

## CHECKLIST OF HARD AND SOFT CORALS PRESENT IN THE ZOOLOGICAL AND GEOLOGICAL MUSEUMS, UNIVERSITY OF KARACHI

Abid Raza Zaidi and Rukhsana Perveen

Department of Zoology, University of Karachi, Karachi-75270, Pakistan  
[zoicone@gmail.com](mailto:zoicone@gmail.com)

---

### ABSTRACT

The collection of marine invertebrate's representatives of class Anthozoa present in the Zoological Museum, since 1952, lacked faunistic studies as well as species of the *Scleractinian* present in Geological Museums of the University of Karachi. The present work is a comprehensive checklist of subclasses Octocorallia and Hexacorallia, order Scleractinia of the class Anthozoa belonging to the Phylum Cnidaria. The present checklist contains 8 families and belongs to the subclass octocorallia and 13 families belonging to the subclass Hexacorallia in the order Scleractinia. The specimens were identified through fauna of British India and pertinent literature.

**Key words:** Scleractinia, corals, zoological museum, marine invertebrate.

---

### INTRODUCTION

The collections of corals present in the Zoological and Geological Museum of University of Karachi were originally collected by Mr. James A. Murray (Museum Curator and Zoologist in Karachi in 1880). He was member of Anthropological Society of Bombay, Bombay Natural History Society and a manager at Victoria Natural History Institute and curator at the Kurrachee (Karachi) Municipal Library and Museum. More than my research material was lodged in his Museum before partition, after partition these collections were transferred to Frere Hall (Victoria Museum) Karachi. His collections comprises of corals of Indian Ocean, Persian Gulf and Arabian Sea. And his collections of corals include: Scleractinines (Hexacorallia-Hard Corals), and Pennatulaceans, Alcyonaceans & Gorgonaceans (Octocarallians-Soft Corals). The collection of corals which is present in the Zoological Museum of University of Karachi is the result of efforts of Prof. Dr. Afzal Hussain Qadri (founder of the Department of Zoology, University of Karachi) and Prof. Dr. Hamid Mehmood (Curator and Ex. Chairman of Department of Zoology, University of Karachi). This collection was transferred from Victoria Museum to Zoological Museum in 1952. The collections of corals (comprises of corals from the collection of James A. Murry, 1880 to up till now) which is present in the Zoological Museum, University of Karachi. But no faunistic studies were made on the said collection of corals. Similarly no studies were made on the corals present in the Geological Museum, University of Karachi. Some of the quantitative data on the corals and corals reef in Pakistan has been provided by earlier workers. According to the Alizai *et al.*, (1988) Coral reefs are absent in Pakistan. The coastal environment of Pakistan is not favorable for the formation of corals reefs (UNEP, 1986). In Red Data Book of IUCN (1996) under provision of UNCLOS, any coral species was never mentioned related to biodiversity Pakistan. Ahmed (1986) pointed out that corals do not flourish in Pakistan but a world map has given an encyclopedia indicating presence of corals. The sub aquatic coast of Makran has patches of corals in some areas and this coast is suitable for coral growth than Sindh coast (Qureshi, 1961). According to the (Ali & Memon, 1995) living corals have been seen by divers in the patch reefs on the rocky shore of Churna waters. The unblemished part of our sea is still the Balochistan Coast. The scientist of the Geological department of the University of Karachi visited the Churna Island for the collection of fossilized corals and some fossilized corals reported from the same area. This area is much more expanded and diversified for the corals (Kazmi & Kazmi, 1997). Astola Island is the only place in the whole coastal belt of Pakistan where such live corals are still thriving (Tourism Sector Analysis Report, 2008). It is a special moment in the history of Islamic Republic of Pakistan that recently Sindh Wildlife Department (SWD) has discovered vastly scattered coral reefs along the coastal belt of Baluchistan in 2009 ([www.dailytimes.com](http://www.dailytimes.com)). Amjad Ali, (2008) described 29 species of scleractinia 14 genera from Balochistan and Sindh coast. Siddiqui *et al.*, (2011) described two families and eight genera of fossilized corals from the jiwani, Balochistan (Makran) coast, Pakistan. Similarly a large number of workers have described the corals intensively throughout the world right from 1893 till to date like Linnaeus (1758), Palls (1766), Ellis & Solander (1786), Esper (1789;1797), Lamarck (1801;1815; 1816), Oken (1815), Ehrenberg (1828; 1834), Milne-Edwards & Haime (1848; 1849; 1851; 1857), Bernard (1896; 1897; 1900; 1903; 1905; 1906), Gray (1859; 1860; 1867; 1869; 1870), Verrill (1901a; 1902; 1864; 1866; 1868), Moseley

