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Diversity of Cnidaria and Ctenophora from the coasts of Türkiye

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Abstract: The compilation of papers on the phyla Cnidaria and Ctenophora inhabiting the coasts of Türkiye (Black Sea, Sea of Marmara, Aegean Sea, and Levantine Sea) together with the new records of cnidarian species presented in this study yielded 296 cnidarian and 8 ctenophore species. Among the cnidarian groups, Hydrozoa were represented by 160 species, Scyphozoa by 16 species, Anthozoa by 87 species, and Myxozoa by 31 species. The number of species of cnidarians and ctenophores varies greatly between regions due to the different environmental conditions of the seas and the level of scientific effort in each sea. A total of 47 cnidarian and five ctenophore species were reported from the Black Sea, 160 cnidarian and four ctenophore species from the Sea of Marmara, 176 cnidarian and six ctenophore species from the Aegean Sea, and 103 cnidarian and four ctenophore species from the Levantine Sea. A total of 18 alien cnidarian and two alien ctenophore species have been found on the coasts of Türkiye, of which eight species belong to Hydrozoa, five species belong to Scyphozoa, and five species belong to Anthozoa. Four endangered and six vulnerable species are known from the regions.

Key words: Biodiversity, checklist, alien species, threatened species, depth range

1. Introduction

The phylum Cnidaria is a diverse group of animals sharing the synapomorphy of the presence of cnidae (Daly et al., 2007). It has three subphyla, namely Anthozoa, Endocnidozoa, and Medusozoa, and distinctions between them are based on their anatomy and life history traits (Bridge et al., 1995). Medusozoans use both benthic and pelagic environments due to their metagenetic life cycles and play an important role in benthic–pelagic coupling (Gili and Coma, 1998; Pitt et al., 2008). The phylum Cnidaria contains almost 10,910 species worldwide, more than half of which (6326 species) belong to Anthozoa, with the rest belonging to Hydrozoa (3602 species, including Siphonophorae), Myxozoa (700 species), Scyphozoa (200 species), Staurozoa (48 species), and Cubozoa (37 species) (Appeltans et al., 2012). The WoRMS database now indicates the presence of 15,922 accepted marine cnidarian species worldwide.[1] Several anthozoan species are known to be habitat builders. In the Mediterranean Sea, some invertebrate species including anthozoans, together with coralline algae, contribute to the production of protected biogenic (EU Fisheries and Environmental Legislation-Council Regulation EC 1967/2006 and Council Directive 92/43/EEC) and coralligenous habitats (Ballesteros, 2006; Çinar et al., 2020).

The phylum Ctenophora (comb jellies), previously grouped with cnidarians in the phylum Coelenterata, occurs in almost all pelagic zones of the world's oceans (Gershwin et al., 2010). Ctenophores are holopelagic, lacking a benthic phase, and spend their entire lives in pelagic environments (Horridge, 1974). Nearly 190 species have been described worldwide and there are 30 species in the Mediterranean Sea (Coll et al., 2010; Appeltans et al., 2012). Some species in this group, such as *Mnemiopsis leidyi*, have been translocated between zoogeographical regions via the ballast water of ships and have become invasive in some areas, such as the Black Sea (Çinar et al., 2021). *Mnemiopsis leidyi* devastated the Black Sea ecosystem in a period in which its biomass reached up to 1 kg m^{-2}, resulting in a sharp decrease in anchovy production (Kideys, 2002; Çınar et al., 2011).

For censusing of the marine fauna of Türkiye, a series of papers were published in the *Turkish Journal of Zoology* in 2014. The phylum Cnidaria (excluding Myxozoa, which was treated as a separate phylum at that time) was represented by 195 species and Ctenophora by seven

[1]WoRMS (2024). World Register of Marine Species [online]. Website https://www.marinespecies.org/ [accessed 13 May 2024].

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species (Çınar et al., 2014). Following the publication of the 2014 checklist, several detailed studies on Hydrozoa (e.g., İşinibilir et al., 2015a; Topçu et al., 2018) and Anthozoa (e.g., Özalp and Alparslan, 2016; Ocaña and Çinar, 2018) were carried out in the region.

The aim of this revised checklist of cnidarians and ctenophores is to provide baseline knowledge of the diversity of these groups as reported in scientific papers from Türkiye until May 2024. A list of all cnidarian and ctenophore species reported along the coasts of Türkiye is given in this study together with newly reported species and the presence of some species in the region is discussed. The previous checklist compiled by Çınar et al. (2014) was updated and expanded in light of recent literature and taxonomic knowledge.

2. Materials and methods

The species list was prepared on the basis of species data from published papers on the marine cnidarians and ctenophores reported from the coasts of Türkiye. All available databases (e.g., Web of Science, Google Scholar, and Scopus) and national and international conference proceedings were searched using geographic, group and species names. The presented checklist of Cnidaria and Ctenophora is primarily based on the paper by Çınar et al. (2014), who compiled a list of species along the coasts (territorial waters) of Türkiye. Species records were evaluated separately for each of the seas surrounding Türkiye and the list presented here is based on the first species records. The alien or protected status of species was established according to recent publications (e.g., Otero et al., 2017; Çinar et al., 2021; Galanidi et al., 2023). The marine boundary between the Levantine Sea and Aegean Sea was considered to be a straight line passing between the Dalaman River and Rhodes. Species records from the straits of Çanakkale (Dardanelles) and İstanbul (Bosphorus) were added to the Sea of Marmara, as these straits are strongly influenced by the Black Sea with its brackish water and have two layered water masses, typical of the Sea of Marmara. As the first records of species up to 2014 were given in the 2014 checklist compiled by Çınar et al. (2014), species reports from the seas before 2014 are presented as "+" in this updated checklist, unless a reference missed in the past is specified.

The first records of species after 2014 have been included in the species list together with their depth and habitat preferences as compiled before and after 2014. Seven depth ranges (I: 0–10 m; II: 11–50 m; III: 51–100 m; IV: 101–200 m; V: 201–400 m; VI: 401–600 m; VII: >600 m) were established to determine species distributions by depths. Species whose presence in the region seems questionable have also been included and discussed. The list presented here is based on species recorded up to May 2024.

New species records have also been included in this paper based on data from one station (indicated as PS[1] in Table) in İzmir Bay, Aegean Sea (10 m depth, sandy mud with shell fragments, coordinates: 38.4220°N, 27.0016°E) and one station (indicated as PS[2] in Table) off Akkuyu, Levantine Sea (0–100 m depth, pelagic, coordinates: 36.0999°N, 33.5456°E). The hydrozoan species new to the marine fauna of Türkiye were identified according to the monograph of Bouillon et al. (2004).

3. Results

3.1. New records

Among the species presented here, two hydrozoans (*Cunina globosa* and *Helgicirrha cari*) are new to the marine fauna of Türkiye, having been identified in the Levantine Sea; nine hydrozoans (*Liriope tetraphylla*, *Solmundella bitentaculata*, *Halistemma rubrum*, *Nanomia bijuga*, *Lensia campanella*, *L. conoidea*, *L. subtilis*, *Vogtia glabra*, and *Sphaeronectes koellikeri*) are new to the fauna of the Levantine coast of Türkiye; and two anthozoans (*Scolanthus mediterraneus* and *Cavernularia pusilla*) are new to the fauna of the Aegean coast of Türkiye.

3.2. Species list

Until May 2024, together with the new records presented in the present study, a total of 296 cnidarian and eight ctenophore species were reported from the coasts of Türkiye. The Black Sea is represented by 47 cnidarian and five ctenophore species, the Sea of Marmara by 160 cnidarian and four ctenophore species, the Aegean Sea by 176 cnidarian and six ctenophore species, and the Levantine Sea by 103 cnidarian and four ctenophore species (Table; Figure 1).

On the coasts of Türkiye, the class Hydrozoa has the highest number of species (160 species in total), accounting for 65% (115 species) and 55% (57 species) of the total number of cnidarian species reported from the Aegean Sea and Levantine Sea, respectively (Figure 1). A total of 16 Scyphozoa species were reported from the coasts of Türkiye, with two species (*Aurelia aurita* and *Rhizostoma pulma*) from the Black Sea, 10 species from the Sea of Marmara and the Aegean Sea, and nine species from the Levantine Sea. Two cnidarian classes (Cubozoa and Staurozoa) are represented by only one species (Cubozoa: *Carybdea marsupialis*; Staurozoa: *Calvadosia campanulata*) in the region. The subphylum Anthozoa (formerly a class of Cnidaria) has 87 species in the region: seven species in the Black Sea, 71 species in the Sea of Marmara, 49 species in the Aegean Sea, and 35 species in the Levantine Sea. The parasitic class Myxozoa has 31 species along the coasts of Türkiye, most of which (29 species) were identified on different fish species in the Black Sea. Only one or two species were reported from the other seas bordering Türkiye. The phylum Ctenophora is

Table. Species list of marine Cnidaria and Ctenophora from Türkiye and their first reports in each sea. *: Alien species; EN: endangered species; VU: vulnerable species; NT: near-threatened species; BS: Black Sea; SM: Sea of Marmara; AS: Aegean Sea; LS: Levantine Sea; DR: depth range (I: 0–10 m; II: 11–50 m; III: 51–100 m; IV: 101–200 m; V: 201–400 m; VI: 401–600 m; VII: >600 m); H: habitat (Hs: hard substratum, including algae, sponges, mussels, etc.; Ss: soft substratum, including all phanerogams; P: pelagic; Pz: parasite); PS: present study. Numbers in cells refer to references in the footnote.

