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1124

Marine and Coastal Biodiversity in the Tropical Island Pacific Region

Volume 1

Species Systematics and Information Management Priorities

edited by

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October 1995

Program on Environment
East-West Center
Honolulu, Hawaii

Ocean Policy Institute
Pacific Forum/CSIS
Honolulu, Hawaii

Pacific Science Association
c/o Bishop Museum
Honolulu, Hawaii

The Sponges of the Tropical Island Region of Oceania: A Taxonomic Status Review

Michelle Kelly-Borges and Clare Valentine

ABSTRACT

The taxonomic status of the sponges of the tropical island region of Oceania is reviewed and summarized to assist in the development of information management systems for biodiversity conservation initiatives within the region. More than 1,000 sponge species are listed for the Federated States of Micronesia, Tonga, Fiji, Samoa, Hawaii, the Solomon Islands, Vanuatu (New Hebrides), Kiribati and Tuvalu, French Polynesia, the Kermadec Islands of New Zealand, Norfolk and Lord Howe Islands of Australia, the Ryukyu Islands of Japan, Easter Island and Sala-y-Gómez of Chile, New Caledonia, and Papua New Guinea.

INTRODUCTION

Sponges are a significant component of all tropical, temperate, and polar marine benthic communities, having a large biomass above and within the substratum. They are a source of nutrition for fish, turtles, and molluscs and provide refuge for a diversity of micro- and macro-organisms. Far less is known about sponges and their basic bioecology than for most other sessile marine invertebrates; yet, as the oldest metazoans, studies on them have contributed a great deal to our understanding of life on earth. For example, the discovery of complex immune and cell aggregation systems in sponges has led to a better understanding of the cellular processes of higher organisms, and, in particular, the nature of their cell surfaces as active agents in cell and tissue recognition (Bergquist 1994; Kelly-Borges 1995).

The sponges are divided into three classes. Those in the largest class, the Demospongiae, possess a skeletal network of siliceous spicules, frequently supplemented or entirely replaced by spongin fibers. The Hexactinellida possess a unique skeletal structure of six-rayed siliceous spicules and a syncytial, rather than cellular organization, constructed of extensive regions of multinucleate cytoplasm (Reiswig and Mackie 1983). Fossil and recent sclerosponges, previously thought to be a fourth class of sponges, possess siliceous skeletons and calcareous basal skeletons. Recent sclerosponges are thought to represent relict forms of an ancestral sponge fauna, which includes the ancestry of several extant demosponge groups (Reitner 1991; Reitner and Engeser 1987).

The higher classification of the sponges has been based historically upon spicule shape, skeletal structure and organization, and gross morphology (Lévi 1956). Since the 1950s a substantial literature has been amassed, providing comparative data from ultrastructural histology, chemotaxonomy (Hooper et al. 1992; Kelly-Borges et al. 1994), and reproductive and benthic ecology of sponges (Fromont 1994; Fromont and Bergquist 1994; Kelly-Borges and Bergquist 1988). More recently, morphological (van Soest and Hooper 1993; Bergquist and Kelly-Borges 1991), biochemical (Kerr and Kelly-Borges 1994), and molecular data (Kelly-Borges, Bergquist, and Bergquist 1991; Kelly-Borges and Pomponi 1994; Rodrigo et al. 1994) have been used in phylogenetic analyses to enhance our understanding of the relationships between sponges.

Despite this recent progress, sponge classification is still relatively unstable. Within the Class Demospongiae alone, four out of the thirteen previous orders are currently undergoing revision. The "living fossil" sclerosponges and lithistids, and the axinellids, are now acknowledged to be polyphyletic (Reitner 1991; Kelly-Borges and Pomponi 1994; Hooper and Lévi 1993b); yet, it remains difficult to determine the affinities of their component species groups with other demosponge orders, and expert opinion is clearly divided (see Hooper and Wiedenmayer 1994).

Sponge Biodiversity

There are 6,000 to 7,000 described species of sponges (Minelli 1993; van Soest 1994), 150 of which are from freshwater. This is, however, an underestimate of the numbers of species that are known to exist; Hooper and Lévi (1994) estimate that there are about 5,000 undescribed species in the Australian island and continental faunas, alone. Very few regional sponge faunas are well known, except for those along the northeastern European coastline, in the Mediterranean Sea, the Caribbean Sea, and the north-west shelf of Australia. Only in rare cases are total regional faunas or taxonomic components of faunas thoroughly documented (e.g., Hooper and Lévi 1993a, b; Hooper 1991; Kelly-Borges and Vacelet in press; Bergquist and Kelly-Borges 1991; Kelly-Borges and Bergquist 1994; Hajdu and Desqueyroux-Faundez 1994; Bergquist, Ayling, and Wilkinson 1988).

Underestimates in worldwide sponge diversity are primarily due to difficulties in sponge classification and to a lack of comprehensive locality-specific collections. The most serious deterrent to obtaining accurate estimates of biodiversity is that many sponge genera lack an adequate range of taxonomic characters for species differentiation, and morphological and skeletal characters are plastic. Because of this, large numbers of established genera and "species" contain several entities (see Hooper 1994; Bergquist and Kelly-Borges 1991).

With the exception of a few studies, most older collections contain small numbers of specimens from diverse locations, rather than comprehensive collections from single habitats or regions. Most early publications are taxonomically unreliable and supply inadequate, unillustrated descriptions. There has been a tendency in the past for workers to use these few poorly described species names for sponges from diverse worldwide locations, giving the impression that large numbers of sponges are cosmopolitan (e.g., *Tethya aurantium* and *Aaptos aaptos*, but see Bergquist and Kelly-Borges 1991 and Kelly-

Borges and Bergquist 1994). It is becoming increasingly clear that regional endemism of sponges is substantially higher than for many other marine invertebrate phyla (Wilson and Allen 1987; van Soest 1989, 1990), and the size of local endemic faunas can be relatively small (remote islands or atolls, isolated patch reefs, bays, marine lakes) (Hooper 1994; Bergquist and Kelly-Borges 1991; Kelly-Borges, Bell, and Sharron 1994). What were once previously considered to be valid sponge "species" are increasingly being found to comprise heterogeneous populations, with biochemical and genetic diversity not necessarily manifested at the morphological level (Solé-Cava et al. 1991; Boury-Esnault, Solé-Cava, and Thorpe 1992; Hooper et al. 1992; Kerr and Kelly-Borges 1994; Kelly-Borges et al. 1994).

The Sponge Fauna of the Tropical Island Region of Oceania

Our knowledge of the general Indo-Pacific sponge fauna is derived from the early works of Baar (1903), Bowerbank (1877), Burton (1934), Hentschel (1912), Kirkpatrick (1900), Lendenfeld (1885a, b), Lindgren (1897), Ridley (1884a, b), Thiele (1898, 1899, 1900, 1903), Wilson (1925), and more recently the works of Bergquist (1965, 1979), Bergquist, Morton, and Tizard (1971), de Laubenfels (1935, 1949, 1950a, b, 1951, 1954, 1955, 1957), Desqueyroux-Faundez (1981, 1984, 1987, 1990), Fromont (1991, 1993), Kelly (1986), Kelly-Borges and Bergquist (1988), Hooper and Lévi (1993a, b, 1994), Hooper and Wiedenmayer (1994), Lévi (1961, 1967, 1993), Thomas (1982, 1991), and van Soest (1989, 1990). However, most of the earliest of these publications are extremely unreliable taxonomically, contain inadequate descriptions, and synonymies that require extensive revision. De Laubenfels (1954) expressed the difficulty of applying the older names in the literature to modern sponges:

> More than one hundred species are treated as new (for Micronesia). This is quite to be expected in view of the previously unstudied nature of the territory and the tendency of evolution to provide unique species in insular locations. Yet there is a problem here, because many of the students of sponges in the nineteenth century named species with utterly inadequate descriptions and no illustrations or poor ones. An example is found in Kieschnick's descriptions of East Indian species. Many of his descriptions are less than thirty words in total length, and some in less than twenty! They are completely devoid of measurements and provide no illustrations at all. If there are any types, their location is unknown. Because of the wars, it may well be that no specimens remain. Some names, thus unrecognizably given, may have been based on the species which also occur in my collections. Yet how can we ever know which, if any, are thus affected?

With the exception of Micronesia, Hawaii, Papua New Guinea, and New Caledonia, most regional faunas of the tropical island region of Oceania are poorly known. Prior to the 1950s, sponge species records are fragmentary, appearing in scientific reports of such major expeditions as that of the H. M. S. *Alert* (Ridley 1884a, b), the H. M. S. *Challenger* (Ridley and Dendy 1886, 1887), and the *Albatross* (Agassiz 1906; Lendenfeld 1910a, b, 1915; Wilson 1925), and in accounts of small numbers of species from isolated atolls and islands. The most valuable contribution to our knowledge of the sponge fauna of the tropical island region of Oceania was made by de Laubenfels (1954) in his monograph on the sponges of Micronesia. This was preceded and followed by numerous publications (de Laubenfels, 1935, 1950a, b, 1951, 1955) focusing on Micronesia and Hawaii. Bergquist

(1965, 1979) followed with valuable contributions on Belau (Palau) and Hawaiian sponges. Unfortunately her revisionary work on the sponges of Belau (Bergquist 1965) considered only a small number of the several hundred species that were described as new in de Laubenfels (1954). Although the 1954 monograph now requires extensive revision, the redeeming feature of de Laubenfels' work is that his species descriptions were based on the field characteristics of the living sponge. The clarity and accuracy of his descriptions have facilitated re-identification of these species in the locations from which they were described. The only other recent general systematic reviews available for the Oceania region cover the Solomons (Bergquist, Morton, and Tizard 1971), and Motupore Island in southern Papua New Guinea (Kelly-Borges and Bergquist 1988).

Today, sponge research in Oceania is pursued as part of general marine invertebrate programs at the University of Guam Marine Laboratory (chemical ecology), the University of Hawaii (sponge natural products chemistry), and the Center of Tropical and Subtropical Aquaculture, Hawaii, and College of Micronesia in Pohnpei (commercial bath-sponge culture). Current revisionary systematic studies (taxonomic monography), essential to our understanding and documentation of sponge biodiversity, are usually much broader in scope than the Oceania fauna, and so valid species records for the tropical island region of Oceania appear in a fragmented fashion in general taxonomic revisions (e.g., Kelly-Borges and Vacelet in press; Bergquist and Kelly-Borges 1991; Hooper and Bergquist 1992). While this later approach is crucial for the revision of diagnostic characters in an attempt to stabilize the systematics of the sponges, the accumulation of species information vital to biodiversity and conservation studies is slow.