(1876; 1881), Klunzinger (1879), Thurston (1895), Gardiner (1904; 1905), Hocksema (1989; 1990; 1991; 1992; 1993ab), Wijsman-Best (1972; 1976a; 1974), Scheer and Pillai (1974; 1976; 1983), Pillai and Scheer (1973; 1974; 1976), Veron and Pichon (1976; 1980; 1982), Pichon (1976), Cairns (1977;1979;1982;1991; 1998; 1999; 2002), Faure (1977), Veron *et al.* (1977;1996), Bayer (1956; 1956; 1981). Scheer (1984;1985), Veron (1985; 1986; 1990;1992; 1993; 1994; 2000; 2001; 2005),Wallace and Willis (1984), Wallace (1999), Ofwegen & Chou (2000), Fabricius & Alderslade (2000; 2001), Kleemann (2001), Amjad Ali (2008), Siddiqui *et al.* (2011), Aileen *et al.* (2011).

This work provides the checklist of soft and hard corals Present in the Zoological and Geological Museum of University of Karachi.

## MATERIALS AND METHODS

The present study was under taken to A Taxonomic study of collections of scleractinian corals (Cnidaria; Anthozoa; Zoantharia), in the Zoological and Geological Museum of the Karachi University, Karachi. Some hard corals were collected with the help of fisherman from the coast of Balochistan, Pakistan. These corals also identified. The present research was aimed to identify the unidentified species from the collection of corals. The collections of corals were identified conformed and compared with the descriptive catalogue of corals and pertinent literature, keys. Photographs of family fungiidae and corals of coast of Balochistan, Pakistan is given in this checklist.

## RESULTS AND DISCUSSION

In the present study, thirteen families are belonging order scleractinia; Acroporidae, Agariciidae, Caryophylliidae, Dendrophylliidae, Faviidae, Fungiidae, Meandrinidae, Mussidae, Oculinidae, Pocilloporidae, Poritidae, Rhizangiidae, Siderastreidae and nine families Isididae, Plexauridae, Gorgoniidae, Coralliidae, Melithaeidae, Tubiporidae, Renillidae, Pennatulidae of octocorallia (soft corals) totally 54 species of 40 genera belong to 21 families have been identified.

Phylum Cniadaria Hatschek, 1888  
 Class Anthozoa Erhenberg, 1834  
 Subclass Octocorallia Haeckel, 1866  
 Order Alcyonacea Lamouroux, 1816  
 Suborder Calcaxonia (Grasshoff, 1999)  
 Family Isididae Lamouroux, 1812  
     Genus *Isis* Linnaeus, 1766  
         Species *Isis hippuris* (Linnaeus, 1766)  
 Order Gorgonacea Lamouroux, 1816 (Emend.Verrill, 1866)  
 Suborder Holaxonia Studer, 1887  
 Family Gorgoniidae Lamouroux, 1812  
     Genus *Gorgonia* Linnaeus, 1758  
         Species *Gorgonia flabellum* Linnaeus, 1758  
     Genus *Rumphella* Bayer, 1955  
         Species *Rumphella aggregata* (Nutting, 1910b)  
     Genus *Pterogorgia* Ehrenberg, 1834  
         Species *Pterogorgia citrine* (Esper, 1792)  
 Family Plexauridae Gray, 1859  
     Genus *Eunicea* Lamouroux, 1816  
         Species *Eunicea fusca* Duchassaing & Michelotti, 1860  
     Genus *Echinogorgia* Kolliker, 1865  
         Species *Echinogorgia flora* Nutting, 1910  
 Suborder Scleraxonia Studer, 1887  
 Family Corallidae Lamouroux, 1812  
     Genus *Corallium* Cuvier, 1798  
         Species *Corallium johnsoni* Gray, 1860



*Fungia fungites*



*Fungia horrida*



*Ctenactis echinata*



*Herpolitha limax*



*Polyphyllia talpina*



*Cycloseris cyclolites*



*Plesiastrea versipora*



*Favites flexusoa*

Fig.1. Some important corals deposited in Karachi University Museum, Zoology Department.