Group/Species	BS	SM	AS	LS	DR	H	
Phylum: CNIDARIA							
Subphylum: Medusozoa							
Classis: Hydrozoa							
Subclasis: Trachylinae							
Order: Limnomedusae							
Family: Geryoniidae							
Geryonia proboscidalis (Forsskål, 1775)	-	-	+	+	I	P	
Liriope tetraphylla (Chamisso & Eysenhardt, 1821)	-	+	-	PS[2]	I-III	P	
Family: Olindiidae							
Olindias muelleri Haeckel, 1879	-	-	+	-	I	P	=*Olindias phosphorica*
Order: Narcomedusae							
Family: Cuninidae							
Cunina globosa Eschscholtz, 1829	-	-	-	PS[2]	I-III	P	
Family: Solmarisidae							
Solmaris corona (Keferstein & Ehlers, 1861)	-	-	24	-	I	P	
Family: Solmundaeginidae							
Solmundella bitentaculata (Quoy & Gaimard, 1833)	-	+	-	PS[2]	I-III	P	
Order: Trachymedusae							
Family: Petasidae							
Petasus atavus Haeckel, 1879	-	-	48	-	I	P	
Family: Rhopalonematidae							
Rhopalonema velatum Gegenbaur, 1857	-	-	+	-	?	P	
Aglaura hemistoma Péron & Lesueur, 1810	-	+	+	+	II-III	P	
Subclasis: Hydroidolina							
Order: Anthoathecata							
Family: Acauloidae							
Acauloides ammisatum Bouillon, 1965	-	-	-	47	I	Hs	
Family: Bougainvilliidae							
Bougainvillia muscus (Allman, 1863)	+	+	+	+	I-III	Hs	
Dicoryne conferta (Alder, 1856)	-	+	-	47	I	Hs	
Garveia grisea (Motz-Kossowska, 1905)	-	-	+	-	?	Hs	
Garveia nutans Wright, 1859	+	-	-	-	?	Hs	
Koellikerina fasciculata (Péron & Lesueur, 1810)	-	13	-	-	II	P	
Rhizorhagium arenosum (Alder, 1862)	-	+	-	-	I	Hs	
Family: Cladocorynidae							
Cladocoryne floccosa Rotch, 1871	-	-	+	-	I, II	Hs	
Family: Cladonematidae							
Cladonema radiatum Dujardin, 1843	-	+	-	-	II	Hs	
Family: Cordylophoridae							
**Cordylophora caspia* (Pallas, 1771)	-	-	+	-	I	Hs	
Family: Corynidae							
**Coryne eximia* Allman, 1859	-	+	-	47	I	Hs	
Coryne muscoides (Linnaeus, 1761)	-	-	+	-	I	Hs	

Table. (Continued.)

Coryne pintneri Schneider, 1897	-	-	37	-	I	Hs
Sarsia tubulosa (M. Sars, 1835)	-	+	-	-	I	Hs
Slabberia halterata Forbes, 1846	-	-	8	-	II	Hs
Family: Cytaeididae						
Perarella schneideri (Motz-Kossowska, 1905)	-	-	8	-	I	Hs
Family: Eudendriidae						
Eudendrium album Nutting, 1898	-	-	8	-	I, II	Hs
Eudendrium armatum Tichomiroff, 1890	-	29	8	-	I, II	Hs
Eudendrium capillare Alder, 1856	-	+	+	25	I-III	Hs
Eudendrium glomeratum Picard, 1952	-	29	+	-	II	Hs
**Eudendrium merulum* Watson, 1985	-	+	+	47	I	Hs
Eudendrium moulouyensis Marques, Peña Cantero & Vervoort, 2000	-	-	37	-	I	Hs
Eudendrium racemosum (Cavolini, 1785)	-	29	+	-	I, II	Hs
Eudendrium rameum (Pallas, 1766)	-	+	-	-	II	Hs
Eudendrium ramosum (Linnaeus, 1758)	-	+	8	-	I, II	Hs
Eudendrium simplex Pieper, 1884	-	-	+	47	I, II	Hs
Family: Hydractiniidae						
Hydractinia aculeata (Wagner, 1833)	-	-	8	47	I, II	Hs
Hydractinia echinata (Fleming, 1828)	-	+	-	-	I-II	Hs
Podocoryna carnea M. Sars, 1846	-	+	-	-	I-II	Hs
Podocoryna exigua (Haeckel, 1880)	-	29	-	-	I	Hs
Stylactis fucicola (M. Sars, 1857)	-	-	+	-	I, II	Hs
Stylactis inermis Allman, 1872	-	29	37	-	I	Hs
Family: Oceaniidae						
Oceania armata Kölliker, 1853	-	-	19	42	I	P
Turritopsis dohrnii (Weismann, 1883)	-	-	8	-	I, II	Hs
Turritopsis nutricula (McCrady, 1857)	-	-	-	3	I	P, Hs
Family: Pandeidae						
Amphinema dinema (Péron & Lesueur, 1810)	-	29	37	-	I, II	Hs
Amphinema rugosum (Mayer, 1900)	-	-	8	47	I, II	Hs
Leuckartiara octona (Fleming, 1823)	-	+	-	-	I-III	Hs
Neoturris pileata (Forsskål, 1775)	-	+	-	-		P
Family: Pennariidae						
Pennaria disticha Goldfuss, 1820	-	-	-	+	I	Hs
Family: Porpitidae						
Porpita porpita (Linnaeus, 1758)	-	-	-	+	I	P
Family: Proboscidactylidae						
Proboscidactyla ornata (McCrady, 1859)	-	29	-	-	II	Hs
Family: Rathkeidae						
Podocorynoides minima (Trinci, 1903)	-	13	-	-	I	P
Family: Tubulariidae						
Tubularia indivisa Linnaeus, 1758	-	+	-	-	II	Hs, Ss
Ectopleura crocea (Agassiz, 1862)	-	-	+	-	I	Hs
Ectopleura larynx (Ellis & Solander, 1786)	-	+	+	-	I	Hs
Family: Zancleidae						
Halocoryne epizoica Hadzi, 1917	-	-	37	-	I	Hs
Zanclea giancarloi Boero, Bouillon & Gravili, 2000	-	29	37	-	I, II	Hs
Zanclea sessilis (Gosse, 1853)	-	-	8	-	I	Hs

Table. (Continued.)

Order: Siphonophorae							
Family: Abylidae							
Abylopsis tetragona (Otto, 1823)	-	-	+	+	?	P	
Bassia bassensis (Quoy & Gaimard, 1833)	-	-	2	-	?	P	
Family: Agalmatidae							
Agalma elegans (M. Sars, 1846)	-	-	2	-	?	P	
Halistemma rubrum (Vogt, 1852)	-	-	2	PS[2]	I-III	P	
Nanomia bijuga (Delle Chiaje, 1844)	-	-	2	PS[2]	I-III	P	
Family: Diphyidae							
Chelophyes appendiculata (Eschscholtz, 1829)	-	-	2	12	V	P	
Diphyes dispar Chamisso & Eysenhardt, 1821	-	-	2	-	?	P	
Eudoxoides spiralis (Bigelow, 1911)	-	-	+	+	?	P	
Lensia campanella (Moser, 1917)	-	-	2	PS[2]	I-III	P	
Lensia conoidea (Keferstein & Ehlers, 1860)	+	-	+	PS[2]	I-III	P	
Lensia fowleri (Bigelow, 1911)	-	-	2	-	?	P	
Lensia meteori (Leloup, 1934)	-	-	2	-	?	P	
Lensia multicristata (Moser, 1925)	-	-	2	-	?	P	
Lensia subtilis (Chun, 1886)	-	-	2	PS[2]	I-III	P	
Lensia subtiloides (Lens & Van Riemsdijk, 1908)	-	-	+	+	?	P	
Muggiaea kochii (Will, 1844)	-	-	2	-	I-VI	P	
Sulculeolaria chuni (Lens & van Riemsdijk, 1908)	-	-	2	-	?	P	
Sulculeolaria quadrivalvis de Blainville, 1830	-	-	2	3	?	P	
Family: Forskaliidae							
Forskalia contorta (Milne-Edwards, 1841)	-	-	-	+	?	P	
Family: Hippopodiidae							
Hippopodius hippopus (Forsskål, 1776)	-	-	2	-	?	P	
Vogtia glabra Bigelow, 1918	-	-	2	PS[2]	I-III	P	
Family: Physophoridae							
Physophora hydrostatica Forsskål, 1775	-	-	31	-	I	P	
Family: Sphaeronectidae							
Sphaeronectes irregularis (Claus, 1873)	-	-	2	-	?	P	
Sphaeronectes koellikeri Huxley, 1859	-	-	2	PS[2]	I-III	P	=*S. gracilis*
Order: Leptothecata							
Family: Aequoreidae							
**Aequorea globosa* Eschscholtz, 1829	-	-	-	+	II	P	
Aequorea forskalea Péron & Lesueur, 1810	-	41	24	+	I, II	P	
Aequorea pensilis (Haeckel, 1879)	-	-	20	-	I	P	
**Aequorea vitrina* Gosse, 1853	-	26	-	-	I	P	
Family: Aglaopheniidae							
Aglaophenia dichotoma Kirchenpauer, 1872	-	+	-	-	II	Hs	
Aglaophenia elongata Meneghini, 1845	-	+	+	-	II-III	Hs	
Aglaophenia harpago Schenck, 1965	-	-	8	-	II	Hs	
Aglaophenia octodonta Heller, 1868	-	+	+	-	I, II	Hs	
Aglaophenia picardi Svoboda, 1979	+	-	8	25	I, II	Hs	
Aglaophenia pluma (Linnaeus, 1758)	+	+	+	-	I-II	Hs	
Aglaophenia tubiformis Marktanner-Turneretscher, 1890	-	-	8	-	I, II	Hs	
Lytocarpia myriophyllum (Linnaeus, 1758)	-	+	+	23	II-IV	Hs	
**Macrorhynchia philippina* Kirchenpauer, 1872	-	-	-	+	I	Hs	

Table. (Continued.)

