

RESEARCH ARTICLE

Octocoral diversity of Balıkçı Island, the Marmara Sea

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Abstract

We investigated the octocoral diversity of Balıkçı Island in the Marmara Sea. Three sites were sampled by diving, from 20 to 45 m deep. Nine species were found, two of which are first records for Turkish fauna: *Alcyonium coralloides* and *Paralcyonium spinulosum*. Scientific identification of *Alcyonium acaule* in the Turkish seas was also done for the first time in this study.

Key words: Octocoral, soft coral, gorgonian, diversity, Marmara Sea.

Introduction

The Marmara Sea is a semi-enclosed sea connecting the Black Sea to the Aegean Sea via the Turkish Straits System, with peculiar oceanographic, ecological and geomorphologic characteristics (Öztürk and Öztürk 1996). The benthic fauna consists of Black Sea species until approximately 20 meters around the Prince Islands area, where Mediterranean species take over due to the two layer stratification in the Marmara Sea. The Sea of Marmara, together with the straits of Istanbul and Çanakkale, serves as an ecological barrier, a biological corridor and an acclimatization zone for the biota of Mediterranean and Black Seas (Öztürk and Öztürk 1996). The Islands in the Sea of Marmara constitute habitats particularly for hard bottom communities of Mediterranean origin.

Ten Octocoral species were reported by Demir (1954) from the Marmara Sea but amongst them, *Gorgonia flabellum* was probably reported by mistake and

should not be considered as a valid record from the Sea of Marmara. On the other side, eight anthozoan species have been recorded so far from the Black Sea (Vafidis *et al.* 1997) and only one of them is an octocoral: *Virgularia mirabilis* which is found solely on the small section of the southern Black Sea shelf close to the Istanbul Strait that creates a zone of high salinity and provides living conditions for many Mediterranean species (Zaitsev and Mamaev 1997). For the Marmara Sea, Tixier-Durivault (1961) reported *Alcyonium bosphorense* from the Istanbul Strait. The number of octocoral species in the Marmara Sea rose to 16 with contributions of some recent studies (Öztürk and Bourguet 1990; Uysal *et al.* 1998; Topaloğlu *et al.* 2004) and by guidebooks for divers (Öztürk *et al.* 2004; Gökalp 2011). On the other hand, 51 species are listed in the Mediterranean check-list of octocorals whereas 28 species from the Aegean Sea (Coll *et al.* 2010). In other words, octocoral biodiversity of the Marmara Sea is 31% that of the Mediterranean and it is 1.7 times less than that in the Aegean Sea. However, this picture could be biased by the scarcity in the number of studies on octocorals, performed in the Marmara Sea.

Many octocoral species like *Alcyonium coralloides*, *Alcyonium acaule*, *Paramuricea clavata* and *E. cavolini* are considered as typical components of Mediterranean coralligenous communities. Among them, long-living species serve as “ecosystem engineers” (Jones *et al.* 1994) in Mediterranean marine hard-bottom communities, with significant effects on the structure, biomass and biodiversity of coralligenous communities (Ballesteros 2006). The coralligenous in the circalittoral zone on hard substrata is stated as the most important biocoenosis in “Guidelines for the Establishment and Management of Mediterranean Marine and Coastal Protected Areas” (Lopez Ornat 2006). Octocorals and particularly gorgonians are under threat by fishing nets, anchoring, fin hits of divers, etc. Council Regulation 1967/2006 of European Union, Fishing with trawl nets, dredges, shore seines or similar nets above coralligenous habitats shall be prohibited. An Action Plan for the conservation of the coralligenous and other calcareous bio-concretions in the Mediterranean Sea was established in the framework of the Barcelona Convention (UNEP-MAP-RAC/SPA 2008). Consequently, particular attention should be given to these sensitive organisms under threat in order to protect their species diversity and habitats.

The aims of this study were to assess the octocoral diversity in benthic habitats of Balıkçı Island and thus contribute to the knowledge of marine fauna in the Marmara Sea as well as providing a basis for future monitoring studies of marine biodiversity in the area.