- Family Melithaeidae Gray, 1870  
Genus *Melithaea* Milne & Haime, 1857  
Species *Melithaea ochracea* (Linnaeus, 1758)
- Order Stolonifera Thomson & Simpson, 1909
- Family Tubiporidae Ehrenberg, 1828  
Genus *Tubipora* Linnaeus, 1758  
Species *Tubipora musica* Linnaeus, 1758
- Order Pennatulacea Verrill, 1865
- Family Renillidae Gray, 1860  
Genus *Renilla* Lamarck, 1816  
Species *Renilla reniformis* (Pallas, 1766)
- Family Pennatulidae Ehrenberg, 1834  
Genus *Ptilosarcus* Verrill, 1865  
Species *Ptilosarcus gurneyi* Gray, 1860
- Subclass Hexacorallia Haeckel, 1896
- Order Scleractinia Bourne, 1900
- Family Acroporidae Verrill, 1902  
Genus *Acropora* Oken, 1815  
Species *Acropora digitifera* (Dana, 1846)  
*Acropora hyacinthus* (Dana, 1846)  
*Acropora valida* (Dana, 1846)  
*Acropora glauca* (Brook, 1893)  
*Acropora cervicornis* (Lamarck, 1816)  
*Acropora Formosa* (Dana, 1846)
- Family Agaricidae Gray, 1847  
Genus *Agaricia* Lamarck 1801  
Species *Agaricia tenuifolia* Dana, 1848  
*Agaricia agaricites* (Linnaeus, 1758)
- Genus *Pavona* Lamarck, 1801  
Species *Pavona decussate* (Dana, 1846)
- Family Carolophyllidae Gray, 1846  
Genus *Eusmilia* Milne Edwards & Haime. 1848  
Species *Eusmilia fastigiata* (Pallas, 1766)
- Family Denderophyllidae Gray, 1847  
Genus *Turbinaria* Oken, 1815  
Species *Turbinaria mesenterina* (Lamarck, 1816)
- Family Faviidae Gregory, 1900  
Genus *Favia* Oken, 1815  
Species *Favia pallida* (Dana, 1846)
- Genus *Platygyra* Ehrenberg, 1834  
Species *Platygyra daedalea* (Ellis and Solander, 1786)  
*Platygyra lamellina* (Hemprich and Ehrenberg, 1834)
- Genus *Leptoria* Milne Edwards & Haime (1848)  
Species *Leptoria Phrygia* (Ellis & Solander, 1786)
- Genus *Echinopora* Lamarck, 1816  
Species *Echinopora lamilosa* (Esper, 1795)
- Genus *Caulastrea* Dana, 1848  
Species *Caulastrea tumida* Matthai, 1928
- Genus *Diploria* Milne-Edwards, 1848  
Species *Diploria labyrinthiformis* (Linnaeus, 1758)
- Genus *Plesiastrea* Milne Edwards and Haime, 1848  
Species *Plesiastrea versipora* (Lamarck, 1816)
- Genus *Favites* Link, 1807  
Species *Favites flexuosa* (Dana, 1846)  
*Favites halicora* (Ehrenberg, 1834)
- Family Fungiidae Dana, 1846

- Genus *Fungia* Lamarck, 1801  
 Species *Fungia fungites*(Linnaeus, 1758)  
*Fungia horrida* Dana, 1846
- Genus *Ctenactis* Verrill, 1864  
 Species *Ctenactis echinata*(Pallas, 1766)
- Genus *Herpolitha* Eschscholtz, 1825  
 Species *Herpolitha limax*(Esper, 1797)
- Genus *Polyphyllia* De Blainville, 1830  
 Species *Polyphyllia talpina*(Lamarck 1801)
- Genus *Cycloseris* Milne Edwards & Haime, 1849  
 Species *Cycloseris cyclolites* (Lamarck) 1816
- Family Meandrinidae Gray, 1847  
 Genus *Dichocoenia* Milne Edwards & Haime, 1848  
 Species *Dichocoenia stokesi* Milne- Edwards and Haime, 1848  
*Dichocoenia stellaris* Milne Edwards & Haime, 1848
- Genus *Dendrogyra* Ehrenberg, 1834  
 Species *Dendrogyra cylindricus* Ehrenberg, 1834
- Family Mussidae Ortmann, 1890  
 Genus *Isophyllia* Milne Edwards & Haime, 1851  
 Species *Isophyllia sinuosa* (Ellis & Solander, 1786)  
*Isophyllia multiflora* Verrill, 1902
- Family Oculinidae Gray, 1847  
 Genus *Galaxea* Oken, 1815  
 Species *Galaxea fascicularis* (Linnaeus, 1767)
- Genus *Madrepora* Linnaeus, 1758  
 Species *Madrepora oculata* Linnaeus, 1758
- Family Pocilloporidae Gray, 1842  
 Genus *Pocillopora* Lamarck 1816  
 Species *Pocillopora verrucosa*(Ellis and Solander, 1786)  
*Pocillopora capitata* Verill, 1864
- Genus *Palauastrea* Yabe and Sugiyama, 1941  
 Species *Palauastrea ramose* Yabe &Sugiyama, 1941
- Genus *Madracis* Edwards &Haime, 1849  
 Species *Madracis Formosa* Wells, 1973
- Family Poritidae Gray 1842  
 Genus *Porites* Link, 1807  
 Species *porites porites* ( Pallas, 1766)  
*Porites cylindrical* Dana, 1846
- Family Rhizangiidae d'Orbigyn, 1851  
 Genus *Astrangia* Milne Edwards & Haime, 1848  
 Species *Astrangia haimei* Verrill, 1866
- Family Siderastreidae Vaughan and Well, 1943  
 Genus *Siderastrae* de Blainville 1830  
 Species *Siderastrae siderea* (Palla, 1766)  
*Siderastrea radians* (Ellis & Solander, 1786)