However, some headway is being made in the general documentation of sponge biodiversity in the tropical island region of Oceania. A volume describing the sponges of New Caledonia is currently being prepared in conjunction with ORSTOM, New Caledonia (Contributors: P. R. Bergquist, C. Battershill, P. J. Fromont, J. N. A. Hooper, M. Kelly-Borges, C. Lévi, and J. Vacelet). The Coral Reef Research Foundation (CRRF), a non-profit organization based in Chuuk Atoll (Truk Atoll), Federated States of Micronesia, and Koror, Belau, is engaged in a long-term collection program in Micronesia and the western Pacific. One aspect of the foundation's work is to compile complete inventories of invertebrate diversity for selected Micronesian localities, but short-term expeditionary work has resulted in the recording of many new taxa and geographic records of sponges for Papua New Guinea, the Philippines, and other areas of the western Pacific (see Kelly-Borges and Vacelet in press; Colin and Arneson in press; Kelly-Borges, Bell, and Sharron 1994).

There is an urgent need to expand sponge biodiversity initiatives within the tropical island region of Oceania. It is a priority to review and define the diagnostic characters for sponge species and genera through comprehensive site-specific collections. Where genera contain numerous closely related species, greater emphasis needs to be placed upon photographic documentation of sponges in life, as details of important field characteristics such as color, habitat, and gross morphology are often lost upon preservation. This is particularly important for species in the genera *Niphates, Amphimedon, Haliclona, Callyspongia, Petrosia, Xestospongia, Oceanapia, Spheciospongia* (more commonly known as *Spirastrella*), *Axinyssa, Agelas, Clathria, Ircinia, Hyrtios,* and *Dysidea,* which

are prevalent throughout Oceania. The primary aim of this review is to compile published and unpublished records of sponge species in the tropical island region of Oceania to assist in the development of information management systems for biodiversity conservation initiatives within the region. The resultant baseline taxonomic information will highlight problem areas for new revisionary systematic initiatives.

METHODS

More than 1,000 taxonomic, chemical, and ecological references to sponges from Oceania were compiled from the Zoological Record (Zoological Record: Porifera and Archaeocyatha, Vols. 1–130, Publishers: Zoological Society London and Biosis). The registers of the Porifera collection of the Natural History Museum of London (ca. 90,000 specimens) were searched for records of material from Oceania. Identifications of material in personal collections and several unpublished reports have also been included. Species records are listed by location within Tables 6.1–6.11 and are arranged alphabetically under their appropriate taxonomic order within these tables. The reference for each species record is given as a superscript numeral after the record, corresponding to the alphabetically arranged and numbered references in the bibliography. General references are also arranged alphabetically within the reference list but are not numbered.

For practicality this review is largely historical, and species names have been taken directly from the literature. No attempt has been made to revise them, except where they are well-known synonyms such as in the examples of *Chalina* (= *Haliclona*) and *Euspongia* (= *Spongia*). It is well known that sponge type material has been poorly described and mis-diagnosed in the past (Hooper and Wiedenmayer 1994), and sponge genera are currently undergoing intense revision. There is no value in altering any of the taxonomic assignments in this review without full histological examination of the material involved.

As the classification of the Porifera is relatively fluid, obviously polyphyletic groups such as the lithistid sponges and sclerosponges have been listed in the tables under these separate headings, rather than in their "new" systematic location, for ease of location. Although many calcareous and hexactinellid sponges are deep-water organisms, they have been included in this review for completeness. A classification of the demosponges reflecting major recent changes and systematic uncertainties is given in Table 6.12.

In recent years major initiatives have been established by pharmaceutical companies to discover biologically active compounds in marine invertebrates. This quest for new drugs focuses particularly on sponges, as they contain the widest diversity of biologically active compounds of any marine phylum (Garson 1994). Sponge secondary metabolite discoveries gradually began to dominate the sponge literature for Oceania and the general Indo-Pacific from the mid-1980s. There has been a tremendous surge of interest in the sponges of this region as it is a source of probably the greatest sponge diversity (van Soest 1989, 1990; Briggs 1974, 1987). Sponges recorded in the chemical literature are frequently identified only to the genus level reflecting the lack of recent revisionary systematic studies and new species descriptions, but have been included here as an aid to literature search for chemical structures in natural products research.

RESULTS

Easter Island and Sala-y-Gómez of Chile

Desqueyroux-Faundez (1990) provided the first full species account of sponges from Easter Island, but there are no records known for Sala-y-Gómez other than from a study of Hexactinellida by Tabachnik (1990) (Table 6.1). The general Chilean sponge fauna has been reviewed by Desqueyroux-Faundez (1994) but does not list specific information on Easter Island sponges. Prior to this, the ecological work of Di Salvo, Randall, and Cea (1988) identified nine sponges to genus and one to species. In a comprehensive bibliographic revision of the marine invertebrate fauna of the coastal zones of the Juan Fernandez Archipelago, Castilla and Rozbaczylo (1987) did not record any sponge species from Easter Island and Sala-y-Gómez, but provided general sponge references for the Archipelago (see Ridley and Dendy 1886, 1887; Breitfuss 1898; Thiele 1905, and Desqueyroux 1972). Agassiz (1906) visited Easter Island in the *Albatross* expedition of 1904 and remarked on the paucity of the sponge fauna of the region. A single sponge was described by Lendenfeld (1910b) from Easter Island.

French Polynesia

There is no general account of the sponge fauna of French Polynesia, but several records of sponges occur in scientific reports of the voyage of the H. M. S. *Challenger* (Ridley and Dendy 1887; Schulze 1887), and other papers on clionids (Topsent 1932, 1934), and "sclerosponges" (Vacelet 1977) (Table 6.2). Seurat (1934) and Salvat and Renaud-Mornant (1969) provide general ecological discussions of the region.

Hawaii

Prior to the 1950s, Hawaiian sponges were known only from remote deep-water collections of the H. M. S. *Challenger* (Schulze 1887; Ridley and Dendy 1887) and *Albatross* (Edmondson 1935; Baar 1903; Preiwisch 1903; Lendenfeld 1910a) expeditions (Table 6.3). The coastal fauna received considerably more attention after the 1950s by de Laubenfels (1950a, b, 1951, 1957) and Bergquist (1967, 1979). Bergquist (1979) revised de Laubenfel's species names and provided the most recent checklist of the sponge fauna to date, with

Table 6.1 Published records of sponges from Easter Island and Sala-y-Gómez of Chile

Class/Order	Species
DEMOSPONGIAE	
Astrophorida[72]	*Asteropus simplex, A. ketostea, Geodia amphistrongyla*[144]
Hadromerida[72]	*Cliona vastica, Pseudosuberites sulcatus, P. vakai, Spirastrella cuncatrix, Tethya deformis*
Poecilosclerida[72]	*Mycale paschalis, Tedania tepitootehenuaensis*
Haplosclerida[72]	*Cribrochalina dura, Callyspongia fusifera, Haliclona agglutinata, H. nitens, H. translucida, Reniera rapanui*
Dictyoceratida[72]	*Spongia virgultosa, Phyllospongia papyracea*
Verongida[72]	*Psammaplysilla purpurea*
HEXACTINELLIDA[111]	
	Caulodiscus polyspicula, Caulopacus abyssalis, C. vaniens juvenilis, Eurete lamellina, Farrea microclavula, F. occa polyclavula, Hexactinella divergens, Hyalonema campanula longispicula, Lophocalyx moscalevia, Malacosaccus leteropinlana, Pheronema megaglobosum, P. nasckaniensis, Platella polybasalta, Poliopogon amadon pacifica, P. maitai, Pseudoplectella dentatum, Regardrella peni, Schulzeviella gigas spinosum, Semperella alba, Tretopleura styloformis, Walteria leucarti longina

Table 6.2 Published records of sponges from French Polynesia

Class/Order	Species
DEMOSPONGIAE	
Astrophorida	*Pilochrota pachydermata*[206]
Hadromerida[221]	*Cliona carpenteri, C. vasifera, C. viridis, C. viridis caribbae, C. vermifera, C. celata, C. topsenti, C. ecaudis, Cliothoosa hancocki, Thoosa amphiasterina, Tethya seychellensis*[19]
Halichondrida	*Halichondria solida*[182]
Poecilosclerida	*Acarnus ternatus*[182], *Echinodictyum aspersum*[182], *Fausubera debrumi*[190]
Dictyoceratida	*Carteriospongia foliascens*[17,141], *C. lamellosa*[17], *C. otahitica*[179], *Lufferiella variabilis*[140,141,169]
Dendroceratida	*Dysidea* sp[190]
CALCAREA[224]	
	Lelapiella incrustans sphaerulifera, Lepidoleucon inflatum, Murrayona phanolepis, Plectoninia radiata
HEXACTINELLIDA[197]	
	Dictyocalyx gracilis

Table 6.3 Published records of sponges from Hawaii

Class/Order	Species
DEMOSPONGIAE	
Homosclerophorida	*Oscarella tenuis*[15], *Plakina monolopha*[62,15], *Plakortis simplex*[62,15]
Astrophorida	*Asteropus kaena*[66,15], *Erylus rotundus*[163,15,66], *E. sollasi*[163], *E. caliculatus*[163], *E. proximus*[62], *Geodia gibberella*[15,62], *Rhabdastrella pleopora*[66], *Stelletta debilis*[15,62], *Zaplethes digonoxea*[15,60]
"Lithistida"	*Leidermatium* sp[15]
Hadromerida	*Anthosigmella valentis*[15,66], *Cliona vastifica*[15,60], *Chondrosia chucalla*[62], *Chondrosia* sp[176], *Diplastrella spiniglobata*[13,15], *Kotimea tethya*[15], *Prosuberites oleteira*[15,66], *Spheciospongia vagabunda*[13], *Spirastrella coccinea*[15,13], *S. keaukaha*[62], *Terpios zeteki*[15,62,60], *T. granulosa*[13,15,100,191], *Tethya diploderma*[62,60,15], *Timea xena*[15]
Halichondrida	*Axechina lissa*[15], *Axinella solenoides*[15,66], *Ciocalypta pencillus*[13], *Eurypon nigra*[15,13], *E. distincta*[15,66], *Hymeniacidon chloris*[15,60], *Homaxinella anamesa*[15,66], *Halichondria coerulea*[13,15], *H. dura*[15,62], *H. melanadocia*[13,15], *Phycopsis aculeata*[15,63], *Raphisia myxa*[15,62], *Ulosa rhoda*[66]
Poecilosclerida	*Axociella kilauea*[15,62], *Clathria procera*[13,15], *Damiriana hawaiiana*[15,64,65,63,60], *Esperiopsis anomala*[182], *Iotrochota protea*[15,60,62], *Kaneohea poni*[60], *Lissodendoryx calypta*[15,66], *Mycale cecilia*[60,15], *M. contarenii*[62,15], *M. maunakea*[62], *Myxilla rosacea*[15,62,66], *Naniupi ula*[15,60], *Microciona haematodes*[15,66], *M. maunaloa*[15,62,66], *Strongylacidon* sp.[62], *Tedania ignis*[15,60,63], *T. macrodactyla*[13,15], *Xytopsiphum kaneohe*[15,60], *X. meganese*[15,62], *Xytopsues zukerani*[66], *Zygomycale parishii*[15,60]
Haplosclerida	*Adocia gellindra*[15], *Callyspongia diffusa*[15,62,60,160,202], *Haliclona flabellodigitata*[15,66], *H. aquaeducta*[15,62], *H. permollis*[15,62], Toxadocia violacea[15,60,62]
Petrosida	*Pellina eusiphonia*[15], *P. sitiens*[66], *Petrosia puna*[15,62]
Dictyoceratida	*Coscinoderma denticulatum*[169], *Hippospongia densa*[7], *Lufferiella* sp[169], *Spongia irregularis dura*[7], *S. irregularis tenuis*[7], *S. irregularis lutea*[7], *S. irregularis mollior*[7], *S. denticulata*[141], *S. oceania*[15,62], *Stelospongia lordii*[7]
Dendroceratida	*Aplysilla rosea*[13,15], *A. sulphurea*[13,15], *A. violacea*[13,15], *Dendrilla cactus*[15], *Dysidea herbacea*[13,15], *D. avara*[60], *Dysidea* sp[169], *Pleraplysilla hyalina*[15,60]
Verongida	*Psammaplysilla purpurea*[13,15,110]
CALCAREA	
	Clathrina sp[15], *Leucosolenia vesicula*[15,66], *L. eleanor*[15], *Leucetta solida*[15,60,62], *Leuconia kaiana*[60], *Sycandra parvula*[171], *S. staurifera*[171], *S. coronata*[187]
HEXACTINELLIDA	
	Euplectella sp[9], *Stylocalyx elegans*[197]

sixty coastal species identified from Hawaii. Since this time, sponge species names have appeared sporadically within the chemical literature (see Erdman and Scheuer 1976; Carney, Scheuer, and Kelly-Borges 1993b; Jurek et al. 1993).