Material and Methods

Sampling was made by scuba diving in April 2012 on rocky and sandy bottoms of Balıkçı Island (Figure 1) at depths from 20 to 45 m. Colonies were photographed *in situ*. Anaesthetization, fixation, preservation, sclerite isolation and preparation of permanently mounted microscope slides were made according to Janes and Wah (2007). Species were identified according to Williams (1995), Weinberg (1976), Weinberg (1977) and Carpine and Grasshoff (1975).

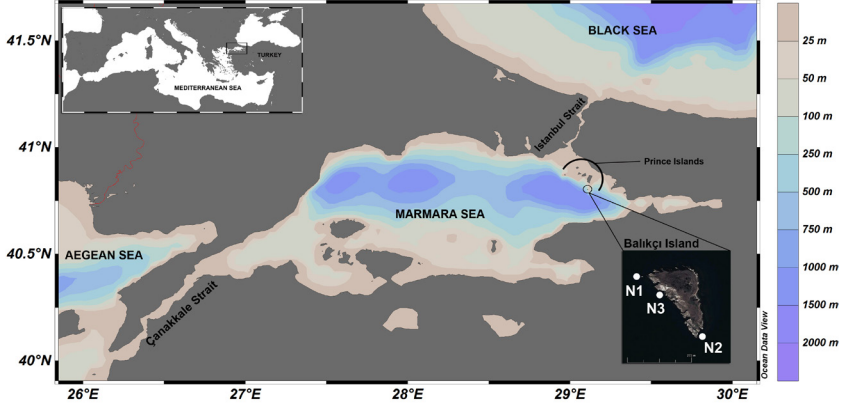


Figure 1. Map of the study area. Balıkçı Island is a part of “Prince Islands” group in the Northern Marmara Sea. Three sites (N1, N2 and N3) were investigated around Balıkçı Island.

Results

Nine species were found in Balıkçı Island in the northern Marmara Sea in the present study.

Order Pennatulacea Verrill, 1865

Suborder Sessilliflorae Kükenthal, 1915

Family Veretillidae Herklots, 1858

Veretillum cynomorium (Pallas, 1766)

Material examined: Three colonies were collected at N1, N2 and N3 on sandy and muddy bottoms at depths 25-32 m.

Notes: Colony height ranged from 23 to 52 cm in Balıkçı Island. The species is abundant on sandy and muddy bottoms of the Prince Islands. Uncontracted colonies were encountered anytime in the day (Figure 2A).

Distribution: This species is distributed along Eastern Atlantic Coasts and in the Mediterranean. There is also a single report from Southern Mozambique, the Indian Ocean (Tixier-Durivault 1960).

