

Status of knowledge of the Indo-Pacific soft coral genus *Sinularia* May, 1898 (Anthozoa: Octocorallia)

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ABSTRACT

The distribution of the octocoral genus *Sinularia* has been examined using the latest revision of the genus and all subsequent publications.

Keywords *Sinularia*, Octocorallia, Anthozoa, Distribution.

Introduction

The Indo-Pacific genus *Sinularia*, with 128 nominal species, is the largest zooxanthellate shallow-water soft coral genus. Its species show highly variable growth forms, from encrusting with small knobs or ridges to tall and abundantly lobed. They occur in shallow water of less than 1 m down to 35 m and are represented at various reef habitats. Colonies can be a few cm to several meters in diameter. Some species may even dominate vast regions of the reef. However, much research has to be done before most species are well known. Nevertheless, thanks to the latest revision of the genus (Verseveldt 1980), specimens of *Sinularia* can be identified with reasonable certainty.

Methods

In order to examine species diversity patterns for *Sinularia* in the Indo-Pacific, species numbers of 30 areas were counted using Verseveldt's (1980) revision. Additionally, all subsequent publications dealing with taxonomy were checked. All together, 27 papers were found (Li 1982, Verseveldt and Alderslade 1982, Verseveldt 1983, Verseveldt and Benayahu 1983, Alderslade 1987, Alderslade and Baxter 1987, Chang et al. 1988, Humes 1990, Malyutin 1990, 1992, Alderslade and Shirwaiker 1991, Imahara 1991, 1997, Ofwegen and Vennam 1991, 1994, Ofwegen and Benayahu 1992, Benayahu 1993, 1995, 1997, Ofwegen and Slierings 1994, Vennam and Parulekar 1994, Ofwegen 1996, Benayahu and Schleyer 1996, Jayasree et al. Parulekar 1996, Vennam and Ofwegen 1996, Jayasree and Parulekar 1997, Benayahu et al. 1998). Because Verseveldt did not include all of his own publications in his revision dealing with *Sinularia*, ten additional relevant previous papers of Verseveldt had to be included as well (Verseveldt 1971, 1972, 1974a, 1974b, 1976, 1977a, 1977b, 1977c, 1978, Verseveldt and Benayahu 1978).

The result of this count is presented in Table 1 and Fig. 1 and should be considered a first attempt to sort out the distribution of *Sinularia* species. Some species descriptions are of such a poor quality that their recognition is hardly possible (i.e. Li 1982). Many more species await description and several of the presently recognised species probably will be synonymised after

more material has been examined.

For comparison, the designated regions used by Hoeksema (1989) for the distribution of mushroom corals (Scleractinia: Fungiidae) have been adopted for the *Sinularia* distribution. That study showed a concentration of species in the Indo-Malayan region, including New Guinea, around the centre of which the diversity decreases in both longitudinal and latitudinal directions.

Results

Since Verseveldt's revision, 35 new species have been described. The four most widespread *Sinularia* species proved to be *S. leptoclados* (18 areas), *S. polydactyla* (17 areas), *S. brassica* (16 areas), and *S. flexibilis* (12 areas); all of which were already described in the 19th century. It is remarkable that of these apparently common species, with regard to the Indian Ocean, the easily recognisable *S. flexibilis* was only reported from the Andamans (Jayasree et al. 1996).

So far, only eight species have been recorded in ten or more areas. Of the 128 nominal species, no less than 49 were each found in a single area only. Of these 49 species, 13 were described from the Red Sea area only. From four regions no *Sinularia* species have been recorded, i.e., Galapagos + Cocos Islands, Mexico, Easter island, and the Persian Gulf. The easternmost record for the distribution of the genus is the Tuamotu Archipelago + Marquesas area. The Persian Gulf clearly needs more research with regard to its octocoral fauna as it would be expected that the genus occurs in that region.