Kermadec Islands of New Zealand

Kirk (1911) described six of "apparently eleven or twelve species" represented in a collection of sponges from the Kermadec Islands off the northeast coast of New Zealand (Table 6.4). All were undescribed species, and he expressed surprise at this because the *Challenger* collections contained sponges from the Kermadec Islands and "Von Lendenfeld had described others." A search through Lendenfeld's publications failed to turn up those species names due to a lack of precise locality data. Published species names were re-listed in Barraclough-Fell (1950). Lévi (1964) provides the most recent account of extremely deep-water sponges from the Kermadec Trench.

Norfolk Island and Lord Howe Island of Australia

There are no published records of sponges from any of the Australian Territorial Islands (J. N. A. Hooper, pers. com.). The only sponge collections known from Lord Howe Island and Norfolk Island were made by N. Coleman between 1960 and 1970. These specimens were deposited in the Australian Museum but were recently disposed of due to a lack of locality data. The genus *Ianthella* has been recorded from Lord Howe Island (Bergquist and Kelly-Borges in press).

Fiji, Samoa, and Tonga

In 1965, a small collection of shallow-water sponges from Viti Levu in the Fiji Islands was made by Dr. T. Wolff during an expedition on the U.S. research vessel *Te Vega*. (Table 6.5). Previously only four sponges had been reported by Bowerbank (1873) and Lendenfeld (1889). A number of species have been added to this list in natural products publications, some of which are undescribed species. There is very little published information on the sponges of Samoa; two species were described in Selenka (1867), and de Laubenfels (1943) describes several sponges from the region. A single species was described from the *Challenger* collection by Schulze (1887). There is a single species recorded from Tonga by Lendenfeld (1906). One of the authors' (MKB) personal collections from Vava'u, Tonga, included several species common throughout the Indo-Pacific (*Hyrtios erecta, Stylotella aurantium, Dysidea avara*), in addition to species of *Latrunculia*, and a higher proportion

Table 6.4 Published records of sponges from the Kermadec Islands of New Zealand

Class/Order	Species
DEMOSPONGIAE	
Hadromerida	*Tethya lyncurium australis*[120], *T. deformis*[14,120]
Poecilosclerida	*Asbestopluma wolffi*[148], *A. hadalis*[148], *A. brunni*[148], *A. biserialis*[148], *Chondrocladia asigmata*[148], *Clathria intermedia*[18,120], *Myxilla frondosa*[102], *Raspailia rubrum*[120]
Haplosclerida	*Callyspongia fistulosa*[22,120], *Callyspongia oliveri*[22,120], *Haliclona reversa*[22,120]
HEXACTINELLIDA[197]	
	Aulochone cylindrica, Chonelasma lamela, C. hamatum, Euryplegma auriculara, Farrea occa, Polipogon gigas, Walteria flemmingii

Table 6.5 Published records of sponges from Fiji†, Samoa§, and Tonga‡

Class/Order	Species
DEMOSPONGIAE	
Homosclerophorida	*Plakortis* sp[150]
Astrophorida	*Ancorina acervus*[‡212], *A. densa*[‡27,179], *Pachymatisma contorta*[‡144], *Myriastra purpurea*[‡212], *Rhabdastrella dura*[‡212], *Jaspis johnstoni*[‡237], *jaspidae*[‡1], *Geodia nux*[§144,198], *Halina plicata*[‡211]
Spirophorida	*Paratetilla bacca*[‡50], *Cinachyra australiensis*[‡212], *C. alba-bidens*[‡142]
"Lithistida"	*Neosiphonia superstes*[‡206], *Pleroma turbinatum*[‡206]
Hadromerida	*Chondrilla australiensis*[‡212], *Diacarnus spinipoculum*[‡114], *Placospongia carinata*[‡212], *Spheciospongia vagabunda*[‡212], *Spirastrella solida*[‡211], *Tethya diploderma*[‡212], *Timea stellata*[‡212], *Terpios hoshinoto*[§189]
Halichondrida	*Cymbastela* sp[‡112]
Poecilosclerida	*Chondrocladia clavata*[‡18,181,182], *Microciona eurypa*[‡213]
Haplosclerida	*Callyspongia* sp[26], *Haliclona* sp[26], *Niphates* sp[‡172]
Petrosida	*Xestospongia caycedoi*[‡142], *Xestospongia* sp[‡110]
Dictyoceratida	*Aplysinopsis* sp[149], *Carteriospongia contorta*[‡17], *C. lamellosa*[‡17], *Carteriospongia* sp[‡196], *Fascaplysinopsis reticulata*[‡107], *Fascaplysinopsis* sp[‡186], *Ircinia* sp[‡140], *Spongia irregularis silicata*[‡139], *S. discus*[‡139,141], *S. irregularis lutea*[‡139,141], *S. mycofijiensis*[‡111,112], *thorectid*[287]
Dendroceratida	*Dysidea fragilis*[‡143], *Dysidea* sp[‡196]
Verongida	*Ianthella concentrica*[‡103,140,141], *Psammaplysilla purpurea*[‡48], *Psammaplysilla* sp[‡‡173]
CALCAREA	
	Ascetta primordialis[‡128], *Leucetta* sp[‡5], *Leucandra bomba*[‡137]
HEXACTINELLIDA	
	Taegeria pulchra[‡197]

of dictyoceratid sponges than in the more western Pacific locations. These observations indicate a temperate-water influence on the sponge fauna. See also Wicksten (1981).

Papua New Guinea

It was not until 1988 that the first general account of sponges from Papua New Guinea became available (Kelly-Borges and Bergquist 1988), although Thomas (1982) earlier provided brief descriptions of some haplosclerids (Table 6.6). Kelly (1986) identified 100 species, most of which were new, from Motupore Island within the southern Papua New Guinea Barrier Reef system. Prior to this recent literature, one or two species were recorded but these were either deep-water records (Lendenfeld 1906) or from the western part of the island, now known as Iryan Jaya (Bowerbank 1877). There are no recent papers that deal exclusively with Papua New Guinea sponges. Most records are parts of revision of monophyletic genera (Bergquist and Kelly-Borges 1991; Kelly-Borges and Vacelet in press; Sará 1992), ecological considerations (Bakus and Ormesby 1994), or natural products chemistry (see Uchio 1992; Iwagawa et al. 1992). There are, however, several comprehensive unpublished collections available from the northern and southern Papua New Guinea coastlines, made by one of the authors (MKB), CRRF, and the Australian Institute of Marine Science (McCauley et al. 1992). Unpublished species names are also listed in Table 6.6.

New Caledonia

The fauna of New Caledonia has been comparatively well studied with more than 200 species recently recorded for the region (Lévi 1967, 1979, 1983, 1993; Lévi and Lévi 1979, 1982, 1983, 1984, 1988; Desqueyroux-Faundez 1984, 1987; Hooper and Lévi 1993a, b;