Family: Campanulariidae							
Campanularia hincksii Alder, 1856	-	29	+	-	I, II	Hs	
Campanularia volubilis (Linnaeus, 1758)	-	-	8	-	I	Hs	
Clytia brevithecata (Thornely, 1900)	-	-	-	47	I	Hs	
Clytia gracilis (Sars, 1850)	-	+	+	47	I-II	Hs	
Clytia hemisphaerica (Linnaeus, 1767)	-	+	+	+	I-II	Hs	=*Clytia viridicans*
**Clytia linearis* (Thorneley, 1900)	-	29	+	47	I, II	Hs	
Clytia noliformis (McCrady, 1859)	-	-	-	47	I	Hs	
Clytia paulensis (Vanhöffen, 1910)	-	29	+	-	I, II	Hs	
Gastroblasta raffaelei Lang, 1886	-	13	-	-	II, III	P	
Gonothyraea loveni (Allman, 1859)	-	+	-	-	I-II	Hs	
Hartlaubella gelatinosa (Pallas, 1766)	+	+	+	-	I-II	Hs	
Laomedea angulata Hincks, 1861	+	+	+	47	I-II	Hs, Ss	
Laomedea calceolifera (Hincks, 1871)	-	+	+	-	I	Hs	
Laomedea exigua M. Sars, 1857	-	+	+	-	I-II	Hs	
Laomedea flexuosa Alder, 1857	-	+	+	47	I-III	Hs	
Obelia bidentata Clark, 1875	-	+	+	-	I-III	Hs	
Obelia dichotoma (Linnaeus, 1758)	-	+	+	+	I-II	Hs	
Obelia geniculata (Linnaeus, 1758)	-	-	+	-	I	Hs	
Obelia longissima (Pallas, 1766)	-	+	-	-	I	Hs	
Orthopyxis crenata (Hartlaub, 1901)	-	-	+	-		Hs	
Orthopyxis integra (MacGillivray, 1842)	-	+	+	47	I-II	Hs	
Family: Campanulinidae							
Lafoeina tenuis Sars, 1874	-	29	8	-	I, II	Hs	
Family: Eirenidae							
Helgicirrha cari (Haeckel, 1864)	-	-	-	PS[2]	I-III	P	
Family: Haleciidae							
Halecium beanii (Johnston, 1838)	-	+	+	-	I, III	Hs	
Halecium halecinum (Linnaeus, 1758)	-	+	+	-	I-II, IV	Hs	
Halecium labrosum Alder, 1859	-	+	-	-	III	Hs	
Halecium lankesterii (Bourne, 1890)	-	-	+	-	II	Hs	
Halecium mediterraneum Weismann, 1883	-	-	+	-	I, II	Hs	
Halecium nanum Alder, 1859	-	-	+	-	?	Hs	
Halecium petrosum Stechow, 1919	-	-	37	-	I	Hs	
Halecium pusillum Sars, 1856	-	-	+	-	I, II	Hs	
Halecium tenellum Hincks, 1861	-	29	8	47	I, II	Hs	
Family: Halopteridae							
Antennella secundaria (Gmelin, 1791)	-	+	+	-	II-III	Hs	
Halopteris catharina (Johnston, 1833)	-	-	+	-	I-II	Hs	
Halopteris diaphana (Heller, 1868)	-	-	+	25	I, II	Hs	
Family: Hebellidae							
Anthohebella parasitica (Ciamician, 1880)	-	+	+	-	I-III	Hs	
Hebella scandens (Bale, 1888)	-	-	+	-	?	Hs	
Scandia gigas (Pieper, 1884)	-	-	-	47	I	Hs	
Family: Kirchenpaueriidae							
Kirchenpaueria halecioides (Alder, 1859)	-	+	+	-	I	Hs	
Kirchenpaueria pinnata (Linnaeus, 1758)	-	29	+	+	I, II	Hs	
Family: Laodiceidae							

Table. (Continued.)

Laodicea undulata (Forbes & Goodsir, 1853)	-	-	+	-	?	Hs
Family: Lafoeidae						
Acryptolaria conferta (Allman, 1877)	-	+	-	-	IV	Hs
Filellum serpens (Hassall, 1848)	-	+	8	-	I, II	Hs
Filellum serratum (Clarke, 1879)	-	+	+	-	II	Hs
Lafoea dumosa (Fleming, 1820)	-	+	+	-	I-IV	Hs
Family: Mitrocomidae						
Earleria panicula (G.O. Sars, 1874)	-	29	-	-	II	Hs
Family: Phialellidae						
Phialella quadrata (Forbes, 1848)	-	+	-	-	I	Hs
Family: Phylactothecidae						
Hydrodendron mirabile (Hincks, 1866)	-	-	+	47	I	Hs
Family: Plumulariidae						
Monotheca obliqua (Johnston, 1847)	-	-	+	47	I, II	Hs
Nemertesia antennina (Linnaeus, 1758)	-	+	+	-	I-IV	Hs
Nemertesia ramosa (Lamarck, 1816)	-	+	-	-	III	Hs
Nemertesia tetrasticha Meneghini, 1845	-	+	-	-	III	Hs
Plumularia setacea (Linnaeus, 1758)	-	29	+	-	I, II	Hs
Plumularia syriaca Billard, 1931	-	+	-	+	II-III	Hs
Family: Sertularellidae						
Sertularella crassicaulis (Heller, 1868)	-	+	-	-	II, IV	Hs
Sertularella ellisii (Deshayes & M. Edwards, 1836)	-	+	+	47	I-II	Hs
Sertularella fusiformis (Hincks, 1861)	-	-	+	-	I, II	Hs
Sertularella mediterranea Hartlaub, 1901	-	-	+	+	I	Hs
Sertularella polyzonias (Linnaeus, 1758)	+	+	+	-	I-III	Hs
Family: Sertulariidae						
Amphisbetia operculata (Linnaeus, 1758)	-	-	+	-	I	Hs
Dynamena disticha (Bosc, 1802)	-	-	+	+	I, II	Hs
Salacia desmoides (Torrey, 1902)	-	-	+	25	I	Hs
**Tridentata marginata* (Kirchenpauer, 1864)	-	-	+	-	?	Hs
Tridentata perpusilla (Stechow, 1919)	-	-	+	-	I	Hs
Family: Tiarannidae						
Modeeria rotunda (Quoy & Gaimard, 1827)	-	+	-	-	II-IV	Hs
Class: Cubozoa						
Order: Charybdeida						
Family: Carybdeidae						
Carybdea marsupialis (Linnaeus, 1758)	-	-	+	-	?	P
Class: Scyphozoa						
Subclass: Discomedusae						
Order: Rhizostomeae						
Family: Cassiopeidae						
**Cassiopea andromeda* (Forsskål, 1775)	-	-	+	+	I	Ss, P
Family: Cepheidae						
Cotylorhiza tuberculata (Macri, 1778)	-	38	+	-	I-II	P
**Marivagia stellata* Galil & Gershwin, 2010	-	-	-	30	I	P
Family: Mastigiidae						
**Phyllorhiza punctata* Lendenfeld, 1884	-	-	+	+	I	P
Family: Rhizostomatidae						

Table. (Continued.)