The distribution of *Sinularia* is somewhat similar to that of other tropical shallow-water animals in the Indo-Pacific, showing a decrease of species number towards America, Japan and Australia (Fig. 1), but the highest number of recorded species is not found in the central Indo-Pacific. Instead, most records are for the Red Sea and the Seychelles-Mauritius Plateau (both 38 species), and eastern Africa (33 species), although the Indonesian Archipelago (28 species) and New Guinea (32 species) score rather well. The Philippines, on the other hand, with only seven species, seems to be depauperate, but it is obvious that very few papers about Philippine octocorals have been published relative to those for the Red Sea and the Seychelles. It seems, therefore, that the known distribution of *Sinularia* is highly biased by the amount of research performed in each area. The Great Barrier Reef, for example, is very rich in *Sinularia* species (Alderslade, pers. com.), but the data is yet to be published.

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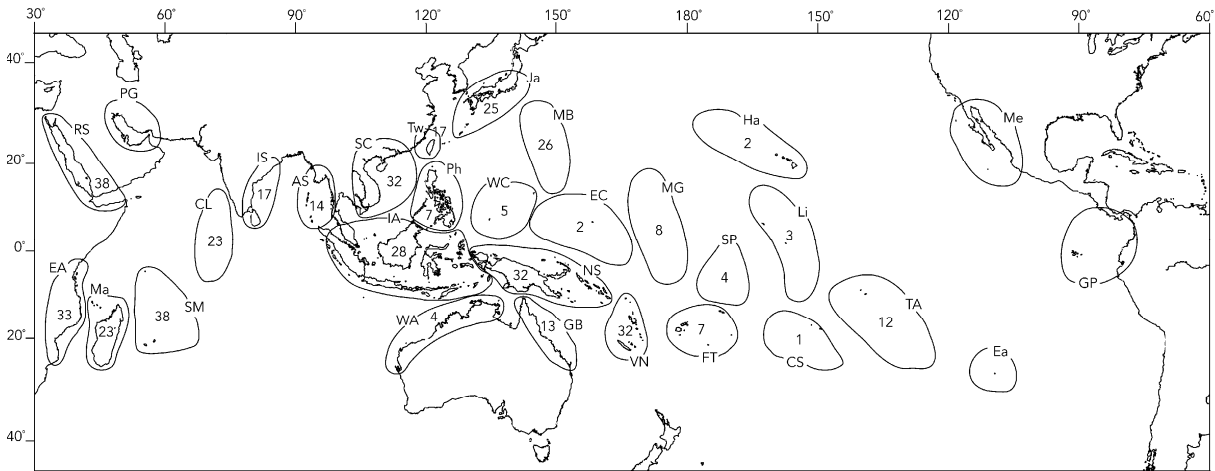


Fig. 1. Areas in the Indo-Pacific and their number of recorded species of *Sinularia*: AS = Andaman Sea; CL = Chagos-Laccadive Plateau; CS = Cook Is. + Society Is.; EA = Eastern Africa; Ea = Easter I.; EC = East Carolines; FT = Fiji + Tonga Is.; GB = Great Barrier Reef; GP = Galapagos + Cocos Is. + Gulf of Panama; Ha = Hawaii Is.; IA = Indonesian Arch.; IS = SE India + Sri Lanka; Ja = Japan; Li = Line Is.; Ma = Madagascar; MB = Marianas + Bonin Is.; Me = Mexico; MG = Marshall + Gilbert Is.; NS = New Guinea + Solomon Is.; PG = Persian Gulf; Ph = Philippines; RS = Red Sea; SC = South China Sea; SM = Seychelles- Mauritius Plateau; SP = Samoa + Phoenix Is.; TA = Tuamotu Arch. + Marquesas; Tw = Taiwan; VN = Vanuatu + New Caledonia; WA = Western Australia; WC = West Carolines (after Hoeksema, 1989).