Table 6.6 Published records of sponges from Papua New Guinea

Class/Order	Species
DEMOSPONGIAE	
Homosclerophorida	*Plakinastrella ceylonica**, *P. schulzei**, *Plakortis mammilaris*[161], *P. lita*[161,*]
Astrophorida	*Ancorina acervus*[118,113,*], *Geodia globostellifera*[113,*], *Jaspis johnstoni*[11,80], *Melophlus sarasinorum*[141,113,*], *Myriastra clavosa*[142,113,161,*], *Neamphius huxleyi*[66], *Plakinastrella schulzei**, *Rhabdastrella pleopora**, *Stelletta bouginvillea*[142]
"Lithistida"	*Leiodermatium pfeifferae**, "*Plakinalopha*" *mirabilis**, *Theonella cylindrica**, *T. invaginata**, *T. swinhoei**
Spirophorida	*Cinachyrella porosa**, *Cinachyra australiensis*[112], *C. schulzei**, *C. alba-obtusa*[142], *Paratetilla bacca*[113]
Hadromerida	*Chondrilla australiensis**, *Chondrosia corticata**, *Cliona jullieni**, *C. coralliophila**, *Spheciospongia vagabunda*[193,161,113,114,*], *S. trincomalensis*[113], *S. tubulodigitata**, *S. gallensis*[113,*], *S. fungiodes*[113], *S. globularis**, *Terpios zeteki*[118,113], *T. aploos**, *Tethya coccinea*[19,113], *T. seychellensis*[19,193,113], *T. robusta*[19,193,113], *T. boeroi*[193], *T. densa*[193], *T. diploderma*[193], *T. microstella*[193], *T. pulchra*[193], *T. viridis*[193]
Halichondrida	*Axinyssa terpnis**, *A. fenestratus**, *A. aplysinoides**, *A. topsenti**, *Amorphinopsis foetida**, *Acanthella inflexa*[161], *A. costata**, *Ciocalypta sacciformis*[118,113,*], *Cymbastela coralliophila**, *Cymbastela* sp[47], *Collocalypta* sp*, *Didiscus aceratus**, *Epipolasis stalagmites**, *Higginsia mixta**, *H. scabra**, *H. strigilata*.*, *Katiba milnei**, *Phakellia flabellata*[161], *P. cavernosa*[113,*], *P. dendyi*[161], *P. carduus**, *P. stipitata**, *Pararaphoxya tenuiramosa**, *Reniochalina stalagmites**, *Stylotella aurantium*[118,161,*], *S. aldis*[113], *Topsentia cavernosa**
Poecilosclerida	*Agelas mauritiana*[161], *A. robusta**, *Aegogropila digitata*[118,113,*], *Acarnus ternatus*[113], *A. wolfgangi**, *Biemna fortis*[118,113,*], *B. fistulosa**, *B. mnioeis**, *Coelocarteria singaporense*[118,113,161,*], *Clathria (Thalysias) reinwardti*[118,113,161,*], *C. vulpina**, *C. araiosa**, *Ectyodoryx frondosa**, *Echinodictyum asperum*[161], *E. antrodes**, *Iotrochota baculifera*[11,113,161], *I. purpurea*[220], *I. ditrochota**, *Liosina granularis*[118,161,*], *L. paradoxa*[161,*], *Microciona eurypa*[118,113], *Mycale armata**, *M. strongylophora**, *Neofolitispa ungiculata*[118,113,161,*], *Ophlitospongia meyeri*[29], "*Prianos*" *osiris**, *Psammopemma densum subfibrosa**, *Raspailia bifurcata**, *Sideroderma navicelligerum*[161,181], *Zyzzya grata**
Haplosclerida	*Adocia pigmentifera*[161], *Aka mucosa*[118,*], *A. coralliphagum*[161], *Callyspongia rosa*[118], *C. fibrosa*[220], *C. confoederata*[161,113,*], *C. aerizuza*[161,*], *C. schulzei*[161], *C. flammea*[201], *C. diffusa**, *C. muricina**, *Cribrochalina olemda**, *Euplacella ridleyi*[113], *E. annulata**, *E. elongata**, *Haliclona koremella*[118,*], *H. acoroides*[118,113,161], *H. cribricutis*[220], *H. viridis*[113,*], *H. scyphonoides*[113], *H. coerulescens**, *H. nigra**, *Haliclona* sp[9], *Gelliodes fibulata*[118,220,161,113,*], *Niphates cavernosa*[118], *N. obtusa**, *N. chinensis**, *N. (Pachychalina) melior**, *Sigmadocia symbiotica*[118,113,*], *S. amboinensis*[118,113,*], *Siphonochalina extensa*[140], *S. fascigera**, *Toxochalina foliodes*[38,179]
Petrosida	*Oceanapia saggitaria*[118,113], *O. fistulosa*[82,113], *O. amboinensis**, *O. media**, *Petrosia seriata*[220], *P. sphaeroida*[220], *P. constignata*[161], *P. pigmentosa*[161], *P. ficiformis**, *P. capsa**, *P. hebes**, *P. ficiformis**, *Strongylophora durissima*[220], *S. strongylata**, *S. septata*[220,*], *Xestospongia testudinaria*[220,161,113,*], *X. nigricans*[220], *X. pacifica*[118], *Xestospongia exigua*[161,113,*]
Dictyoceratida	*Carteriospongia foliascens*[17,140,219,161], *C. otahitica*[169], *C. flabellifera*[29,17,118,113,*], *Coscinoderma mathewsi**, *Fasciospongia cavernosa*[219], *F. chondrodes*[144], *Fascaplysinopsis reticulata**, *Hyrtios erecta*[219,161,113,*], *Hyatella intestinalis*[161], *Halispongia stellifera*[29], *Ircinia variabilis*[140], *Phyllospongia papyracea**, *Spongia irregularis*[113], *S. officinalis ceylonensis*[219], *Sarcotragus arbuscula**, *Smenospongia lamellata**
Dendroceratida	*Dysidea fragilis*[219,161,113], *D. herbacea*[219,113], *D. avara**, *Dysidea* sp[184]
Verongida	*Aplysinella strongylata**, *A. pedunculata**, *A. tyroeis**, *Ianthella flabelliformis*[219,113], *I. basta*[208,113,161,*], *Psammaplysilla purpurea*[118,219,161,113]
"Sclerosponges"	*Astrosclera willeyana**
CALCAREA	
	Leucetta philippinensis[161], *Leuconia palaoensis**, *Pericharax heteroraphus*[161,113]

* = Coral Reef Research Foundation identifications

Hooper and Bergquist 1992) (Table 6.7). A volume describing the common sponges of New Caledonia is currently in preparation (Contributors: P. R. Bergquist, C. Battershill, P. J. Fromont, J. N. A. Hooper, M. Kelly-Borges, C. Lévi, and J. Vacelet). Additional references include Rützler (1970) on freshwater sponges, and La Barre, Laurent, Sammarco, Williams, and Coll (1988) on sponge ichthyotoxicity.

Table 6.7 Published records of sponges from New Caledonia

Class/Order	Species
DEMOSPONGIAE	
Astrophorida[155]	*Ancorina acervus*[149], *Asteropus simplex*[149], *Characella flexibilis*[152], *Chelotropella neocaledonica*[152,156], *Erylus fibrillosus*, *E. burtoni*, *Erylus* sp.[52], *Geodia vaubani*, *Monosyringia patriciae*[152], *Penares schulzi*, *P. micraster*[152], *P. palmatoclada*[151], *Pachataxa enigmata*, *Psammastra oxygigas*[152], *Poecillastra laminaris*, *P. stipitata*[152], *Sphinctrella orthotriaena*[152,155], *Stelletta centroradiata*, *S. radicifera*, *S. hyperoxea*, *S. vaceleti*, *S. phialimorpha*[152], *S. toxiastra*[152], *Tylaspis topsenti*[156], *Thenea microspirastra*
"Lithistida"[156]	*Anaderma rancureli*, *Aulaxinia clavata*[157], *Corallistes fulvodesmus*, *C. multituberculatus*, *C. undulatus*, *C. microstylifer*, *Callipelta punctata*, *Costifer wilsoni*[152], *Discodermia proliferans*, *Herengeria auriculata*[157], *Iouea moreti*[157], *Jereicopsis graphidophora*[52,156], *Lepidosphaera hindei*[152], *Macandrewia spinifoliata*, *Neosiphonia superstes*[155,157,166], *Neopelta plinthosellina*[157], *Pleroma menouf*[88,156], *P. turbinatum*, *Reidispongia coerulea*[147], *Aciculites oxytylota*, *A. papillata*, *Microscleroderma herdmani*, *M. stonae*, *Scleritoderma camusi*
Spirophorida[155]	*Craniella neocaledonica*, *Tetilla falcipara*[152]
Hadromerida	*Atergia acanthoxa*[152], *Chondrilla australiensis*[149], *Cliona orientalis*[229], *Halicometes hooperi*[152], *Latrunculia brevis*[152], *L. crenulata*[152], *Podospongia similis*[152], *Polymastia tropicalis*[149], *Rhizaxinella dichotoma*[152], *Spheciospongia vagabunda*[149], *Spirastrella inconstans*[229], *Suberites pisiformis*[152], *Sphaerotylus exospinosus*[152], *Spinularia australis*[152], *Tethya japonica*[149], *T. sollasi*[19], *T. levii*[192], *T. novaecaledoniae*[192], *Tylexocladus hispidis*[152], *Trichostemma sarsi*[152], *Trachycladus stylifer*[152], *Trachostylea lamellata*[152]
Halichondrida[97]	*Axinella lifouensis*[152,97], *A. carteri*, *Cymbastela cantherella*[95,151], *C. concentrica*, *Higginsia anfractuosa*, *H. tanekea*, *H. massilis*, *Myrmekioderma granulata*, *Phakellia columnata*, *P. pulcherima*, *P. stipitata*, *P. plumosa*[156], *Ptilocaulis epakros*, *P. fusiformis*[149], *P. papillatus*, *Pseudaxinella debitusae*, *Parahigginsia phakellioides*, *Prostylissa radiata*[156], *Reniochalina plumosa*, *R. condylia*, *Raphoxya systrema*, *Stylissa flabelliformis*, *Spongosorites bubaroides*[152], *Trachycladus digitatus*
Poecilosclerida[96]	*Aulospongus clathrioides*[96,149], *A. gardineri*, *Antho novizelanica*, *Acarnus caledoniensis*, *Agelas mauritiana*[97,149], *A. novaecaledoniae*[97,156], *Agelas dendromorpha*[155], *Asbestopluma bilamellata*[152], *A. biserialis*[152], *Artemisina elegantula*[152], *Biemna granulosigmata*[152], *Crella spinulata*, *Clathria australiensis*[96,149], *C. rugosa*, *C. litos*, *C. vulpina*, *C. flabellifera*, *C. cornoelia*, *C. araiosa*, *C. hirsuta*, *C. kylista*, *C. bulbosa*, *C. menoui*, *Clathria anthoides*[152], *C. macroisochela*[152], *Ceratopsion clavata*, *C. palmata*, *Coelosphaera bullata*[152], *C. chondroida*[152], *C. pedicellata*[152], *Coelodischela massa*[152], *Cladhoriza schistochela*[152], *C. similis*[152], *Chondrocladia concrescens*[152], *C. scolionema*[152], *C. pulvinata*[152], *Desmacella toxophora*[152], *Echinochalina intermedia*, *E. mollis*[86], *E. laboutei*, *E. bargibanti*, *Echinostylinos gorgonopsis*[152], *Esperiopsis macrosigma novaezelandiae*[18], *Esperiopsis challengeri*[152], *E. diasolenia*[152], *E. flava*[152], *E. inodes*[152], *E. magnifolia*[152], *Heterocornulum virguliferum*[156], *Hymedesmia brachyrhabda*[156], 152, *H. spiniarcuata*[156], *Hamacantha acerata*[152], *H. atoxa*[152], *H. forcipulata*[152], *Hoplikathara exoclavata*[152], *Iotrochota baculifera*[149], *Lissodendoryx bifacialis*[96,152,156], *L. stylophora*[96,156], *L. catenata*[152], *L. tubiformis*[152], *Lithoplocamia dolichosclera*[96,156], *Mycale myriasclera*[97,156], *M. incurvata*[152], *Neofibularia hartmani*, *Plocamione pachysclera*[152,96], *Phlyctaenopora bocagei*[152], *Phorbas erectus*[152], *Raspailia wilkinsoni*, *Stelodoryx chlorophylla*[66,152], *S. phyllomorpha*[152], *Tedaniopsis turbinata*[152], *Yvesia acanthosclera*[96,156]
Haplosclerida[71]	*Adocia* sp[97], *Amphimedon conica*, *A. viridis*, *Arenosclera heroni*, *A parca*, *A. rosacea*, *Cladacroce incurvata*[64], *Callyspongia carens*, *C. diffusa*[149], *C. communis*, *C. confoederata*, *C. fallax*, *C. fibrosa*, *C. laxa*, *C. peroni*, *C. subarmigera*, *C. tenerrima*, *C. villosa*, *C. aerizusa*[71,83], *C. flammea*, *C. fruticosa*, *C. hispidoconulosa*, *C. parva*, *C. polymorpha*, *C. pseudoreticulata*[71,83], *C. rigida*, *C. spinimarginata*, *Gelliodes fibulata*[71,149], *G. carnosa*, *G. incrustans*, *G. fragilis*, *Gellius flagellifer*[152], *G. pedunculatus*[152], *G. cymiformis*[83,149,229], *Haliclona nodosa*[152], *Niphates amorpha*, *N. hispida*, *Rhizoniera strongylata*[156], *Toxochalina murata*, *T. robusta*, *T. fenestrata*, *T pseudofibrosa*, *T. staminea*
Petrosida[73]	*Inflatella perlucida*, *Foliolina vera*[152], *Oceanapia bartschii*, *O. fistulosa*[83,73], *O. papula*, *O. tenuis*, *Oceanpia* sp[138], *Pellina triangulata*, *Petrosia ficiformis*, *P. hebes*, *P. capsa*, *P. granifera*, *Xestospongia coralloides*, *X. subtriangularis*, *X. testudinaria*, *Xestospongia* sp[175]
Dictyoceratida	*Fasciospongia* sp[119], *Lendenfeldia dendyi*[229]
"Sclerosponges"	*Acanthochaetetes wellsi*[228], *Astrosclera willeyana*[97,228,232], *Merlia deficiens*[228], *M. normani*[96], *Stromatospongia micronesica*[228], *Vaceletia crypta*[226,227,228]
CALCAREA[228]	*Anamixilla torresi*[26], *Grantessa syconiformis*[26], *Leucetta chagosensis*[26], *L. microraphis*[26], *Lelapiella incrustans*, *Lepidoleucon inflatum*, *Murrayona phanolepis*, *Minchinella kirkpatricki*, *Paramurrayona corticata*, *Plectronina neocaledoniense*, *P. microstyla*, *P. tetractinosa*, *P. lepidophora*, *P. hindei*, *P. minima*, *P. vasseuri*, *P. tecta*, *Tulearinia stylifera*
HEXACTINELLIDA[186]	*Aulochone clathroclada*, *Eurete farreopsis*, *Hyalonema* sp, *Pheronema semiglobosum*, *P. conicum*, *Semperella schulzei*, *Regadrella okinoseana*, *Pleurochorium cornatum*