Rhizostoma pulmo (Macri, 1778)	+	+	+	+	I-II	P	
**Rhopilema nomadica* Galil, Spanier & Ferguson, 1990	-	-	+	+	I	P	
Order: Semaeostomeae							
Family: Drymonematidae							
Drymonema dalmatinum Haeckel, 1880	-	35	+	-	I-II	P	
Family: Pelagiidae							
Chrysaora hysoscella (Linnaeus, 1767)	-	+	+	+	I-II	P	
**Chrysaora pseudoocellata* Mutlu, Çağatay, Olguner & Yilmaz, 2020	-	-	-	34	I	P	
Pelagia noctiluca (Forsskål, 1775)	-	40	+	+	I-II	P	
Mawia benovici (Piraino, Aglieri, Scorrano & Boero, 2014)	-	41	-	-	II, III	P	
Family: Ulmaridae							
Aurelia aurita (Linnaeus, 1758)	+	+	+	+	I-II	P	
Discomedusa lobata Claus, 1877	-	13	-	-	II	P	
Subclass: Coronamedusae							
Order: Coronatae							
Family: Nausithoidae							
Nausithoe punctata Kölliker, 1853	-	-	+	-	II		
Family: Paraphyllinidae							
Paraphyllina ransoni Russell, 1956	-	+	-	-	I-II	P	
Family: Periphyllidae							
Periphylla periphylla (Péron & Lesueur, 1810)	-	+	-	-	I-II	P	
Class: Staurozoa							
Order: Stauromedusae							
Family: Kishinouyeidae							
Calvadosia campanulata (Lamouroux, 1815)	+	+	-	-	I	Hs?	
Subphylum: Anthozoa							
Class: Hexacorallia							
Order: Actiniaria							
Family: Actiniidae							
Actinia cari Delle Chiaje, 1822	-	-	+	+	I-III	Hs	
Actinia equina (Linnaeus, 1758)	+	+	+	+	I	Hs	
Anemonia viridis (Forskål, 1775)	-	+	+	+	I, II	Hs	
Bunodactis verrucosa (Pennant, 1777)	-	-	+	+	I	Hs	
Bunodactis rubripunctata (Grube, 1840)	-	-	+	-	I	Hs	
Condylactis aurantiaca (Delle Chiaje, 1825)	-	+	+	+	I, II	Ss	
Paranemonia cinerea (Contarini, 1844)	-	-	11	-	I, II	Hs	
Family: Actinostolidae							
Paranthus chromatoderus (Schmarda, 1852)	-	-	+	-	I	Hs	=*Paranthus rugosus*
Family: Aiptasiidae							
Exaiptasia diaphana (Rapp, 1829)	-	-	+	+	I	Hs	
Aiptasia mutabilis (Gravenhorst, 1831)	-	+	+	+	I, II	Hs	
Aiptasiogeton hyalinus (Delle Chiaje, 1822)	-	+	+	22	I	Hs	=*A. pellucidus*
Family: Aliciidae							
Alicia mirabilis Johnson, 1861	-	43	+	+	I, II	Hs	
Family: Andresiidae							
Andresia partenopea (Andrès, 1883)	-	15	11	-	I, II	Ss	
Family: Andvakiidae							
Telmatactis cricoides (Duchassaing, 1850)	-	-	+	+	I	Hs	

Table. (Continued.)

Telmatactis forskalii (Ehrenberg, 1834)	-	-	+	+	I	Hs	
Family: Boloceroididae							
Bunodeopsis strumosa Andrès, 1881	-	+	+	+	I	Hs	
Family: Condylanthidae							
Charisactis tetiana Ocaña & Çinar, 2018	-	28	-	-	II	Hs	
Family: Diadumenidae							
**Diadumene cincta* Stephenson, 1925	-	+	-	-	I	Hs	
**Diadumene lineata* (Verrill, 1869)	-	-	+	-	I	Hs	
Diadumene turcica Ocaña & Çinar, 2018	-	28	-	-	VII	Hs	
Family: Edwardsiidae							
Edwardsia claparedii (Panceri, 1869)	+	45	+	+	I-III	Ss	
Scolanthus mediterraneus Ocaña & Çinar, 2018	-	28	PS[1]	-	I, II	Ss	
Family: Halcampoididae							
Calamactinia incubans Ocaña & Çinar, 2018	-	28	-	-	I	Ss	
Halcampoides purpureus (Studer, 1879)	-	-	-	+	I, II	Ss	
Family: Hormathiidae							
Calliactis palliata (Müller, 1776)	-	43	+	+	I, II	Hs	
Calliactis parasitica (Couch, 1842)	-	15	+	+	I, II	Hs	
Family: Peachiidae							
Peachia cylindrica (Reid, 1848)	+	+	+	-	I, II	Ss	
Family: Sagartiidae							
Cereus pedunculatus (Pennant, 1777)	-	+	+	-	I, II	Ss	
Marmara musculata Ocaña & Çinar, 2018	-	28	-	-	I, II	Hs	
Sagartia elegans (Dalyell, 1848)	-	+	+	-	II	Hs	
Sagartia undata (Müller, 1778)	+	+	-	-	II, III	Ss, Hs	=*Actinothoe clavata*
**Sagartia lacerata* (Dalyell, 1848)	-	+	-	-	II	Hs	
Sagartia (*Cylista*) *viduata* (Müller, 1776)	1	+	-	-	II	Ss	
Order: Antipatharia							
Family: Schizopathidae							
[NT]*Parantipathes larix* (Esper, 1788)	-	+	-	-	V-VII	Ss	
Order: Ceriantharia							
Family: Arachnactidae							
Arachnanthus oligopodus (Cerfontaine, 1891)	-	-	-	+	II	Ss	
Family: Cerianthidae							
Cerianthus membranaceus (Spallanzani, 1784)	-	+	+	+	I-V	Ss	
**Pachycerianthus multiplicatus* Carlgren, 1912	-	-	-	+	I	Ss	
Pachycerianthus solitarius (Rapp, 1829)	1	+	+	+	II	Ss	
Family: Synarachnactidae							
Synarachnactis lloydii (Gosse, 1859)	-	+	-	-	I	Ss	Questionable
Order: Scleractinia							
Family: Caryophyllidae							
Caryophyllia (*Caryophyllia*) *cyathus* (Ellis & Solander, 1786)	-	+	-	-	II, III	Hs	
Caryophyllia (*Caryophyllia*) *inornata* (Duncan, 1878)	-	14	+	+	I, II	Hs	
Caryophyllia (*Caryophyllia*) *smithii* Stokes & Broderip, 1828	-	+	+	+	II, III	Hs	
Coenocyathus anthophyllites Milne Edwards & Haime, 1848	-	+	-	-	II	Ss	
[EN]*Desmophyllum dianthus* (Esper, 1794)	-	+	-	-	VII	Hs	
[EN]*Desmophyllum pertusum* (Linnaeus, 1758)	-	-	7	-	?	?	
Hoplangia durotrix Gosse, 1860	-	-	+	-	I	Hs	

Table. (Continued.)

Paracyathus pulchellus (Philippi, 1842)	-	+	-	-	II	Hs
Phyllangia americana mouchezii (Lacaze-Duthiers, 1897)	-	14	+	+	II	Hs
Polycyathus muellerae (Abel, 1959)	-	14	+	+	I, II	Hs
Family: Cladocoridae						
[EN]*Cladocora caespitosa* (Linnaeus, 1767)	-	+	+	+	I, II	Hs
Family: Dendrophyllidae						
Balanophyllia (*Balanophyllia*) *europaea* (Risso, 1826)	-	+	+	+	I-III	Hs
[VU]*Dendrophyllia ramea* (Linnaeus, 1758)	-	+	-	-	II	Hs
Leptopsammia pruvoti Lacaze-Duthiers, 1897	-	14	+	+	II	Hs
Family: Oculinidae						
**Oculina patagonica* de Angelis D'Ossat, 1908	-	-	-	+	I	Hs
Family: Pocilloporidae						
Madracis pharensis (Heller, 1868)	-	14	+	+	II	Hs
Order: Corallimorpharia						
Family: Corallimorphidae						
Corynactis viridis Allman, 1846	-	+	-	-	II	Hs
Order: Zoantharia						
Family: Epizoanthidae						
Epizoanthus arenaceus (Delle Chiaje, 1841)	-	28	-	-	II	Hs
Epizoanthus couchii Johnston in Couch, 1844	-	+	-	-	II	Hs
Epizoanthus marmarensis Ocaña & Çinar, 2018	-	28	-	-	III	Ss
Family: Parazoanthidae						
Parazoanthus axinellae (Schmidt, 1862)	-	+	+	+	II	Hs
[NT]*Savalia savaglia* (Bertoloni, 1819)	-	+	+	-	II, III	Hs
Class: Octocorallia						
Order: Malacalcyonacea						
Family: Alcyoniidae						
Alcyonium acaule Marion, 1878	-	+	+	-	II	Hs
Alcyonium bosphorense (Tixier-Durivault, 1961)	-	+	-	-	II	Ss
Alcyonium coralloides (Pallas, 1766)	-	+	+	-	II, III	Hs, Ss
Alcyonium palmatum Pallas, 1766	-	+	+	-	II-V	Ss
Family: Clavulariidae						
Clavularia crassa (Milne Edwards, 1848)	-	+	-	-	I	Hs
Family: Eunicellidae						
[NT]*Eunicella cavolini* (Koch, 1887)	-	+	+	-	II	Hs
Eunicella singularis (Esper, 1791)	-	+	+	-	II	Hs
[NT]*Eunicella verrucosa* (Pallas, 1766)	-	+	-	-	II, III	Hs
Family: Paralyconiidae						
Maasella edwardsii (de Lacaze-Duthiers, 1888)	-	15	-	-	II	Hs
Paralcyonium spinulosum Delle Chiaje, 1822	-	+	-	-	II	Hs
Family: Paramuriceidae						
Bebryce mollis Philippi, 1842	-	+	-	-	III	Ss
[VU]*Paramuricea clavata* (Risso, 1826)	-	+	+	-	II	Hs
Paramuricea macrospina (Koch, 1882)	-	+	-	-	II, III	Hs
Spinimuricea klavereni (Carpine & Grasshoff, 1975)	-	+	-	-	II, III	Hs, Ss
Order: Octocorallia *incertae sedis*						
Rolandia coralloides de Lacaze Duthiers, 1900	-	+	-	-	II, III	Hs, Ss
Order: Scleralcyonacea						

Table. (Continued.)