Conclusions and further study

The presently known distribution of the *Sinularia* does not match the known distribution of other groups of tropical shallow-water animals. Especially, the central Indo-Pacific, Western Australia, and the Great Barrier Reef deserve more research. In order to test the influence of the amount of research performed in a certain area, the number of specimens examined per publication could be counted. Unfortunately, this is not always possible as sometimes only species lists are given without mentioning the material examined. Therefore, in the future, reports planned on recently collected material from the, Seychelles, Indonesia and Philippines will have the number of species per area related to the total number of specimens examined. All this material has been collected using similar collecting methods, facilitating comparison.

References

Alderslade P (1987) A new species of *Sinularia* (Coelenterata: Octocorallia) from western Australia, with extraordinary massive sclerites. *The Beagle* 4: 85-94.

Alderslade P, Baxter J (1987) A new species of *Sinularia* (Coelenterata: Octocorallia) from Western Australia. *Rec West Aust Mus* 13: 203-214.

Alderslade P, Shirwaiker P (1991) New species of soft corals (Coelenterata: Octocorallia) from the Laccadive Archipelago. *The Beagle* 8: 189-233.

Benayahu Y (1993) Corals of the south-west Indian ocean. I. Alcyonacea from Sodwana Bay, South Africa. *Invest Rep Oceanogr Res Inst* 67: 1-16.

Benayahu Y (1995) Species composition of soft corals (Octocorallia, Alcyonacea) on the coral reefs of Sesoko Island, Ryukyu Archipelago, Japan. *Galaxea* 12: 103-124, pl 1.

Benayahu Y (1997) A review of three alcyonacean families (Octocorallia) from Guam. *Micronesica* 30: 207-244, pls 1-3.

Benayahu Y, Schleyer MH (1996) Corals of the South-west Indian Ocean III. Alcyonacea (Octocorallia) of Bazaruto Island, Mozambique, with a redescription of *Cladiella australis* (Macfadyen, 1936) and a description of *Cladiella kashmani* spec. nov. *Invest Rep Oceanogr Res Inst* 69: 1-22.

Benayahu Y, Ofwegen LP van, Alderslade P (1998) A case study of variation in two nominal species of *Sinularia* (Coelenterata: Octocorallia), *S. brassica* May, 1898, and *S. dura* (Pratt 1903), with a proposal for their synonymy. *Zool Verh Leiden* 323: 277-309.

Chang KH, Dai CF, Seng MS (1988) Studies on soft corals of the Kenting National Park. *Conserv. Res. Rep.* 53, Kenting National Park Headquarters, pp 44.

Hoeksema BW (1989) Taxonomy, phylogeny and biogeography of mushroom corals (Scleractinia: Fungiidae). *Zool Verh Leiden* 254: 1-295.

Humes AG (1990) Synopsis of lichomolgid copepods (Poecilostomatoidae) associated with soft corals (Alcyonacea) in the tropical Indo-Pacific. *Zool Verh Leiden* 266: 1-201.

Imahara Y (1991) Report on the Octocorallia from the Ryukyu Islands of Japan. *Bull Inst Oceanic Res Develop Tokai Univ* 11/12: 59-94.

Imahara Y (1997) Alcyonacean Fauna of the Ashizuri-Uwakai Region. *Marine Parks Journal* 114: 7-12.

Jayasree V, Bhat KL, Parulekar AH (1996) Occurrence and distribution of soft corals (Octocorallia: Alcyonacea) from the Andaman and Nicobar islands. *J Bombay Nat Hist Soc* 93: 202-209.

Jayasree V, Parulekar AH (1997) The ecology and distribution of alcyonaceans of Mandapam (Palk Bay, Gulf of Mannar), South India. *J Bombay Nat Hist Soc*