## REFERENCE

- Ahmed, M. (1986). A country profile of marine environment, Pakistan.78 pp. Government of Pakistan, Env. & Urban Affairs Division, Islamabad.
- Aileen Tan Shau-Hwai, W. Abe, F. Hironobu, H. Kohei, Jr. F.P (2011). Training Manual on Corals Taxonomy in Southeast Asia. Published by the ASEAN Centre for Biodiversity in collection with Universiti Sains Malaysia, Biodiversity Center, Ministry of Enviroment- Japan Wildlife Research Center.
- Ali, A. (2008). *Distribution and diversity of corals and reef associated fauna inhabiting coastal waters of Pakistan*. M.Phil. thesis, Center of Excellence in Marine Biology, University of Karachi, Karachi Pakistan.

- Ali, S. Ikramuddin and G.D. Memon, (1995). *Geology of the Pakistan Coast and its influence on corals, oysters and mangroves*. In: The Arabian Sea-Living Marine Resources and the Environment (Eds. Thompson and Tirmizi):575-585.
- Alizai, S.A.K., J.Ali and M.I. Mirza (1988). Role of satellite remote sensing in monitoring sedimentation processes lagoons along the coast of Baluchistan, Pakistan. *Marine Science of the Arabian Sea* (Eds. Thompson and Tirmizi) 359-372.
- Assessment Survey, (2001). *Coral Reef Systems of the Andaman Islands*. Government of India, UNDP & GEF. United Nations Environment Programme/International Union for the Conservation of University, Goa. 1-47.
- Bayer, F. M. (1956). Octocorallia. Pp. F166-F230 in: R. C. Moore (ed.), *Treatise on Invertebrate Paleontology Part F: Coelenterata*. Geological Society of America and University of Kansas Press, Lawrence.
- Bayer, F.M. (1961). The shallow water Octocorallia of the West Indian Region. *A manual for marine biologists. Studies on the Fauna of Curaçao and other Caribbean Islands* 12:1-373.
- Bayer, F.M. (1981) Key to the genera of Octocorallia exclusive of Pennatulacea (Coelenterata: Anthozoa) with diagnoses of new taxa. *Proceedings of the Biological Society of Washington*, 94, 902-947.
- Bayer, F.M. (1981). *Status of Knowledge of Octocorals of World Seas*. Seminários de Biologia Marinha, Academia Brasileira de Ciências, Rio de Janeiro 1-102 pp.
- Bernard, H.M. (1896). The genus *Turbinaria*. The genus *Astraeopora*. *Catalogue of Madreporarian Corals Brit. Mus. (Natur. Hist.)*
- Bernard, H.M. (1897). The genus *Montipora*. The genus *Anacropora*. *Catalogue of Madreporarian Corals Brit. Mus. (Natur. Hist.)* Ibid 3:1-192.
- Bernard, H.M. (1900). Marine fauna of Christmas Is. (Indian Ocean). *Proc. Zool. Soc. London* 1: 115-141.
- Bernard, H.M. (1903). The family Poritidae, I, The genus *Goniopora*. L. *Brit. Mus. (Natur. Hist.)*, (*Catalogue Madr. Coral*) 4:206.