Solomon Islands and Vanuatu (New Hebrides)

Bergquist, Morton, and Tizard (1971) described a small collection of common sponges collected during the 1965 Royal Society of London Expedition, emphasizing habitat descriptions and ecology in addition to provision of species records (Table 6.8). There is no general account of the Vanuatu sponge fauna, although several species were described from the *Challenger* expedition (Ridley and Dendy 1887; Lendenfeld 1889; Sollas 1888; Polejaeff 1884). Kirkpatrick (1908) described two sclerosponges from this region.

Federated States of Micronesia, Guam, Northern Mariana Islands, Belau (Palau), and the Marshall Islands

Knowledge of the sponge fauna of the Federated States of Micronesia is based upon the comprehensive but largely unrevised work of de Laubenfels (1954) (Table 6.9). Bergquist (1965) revised several of de Laubenfel's species and added new records. The area covered by de Laubenfel's important field-based study extends from 130° to 180° east longitude and from the equator to 20° north latitude consisting of the four largest island archipelagos—Guam, and Saipan in the Northern Mariana Islands, Belau (Palau) and Yap of the Western Caroline Islands, Pohnpei and Chuuk of the Eastern Caroline Islands, and Likiep, Majuro, Ebon, Ailinglaplap, Bikini, and Enewetak Atolls of the Marshall Islands. Intensive study was made at widely scattered points, and collections made by others (T. E. Bullock and J. P. E. Morrison) provided records for Bikini and Enewetak Atolls. The Coral Reef Research Foundation based in Chuuk and Belau are currently carrying out comprehensive habitat-based collections for selected Micronesian localities. Table 6.9 lists all known published and unpublished species (CRRF) from Micronesia. See also Tendal, Barthel, and Tabachnik (1993).

Table 6.8 Published records of sponges from the Solomon Islands and Vanuatu

Class/Order	Species
DEMOSPONGIAE	
Homosclerophorida	*Plakortis quasiamphiaster*[75]
Astrophorida[21]	*Melophlus sarasinorum, Ancorina acervus, Amphius huxleyi*[206], *Jaspis coriacea, Stelletta durissima, S. tethyoides*[140], *Thrombus challengeri*[206]
Spirophorida[21]	*Cinachyra australiensis*
Hadromerida[21]	*Placospongia melobesiodes, Spheciospongia vagabunda, Spirastrella coccinea, Tethya robusta*[19,21], *T. seychellensis*
Halichondrida[21]	*Halichondria solida rugosa*[183], *Halichondria* sp, *Hymeniacidon aldis, Liosina paradoxa, Myrmekioderma granulata*
Poecilosclerida[21]	*Agelas mauritiana, Monanchora ungiculata, Clathria (Rhaphidophlus) reinwardti*
Haplosclerida[21]	*Callyspongia diffusa, Dactylia infundibuliformis, Gelliodes callista, Rhizochalina pedunculata*[182]
Petrosida	*Xestospongia exigua*[21], *Xestospongia* sp[174]
Dictyoceratida	*Carteriospongia foliascens*[21], *Cacospongia spinifera*[169], *C. intermedia*[168], *Hippospongia metachromia*[21], *H. mauritiana*[169], *Hyrtios erecta*[21], *Hyatella intestinalis*[21], *Hyatella sinuosa*[141], *Ircinia foetida*[141], *Lufferiella variabilis*[140,141,169], *Lendenfeldia frondosa*[3], *Phyllospongia papyracea*[21], *Stelospongia cavernosa mediterranea*[141]
Dendroceratida[21]	*Aplysilla violacea, Dysidea herbacea, D. chlorea, Dysidea* sp[4]
Verongida[21]	*Psammaplysilla purpurea*
CALCAREA[122]	
	Minchinella lamellosa (Vanuatu)

Table 6.9 Published species records of sponges from the Federated States of Micronesia, Guam, the Northern Mariana Islands, Belau (Palau), and the Marshall Islands

• = Coral Reef Research Foundation identifications, X denotes records from published data, Saipan = Saipan, Tinian and Rota Islands (Northern Mariana Islands), Lik = Likiep Atoll, Maj = Majuro Atoll, Ebo = Ebon Atoll, All = Ailinglaplap Atoll, Ene = Enewetak Atoll, Bik = Bikini Atoll, Chuuk = Chuuk State. Several of the de Laubenfels[43] species have been excluded from this table due to their uncertain taxonomic status.

	Marianas		Marshalls						W. Carolines		E. Carolines	
Class/Order/Species	Saipan	Guam	Lik	Maj	Ebo	All	Ene	Bik	Belau	Yap	Pohnpei	Chuuk
DEMOSPONGIAE												
Homosclerophorida												
Plakortis lita[55,63,56,•]											X	X•
P. simplex[63]						X						
Plakinastrella ceylonica•												•
Plakina sp[187]											X	
Astrophorida												
Ancorina acervus[63,12,•]	•		X				X	X	X		X	
Dorypleres splendens[63,•]	•								•		X	•
Jaspis coriacea[12]									X			
J. tuberculata[66]			X					X				
J. stellifera[63,•]	•						X					X
Melophlus sarasinorum[12,66,131,134,•]		•							X		?X	X•
Penares nux[63,•]									X			•
Rhabdastrella pleopora•												•
Stelletta durissima[12]									X			
"Lithistida"												
Aciculites papillata•	•											
Spirophorida												
Acanthotetilla enigmatica•												•
Cinachyra australiensis[63,12,•]								X	X		X	X•
Cinachyra porosa[63,•]	X								X			•
Craniella abracadabra[63,•]											X	
Paratetilla bacca[12,•]	•								X			•
P. lipotriaena[63]									X		X	
Tetilla microxea[12]									X			
Hadromerida												
Atergia purpurea[63]					X							
Aaptos unispicularis[63,•]							X					•
A. chromis[63]												X
A. ana[63]												X
Cliona lobata[63]			X		X							X
C. schmidti[63]									X			
C. euryphylla[63]											X	
C. vastifica[63]				X								
Chondrilla australiensis[63]			X	X			X					
C. nucula[63]					X							
C. acanthastra[63]									X			
C. euastra[63,59]										X		
C. grandistellata[63]			X									
Chondrosia chucalla[63]						X		X				
C. corticata•	•											
Diacarnus spinipoculum[116,•]												•
Prosuberites andrewsi[63]				X								
Placospongia melobesiodes[63,12]									X		X	
R. carinata•	•											
Ridleia palia[68,•]									X			•

Table 6.9 *(continued)*

	Marianas		Marshalls						W. Carolines		E. Carolines	
Class/Order/Species	Saipan	Guam	Lik	Maj	Ebo	All	Enc	Bik	Belau	Yap	Pohnpei	Chuuk
Spheciospongia aurivilli[12,•]	•								X			
S. tubulodigitata•												•
S. inconstans•												•
S. globularis•												•
S. vagabunda[12,43,•]	•		X		X		X		X		X	X
S. purpurea•	•											
Spirastrella potamophera[43]			X	X	X	X			X		X	
S. decumbens[43]					X	X						X
Terpios fugax[43,•]						X					X	•
Terpios sp[168]		X										
Terpios sp[19]		X										
T. aploos[43]		X			X							
T. hoshinoto[169]		X									X	
Timea granulata[12]									X			
Tethya seychellensis[43]			X									
T. viridis[43]					X							
T. coccinea[43,•]	•				X			X				
T. robusta•	•											
Halichondrida												
Axinella proliferans•												•
A. carteri•												•
Auletta bia[43,•]											X	•
Axinyssa aplysinoides[90,•]		•		•					X			•
A. pitys[43,12,•]	•								X			•
A. terpnis[43,12,•]	•								X		X	•
A. xutha[43,•]	•											X
Cymbastela marshae•												•
C. vespertina•												•
C. cantherella•	•											•
Ciocalypta sacciformis[43]									X			
Dragmatella hispida•									•			•
Dictyonella dasyphyllia[43]									X			
Densa mollis[43,•]	•											X
Homaxinella trachys[43,234]					X		X					
H. phrix[43]												X
Halichondria adelpha[43]					X			X				
Hymeniacidon maza[43]												X
H. dystacta[43]					X			X				
Halichondria sp[209]											X	
Higginsia anfractuosa•	•											
H. mixta[12,•]	•								X			
Katiba milnei[43]					X							•
Liosina paradoxa•												•
Myrmekioderma granulata[43,12,•]	•								X		X	X•
Pararaphoxya tenuiramosa[43]											X	
Phakellia costata[167]											X	
P. stipitata•												•
P. cavernosa•												•
Pseudaxinella australis•	•										X	•
Quepanetsal madidus[43]					X							
Rhabderemia sorokinae•	•											•

