestospongia muta*
Callyspongia confoederata	*C. vaginalis*
Niphates sp.	*N. digitalis*

foliascens, Phyllospongia papyracea, and *Psammaplysilla purpurea.* Although species lists for the separate areas may eventually turn out to be rather homogeneous (as early evidence suggests), it is still likely that the faunas are quite dissimilar owing to the different local dominance of species.

Indonesia appears to be the main distributional center for the Indo-Pacific sponge fauna since Cz values for Madagascar, Northeast Australia, and the Central Pacific (including Indonesia) are consistently higher than the values for these areas compared among themselves. This coincides with most biogeographic observations (cf. Briggs, 1974) and concurs with the fact that Indonesia is situated in the center of the four considered areas.

West Indian coral reef sponge faunas are dissimilar to Indo-Pacific sponge faunas. The generic composition of the common sponges of the Indo-Pacific area was based on the same data garnered from the literature noted above. Genera containing one or more species cited in three or more instances as common were considered "common." In the same way, a list of common genera was assembled for the West Indian region using recent faunal surveys. A comparison of these lists yielded a Cz value of 28% (ten shared common genera out of total of 72; see Table 3). The species diversity of these ten shared genera is much higher in the West Indian reefs (half of the common species in the West Indies belong to these 10 shared genera) than in the Indo-Pacific (only about one-fifth).

In contrast to the observed dissimilarity, there are some strikingly similar species in both areas; a list of examples is given in Table 4. These forms are considered to be evidence of slow evolutionary change in some sponge genera.

Acknowledgments

The Dutch Council for Research (NRZ) and the Indonesian Institute of Oceanography (LIPI) supported the Snellius II sponge project. I am grateful to J. Van der Land for inviting me to join in on the exploration of the Coral Reef Theme (4) on board R/V *Tyro.* W. Prud'homme van Reijne identified the algae. J. Vermeulen provided technical assistance in the preliminary identifications.

Literature Cited

Ayling, A. L. 1982. A Redescription of *Astrosclera willeyana* Lister (1900) (Ceratoporellida, Demospongiae), a New Record from the Great Barrier Reef. *Memoirs of the National Museum of Victoria,* 43:99–103.

Bergquist, P. R. 1965. The Sponges of Micronesia, Part I. The Palau Archipelago. *Pacific Science,* 19:123–204.

———. 1969. Shallow Water Demospongiae from Heron Island. *University of Queensland Papers,* 1:63–72.

Bergquist, P. R., J. E. Morton, and C. A. Tizard. 1971. Some Demospongiae from the Solomon Islands with Descriptive Notes on the Major Sponge Habitats. *Micronesica,* 7:99–121.

Bergquist, P. R., and C. A. Tizard. 1967. Australian Interidal Sponges from the Darwin area. *Micronesica,* 3:175–202.

Briggs, J. C. 1974. *Marine Zoogeography.* New York: McGraw-Hill. 475 pp.

Brøndsted, H. V. 1934. Sponges. *Résultats scientifiques du Voyage aux Indes Orientales Néerlandaises du Prince Léopold de Belgique,* 2:1–27.

Burton, M. 1930. The Porifera of the Siboga Expedition III. Calcarea. *Monographe Siboga Expeditie,* 6a2:1–18.

———. 1934. Sponges. *Great Barrier Reef Expedition, Scientific Reports,* 44:513–621, 2 pls.

Dauer, D. M., and J. L. Simon. 1975. Repopulation of the Polychaete Fauna of an Intertidal Habitat Following Natural Defaunation Species Equilibrium. *Oecologia (Berlin),* 22:99–117.

Desqueyroux, R. 1981. Révision de la collection d'éponges d'Amboine Moluques, Indonésie) constituée par Bedot et Pictet et conservée au Muséum d'Histoire Naturelle de Genève. *Revue Suisse de Zoologie,* 88:723–764.

Esper, E. J. C. 1794. *Die Pflanzenthiere in Abbildungen nach der Natur mit Farben erleuchtet nebst Beschreibungen. 2. Theil.* Nürnberg: Raspe. 303 pp.

Gómez López, P., and G. Green. 1984. Sistematica de las Esponjas marinas de Puerto Morelos, Quintana Roo, México. *Annales, Instituto de Ciencias del Mar y Limnologia (Mexico),* 11:65–90.

Hechtel, G. J. 1965. A Systematic Study of the Demospongiae of Port Royal, Jamaica. *Bulletin, Peabody Museum of Natural History,* 12:i–xii, 1–155.

Hentschel, E. 1911. Tetraxonida, 2.Teil. *Fauna Südwest-Australiens,* 3(10):277–393.

———. 1912. Kiesel- und Hornschwämme der Aru- und Kei-Inseln. *Abhandlungen der Senckenbergischen Naturforschenden Gesellschaft,* 34:293–448.

Kieschnick, O. 1896. Silicispongiae von Ternate. *Der Zoologische Anzeiger,* 19:526–534.