- Bernard, H.M. (1905). The family Poritidae, II, The genus *Porites*. Pt 1. *Porites* of the Indo-Pacific region. *Brit. Mus. (Natur. Hist.)*, (*Catalogue Madr. Corals*) 5:303.
- Bernard, H.M. (1906). The family Poritidae, II, The genus *Porites*. L. *Brit. Mus. (Natur. Hist.)*, (*Catalogue Madr. Corals*) 6:173.
- Cairns, S. D. and H. Zibrowius. (1997). Cnidaria, Anthozoa: Azooxanthellate Scleractinia from the Philippine and Indonesian regions. *Mémoires du Muséum d'Histoire Naturelle*, 172: 27-243.
- Cairns, S.D. (1979). The Deep-Water Scleractinia of the Caribbean Sea and Adjacent Waters. *Studies on the Fauna of Curacao and Other Caribbean Islands*, 180: 341 pages, 40 plates.
- Cairns, S.D. (1982). Antarctic and Subantarctic Scleractinia. *Antarctic Research Series*, 34(1): 74 pages, 18 plates.
- Cairns, S.D. (1984). New Records of Ahermatypic Corals (Scleractinia) from the Hawaiian and Line Islands. *Occasional Papers of the Bernice Pauahi Bishop Museum*. 25(10): 30 pages. 5 plates.
- Cairns, S.D. (1989a). A Revision of the Ahermatypic Scleractinia of the Philippine Islands and Adjacent Waters. Part 1: Fungiacyathidae, Micrabaciidae, Turbinoliinae, and Flabellidae. *Smithsonian Contributions to Zoology*, 486: 136 pages, 3 figures, 42 plates.
- Cairns, SD (1982) Antarctic and Subantarctic Scleractinia. *Antarct Res Ser* 34(1): 74 pp.
- Cairns, SD (1991) A revision of the ahermatypic Scleractinia of the Galapagos and Cocos Islands. *Smithson Contrib Zool* 504: 32 pp.
- Cairns, SD (1998) Azooxanthellate Scleractinia (Cnidaria: Anthozoa) of Western Australia. *Rec West Australian Mus* 18: 361-417.
- Cairns, SD (1999) Cnidaria Anthozoa; deep-water azooxanthellate Scleractinia from Vanuatu, and Wallis and Futuna Islands. *M&M Mus natn Hist nat* 180: 3 1-167.
- Cairns, SD, Parker, SA. (1992) Review of the Recent Scleractinia of South Australia, Victoria, and Tasmania. *Rec S Austr Mus, Monogr Ser* 3: 82 pp.
- Cairns, Stephen D. (1977). Review of the deep-water ahermatypic corals (Scleractinia) of the tropical western Atlantic. *Dissertation Abstracts International*, 37(7): 3292.
- Cairns, Stephen D. (1982). Stony corals (Cnidaria: Hydrozoa, Scleractinia) of Carrie Bow Cay, Belize. *Smithsonian Contributions to the Marine Sciences*, 12: 272-302. doi:10.5479/si.01960768.12.272.
- Ehrenberg C (1828) In Hemprich F, Ehrenberg C (eds) *Symbolae physicae, seu icones et descriptiones corporum naturalium novorum aut minus cognitorum quae ex itineribus per Libyam, Aegyptium, Nubiam, Dongalam, Syriam, Arabiam et Habessiniam, pars zoologica II, animalia evertebrata exclusis insectis*. Officina Academica, Berolina.
- Ehrenberg, C. G. (1834). *Die Corallenthiere des rothen Meeres, physiologisch untersucht und systematisch verzeichnet*. Berlin. 158 pp.