Table 6.9 *(continued)*

	Marianas		Marshalls						W. Carolines		E. Carolines	
Class/Order/Species	Saipan	Guam	Lik	Maj	Ebo	All	Enc	Bik	Belau	Yap	Pohnpei	Chuuk
Rhaphisia hispida[63]											X	
Stylotella aurantium[63,167,•]	•	X							X		X	X
S. aldis[63,•]	•					X						
S. maza•												•
S. agminata•												•
Spongosorites porites[63,59]										X		
Stylissa flabelliformis•												•
Topsentia cavernosa•												•
Haplosclerida												
Adocia turquosia[63,•]	•.			X				X	X		X	X
Adocia sp[196]												X
A. viola[63,•]		X									X	•
A. neens[63]			X	X				X			X	
Aka mucosa[12,•]	•											•
A. cf *corallophagum*•												•
Amphimedon sp[196]		X										
Arenosclera psammophera[63,•]						X						•
A. heroni•												•
Cribrochalina olemda[63,12,•]									X			X•
Callyspongia subarmigera[12]									X			
C. ridleyi[12]									X			
C. fistularis[63]				X	X		X					
C. fibrosa[63]				?	?		?					
C. diffusa[63,•]		X							X		X	•
C. brucei•												•
C. parva•	•											•
C. aerizusa•	•											•
Gellius gracilis[63,12,•]	•								X			•
Gelliodes callista[63,•]									X			•
Haliclona velinea[63,12]					X				•			
Haliclona sp[81]									X			
H. koremella[63,12,•]	•								X			•
H. monilata[63,•]												X•
H. lingulata[63]		X										
H. streble[63]	X											
H. korema[63]								X	X			
H. coerulescens[63,•]												X•
H. viridis[63,•]	•					X			X		X	X
H. permollis[63]											X	
H. decidua[63]												X
H. parietilis[63]			X									
H. nigra[63]					X							
H. massilis[63]					X							
H. rotographura[63,•]			X									•
H. acoroides•	•											
H. pigmentifera•												•
"*H. pellasarca*"•	•											
Kallypilidion poseidon[63,12]									X			X
Niphates cavernosa•	•											
N. spinosella•	•											
Nara nemitifera[63]					X	X						•

Table 6.9 *(continued)*

	Marianas		Marshalls						W. Carolines		E. Carolines	
Class/Order/Species	Saipan	Guam	Lik	Maj	Ebo	All	Enc	Bik	Belau	Yap	Pohnpei	Chuuk
Reniera implexa[63],•					X							•
Reniera sp[59]									X			
R. chrysa[63],•					X	X						•
Sigmadocia emphasis[63]									X			
S. amboinensis•	•											
S. symbiotica•	•											
Toxidocia tyroeis[63]									X			
T. violacea[12]									X			
Petrosida												
Oceanapia fistulosa•												•
Oceanapia saggittaria[63],•									X			X•
Petrosia pandora•												•
Pellina carbonaria[63,12]									X			
P. eusiphonia[63],•	•				X							
P. pinella[63]					X							
P. carbonilla[63]					X							
P. pulvilla[63]		X										
P. triangulata•												•
Xestospongia exigua[63,12,50,195]						X		X	X	X	X	X
Xestospongia sp[203]		X										
Poecilosclerida[63]												
Axocielita linda			X			X			X			X
Acamas caledoniensis•	•											
Agelas mauritiana				X	X		X	X				
Amphinomia sulphurea•	•											
Anaata lajorei•						X			•			•
Axociella arteria											X	
Biemna fortis•	•								•		•	•
B. mnioeis											X	
Coelocartaria singaporense[63,12],•	•								X			
Clathria cervicornis[12],•									X		X	X•
C. fasciculata[12],•									X			X•
C. frondifera		X										
C. cratita											X	•
C. abietina							X					X
C. vulpina•	•											•
C. reinwardti•												•
Crella spinulata•	•								X			
C. calypta•												•
Chondropsis ceratosus•											X	X•
Carmia stegoderma											X	
Desmacella lampra[63,12],•	•								X			X•
Damiria sp[207,208]									X			
Damiriana hawaiiana•												•
Echinoclathria waldoschmitti•												•
E. intermedia•												•
Echinodictyum antrodes•		X	X					X	•		X	•
E. asperum•												•
Fausubera debrumi			X						X			
Iotrochota baculifera[12],•	•								X			•
Iotrochota pella•				X								•

Table 6.9 *(continued)*

	Marianas		Marshalls						W. Carolines		E. Carolines	
Class/Order/Species	Saipan	Guam	Lik	Maj	Ebo	All	Ene	Bik	Belau	Yap	Pohnpei	Chuuk
I. ditrochota											X	
I. hiatti												X
I. mystile			X									X
Iotrochostyla iota												X
Lissodendoryx oxytes[•]	•						X		X			
L. calypta							X					
Microciona eurypa[63,12•]	•								X			•
M. plinthina[•]						X			X			•
M. micronesica				X					X			
M. placenta												X
Mycale lissochela[12]									X			
M. cavernosa[12,•]									X			
M. armata					X				X		X	•
M. cecile[•]	•											•
M. parishii[•]												•
Monanchora ungiculata[63,12]									X		X	X
Neofibularia irata[•]												•
Oxymycale stecarmia											X	
O. strongylophora						X						
Oxycarmia confundata											X	
Ophlitospongia mima				X					X			
Protolithospongia ada											X	
P. aga									X			
Prianos phlox	•		X	X		X						
P. melanos					X							
P. osiris												X
Stylotrichophora rubra					X							
Tedania oligostyla					X							
T. ignis									X			
Ulosa spongia[•]					X							
Xytopsiphum meganese[•]	•											
Dictyoceratida												
Aulena concertina[63]						X						
Coscinoderma mathewsi[63,139,141,115]											X	X
Dactylospongia elegans[12,•]									X			•
Fasciospongia chondrodes[63,12,•]	•								X			
Fenestraspongia sp[63]									X			
Hippospongia metachromia[63,•]	•								X			X
Hyrtios erecta[63,12,183,•]		X			X	X	X		X		X	X[•]
Ircinia ramosa[63,12,•]									X			X[•]
I. strobilina[63]									X		X	
I. halmiformis[63]							X	X				
Lendenfeldia dendyi[63,12]	•								X			
Lufferiella variabilis[78,170,•]		X							X			•
L. geometrica[•]												•
Leiosella levis[•]												•
L. silicata[•]												•
Phyllospongia papyracea[17]									X			
Strepsichordaia lendenfeldi[•]	•											
Satcotragus arbuscula[•]												•

Table 6.9 *(continued)*

	Marianas		Marshalls						W. Carolines		E. Carolines	
Class/Order/Species	Saipan	Guam	Lik	Maj	Ebo	All	Ene	Bik	Belau	Yap	Pohnpei	Chuuk
Spongia matamata[63,12,•]				X		X		X	X		X	X•
S. zimocca[63,•]									X		X	•
Verongida												
Aplysinella tyroeis[63,•]	•										X	•
A. strongylata•	•											•
Ianthella basta		•										
Psammaplysilla purpurea[63,12,41]			X	X	X	X	X		X		X	X
P. verongiformis•	•								•			
Dendroceratida												
Aplysilla sulfurea[63]				X							X	X
A. polyraphis[63]											X	
A. rosea•		•										
Chelonaplysilla sp[34,35]									X		X	
Dysidea herbacea[63,224,12,•]						X			X			X•
Dysidea sp[78]		X										
D. chlorea[63,12,•]					X				X			•
D. granulosa[12,•]									X			•
D. arenaria[12,•]									X			•
D. fragilis[63,•]	•					X						•
D. avara[63,•]	•	X				X					X	•
D. rhax[63,•]			X	X	X						X	•
D. crawshayi[63]			X	X	X						X	
Dendrilla nigra[63,•]	•		X						X			
Dendrilla sp[13]									X			
Euryspongia lobata[12,•]	•								X			•
E. phlogera[63]						X						
Halisarca melana[63]									X			
"Sierosponges"												
Astrosclera willeyana[11,164,178,•]	•	X					•					•
Acanthochaetetes wellsi•	•						X					•
Stromatospongia micronesica[88,•]	•	X					X					
CALCAREA												
Dendya prolifera•												•
Leucetta microraphis[47,132]									X		X	
Leucetta primigenia[63,•]											X	X•
Leucetta avacado[63,•]		X							X			X•
Leuconia tropica[63,•]									X			•
Leuconia palaoensis[63,210,•]									X			•
Leucandra pacifica•												•
Murrayona phanolepis	•						X					
Pericharax heteroraphus•												•
Scypha plumosa[63]									X			

Ryukyu, Bonin, and Marcus Islands of Southern Japan

Records of sponges from the Ryukyu Islands of southern Japan (Hoshino 1985a, b, 1987; Mori 1977) appear predominantly within the chemical literature (Table 6.10). Bruce (1985, 1988) recorded crustacean-associated sponges. There are no recorded sponge species from Bonin and Marcus Islands.

Onotoa (Gilbert Island Group, Kiribati) and Funafuti Atoll (Ellice Island Group, Tuvalu)

In July and August of 1951, twenty sponges were collected by P. E. Cloud and A. H. Banner and later identified by de Laubenfels (1955) (Table 6.11). Kirkpatrick (1900) described twenty-one sponges from the second expedition of the *Boring* to Funafuti Atoll provided

Table 6.10 Published records of sponges from the Ryukyu Islands of southern Japan

Class/Order	Species
DEMOSPONGIAE	
Homosclerophorida	*Plakortis* sp[129]
Astrophorida	*Iaspis* sp[126], *Theonella swinhoei*[129], *Theonella* sp[124], *Theonella* sp[125]
Hadromerida	*Terpios hoshinoto*[189]
Petrosida	*Xestospongia* sp[123]
Poecilosclerida	*Agelas nakamurai*[100], *A. nemechinata*[101]
Dictyoceratida	*Hyrtios erecta*[120], *Hyrtios* sp[77], *Lufferiella* sp[127]
Dendroceratida	*Dysidea minna*[101], *Dysidea* sp[104]
"Sclerosponges"	*Tubulospongia japonica*[165]

Table 6.11 Published records of sponges from Onotoa† (Gilbert Island Group, Kiribati) and Funafuti Atoll (Ellice Island Group, Tuvalu)

Class/Order	Species
DEMOSPONGIAE	
Homosclerophorida[121]	*Corticium candelabrum, Plakinalopha spinosa, Plakinastrella clathrata*
Astrophorida	*Erylus monticularis*[141], *E. nobilis*[121], *Iaspis stellifera*[164], *Myriastra debilis*[164]*Onotoa amphiastra*[164]
Hadromerida	*Chondrilla mixta*[121], *Chondrosia chucalla*[164], *Cliona mucronata*[121], *C. lobata*[164], *C. schmidti*[121], *Dyscliona davidi*[121], *Latrunculia clavigera*[121], *Polymastia dendyi*[2,3], *Spirastrella papillosa*[2,3], *S. potamophora*[164]*Tethya diplodermo*[164], *Tethytimea stellagrandis*[164]
Halichondrida	*Acanthella stipitata*[2,3], *A. pulcherrima*[2,3], *Ciocalypta incrustans*[2,3], *Halichondria solida rugosa*[2,3], *Spongosorites porites*[164], *Stylotella aurantium*[164]
Poecilosclerida	*Agelas gracilis*[121,2,3], *A. mauritiana*[164], *Chondropsis ceratosus*[121], *Clathria pellicula*[2,3], *Echinodictyum asperum*[2,3], *Mycale armata*[164], *Psammopemma purpureum*[121], *Tedania levis*[121]
Haplosclerida	*Callyspongia glomerata*[2,3], *C. fistularis*[164], *Gellius aculeatus*[2,3], *Niphates fibrosa*[121], *Reniera australis*[2,3]
Petrosida	*Pellina carbonaria*[164]
Dictyoceratida	*Carteriospongia sweeti*[121], *Hippospongia dura*[2,3], *Hyrtios erecta*[164], *Lufferiella variabilis*[121], *L. geometrica*[121], *Spongia irregularis silicata*[2,3], *Spongia irregularis pertusa*[141], *S. officinalis matamata*[164], *S. matamata canaliculata*[164], *Stelospongus cavernosus*[121]
Dendroceratida	*Dysidea fragilis irregularis*[2,3], *D. chlorea*[164]
"Sclerosponges"	*Astrosclera willeyana*[121,150]
CALCAREA	
	Clathrina depressa[121]
HEXACTINELLIDA	
	Plectroninia hindei[121]

to him for description by Professor Judd. These later sponges were mostly small and encrusting, being attached to coral that was dredged from 30–145 fathoms. Whitelegge (1897) described sixteen species from the reef flat, bringing the total to thirty-six described sponges for the region. First accounts of sclerosponges in the Pacific are given by Lister (1900) and Willey (1902).