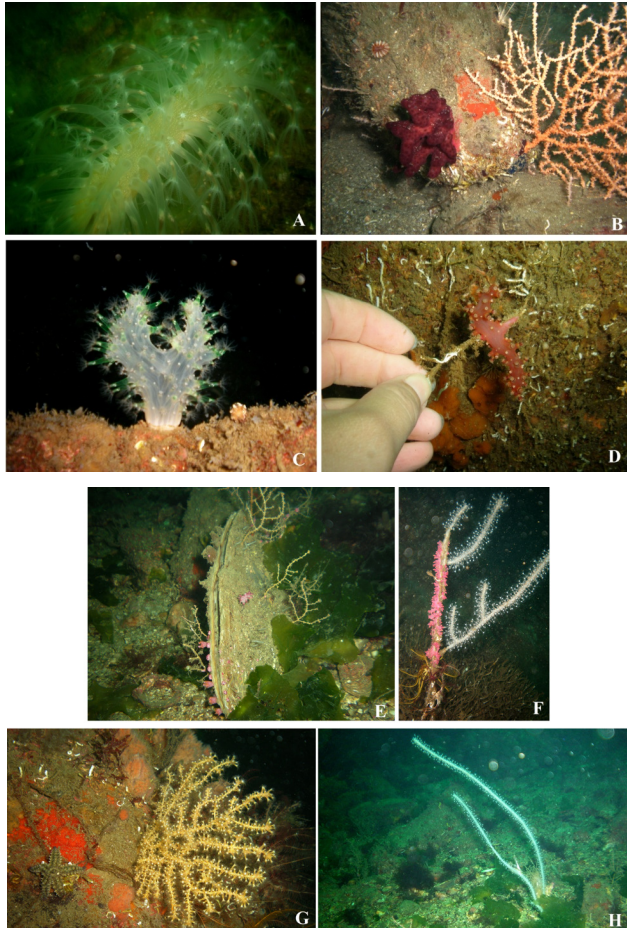


Figure 2. Various octocoral species from Balıkçı Island. *Veretillum cynomorium* (A); *Alcyonium acaule* at left and *Eunicella cavolini* at right (B); *Alcyonium palmatum* (C); *Alcyonium coralloides* (D); *A. coralloides*, lobular form on Pinna shell (E); *A. coralloides*, encrusting form on gorgonian (F); *Paramuricea macrospina* (G); *Spinimuricea klavereni* (H)

Order Alcyonacea Lamouroux, 1816

Suborder Stolonifera Hickson, 1883

Family Cornulariidae Dana, 1846

Alcyonium palmatum (Pallas, 1766)

Material examined: Four colonies were collected at N1, N2 and N3 on rocky and muddy bottoms, 25-38 m deep.

Notes: Colony coloration varied from mainly white, to pale red and yellowish. The species is abundant on rocky substrata and on shells or small stones buried in sandy and muddy bottoms of the Prince Islands (Figure 2C).

Distribution: The species is distributed along the Eastern Atlantic and the Mediterranean (Weinberg 1977; Vafidis *et al.* 1994).

Alcyonium acaule (Marion, 1878)

Material examined: Two colonies were collected at N1 and N3 on rocky bottom, 34-38 m deep.

Notes: Colony coloration varied from dark red (Figure 2B) to orange and creamy white with a red stalk. The species is found occasionally on rocky substrata of the Prince Islands.

Distribution: The species is distributed along the Mediterranean (Weinberg 1977; Vafidis *et al.* 1994).

Alcyonium coralloides (Pallas, 1766)

(*Parerythropodium coralloides*)

Material examined: Five colonies were collected at N1 and N3 on rocky bottom, 31-40 m.

Notes: Colony colors varied from pink to violet pink and red (Figure 2D). Sclerites were also of various colors as previously reported in Groot and Weinberg (1982). Most colonies were encrusting on polychaete tubes although a few encrusting on gorgonians were also observed (Figure 2E). Besides some lobular forms were observed on the Pinna shells (Figure 2F).

Distribution: The species is distributed along the Mediterranean (Weinberg 1977; Groot and Weinberg 1982) and the Northeastern Atlantic (Vafidis *et al.* 1994; Mcfadden 1999).

Family Maasellidae Poche 1914

Paralcyonium spinulosum (Delle Chiaje, 1822)

Material examined: Six colonies were collected at N1, N2 and N3 on rocky bottoms, 25-34 m deep.

Notes: *P. spinulosum* colonies were translucent brown and white, sclerites were visible to the naked eye dispersed on the trunk and forming chevron in the crown (Figure 3). The species is abundant on rocky substrata of the Prince Islands.

Distribution: The species is distributed along the Mediterranean and the Northeastern Atlantic (Weinberg 1977; Vafidis *et al.* 1994).