- Ehrenberg, C.G. (1834). Beitrage zur physiologlschen Kenntniss der Corallenthiere im Allgemeinen und besonders des Rothen Meere. Abh. Akad. Wiss. Berlin for 1832.: 250-380.
- Ehrenberg, C.G. (1834). Die Corallenthiere des Rothen Meers. Kgl. Akad. Wiss. Berlin, 156 pp. Ergeb. der Deutsch. Tiefsee-Exp. "Valdivia", 13(1): 113-576.
- Ehrenberg, Christian Gottfried (1834). Beitrage zur physiologisehen Kenntniss der Corallenthiere im Allgemeinen, und besonders des rothen Meeres, nebst einem Versuche zur physiologisehen Systematik derselben. Abhandl. konigl. [preussischen] Akad. Wiss. Berlin (1832), Theil 1, pp. 225-380.
- Ellis, J., and D. Solander (1786). The Natural History of Many Curious and Uncommon Zoophytes, Collected. by the late John Ellis, Syslema ically Arranged and Described by the LaU Daniel Solander. xii + 208 pages, 63 plates. London.
- Esper, E. J. C. (1789-1797). Die Pflanzenthiere 1(1791), Fortsetzungen, 1(1795). Nurnberg.
- Fabricius, K. & P. Alderslade. (2000). Soft Corals and Sea Fans: A Comprehensive Guide to the Tropical Shallow Water Genera of the Central-West Pacific, the Indian Ocean and the Red Sea. Australian Institute of Marine Sciences, Townsville, Australia. 264 p.
- Fabricius, K., Alderslade, P., 2001. Soft Corals and Sea Fans: A Comprehensive Guide to the Tropical Shallow-Water Genera of the Central- West PaciWc, the Indian Ocean and the Red Sea. Australian Institute of Marine Science, Townsville.
- Faure, G. (1977) Annotated check list of Octocorallia in the Mascarene Archipelago, Indian Ocean. Atoll Research Bulletin 204, 1–13.
- Faure, G. (1977). Distribution of coral communities on reef slopes in the Mascarene Archipelago, Indian Ocean. Mar. Res. Indonesia 17:73-97.for marine biologists. Martinus Nijhoff, The Hague, 400 pp.
- Gardiner, J. S. (1904-1905). Madreporaria. 1. Introduction. 2. Astreaeidae. 2.Fugiidae. 4 Turbinolidae.Fauna and geography of the Maldives and Laccadives Archipelagoes. Cambridge 2:756-764, 933- 957.
- Gray J (1859) On the arrangement of zoophytes with pinnated tentacles. Ann Mag Nat Hist 3:439-444
- Gray JE (1842) Northern Zoological Gallery. Room II.III, Radiated animals. In: Synopsis of the contents of the British Museum, 44th Edition, London. pp 128-135
- Gray, J. F. (1860). Revision of the family Pennatulidae, with some descriptions of some new species in the British Museum. Annals and Magazine of Natural History ser. 3, 5:20-25.
- Gray, J. F. (1870). Catalogue of sea-pens or Pen.natulariidae in the collection of the British Museum. London, 40 p.
- Gray, J.E. (1859) On the arrangement of zoophytes with pinnated tentacles. Annals and Magazine of Natural History, 4, 439– 444.
- Gray, J.E. 1847. An outline of an arrangement of stony corals. *Ann. Mag. Nat. Hist.* 19:120-128.
- Gray, J.E. 1849. Description of Some Corals, Including a New British Coral Discovered by W. MacAndrew, Esq. Proceedings of the Zoological Society of London, 17:74-77, plate 2.
- Gray, John Edward (1869). Notes on the fleshy alcyonoid corals {Alcyonium, Linn., or Zoophyaria carnosia). *Ann. Mag. Nat. Hist.*, ser. 4, vol. 3, pp. 117-131.
- Gray. (1860). Description of a new coral (*Corallium Johnsonia*) from Madeire. Proceedings of the Zoological Society of London.
- Gray. (1867). Additional nots on *corallium Johnsonia*—proceedings of the zoological Society of London.
- Hoeksema B. W. (1991). Control of bleaching in mushroom coral populations (Scleractinia: Fungiidae) in the Java Sea: stress tolerance and interference by life history strategy. *Marine Ecology Progress Series* 74:225-237.
- Hoeksema B. W. (1993a). Mushroom corals (Scleractinia: Fungiidae) of Madang Lagoon, northern Papua New Guinea: an annotated checklist with the description of *Cantharellus jebbi* spec. nov. *Zoologische Mededelingen, Leiden* 67: 1-19.
- Hoeksema B. W. (1993b). Historical biogeography of *Fungia (Pleuractis)* spp. (Scleractinia: Fungiidae), including a new species from the Seychelles. *Zoologische Mededelingen Leiden* 67: 639-654.
- Hoeksema, B. W., (1989). Taxonomy, Phylogeny and Biogeography of mushroom corals (Scleractinia: Fungiidae). *Zoologische Verhandelingen, Leiden*, 254:1-295.
- Hoeksema, B., Dai, C-F. (1992). Scleractinian of Taiwan. II. Family Fungiidae (including a new species). *Bull. Zool. Academia Sinica*, 30: 201-226.
- Hoeksema, B.W. & C F. Dai. (1991). Scleractinia of Taiwan II. Family Fungiidae (including a new species). *Bull. Inst. Zool. Academia Sinica* 30:203-228.
- Hoeksema, B.W.,(1990). Systematic and ecology of mushroom corals (Scleractinia; Fungiidae). Phd Thesis, University of Leiden.
- Kazmi Q. B. & Kazmi, M. A. (1997), ‘Status of Research on Corals in Pakistan’, in Proceedings of the Regional Workshop on the Conservation and Sustainable Management of Coral Reefs, V. Hoon,Proceedings No. 22, CRSARD, Madras.