DISCUSSION

There are over 1,000 published and unpublished species records for the tropical island region of Oceania. The sponge faunas of Easter Island (forty species), French Polynesia (twenty-six species), the Kermadec Islands of New Zealand (twenty species), the Ryukyu Islands of southern Japan (fifteen species), the Solomon Islands and Vanuatu (forty-eight species), Kiribati and Tuvalu (fifty-six species), and Fiji, Tonga, and Samoa (fifty-two species) are poorly represented in the published literature, and phyletic diversity of the collections is low. The sponge faunas of Hawaii (ninety-eight species), Papua New Guinea (184 species), New Caledonia (274 species), and the Federated States of Micronesia (277 species) are better represented, reflecting the greater effort that has been made in collections and taxonomic research in these locations, both historically and recently. However, even within these better-known faunas, the collections have been restricted to several widely separated locations and so are not geographically representative. Collections also frequently reflect research bias; the Sala-y-Gómez and New Caledonia species lists are dominated by records of hexactinellid sponges, and by tetractinomorph and poecilosclerid sponges, respectively.

The sponge fauna of the broad Indo-West Pacific region, with a center of diversity in the East Indies, is considered to be the most diverse in the world (Briggs 1987; van Soest 1989, 1990). However, as the sponge faunas of this broad region become better known, the notion of an East Indies center of diversity becomes less tenable. Hooper (1994) has found that the northwestern shelf of Australia to be equally as diverse. There are several regions within western Oceania also extremely rich in terms of species number and phyletic diversity. These include Lemetol Bay within the Chuuk Lagoon (de Laubenfels 1954; CRRF, unpublished data), Bootless Inlet within the southern Papua New Guinea Barrier Reef system (Kelly 1986; Kelly-Borges and Bergquist 1988; CRRF, unpublished data), and the marine lakes system in Belau (Kelly-Borges, Bell, and Sharron 1994). Nutrient-rich mangrove-lined inlets with pinnacle-like patch-reefs adjacent to mountainous coastlines such as within Bootless Inlet and Lemetol Bay are exceptionally diverse; more than 250 sponge species have been collected from Bootless Bay (MKB; CRRF, unpublished data), Papua New Guinea, and over 500 species are known for Chuuk Atoll (CRRF, unpublished data). A recent survey of six of the eighty known marine lakes in Belau resulted in more than 140 sponge species, each lake fauna being significantly different from the next, with the exception of the presence of several "cosmopolitan" Indo-Pacific species such as *Hyrtios erecta*, *Monanchora ungiculata*, *Stylotella aurantium*, and *Paratetilla bacca*. Several lakes held taxa that represent new genus records for Oceania (e.g., *Tetrapocillon*). (See Table 6.12 for classification of the recent demosponges.)

Table 6.12 Classification of the recent demosponges

CLASS DEMOSPONGIAE	
ORDER HOMOSCLEROPHORIDA	
FAMILY PLAKINIDAE (syn. Oscarellidae)	*Plakortis, Corticium, Plakina, Plakinastrella, Placinolopha, Diactinolopha, Astroplakina, Dercitopsis, Oscarella*
ORDER ASTROPHORIDA (syn. Choristida)	
FAMILY ANCORINIDAE (syn. Stellettidae)	*Rhabdastrella, Stelletta, Ancorina, Asteropus, Penares*
FAMILY GEODIIDAE	*Geodia, Erylus, Pachymatisma, Caminus, Sidinops, Isops*
FAMILY PACHASTRELLIDAE	*Pachastrella, poecillastra, dercitus, sphinctrella, triptolemus*
FAMILY COPPATIIDAE (syn. Jaspidae)	*Jaspis, Stellettinopsis*
FAMILY CALTHROPELLIDAE	*Calthropella, Pachastrissa, Chelotropella, Pachataxa*
FAMILY THENEIDAE	*Thenea, Papyrula*
FAMILY THROMBIDAE	*Thrombus*
"LITHISTID" FAMILY THEONELLIDAE	*Theonella, Discodermia, Racodiscula, Jereopsis*
"LITHISTID" FAMILY CORALLISTIDAE	*Corallistes, Macandrewia, Homophymia, Iouea, Herengeria,*
"LITHISTID" FAMILY PLEROMIDAE	*Pleroma*
"LITHISTID" FAMILY DORYDERMIIDAE	*Anaderma*
"LITHISTID" FAMILY PHYMATELLIDAE	*Neosiphonia, Reidispongia, Aulaxinia*
"LITHISTID" FAMILY PHYMARAPHINIDAE	*Kaliapsis*
"LITHISTID" FAMILY NEOPELTIDAE	*Neopelta*
ORDER SPIROPHORIDA	
FAMILY TETILLIDAE	*Cinachyra, Cinachyrella, Paratetilla, Craniella, Acanthotetilla*
"LITHISTID" FAMILY SCLERITODERMIDAE	*Scleritoderma, Amphibleptula, Microscleroderma, Aciculites*
"LITHISTID" FAMILY SIPHONIDIIDAE	*Gastrophanella, Siphonidium, Leiodermatium*
ORDER HADROMERIDA	
FAMILY TETHYIDAE	*Tethya, Burtonitethya, Tethycometes, Xenospongia*
FAMILY POLYMASTIIDAE	*Polymastia, Radiella, Tentorium, Weberella, Atergia, Proteleia*
FAMILY SUBERITIDAE	*Terpios, Suberites, Aaptos, Prosuberites, Pseudosuberites*
FAMILY TIMEIDAE	*Timea, Diplastrella*
FAMILY PLACOSPONGIIDAE	*Placospongia*
FAMILY STYLOCORDYLIDAE	*Stylocordyla, Tethycordyla, Oxycordyla*
FAMILY SPIRASTRELLIDAE	*Spirastrella, Anthosigmella*
FAMILY CLIONIDAE	*Cliona, Thoosa, Cliothoosa, Spheciospongia, Alectona*
FAMILY CHONDRILLIDAE (syn. Chondrosiidae)	*Chondrilla, Chondrosia*
"SCLEROSPONGE" FAMILY ACANTHOCHAETIDAE	*Acanthochaetetes*
?FAMILY HEMIASTERELLIDAE	*Hemiasterella*
?FAMILY LATRUNCULIIDAE	*Diacarnus, Latrunculia, Sigmosceptrella, Negombata*
?FAMILY TRACHYCLADIDAE	*Trachycladus*
ORDER HALICHONDRIDA	
FAMILY HALICHONDRIIDAE	*Topsentia, Amorphinopsis, Halichondria, Hymeniacidon, Stylotella, Ciocalypta, Spongosorites, Axinyssa, Epipolasis*
"LITHISTID" FAMILY PETROMICIDAE	*Petromica, Monanthus*
FAMILY DESMOXYIDAE	*Desmoxya, Higginsia, Myrmekioderma, Didiscus, Acanthoclada, Halicnemia, Heteroxya*
?FAMILY AXINELLIDAE	*Axinella, Phakellia, Acanthella, Auletta, Bubaris, Pararaphoxya, Homaxinella, Cymbastela, Ptilocaulis, Teichaxinella, Pseudaxinella, Axinectya, Axinosia, Dragmacidon, Reniochalina, Rhaphoxya*
?FAMILY DICTYONELLIDAE	*Dactylella, Dictyonella, Liosina, Scopalina, Tethyspira*
ORDER AGELASIDA	
FAMILY AGELASIDAE	*Agelas, Ectyonopsis*
"SCLEROSPONGE" FAMILY CERATOPORELLIDAE	*Ceratoporella, Stromatospongia, Hispidoptera, Goreauiella*
"SCLEROSPONGE" FAMILY ASTROSCLERIDAE	*Astrosclera*
ORDER POECILOSCLERIDA	
FAMILY IOPHONIDAE (syn. Cornulidae)	*Acarnus, Coelocarteria, Zyzzya, Damiria, Iophon*
FAMILY MICROCIONIDAE	*Antho, Clathria, Echinochalina, Echinoclathria, Pandoras*
FAMILY RHABDAREMIIDAE	*Rhabdaremia*
FAMILY RASPAILIIDAE	*Raspailia, Endactyon, Ceratopsion, Hymeraphia, Thrincophora, Ectyoplasia, Echinodictyon, Amphinomia*