Family: Coralliidae							
[EN]*Corallium rubrum* (Linnaeus, 1758)	-	-	27	27	II, III	Hs	
Family: Cornulariidae							
Cornularia cornucopiae (Pallas, 1766)	-	+	-	-	II	Hs	
Family: Sarcodictyonidae							
Sarcodictyon catenatum Forbes in Johnston, 1847	-	18	-	-	II	Hs	
Family: Funiculinidae							
[VU]*Funiculina quadrangularis* (Pallas, 1766)	-	+	7	23	II-IV	Ss	
Family: Kophoblemnidae							
Kophobelemnon stelliferum (Müller, 1776)	-	+	-	-	II	Ss	
Family: Pennatulidae							
[VU]*Pennatula phosphorea* Linnaeus, 1758	-	+	7	+	II, III	Ss	
[VU]*Pennatula rubra* (Ellis, 1761)	-	+	-	+	II, III	Ss	
[VU]*Pteroeides griseum* (Linnaeus, 1767)	-	+	-	+	II	Ss	= *Pteroeides spinosum*
Family: Veretillidae							
Cavernularia pusilla (Philippi, 1835)	-	17	PS[1]	-	II	Ss	
Veretillum cynomorium (Pallas, 1766)	-	+	+	-	II-IV	Ss	
Family: Virgulariidae							
Virgularia mirabilis (Müller, 1776)	+	+	-	-	II, III	Ss	
Subphylum: Endocnidozoa							
Class: Myxozoa							
Order: Bivalvulida							
Family: Ceratomyxidae							
Ceratomyxa beloneae Lubat, Radujkovic, Marques & Bouix, 1989	+	-	-	-		Pz	*Belone belone*
Ceratomyxa elegans Jameson, 1929	39	-	-	-		Pz	*Scorpaena porcus*
Ceratomyxa merlangi Zaika, 1966	6	-	-	-		Pz	*Merlangius merlangus*
Ceratomyxa scophthalmi Özer, Gürkanlı, Okkay, Çiftçi & Yurakhno, 2022	44	-	-	-		Pz	*Scophthalmus maeoticus*
Family: Chloromyxidae							
Chloromyxum partistriatus Kovaleva, Donec & Kolesnikova, 1989	39	-	-	-		Pz	*Raja clavata*
Family: Enteromyxidae							
Enteromyxum leei (Diamant, Lom & Dyková, 1994)	10	-	-	-		Pz	*Chromis chromis*
Family: Fabesporidae							
Fabespora nana Naidenova & Zaika, 1969	39	-	-	-		Pz	different fish
Family: Myxidiidae							
Myxidium finnmarchicum Mackenzie, Collins, Kalavati & Hemmingsen, 2010	44	-	-	-		Pz	*Scophthalmus maeoticus*
Myxidium gadi Georgévitch, 1916	6	-	-	-		Pz	different fish
Myxidium parvum Yurakhno, 1991	16	-	-	-		Pz	different fish
Myxidium sphaericum Thélohan, 1895	+	-	-	-		Pz	*Belone belone*
Sigmomyxa sphaerica (Thelohan, 1895)	39	-	-	-		Pz	*Belone belone*
Zschokkella iskovi Kovaleva, Donec & Kolesnikova, 1989	39	-	-	-		Pz	*Gaidropsarus mediterraneus*
Family: Myxobolidae							
Henneguya sinova Özer, Özkan, Gürkanlı, Yurakhno & Çiftçi, 2016	39	-	-	-		Pz	*Parablennius sinova*
Myxobolus asymmetricus (Parisi, 1912)	16	-	-	-		Pz	*Parablennius* spp.
Myxobolus episquamalis Egusa, Maeno & Sorimachi, 1990	39	-	-	5		Pz	*Mugil cephalus*
Myxobolus exiguus Thélohan, 1895	-	39	-	-		Pz	*Mugil cephalus*
Myxobolus ichkeulensis Bahri & Marques, 1996	32	-	-	5		Pz	*Mugil cephalus*

Table. (Continued.)

Myxobolus meglitschi Grinham & Cone, 1990	39	-	-	-		Pz	*Symphodus cinereus*
Myxobolus muelleri Bütschli, 1882	4	-	-	-		Pz	*Mugil cephalus*
Myxobolus parvus Shulman, 1962	21	-	-	-		Pz	*Chelon saliens*
Myxobolus spinacurvatura Maeno, Sorimachi, Ogawa & Egusa, 1990	36	-	-	-		Pz	*Mugil cephalus*
Family: Ortholineidae							
Ortholinea divergens (Thélohan, 1895)	16	-	-	-		Pz	*Parablennius sanguinolentus*
Ortholinea gobiusi Naidenova, 1968	16	-	-	-		Pz	*Neogobius melanostomus*
Ortholinea mullusi Gürkanlı, Okkay, Çiftçi, Yurakhno & Özer, 2018	39	-	-	-		Pz	*Mullus barbatus*
Ortholinea orientalis (Shulman & Shulman-Albova, 1953)	39	-	-	-		Pz	different fish
Family: Sinuolineidae							
Sinuolinea rebae Tripathi, 1948	16	-	-	-		Pz	*Solea solea*
Family: Sphaeromyxidae							
Sphaeromyxa sevastopoli Naidenova, 1970	16	-	-	-		Pz	different fish
Family: Sphaerosporidae							
Polysporoplasma mugilis Sitja-Bobadilla & Alvarez-Pellitero, 1995	39	-	-	-		Pz	*Chelon saliens*
Order: Multivalvulida							
Family: Kudoidae							
Kudoa anatolica Özer, Okkay, Gürkanlı, Çiftçi & Yurakhno, 2018	39	-	-	-		Pz	*Atherina hepsetus*
Kudoa dicentrarchi (Sitjà-Bobadilla & Alvarez-Pellitero, 1992)	-	-	46	-		Pz	*Dicentrarchus labrax*
Kudoa niluferi Özer, Okkay, Gürkanlı, Çiftçi & Yurakhno, 2018	39	-	-	-		Pz	*N. melanostomus*
Phylum: CTENOPHORA							
Class: Nuda							
Order: Beroida							
Family: Beroidae							
**Beroe ovata* Bruguière, 1789	+	+	7	-	I-II	P	
Class: Tentaculata							
Order: Cestida							
Family: Cestidae							
Cestum veneris Lesueur, 1813	-	-	9	+	I	P	
Order: Cydippida							
Family: Cydippidae							
Pleurobrachia pileus (O. F. Müller, 1776)	+	+	-	-	I-II	P	
Pleurobrachia rhodopis Chun, 1879	+	+	+	-	I	P	
Order: Lobata							
Family: Bolinopsidae							
Bolinopsis vitrea (L. Agassiz, 1860)	+	-	+	+	I-III	P	
Bolinopsis infundibulum (O.F. Müller, 1776)	-	-	+	-	II	P	
**Mnemiopsis leidyi* A. Agassiz, 1865	+	+	+	+	I-II	P	
Family: Leucotheidae							
Leucothea multicornis (Quoy & Gaimard, 1824)	-	-	-	33	I, II	P	

+ for the reference, see Çınar et al. (2014) and Çınar (2014, for Myxozoa). 1. Nikitin, 1948; 2. Mavili, 1993; 3. Mutlu, 2005; 4. Umur et al., 2010; 5. Özak et al., 2012; 6. Özer et al., 2012; 7. Gönülal and Güreşen, 2014; 8. İşinibilir et al., 2015a; 9. Katsanevakis et al., 2014; 10. Özer et al., 2014; 11. Yiğit, 2014; 12. Bayhan et al., 2015; 13. Isinibilir et al., 2015b; 14. Özalp and Alparslan, 2015; 15. Özalp and Ateş, 2015; 16. Özer et al., 2015; 17. Sezgin and Yüksek, 2015; 18. Topçu and Öztürk, 2015; 19. Gülşahin et al., 2016; 20. Onmuş et al., 2016; 21. Özer et al., 2016; 22. Çınar et al., 2017; 23. Gönülal and Dalyan, 2017; 24. Topçu et al. 2017; 25. Urcun, 2017; 26. Yilmaz et al., 2017; 27. Çınar et al., 2018; 28. Ocaña and Çinar, 2018; 29. Topçu et al., 2018; 30. Dragičević et al., 2019; 31. İşinibilir et al., 2019; 32. Bölükbaş et al., 2020; 33. Gokoglu and Galil, 2020; 34. Mutlu et al., 2020; 35. Öztürk, 2020; 36. Yardımcı et al., 2020; 37. Yilmaz et al., 2020; 38. İşinibilir et al., 2021; 39. Özer, 2021; 40. Bilecenoğlu and Çinar, 2022; 41. İşinibilir et al., 2022; 42. Mutlu and Özvarol, 2022; 43. Özalp et al., 2022; 44. Özer et al., 2022; 45. Acar et al., 2023; 46. Birincioğlu et al., 2023; 47. Kabadayı Yıldırım and Küçük, 2024; 48. Haeckel, 1879.