- Kleemann, K. (2001). Tropical Marine Biology II, Classification of Scleractinian (Stony) Corals). Revised 2002 and 2009. University of Vienna.
- Klunzinger, C.B. (1879). Die Korallenthiere des Rothen Meeres. B.: Gutmann, 2:88; 3:100.
- Lamarck, J.B.P.A. de M. (1801). Systeme des animaux sans vertebres: Deterville.
- Lamarck, J.B.P.A. de M. (1815-1816). Histoire naturelle des animaux sans vertebres: Verdier, 2:568.
- Linnaeus, C.(1758). Systema naturae (ed. 10). Holmiae: Laurentii Salvii, Vol. 1.
- Milne Edwards, H. and Haime, J. (1849) Mémoire sur les polypiers appartenant à la famille des Oculinides, au groupe intermédiaire des Pseudoastréides. et à la famille des Fongides. C. R. Seanc. Acad. Paris 29: 67-73.
- Milne Edwards, H. and Haime, J. (1857). Histoire naturelle des coralliaires, 1, viii + 326 pp; 2, 633 pp. Paris: Roret.
- Milne Edwards, H., and J. Haime (1848). Recherches sur les polypiers, memoire 4: Monographic des Astreides. Annales des Sciences Naturelles, series 3, 0:209-320, plates 5-9.
- Milne Edwards, H., and J. Haime (1848b). Recherches sur les Polypiers, troisieme memoire: Monographic des Eupsammides. Annales des Sciences Naturelles, Zoologie, series 3, 10:65-114. 1 plate.
- Milne Edwards, H., and J. Haime (1851). Recherches sur les polypiers, memoire 6: Monographic des Fongides. Annales des Sciences Naturelles, series 3, 15:73-144.
- Milne Edwards, H., and J. Haime (1857). Classification et Description des Zoanthaires Scleroderme's de la section des Madriporaires Apores. Histoire Naturelle des Coralliaires ou Polypes proprement dits, 2: 633 pages. Paris: Roret.
- Moseley HN (1876) Preliminary report to Professor Wyville Thomson, F.R.S., director of the civilian scientific staff, on the true corals dredged by H.M.S. 'Challenger' in deep water between the dates Dec. 30th, 1870, and August 31st, 1875. Proc R Soc Lond 24:544-569.
- Moseley HN (1881) Report on certain hydroid, alcyonarian, and madreporarian corals procured during the voyage of H.M.S. Challenger during the years 1873-76. Part III. On deep-sea Madreporaria. In: Thomson CW, Murray J (eds) Report on the scientific results of the voyage of H.M.S. Challenger during the years 1873-76. Zoology, Vol 2, Part 1, p 127-208, 238-248.
- Ofwegen, L.P., Van, Goh, N.K.C., Chou, L.M. (2000). The Melithaeidae of Singapore. Zool. Med.Lediden. 73: 285-304.
- Oken, L. (1815). Lehrbuch der Naturgeschichte. HI. Zoologie. Leipzig; Jena 1:59-74.
- Pallas, P.S. (1766). Elenchus Zoophytorum. Hagae-Comitum: Varrentrapp F. 451 p.
- Pallas, Peter Simon, (1766). Elenchus zoophytorum sistens generum adumbrationes generaliores et specierum cognitarum succinctas descriptiones cum selectis auctorum synonymis. Pp. xvj + 28 + 451. Hagae Comitum.
- Pichon, M. (1964). Contribution a l'etude de la repartition des Madreporaires le rific de Tulfeur, Madagascar. Rec. Trav. Stn. Mar. Endoume-Mars. Fasc. hors. ser. suppl. 2:78-203.
- Pillai, C. S. G., and G.Scheer. (1974). On a collection of Scleractinia from the Strait of Malacca. Proc. II Intern. Coral Reef Symp. Brisbane 1:445-464.
- Pillai, C. S. G., and G.Scheer. (1973). Bericht uber eine Korallemsammlung von den Seychellen: (Notes on a collection of corals from the Seychelles). Zool. Jb. Abt. Syst. 100:457-465.
- Pillai, C. S. G., and G.Scheer. (1976). Report on the stony corals from the Maldive Archipelago. Results of the Xarifa Expedition 1957/58. Zoologica 43(126):1-83.
- Pirzada J.A. Siddiqui, Amjad Ali, Kate Bromfield, Pervaiz Iqbal and Nafisa Shoaib, (2011). Identification of Fossil Corals Inhabiting an Uplifted Area of Ras Gunz Near Jiwani, Balochistan, Pakistan. Center of Excellence in Marine Biology, University of Karachi, Karachi 75270, Pakistan and ARC Centre of Excellence in Ore Deposits, School of Earth Sciences, University of Tasmania, Private Bag 126, Hobart, Tasmania 7001. Australia. Pakistan J. Zool., vol. 43(3), pp. 523-527.
- Qureshi, M.R. 1961. Pakistan's Fisheries. Central Fisheries Dept., Karachi. 70 pp.
- Scheer, G. (1984). The distribution of reef corals in the Indian Ocean with a historical review of its investigation. Deep Sea Res. A, 31:885-900.
- Scheer, G. 1985. The distribution of coral reefs in Indian Ocean with a historical review of its investigation. Deep Sea Research, Part A, 31: 885-900.
- Scheer, G., and C.S.G. Pillai. (1974) Reports on the Scleractinia from the Nicobar Islands, Zoologica Stuttgart, 122: 1-72 pls. 1-33
- Scheer, G., and C.S.G. Pillai. 1974. Report on the Scleractinia from the Nicobar Islands. Zoologica 42:1-75.
- Scheer, G., and C.S.G. Pillai. 1983. Report on the stony corals from the Red Sea. Ibid. 133:1-198. sea pens (Coelenterata: Octocorallia) of the world 1469-1999. Proc. Calif. Acad. Sci. 51: 19-103.
- Thurston, E. (1895). Rameswaram Island and the fauna of Gulf of Mannar. Bull. Madras Govt. Mus. (IInd Ed.), pp. 108-112.
- Tourism Sector Analysis Report. (2008). Balochistan Coastal Zone. Turn Potential into Profit. Small & Medium Enterprise Development Authority. Government of Pakistan 15-A, Chaman Housing Scheme, Airport Road, Quetta.