Table 6.12 *(continued)*

FAMILY ANCHINOIDAE (syn. Phorbasidae)	*Phorbas, Hamigera*
FAMILY COELOSPHAERIDAE	*Anomodoryx, Chaetodoryx, Coelocarteria, Coelosphaera, Histodermella, Amphiastrella, Inflatella, Manawa, Forcepia, Inflatella, Histodermella, Lissodendoryx*
FAMILY CRAMBIDAE	*Crambe, Discorhabdella, Monanchora, Psammochela*
FAMILY CRELLIDAE	*Crella, Naniupi, Barbozia, Yvesia*
FAMILY HYMEDESMIIDAE	*Acanthocora, Spanioplon, Stylopus, Hymedesmia*
FAMILY MYXILLIDAE	*Amphiastrella, Amphilectus, Desmacidon, Desmapsamma, Myxilla, Ectyomyxilla, Sigmarotula, Iotrochota, Stelodoryx*
FAMILY PHORIOSPONGIIDAE	*Batzella, Chondropsis, Strongylacidon, Psammoclemma*
FAMILY TEDANIIDAE	*Tedania, Tedaniopsis, Hemitedania, Kirkpatrickia*
FAMILY CLADHORIZIDAE	*Asbestopluma, Chondrocladia, Cladhoriza*
FAMILY GUITARRIDAE	*Guitarra, Tetrapocillon*
FAMILY DESMACELLIDAE (syn. Biemnidae)	*Desmacella, Biemna, Microtylostylifer, Kerasemmna, Neofibularia, Sigmaxinella*
FAMILY HAMACANTHIDAE	*Hamacantha*
FAMILY MYCALIDAE	*Mycale, Esperiopsis, Paraesperella, Sceptrella*
"SCLEROSPONGE" FAMILY MERLIIDAE	*Merlia, ?Chaetetes*
"LITHISTID" FAMILY DESMANTHIDAE	*Desmanthus*
?"LITHISTID" ORDER SPHAEROCLADINIDA	
FAMILY VETULINIDA	*Vetulina*
ORDER HAPLOSCLERIDA	
FAMILY CHALINIDAE (syn. Haliclonidae)	*Haliclona, Reniera, Gellius, Rhizoniera, Cladacroce*
FAMILY ADOCIIDAE	*Adocia, Sigmadocia, Orina, Toxadocia, Kallypilidion*
FAMILY NIPHATIDAE	*Amphimedon, Niphates, Gelliodes, Cribrochalina, Aka, Hemigellius, Haliclonissa, Siphonochalina, Microxina*
FAMILY CALLYSPONGIIDAE	*Callyspongia, Euplacella, Dactylia, Toxochalina*
"SCLEROSPONGE" FAMILY CALCIFIBROSPONGIIDAE	*Calcifibrospongia*
FAMILY SPONGILLIDAE (Freshwater sponges)	
FAMILY METANIIDAE (Freshwater sponges)	
FAMILY POTAMOLEPIDAE (Freshwater sponges)	
FAMILY LUBOMIRSKIIDAE (Freshwater sponges)	
ORDER PETROSIDA (syn. Nepheliospongida)	
FAMILY PETROSIIDAE	*Xestospongia, Petrosia, Strongylophora*
FAMILY PHLOEODICTYIDAE (syn. Oceanapiidae)	*Oceanapia, Pellina, Pachypellina, Biminia, Calyx, Vagocia, Foliolina, ?Prianos*
ORDER DICTYOCERATIDA	
FAMILY SPONGIIDAE	*Spongia, Hippospongia, Phyllospongia, Strepsichordaia, Coscinoderma, Hyatella, Leiosella, Carteriospongia*
FAMILY THORECTIDAE	*Hyrtios, Thorectandra, Cacospongia, Lufferiella, Thorecta, Fasciospongia, Fenestraspongia, Aplysinopsis,*
FAMILY IRCINIIDAE	*Ircinia, Sarcotragus*
ORDER DENDROCERATIDA	
FAMILY APLYSILLIDAE	*Aplysilla, Pteraplysilla, Chelonaplysilla, Dendrilla*
FAMILY HALISARCIDAE	*Halisarca*
FAMILY DYSIDEIDAE	*Dysidea, Euryspongia, Spongionella*
FAMILY DICTYODENDRILLIDAE	*Dictyodendrilla, Igernella*
ORDER VERONGIDA	
FAMILY APLYSINIDAE	*Aplysina, Verongula*
FAMILY APLYSINELLIDAE	*Pseudoceratina, Aplysinella, Psammaplysilla,*
FAMILY IANTHELLIDAE	*Ianthella, Anomoianthella, Bajalus*
"SCLEROSPONGE" ORDER VERTICILLITIDA	
FAMILY VERTICILLITIDAE	*Vaceletia*

After Bergquist 1968; Bergquist, Ayling, and Wilkinson 1988; Bergquist and Fromont 1988; Bergquist and Kelly-Borges 1991; Kelly-Borges and Bergquist 1994; Bergquist and Warne 1980; Desqueyroux-Faundez 1984, 1987; Diaz and van Soest 1994; Fromont 1991, 1993; Hadju, van Soest, and Hooper 1994; Hooper 1991; Hooper and Bergquist 1992; Hooper and Lévi 1993a, b, 1994; Hooper and Weidenmayer 1994; Kelly-Borges and Vacelet, in press; Kelly-Borges and Pomponi 1994; Lévi 1993; Lévi and Lévi 1983, 1988; Vacelet, pers. com.

RECOMMENDATIONS FOR INFORMATION MANAGEMENT

Sponge Distribution and Ecosystem Classification

As for most marine invertebrates, sponge species in the tropical island region of Oceania are predominately habitat-specific, with only a small number of species occurring in all reef environments. For the fringing reef surrounding Motupore Island in Bootless Inlet, Papua New Guinea, Kelly (1986) identified specific sponge assemblages rather than habitats, as sponge distribution did not correspond to the standard coral reef ecosystem classification system (e.g., reef ridge, reef flat, fore-reef slope, back reef lagoon, seagrass beds). Rather, patterns of distribution were more complicated, with species distributed along major physical oceanographic gradients so that the faunas differed on leeward and windward sides of the island. Similarly, the sponge assemblages in six of eighty marine lakes in Belau seemed to be determined by a complex combination of the lag-time between tidal cycle at the seawater source and within the lake, which is a function of the distance of the lake from the seawater source, the physico-chemical nature of the lake water, and the geomorphology of the surrounding terrain (Kelly-Borges, Bell, and Sharron 1994). Sponge distributions in both locations were further complicated by asexual reproductive mechanisms in many species, leading to dispersal of individuals with prevailing wind-driven currents (Kelly-Borges and Bergquist 1988). Recent evidence suggests that asexual reproduction is surprisingly common in a diversity of sponge morphologies and that the recruits generated have a remarkable behavioral and survivorship capability (Battershill and Bergquist 1990). Thus, biological and physical factors considerably modify sponge distribution within typical reef habitats. This fact and the presence of special sponge-dominated habitats, such as marine lakes, submarine caves, nutrient-rich environments, and areas of high current activity, require recognition when applying standard coral reef habitat classifications to sponge distribution data.

Geographic and habitat scale is also extremely important in the consideration of sponge distribution. In general, the sponge faunas of Oceania can be divided into four broad groups: (1) regionally endemic sponges that are habitat- or locality-specific (e.g., patch-reefs within nutrient-rich bays, specific marine lakes, or caves), (2) regionally endemic sponges that occur within a single atoll or island group, (3) species that are found in "super-regions" (e.g., Micronesia alone or Solomon Islands alone), and (4) species that are found throughout the broad Indo-West Pacific region (de Laubenfels 1954; Hooper 1994).

Biodiversity Database Structure for Resource Management

The minimum information required for management of sponge species data include SPECIES, SITE, and BIBLIOGRAPHIC information, managed in a relational database management system (DBMS) (B. E. Picton, pers. com. 1995). Additional information that might be considered for provision within the DBMS include protection status (CITES listing) and commercial use or application (aquaculture, mariculture, pharmacology). Suggested data fields including those employed in the Species Directory Marine Database (BioMar) of Trinity College, Ireland, currently being developed to serve the Porifera research community (B. E. Picton, pers. com. 1995) are given in Table 6.13. Although SPECIMEN information may seem optional for resource management, where species lists and distributional data are the primary goals, careful consideration should be given for the

Table 6.13 Minimum data requirements for management of sponge biodiversity information in a relational database management system

Species	Specimen	Site	Bibliographic	Addresses
⇔ _____	**specimen number** _____	⇔		
	collection date _____	⇔		
	preservation method			
	status of specimen: cited, type, etc.			
⇔ _____	collection depository _____			⇔ (museum or institution)
⇔ _____	photographs _____			⇔ (photographer)
	collector _____			⇔
⇔ _____	⇔ _____	**site name**		
	⇔ _____	site code		
	⇔ _____	**site description**		
⇔ _____	⇔ _____	**latitude**		
⇔ _____	⇔ _____	**longitude**		
⇔ _____	⇔ _____	**habitat**		
⇔ _____	**depth range**			
⇔ _____	**substrate**			
⇔ _____	**abundance at site**			
⇔ _____	morphology			
⇔ _____	size range			
⇔ _____	surface			
⇔ _____	texture			
⇔ _____	external color			
⇔ _____	internal color			
⇔ _____	exudates			
⇔ _____	odor			
phylum _____	⇔			
class _____	⇔			
order _____	⇔			
family _____	⇔			
genus _____	⇔			
species _____	⇔			
authority _____	⇔ _____		⇔ _____	⇔
⇔ _____	taxonomist _____			⇔
	taxonomy updater _____			⇔

Fields useful for resource managers are in bold-face text, columns are DATA TABLES, rows are DATA FIELDS within tables, ⇔ = data that are accessed from other files

provision of specimen information in the database structure. Individual specimens provide the fundamental data that derive the "species" name applied to that group of specimens. Collections and inventory initiatives are increasing within Oceania, and specimen data, if provided, will greatly facilitate revisionary systematics (taxonomic monography), and thus biodiversity inventory within the region. Indeed, electronic dissemination of specimen-based databases, via GOPHER, or a WORLDWIDE WEB (WWW) server, is a requirement of many recent biodiversity inventory initiatives such as the National Science Foundation's Biotic Surveys and Inventories Program.

The database should allow the storage of hierarchical Linnean taxonomy, enabling the sorting of species by taxa while taking into account changing taxonomies. Attention

should also be given to the coding of synonymous species names. Literature references should be incorporated into the database and linked to the species names. The importance of employing a fully relational database is well illustrated within the SPECIES data fields in Table 6.13. For example, the same personnel information may be required within multiple fields, because a person may be a collector, a taxonomist, a donor, and an author. These personnel data, which might include the details of their employing organization, address, contact details, and research interests, for example, need only to be linked to the use of their name, rather than be stored multiple times in separate fields. The same applies to literature, photographic, and site information.

CONCLUSION

The sponge fauna of the tropical island region of Oceania has received little attention and is relatively unknown. With the exception of some Micronesian, Papua New Guinea, and New Caledonian localities, records consist of only the most common and obvious shallow-water sponges. There is an urgent need to expand sponge biodiversity initiatives within Oceania, several regional components of which are among and adjacent to regions of the world's greatest sponge biodiversity. Sponges are under considerable threat worldwide due to destructive fishing and recreational practices, siltation and pollutants, and exploitation for biomedical purposes. Understanding the mechanisms that promote biodiversity in marine ecosystems will enhance our ability to manage and conserve them. Documenting the biodiversity of sponges in Oceania and ultimately understanding the phylogenetic relationships between these organisms is a crucial first step to conserving them.

Acknowledgments—We thank John N. A. Hooper (Queensland Museum, Brisbane, Australia), Bernard Picton (Trinity College, Dublin, Ireland), Shirley A. Pomponi (Harbor Branch Oceanographic Institution, Fort Pierce, Florida), Rob van Soest (Zoologisch Museum, Amsterdam, The Netherlands), Ruth Desqueyroux-Faundez (Muséum d'Histoire Naturelle, Genève, Switzerland), Patricia R. Bergquist (University of Auckland, Auckland, New Zealand), and Jean Vacelet (Station Marine d'Endoume, Marseille, France) for information pertaining to this review.

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