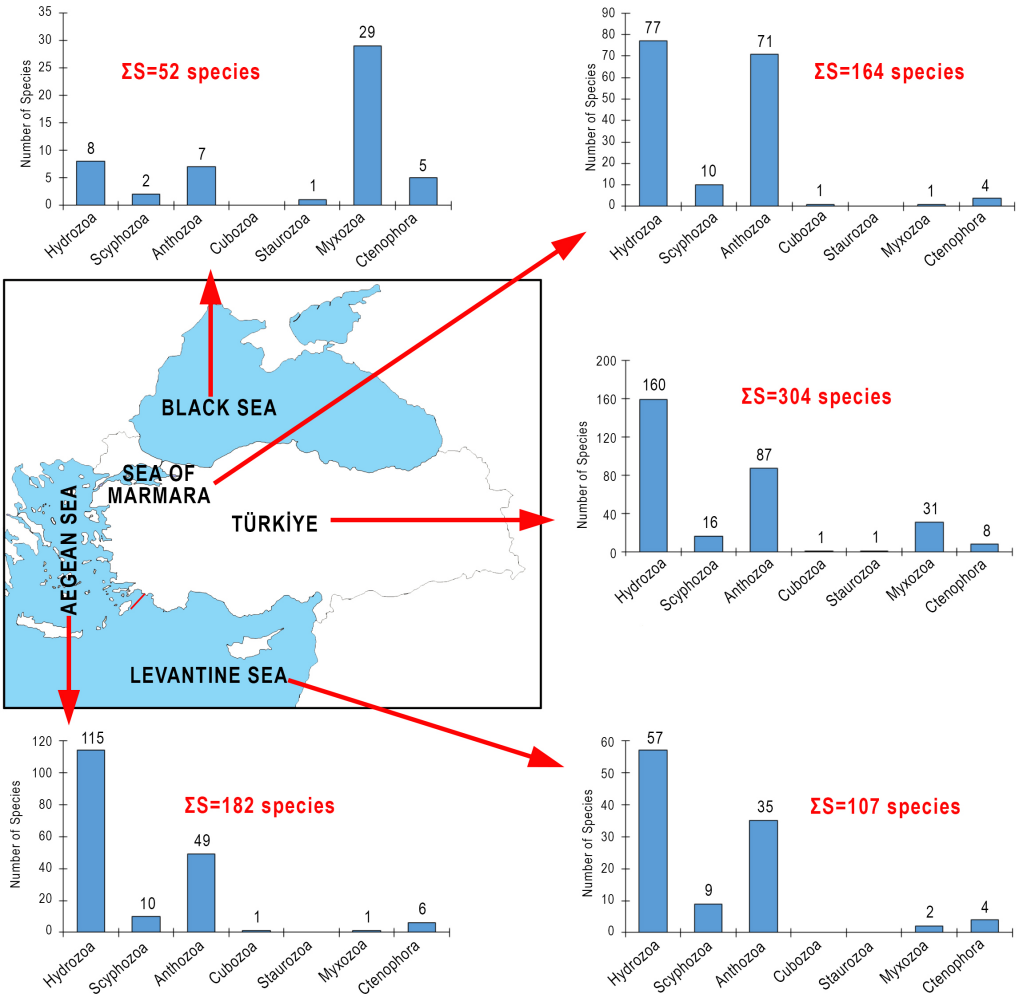

Figure 1. Numbers of Cnidaria and Ctenophora species along the coasts of Türkiye.

represented by eight species in Türkiye and the highest number of species (6 species) was found in the Aegean Sea.

The phyla Cnidaria and Ctenophora on the coasts of Türkiye are represented by 22 orders and 109 families and by four orders and five families, respectively. The number of species of the orders varied among the seas (Figure 2). In general, the orders with the highest numbers of species were Leptothecata (78 species), Anthoathecata (49 species), Actinaria (33 species), Bivalvulida (29 species), and Siphonophorae (24 species) (Figure 2). In the Black Sea, the parasitic order Bivalvulida accounted for almost 54% of the total number of species known from the region. In the other seas, the hydrozoan order Leptothecata ranked first in terms of species richness with 78 families (57 species in the Aegean Sea). The order Anthoathecata ranked second in terms of species richness in the Sea of Marmara and the Aegean Sea. The number of species belonging to the order Actiniaria ranged from five (Black Sea) to 24 (Aegean Sea) in the region.

3.3. Overview of research on free-living cnidarians

The first study on the free-living cnidarians of Türkiye dates back to 1844, when Forbes (1844) reported four species in the Levantine Sea and three species in the Aegean Sea. He was followed by Haeckel (1879) and Colombo (1885), who found seven species in the Sea of Marmara (Çanakkale Strait) and three species in the Aegean Sea (İzmir Bay). Until 1970, only Nikitin (1948) in the Black Sea, Ostroumoff (1894, 1896) and Demir (1952–1954) in the Sea of Marmara, Ergen (1967) in the Aegean Sea, and Billard (1931) in the Levantine Sea contributed significantly to the understanding of the marine cnidarian fauna of Türkiye.

After 1970, the number of species reports tended to increase in the region, and by 1995, the number of species known from the Black Sea, Aegean Sea, and Levantine Sea had doubled, while the number of species from the Sea of Marmara remained fairly constant with a slight increase between 1975 and 1985 (69 species in 1965 and 1975, 80 species in 1985, and 82 species in 1995) (Figure 3).

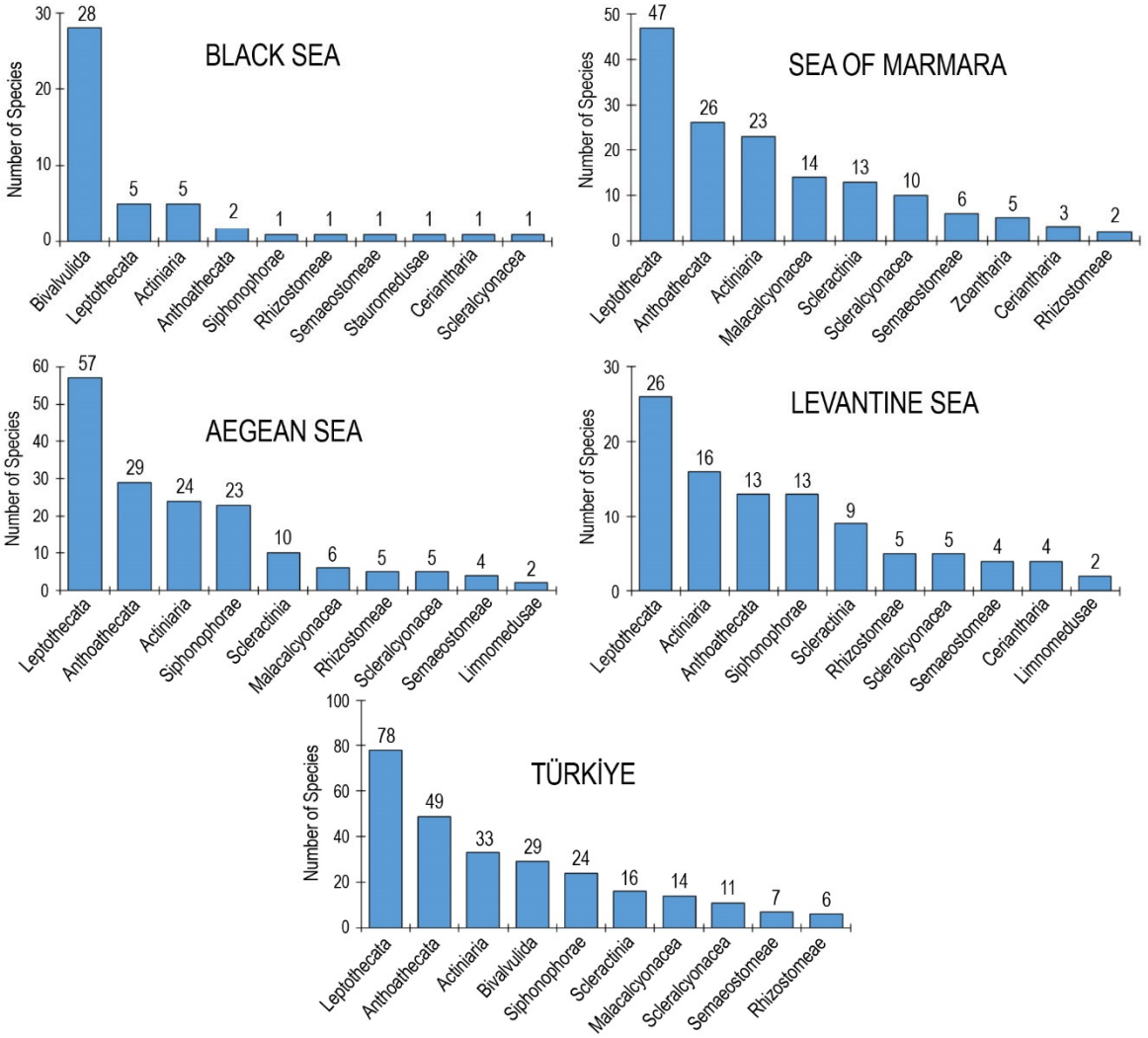

Figure 2. Most species-rich orders of Cnidaria along the coasts of Türkiye.

In the most recent period (1995–2024), with the exception of the Black Sea, specific studies on cnidarians (especially hydrozoans) were carried out in the region, resulting in the number of known species increasing from 82 (1995) to 166 (2024) in the Sea of Marmara (increment: 102%), from 106 to 176 (increment: 66%) in the Aegean Sea, and from 20 to 103 (increment: 415%) in the Levantine Sea.

3.4. Depth and habitat distribution

The highest number of free-living cnidarian species was found in the depth intervals of 0–10 m (156 species) and 11–50 m (155 species) (Figure 4). Species diversity decreased significantly with increasing depth and only 60 and 13 species were recorded in the depth intervals of 51–100 m and 101–200 m, respectively. An exponential relationship (R^2 = 0.94) was found between the number of reported free-living cnidarian species and depth. In the deep sea (>200 m depth), only eight species (roughly 3% of the total number of species) were found in the region: *Chelophyes appendiculata* (201–400 m), *Muggiaea kochii* (201–600 m), *Halecium halecinum* (201–400 m), *Diadumene turcica* (>601 m), *Parantipathes larix* (201 to >601 m), *Cerianthus membranaceus* (201–400 m), *Desmophyllum dianthus* (>601 m), and *Alcyonium palmatum* (201–400 m). Five species, namely *M. kochii* (11–600 m), *C. membranaceus* (11–400 m), *Lafoea dumosa* (0–200 m), *Nemertesia antennina* (0–200 m), and *A. palmatum* (11–400 m), were widespread and occurred in more than 3 depth intervals.