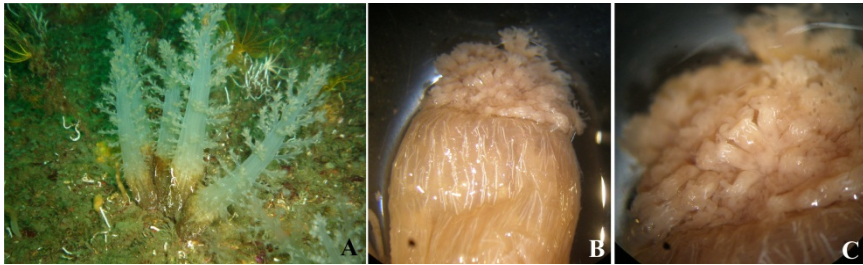


Figure 3. Aggregate of *Paralcyonium spinulosum* colonies (A). Long sclerites into the stout pedicel are visible to the naked eye (B). White sclerites dispersed on trunk and polyps (C)

Suborder Holaxonia Studer, 1887

Family Plexauridae Gray, 1859

Paramuricea clavata (Risso, 1826)

Material examined: Three colonies were collected at N1 and N2 on rocky bottoms, 30-42 m deep.

Notes: All colonies encountered around Balıkçı Island were of violescent red coloration. Colony sizes were generally moderate (10-20 cm) except two large colonies (>30 cm) overhanging in the big cave of Balıkçı. The population around Balıkçı Island has patchy distribution.

Distribution: The species is distributed along the Mediterranean (Weinberg 1976; Vafidis *et al.* 1994) and the Northeastern Atlantic (Watling and Auster 2005).

Paramuricea macrospina (Koch, 1882)

Material examined: Five colonies were sampled at N1, N2 and N3 on rocky bottoms or scattered blocks on muddy bottom, 30-45m deep.

Notes: *P. macrospina* colonies were smaller than *P. clavata* colonies, the sizes varied from 10-22 cm at Balıkçı Island. Although Carpine and Grasshoff (1975) defined the species as small, slender and very little branching, most of the specimens observed around Balıkçı Island were much branched (Figure 2G). Also, different colors from those previously reported were observed: from creamy white to yellow, orange and brownish pink. Macrosclerites of calyx exceeding opercular sclerites (Figure 4) were visible to the naked eye.

Distribution: The species is distributed along the Mediterranean (Carpine and Grasshoff 1975).

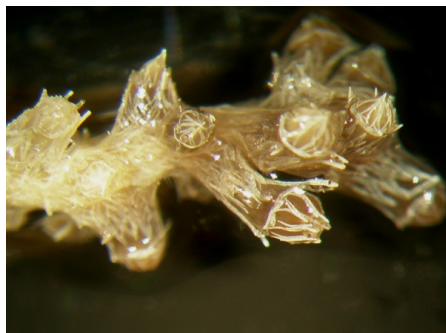


Figure 4. Macrosclerites of calyx exceeding opercular sclerites for *P. macrospina*

Spinimuricea klavereni (Carpine and Grasshoff, 1975)

Material examined: Six colonies were collected at N1, N2 and N3 on rocky bottoms and on stones/shells on muddy bottoms, 25-38 m deep.

Notes: *Spinimuricea klavereni* colonies were long and elegant, white, unbranching or very little branching gorgonians (Figure 2H). The basal part of the colonies denuded of cœnenchyme measured 1-13 cm approximately; total sizes varied from 10-77 cm. The polyps started from the point where the cœnenchyme became thicker, higher than where it started. *S. klavereni* colonies were observed at 23 m depth down to 45 m.

Distribution: The species is distributed along the Mediterranean (Carpine and Grasshoff 1975).

Family Gorgoniidae Lamouroux, 1812

Eunicella cavolini (Koch, 1887)

Material examined: Four colonies were sampled at N1, N2 and N3 on rocky bottoms.

Notes: Colony coloration varied from orange-yellow to salmon pink (Figure 2B). Sclerite measurements were made as in Weinberg (1976) and the head of balloon club sclerites was classified into one of the five categories according to the degree of roughness as in Gori *et al.* (2012). The results of balloon club collar width (13.83 μm [± 1.439]) and spiny end width (24.54 μm [± 3.05]) were in accordance with those of *E. cavolini* in Gori *et al.* (2012). However, the length (65.67 μm [± 3.48]) and width (37.29 μm [± 4.04]) of balloon clubs seemed slightly smaller than those in Gori *et al.* (2012). Head roughness degree was measured as 2.60 ± 0.62 . Some clubs had rough heads although not as much as in *E. verrucosa*.