- 94: 521-524.
- Li CP (1982) Studies on the Alcyonacea of the south China Sea I. Alcyonacea from Yalong bay. *Tropic Oceanology* 1: 156-169, pls 1-6.
- Malyutin AN (1990) Two new species of *Sinularia* (Octocorallia: Alcyonacea) from South Vietnam. *Asian Marine Biology* 7: 9-14, pls 1-2.
- Malyutin AN (1992) Octocorallia from the Seychelles Islands with some ecological observations. *Atoll Res Bull* 367: 1-4.
- Ofwegen LP van (1996) Octocorallia from the Bismarck Sea (part II). *Zool Meded Leiden* 70: 207-215.
- Ofwegen LP van, Benayahu Y (1992) Notes on Alcyonacea (Octocorallia) from Tanzania. *Zool Meded Leiden* 66: 139-154.
- Ofwegen LP van, Slierings M (1994) Octocorallia. In: Land, J. van der (ed.) *Oceanic reefs of the Seychelles*. National Museum of Natural History, Leiden : 93-95.
- Ofwegen LP van, Vennam J (1991) Notes on Octocorallia from the Laccadives (SW India). *Zool Meded Leiden* 65: 143-154.
- Ofwegen LP van, Vennam J (1994) Results of the Rumphius Biohistorical Expedition to Ambon (1990). Part 3. The Alcyoniidae (Octocorallia: Alcyonacea). *Zool Meded Leiden* 68: 135-158.
- Vennam J, Ofwegen LP van (1996) Soft corals (Coelenterata: Octocorallia: Alcyonacea) from the Laccadives (SW India), with a re-examination of *Sinularia gravis* Tixier-Durivault, 1970. *Zool Meded Leiden* 70: 437-452.
- Vennam J, Parulekar AH (1994) *Sinularia mauritiana*, a new species of soft coral (Coelenterata: Octocorallia) from Mauritius, Indian Ocean. *Zool Meded Leiden* 48: 95-122.
- Verseveldt J (1971) Octocorallia from north-western Madagascar (Part II). *Zool Verh Leiden* 117: 1-73, pls 1-15.
- Verseveldt J (1972) Report on a few Octocorals from Eniwetok Atoll, Marshall Islands. *Zool Meded Leiden* 47: 457-464.
- Verseveldt J (1974a) Octocorallia from New Caledonia. *Zool Meded Leiden* 48: 95-122, pls 1-5.
- Verseveldt J (1974b) Alcyonacea (Octocorallia) from the Red Sea, with a discussion of a new *Sinularia* species from Ceylon. *Isr J Zool* 23: 1-37, pls 1-10.
- Verseveldt J (1976) Alcyonacea from the Seychelles (Coelenterata: Alcyonacea). *Rev Zool Afr Bruxelles* 90: 497-513, pl 1.
- Verseveldt J (1977a) Octocorallia from various localities in the Pacific Ocean. *Zool Verh Leiden* 150: 1-42, pls 1-10.
- Verseveldt J (1977b) On two *Sinularia* species (Octocorallia: Alcyonacea) from the Moluccas. *Zool Meded Leiden* 50: 303-307, pls 1-2.
- Verseveldt J (1977c) Australian Octocorallia (Coelenterata). *Aust J Mar Freshw Res* 28: 171-240.
- Verseveldt J (1978) Alcyonaceans (Coelenterata: Octocorallia) from some Micronesian Islands. *Zool Meded Leiden* 53: 49-55, pls 1-3.
- Verseveldt J (1980) A revision of the genus *Sinularia* May, (Octocorallia, Alcyonacea). *Zool Verh Leiden* 179: 1-128.
- Verseveldt J (1983) *Sinularia molokaiensis* a new species of Alcyoniidae (Octocorallia: Alcyonacea) from Hawaiian waters. *Occ Pap Bernice P Bishop Mus.* 25 (8): 1-4.
- Verseveldt J, Alderslade P (1982) Description of types and other Alcyonacean material (Coelenterata: Octocorallia) in the Australian Museum, Sydney. *Rec Aust Mus* 34: 619-647, pls 1-8.
- Verseveldt J, Benayahu Y (1978) Descriptions of one old and five new species of Alcyonacea (Coelenterata: Octocorallia) from the Red Sea. *Zool Meded Leiden* 53: 57-74, pls 1-5.
- Verseveldt J, Benayahu Y (1983) On two old and fourteen new species of Alcyonacea (Coelenterata, Octocorallia) from the Red Sea. *Zool Verh Leiden* 208: 1-33, pls 1-7.