The majority of cnidarian species (176 species) were found on hard substrata, 60 species on pelagic area, 34 species on soft substrata, and 31 species on various fish as parasites.

3.5. Alien species

As of May 2024, a total of 18 alien cnidarian species have been reported from the coasts of Türkiye, of which eight species belong to Hydrozoa, five species belong to

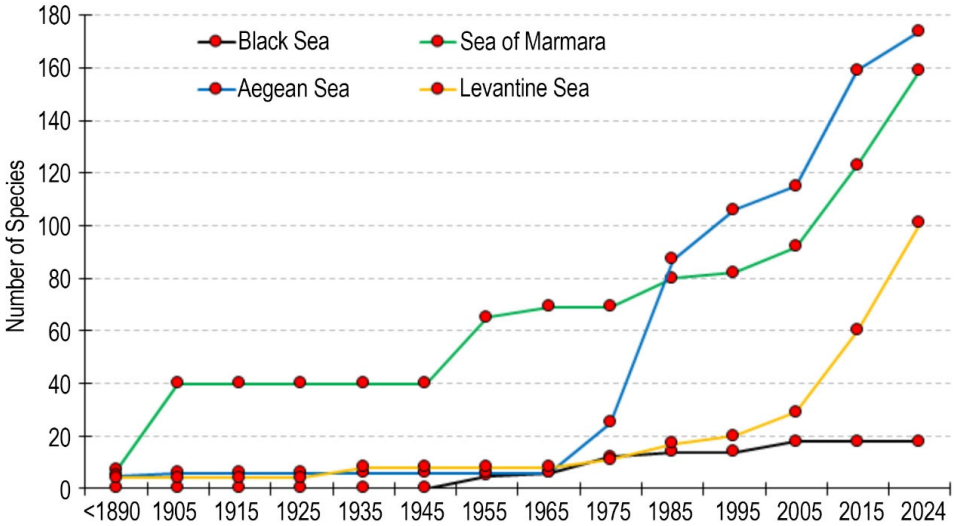

Figure 3. Yearly changes in the numbers of cnidarian species (excluding Myxozoa) along the coasts of Türkiye.

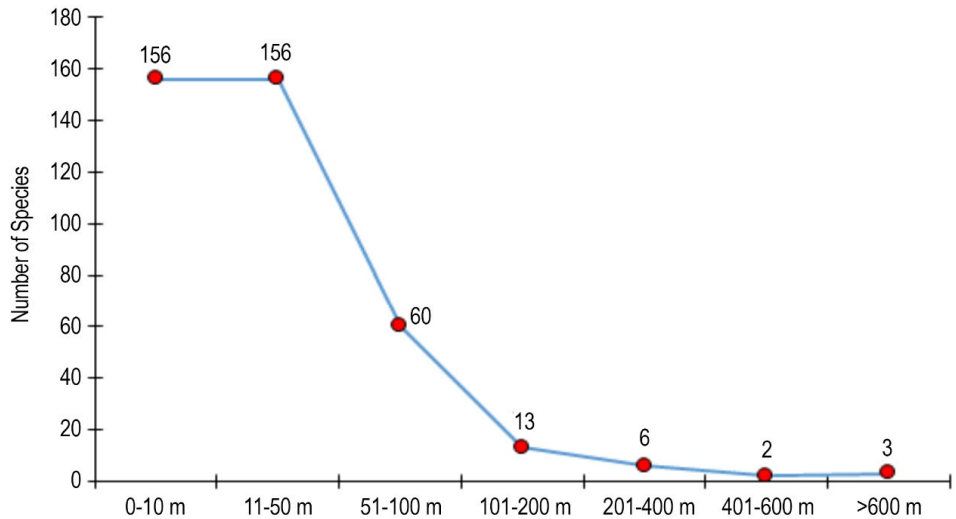

Figure 4. Numbers of free-living cnidarian species reported at different depth intervals along the coasts of Türkiye.

Scyphozoa, and five species belong to Anthozoa. Only two alien ctenophore species (*Mnemiopsis leidyi* and *Beroe ovata*) are known from the region, both of which occur in all seas except for the Levantine Sea, where only *Mnemiopsis leidyi* has been reported to date. The number of alien cnidarian species varies from sea to sea, reaching a maximum (12 species) in the Levantine Sea, and no alien species have been reported in the Black Sea (Table; Figure 5). The number of alien cnidarian species decreases while moving from the south to the north (six species in the Sea of Marmara). The orders with higher numbers of alien species are Leptothecata (five species) and Rhizostomeae (five species).

3.6. Threatened species

According to the IUCN Red List (Otero et al., 2017), four endangered (*Desmophyllum dianthus*, *Desmophyllum pertusum*, *Cladocora caespitosa*, and *Corallium rubrum*) and six vulnerable (*Dendrophyllia ramea*, *Paramuricea clavata*, *Funiculina quadrangularis*, *Pennatula phosphorea*, *P. rubra*, and *Pteroeides griseum*) species have been reported from the coasts of Türkiye. In addition, four near-threatened species, namely *Parantipathes larix* from the Sea of Marmara, *Savalia savaglia* from the Sea of Marmara and the Aegean Sea, *Eunicella cavolini* from the Sea of Marmara and the Aegean Sea, and *E. verrucosa* from the Sea of Marmara, have been found in the region. No

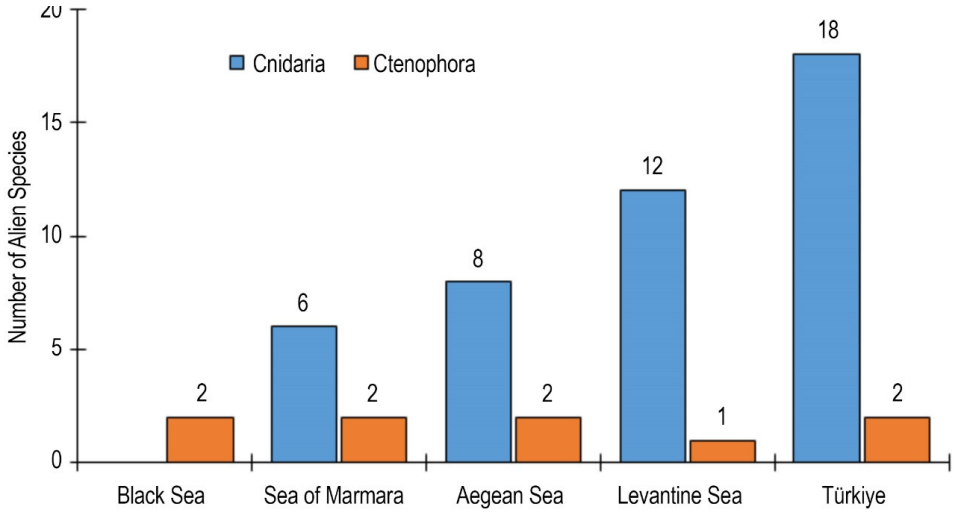

Figure 5. Numbers of alien Cnidaria and Ctenophora species along the coasts of Türkiye.

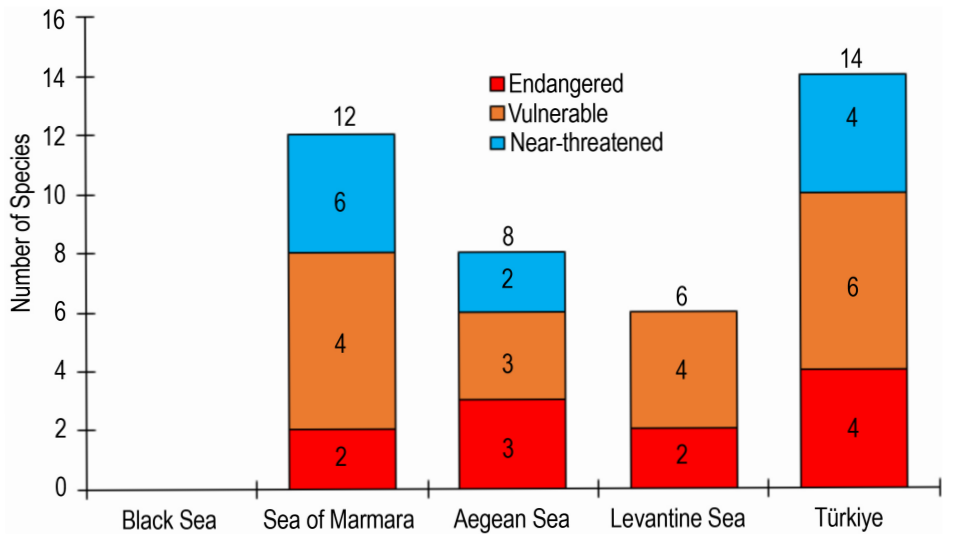

Figure 6. Numbers of endangered, vulnerable, and near-threatened cnidarian species along the coasts of Türkiye.

species of the aforementioned IUCN categories have been reported to occur in the Black Sea. The highest number of threatened (endangered or vulnerable species) and near-threatened species were found in the Sea of Marmara (12 species in total) and the Aegean Sea (eight species) (Figure 6).