———. 1900. Kieselschwämme von Amboina. *Denkschriften der Medizinischen und Naturwissenschaftlichen Gesellschaft Jena,* 8:545–582.

Laubenfels, M. W., de. 1954. The Sponges of the West-Central Pacific. *Oregon State Monographs Studies in Zoology,* 7:1–320.

Lévi, C. 1961. Eponges intercotidales de Nha Trang (Viet Nam). *Archives de Zoologie expérimentale et générale,* 100:127–148.

Pulitzer-Finali, G. 1982. Some New or Little-known Sponges from the Great Barrier Reef of Australia. *Bolletino, Museo e Istituto di Biologia dell'Universitá di Genova,* 48–49(1980–1981):87–141.

Rosen, B. R. 1971. The Distribution of Reef Coral Genera in the

Indian Ocean. Pages 263–299 in *Regional Variation in Indian Ocean Coral Reefs,* edited by D. R. Stoddart and C. M. Young. Symposia of the Zoological Society of London, 28. London: Academic Press.

———. 1975. The Distribution of Reef Corals. *Reports of the Underwater Association* (new series), 1(NS):1–16.

Rützler, K. 1972. Principles of Sponge Distribution in Indo-Pacific Coral Reefs: Results of the Austrian Indo-West Pacific Expedition 1959/60. Pages 315–332 in *Proceedings of the Symposium on Corals and Coral Reefs,* edited by C. Mukundan and C. S. Gopinadha Pillai. Cochin: Marine Biological Association, India.

Soest, R. W. M. van. 1980. A Small Collection of Sponges (Porifera) from Hong Kong. Pages 85–95 in *The Marine Flora and Fauna of Hong Kong and Southern China 2,* edited by B. Morton and C. K. Tseng. Hong Kong: University Press.

———. 1981. A Checklist of the Curaçao Sponges (Porifera, Demospongiae) Including a Pictorial Key to the More Common Reef Forms. *Verslagen en Technische Gegevens, Instituut voor Taxonomische Zoologie, Universiteit van Amsterdam,* 32:1–39 (mimeographed).

Thiele, M. E. 1899. Uber einige Spongien von Celebes. *Zoologica,* 24, II(2):1–33.

———. 1903. Kieselschwämme von Ternate I und II. *Abhandlungen der Senckenbergischen Naturforschenden Gesellschaft,* 25: 19–80, 933–968.

Thomas, P. A. 1979. Studies on Sponges of the Mozambique Channel. *Annalen van het Koninklijk Museum voor Midden-Afrika Tervueren, Zoölogische Wetenschappen,* 227:1–73.

Topsent, E. 1897. Spongiaires de la baie d'Amboine. *Revue Suisse de Zoologie,* 4:421–487.

Udvardy, M. D. F. 1969. *Dynamic Zoogeography.* New York: Van Nostrand Reinhold. 445 pp.

Vacelet, J. 1981. Algal-Sponge Symbioses in the Coral Reefs of New Caledonia: A Morphological Study. Pages 713–719 in *Proceedings of the 4th International Coral Reef Symposium 2,* edited by E. D. Gomez et al. Manila: Marine Sciences Center, University of the Philippines.

Vacelet, J., and P. Vasseur. 1965. Spongiaires des grottes et surplombs des récifs de Tulear (Madagascar). *Travaux de la Station Marine de Tuléar* (supplement 4):71–123.

———. 1971. Eponges des récifs coralliens de Tuléar (Madagascar). *Téthys* (supplement 1):51–126.

———. 1977. Sponge Distribution in Coral Reefs and Related Areas in the Vicinity of Tuléar (Madagascar). Pages 113–117 in *Proceedings of the 3d International Coral Reef Symposium,* edited by D. L. Taylor. Miami: Rosenstiel School of Marine and Atmospheric Sciences.

Vacelet, J., P. Vasseur, and C. Lévi. 1976. Spongiaires de la pente externe des récifs coralliens de Tuléar (sud-ouest de Madagascar). *Memoires, Museum National d'Histoire Naturelle (Paris),* (séries A, Zoology), 99:1–116.

Vosmaer, G. C. J. 1911. The Porifera of the Siboga Expedition II. The Genus *Spirastrella. Monographe Siboga Expeditie,* 6a1:1–69.

Vosmaer, G. C., and J. H. Vernhout. 1902. The Porifera of the Siboga Expedition I. The Genus *Placospongia. Monographe Siboga Expeditie,* 6a:1–17.

Weber, M., and A. Weber. 1889. Quelques nouveaux cas de symbiose. Pages 48–71 in *Zoologische Ergebnisse einer Reise in Niederländisch Ost-Indien I,* edited by M. Weber. Leiden: E. J. Brill.

Wiedenmayer, F. 1977. *A Monograph of the Shallow-Water Sponges of the Western Bahamas.* Basel und Stuttgart: Birkhäuser Verlag. 287 pp.

Zea, S. 1987. *Eponjas del Caribe Colombiano.* Bogotá: Catálago Cientifico. 486 pp.