- UNEP, (1986). Environmental problems of the marine and coastal area of Pakistan: National Report. UNEP Regional Seas Reports and Studies 77: 1-55.
- Veron, J. E. N. & M. Pichon, (1976). Scleractinia of Eastern Australia. Part I: Families Thamnasteriidae, Astrocoeniidae, Pocilloporidae. Australian Institute of Marine Science Australian Government Publishing Service, Australia. 208 pp.
- Veron, J. E. N. & M. Pichon, (1980). Scleractinia of Eastern Australia. Part III: Families Agariciidae, Siderastreidae, Fungiidae, Oculinidae, Merulinidae, Mussidae, Pectiniidae, Caryophylliidae, Dendrophylliidae. Australian Institute of Marine Science and Australian National University Press, Australia. 471 pp.
- Veron, J. E. N. & M. Pichon, 1982. Scleractinia of Eastern Australia. Part IV: Family Poritidae. Australian Institute of Marine Science and Australian National University Press, Australia. 210 pp.
- Veron, J. E. N. (1985). Aspects of the biogeography of hermatypic corals. proc. Fifth Int. Coral Reef Cong., Tahiti 4: 83-88.
- Veron, J. E. N., & Wallace C. C. (1984). Scleractinia of Eastern Australia. Part V. Family Acroporidae. 503 p.
- Veron, J. E. N., M. Pichon & M. Wijsman-Best, (1977). Scleractinia of eastern Australia. Australian Institute of Marine Science Monograph Series Vol. 3. part II:1-233, 469 figs.
- Veron, J. E. N., M. Pichon & M. Wijsman-Best, (1977). Scleractinia of Eastern Australia. Part II: Families Faviidae, Trachyphlliidae. Australian Government Publishing Service, Australia. 231 pp.
- Veron, J.E.N. (1986). Corals of Australia and The Indo-Pacific. Angus & Robertson Publ., London, UK and North Ryde, Australia. 644 pp.
- Veron, J.E.N. (1990). Corals of the world. Volume 1-3. Australian Institute of Marine Science and CRR Qld. Pty. Ltd. Australia.
- Veron, J.E.N. (1990). Corals of the world. Volume 1-3. Australian Institute of Marine Science and CRR Qld. Pty. Ltd. Australia.
- Veron, J.E.N. (1993) Part 2. Hermatypic corals of Ashmore Reef and Cartier Island. In Berry, P.F. (ed.) Marine Faunal Surveys of Ashmore Reef and Cartier Island, north-western Australia. Records of the Western Australian Museum Supplement No. 44: 13-20.
- Veron, J.E.N. (1995). Corals in space and time: the biogeography and evolution of the Scleractinia. USNW press, Sydney. xiii + 321 p.
- Veron, J.E.N. (2000). Corals of the World, Vol. 1-3. (2000). Australian Institute of Marine Science and CRR Qld Pty Ltd., Australia.
- Veron, J.E.N. and L.M. Marsh (1988) Hermatypic corals of Western Australia. Records and annotated species list. Records of the Western Australian Museum Supplement No. 29: 1-136.
- Verrill, A. E. (1865). Synopsis of the polyps and corals of the North Pacific exploring expedition, under Commodore C. Ringgold and Captain John Rogers, U. S. N., from 1853 to 1856, etc. Proceedings of the Essex Institute 4 (2, 3):181-196.
- Verrill, A. E. (1900). Additions to the Anthozoa and Hydrozoa of the Bermudas. Transactions of the Connecticut Academy of Arts and Sciences, 10:551-572, plates 67-69.
- Verrill, A. E. (1901a). Variations and Nomenclature of Bermudian, West Indian, and Brazilian Reef Corals with Notes on Various Indo-Pacific Corals. Transactions of the Connecticut Academy of Arts and Sciences, 11:63-168, plates 10-35.
- Verrill, A. E. (1902). Notes on corals of the genus *Acropora* (*Madrepora* Lam.) with new descriptions and figures of types, and of several new species. Trans. Conn. Acad. Arts. Sci. 11:207-266.
- Verrill, A.E. (1864). List of the polyps and corals sent by the Museum of Comparative Zoology to other institutions in exchange, with annotations. Bull. Mus. Comp. Zool. 1:29-60.
- Verrill, A.E. (1866). On the Polyps and Corals of Panama, with Descriptions of New Species. Proceedings of the Boston Society of Natural History, 10:323-333.
- Verrill, A.E. (1868) Critical remarks on the halcyonoid polyps in the Museum of Yale College, with descriptions of new genera. The American Journal of Science and Arts, 45, 411-415.
- Wallace, C. C. (1999). Staghorn corals of the world: a revision of the genus *Acropora*. Australia: CSIRO.
- Wallace, C. C., Willis, BL (1994) Systematics of the coral genus *Acropora*; implications of new biological findings for species concepts. Annu Rev Ecol Syst 25:237-262.
- Wijsman-Best, M. (1972). Systematics and ecology of New Caledonia Faviinae (Colenterata, Scleractinia). Bijdr. Dierkd. 42(1):1-76.
- Wijsman-Best, M. (1974). Faviidae collected by the Snellius Exped. 1. Zool. Meded. \ Rijksmus. Natur. Hist. Leiden 48(22):249-261.
- Wijsman-Best, M. (1976). Faviidae collected by the Snellius Exped. 2. Ibid. 50(4):45- 63.

(Accepted for publication March 2013)