Distribution: The species is distributed along the Mediterranean (Weinberg 1976; Vafidis *et al.* 1994).

Discussion

Nine species were investigated in the present study, two of which are first records for Turkish marine fauna: *Alcyonium coralloides* and *Paralcyonium spinulosum*. *A. coralloides* is a species that exhibits considerable variation in colony growth form, color, habitat and life history across a broad geographic range (Groot and Weinberg 1982; Mcfadden 1999). Although Groot and Weinberg (1982) suggested, based on morphological and color variants, that all morphotypes of *A. coralloides* belong to one variable species, Mcfadden (1999) proposed that the five morphotypes belong to four distinct species based on genetic investigation. In the Istanbul Strait – Prince Islands Area, the morphotype we observed and that was described by Tixier-Durivault (1961) as *A. bosphorensis* from the Marmara Sea seems similar to morphotype M2 (Mcfadden, pers. comm.), -a distinct species from *A. coralloides*- although further genetic analyses are necessary to accurately identify it.

Scientific identification of *Alcyonium acaule* in the Turkish seas was for the first time done in this study although it was previously reported in a popular guide book for divers, based on field observations (Gökalp 2011).

Demir (1954) reported 10 octocoral species from the Marmara Sea. Shortly, Tixier-Durivault (1961) added *A. bosphorensis* which was considered as *A. coralloides* in Vafidis *et al.* (1994); however Mcfadden (1999) stated that it can also be the undescribed *Alcyonium* morphotype M2. More recently, Öztürk and Bourguet (1990) reported *Paramuricea clavata* and *Eunicella cavolini*, Uysal *et*

al. (1998) reported *Funiculina quadrangularis* and Topaloğlu *et al.* (2004) reported *Pennatula rubra*.

Paralcyonium spinulosum has an occurrence limited to the Mediterranean and North-Eastern Atlantic; records of this species in the Mediterranean are available mostly for the western part and the Adriatic Sea where it was reported as a common species (Kruzic 2007). This species is very common on Balıkçı Island rocky substrata and around Prince Islands in general. After the species was sampled and identified for this study, the photo of this species was presented in a public exhibition of the Prince Islands fauna and in its informative booklet for which the authors of this article were scientific advisors (Evirgen and Ekşiyan 2012).

S. klavereni is a Mediterranean endemic and was reported from both basins (Carpine and Grasshoff 1975). In the Marmara Sea, Demir (1954) reported *Paramuricea placomus*, which was, however, later corrected as *S. klavereni* by Carpine and Grasshoff (1975) because there used to be a descriptive confusion of the two species at their first identification; in fact, *P. placomus* does not exist in the Mediterranean.

S. klavereni, rather sparse on the western basin and poorly known, is abundant around the Prince Islands. Besides, large fragments of mucilage aggregations were observed on *S. klavereni* colonies. The mucilage events resulting from single-cell organisms are periodically observed in the Marmara Sea (Aktan *et al.* 2008; Balkıs *et al.* 2011) and the sedimentation of the aggregates cause negative effects by covering benthic organisms (Aktan *et al.* 2008). Filamentous mucilage gets trapped on gorgonian branches positioned perpendicularly to currents and cause damages to gorgonians, sometimes unrecoverable (Giuliani *et al.* 2005). Following this preliminary study, we have started a long-term monitoring program of gorgonian colonies and particularly those of *S. klavereni* in order to better understand its biology and responses to mucilage aggregation.

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Marmara Denizi, Balıkçı Adası Octocorallia çeşitliliği

Özet

Bu çalışmada Marmara Denizi, Balıkçı Adası'ndaki Oktokoral çeşitliliği incelenmiştir. 20-45 metre arasında 3 istasyon dalış yapılarak örneklenmiştir. 2'si Türkiye denizleri için

yeni kayıt olan (*Alcyonium coralloides* ve *Paralcyonium spinulosum*) toplam 9 tür tespit edilmiştir. *Alcyonium acaule* türünün ilk bilimsel tanımı de bu çalışmada yapılmıştır.

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