4. Discussion

The number of marine cnidarian species known from the coasts of Türkiye increased significantly after the publication of the first checklist in 2014 (Çınar et al., 2014), from 195 species to 265 species, excluding Myxozoa, which was treated as a different phylum in 2014. The current cnidarian diversity of Türkiye includes almost 42% of the overall Mediterranean cnidarian fauna (Coll et al., 2010). The Mediterranean hydrozoan fauna is relatively well studied, with 457 species known from the region (Bouillon et al., 2004), of which 20% are endemic (Gravili et al., 2013). The hydrozoan fauna of Türkiye includes 35% of the overall Mediterranean fauna. In the neighboring seas (Aegean Sea and Ionian Sea), no updated species list of hydrozoans (Cnidaria in general) is available, but a compilation of hydrozoan data (not specified, but presumably excluding Siphonophorae) together with newly published species reports indicated the presence of 67 hydrozoan species on the coasts of Greece and Türkiye (Morri and Bianchi, 1999). However, Çınar et al. (2014) reported five siphonophores and 64 other hydrozoans in

the territorial waters of Türkiye. Thanks to the studies by Mavili (1993 (not included in the 2014 species list)), İşinibilir et al. (2015a), Topçu et al. (2017), and Yilmaz et al. (2020), the number of hydrozoan species along the Aegean coast of Türkiye increased from 69 to 115 species (increment: 67%), indicating the need for detailed studies on this group in the eastern Mediterranean. On the Levantine coast of Türkiye, a total of 57 hydrozoan species (13 siphonophore species, 44 other hydrozoan species) were reported, of which seven siphonophore species were encountered for the first time in this region in the present study. In a relatively intensive sampling campaign, Morri et al. (2009) found 38 nonsiphonophore hydrozoan species on the Lebanese coast (Levantine Sea), of which six species were classified as alien.

The Mediterranean anthozoan fauna has been reported to comprise 182 species, of which 59 species belong to Octocorallia and 123 species belong to Hexacorallia (Trainito and Baldacconi, 2016). However, Otero et al. (2017) limited the number to 136, eliminating several species whose presence in the Mediterranean Sea is questionable. Based on the estimates of Otero et al. (2017), the Turkish anthozoan fauna (87 species) includes 64% of the overall Mediterranean fauna. The class Hexacorallia is represented by 61 species and the class Octocorallia by 26 species in Türkiye. In the eastern Mediterranean, 25 octocoral species were reported from the Greek coast of the Aegean Sea, 13 species from the Ionian Sea, and two species from the Levantine Sea (Vafidis et al., 1994). In 2014, Çınar et al. (2014) listed 22 octocoral species along the coasts of Türkiye. In the last decade, three species, namely *Maasella edwardsii* from the Çanakkale Strait (Özalp and Ateş, 2015), *Corallium rubrum* from the northern Aegean Sea and Levantine Sea (Çınar et al., 2018), and *Sarcodictyon catenatum* from the Sea of Marmara (Topçu and Öztürk, 2015), were reported from the region. The actual diversity of anthozoans in Türkiye is far from being completely known. Besides one study conducted in the distant past (Coşar, 1974), no specific study on the anthozoan fauna of Türkiye was conducted until 2018. In that year, Ocaña and Çinar (2018) described two genera (*Marmara* and *Charisactis*) and six species new to science in the region, some of which were abundant and occurred in shallow waters (e.g., *M. musculata*), highlighting the importance of targeted studies for a proper inventory of marine biodiversity. A peculiar finding was the presence of *Diadumene turcica* in the Çınarcık Basin (1200 m) of the Sea of Marmara, a genus characterized by species inhabiting shallow-water environments. The species described from the Sea of Marmara may have adapted to deeper areas and its presence in the Mediterranean may be overlooked as is often the case for small-sized species, particularly from deep bottoms (Costello et al., 2010).

The report of *Isidella elongata* (Esper, 1788) by Gönülal and Güreşen (2014) off Gökçeada (northern Aegean Sea), a critically endangered species in the Mediterranean Sea, was not included in the present list as there was no concrete evidence of its presence in the area and the report was based on only an old document from the Fisheries Institute (personal communication). However, Vafidis et al. (1994) found a colony of this species in the northern Aegean Sea (off the Halkidiki Peninsula) on a small stone at a depth of 150 m. Among the anthozoan species listed here, the report of *Synarachnactis lloydii* in the Sea of Marmara by Gökalp (2011) seems to be questionable and may have been confused with the common cerianthids of the area such as *Cerianthus membraneceus* and *Pachycerianthus solitarius*. *Sagartia* (*Cylista*) *viduata*, which occurs exclusively in the North Atlantic (Petersen et al., 1996) and has not yet been found in the Mediterranean Sea, was reported from the Sea of Marmara by Ostroumoff (1896) and from the Black Sea by Nikitin (1948). However, recent studies have not indicated its presence in these seas, so its status remains questionable. *Parerythropodium bosphorense*, which was originally described by Tixier-Durivault (1961) from the İstanbul (Bosphorus) Strait, is distinguished from closely related species such as *Alcyonium coralloides* by its polyps and spicules. Groot and Weinberg (1982) later examined the type specimen of the species and stated that "although extremely small, the specimen and its description make it almost certain that it is a synonym of *A. coralloides* (with short crown sclerites: 130–155 μm, as were also found at Cave of Bear and Pointe de la Voile), which would extend its distribution to the easternmost shores of the Mediterranean (Türkiye)," and they eventually synonymized it with *A. coralloides*. However, a molecular analysis of *A. coralloides* suggested that different morphotypes of this species may belong to different species (McFadden, 1999; Topçu and Özalp, 2016). Therefore, this species is retained in the present list until new evidence on its taxonomic status is presented.

The alien species from the coasts of Türkiye were recently documented, including 18 cnidarians and 2 ctenophores (Çinar et al., 2021). In the present study, *Filellum serratum* was excluded from the list of alien species of Türkiye due to its wide distribution in the Atlantic Ocean and the Mediterranean Sea. Galanidi et al. (2023) also considered it as a cryptogenic species. In contrast, the colonial scleractinian *Oculina patagonica*, which was reported as an alien species from the Levantine coast of Türkiye (Çinar et al., 2006) but later excluded from the list of alien species of Türkiye by Çinar et al. (2021), was added again to the alien species list of Türkiye in the present study; its presence and colonization success in the Mediterranean Sea are most likely related to shipping activities (Serrano et al., 2023). The hydrozoan *Macrorhynchia philippina*,

the scyphozoans *Cassiopea andromeda* and *Rhopilema nomadica*, and the anthozoans *Diadumene cincta* and *Oculina patagonica* were considered as invasive alien species due to their detrimental effects on human health and native biodiversity (Çınar et al., 2011; Çinar et al., 2021). Massive swarms of alien jellyfish such as *Rhopilema nomadica* directly affect human health in the Levantine Sea, where 815 injuries were recorded in the summer of 2009 alone (Öztürk and İşinibilir, 2010). The blockage of nets of fishermen by *R. nomadica* created major economic losses (Çınar et al., 2005, 2011). Over time, these species have greatly expanded their distributional range, with *R. nomadica* and *Phyllorhiza punctata*, both Lessepsian species, reaching the northern Aegean Sea (Çınar et al., 2023). *Chrysaora pseudoocellata*, recently described by Mutlu et al. (2020), was considered an alien species (Galanidi et al., 2023).

According to the IUCN assessment of anthozoans in the Mediterranean Sea, one species (*Isidella elongata*) is classified as critically endangered, nine species (*Parabenonia vouliagmeniensis*, *Corallium rubrum*, *Leiopathes glaberrima*, *Crassophyllum thessalonicae*, *Desmophyllum dianthus*, *D. pertusum* (=*Lophelia pertusa*), *Dendrophyllia cornigera*, *Cladocora caespitosa*, and *Madrepora oculata*) as endangered, and seven species (*Ellisella paraplexauroides*, *Paramuricea clavata*, *Funiculina quadrangularis*, *Pennatula phosphorea*, *P. rubra*, *Pteroeides spinosum*, and *Dendrophyllia ramea*) as vulnerable (Otero et al., 2017). According to the Protocol to the Barcelona Convention (latest amendments from the 18th meeting of Contracting Parties in İstanbul in 2013), 14 species (*Astroides calycularis*, *Errina aspera*, *Savalia savaglia*, *Antipathes subpinnata*, *A. dichotoma*, *A. fragilis*, *Leiopathes glaberrima*, *Parantipathes larix*, *Callogorgia verticillata*, *Cladocora caespitosa*, *C. debilis*, *Ellisella paraplexauroides*, *D. pertusum*, and *M. oculata*) were listed as endangered or threatened species (Barcelona Convention Annex II), and *Antipathes* spp. and *Corallium rubrum* (Barcelona Convention Annex III) were considered as species whose exploitation should be regulated. Although *I. elongata* was reported from the Aegean coast of Türkiye (off Gökçeada), it was excluded from the present checklist as the report was not based on a reliable source and the specimen was not deposited in any institution. However, its presence in the northern Aegean Sea was confirmed by Vafidis et al. (1994), suggesting that it may also occur in the territorial waters of Türkiye. New fresh material is needed to confirm its presence in the region. The biogenic structure of the northern Aegean Sea shows an affinity with the western Mediterranean, where animal forests formed by gorgonians predominate. Findings of populations of red coral *Corallium rubrum* in the region (Dounas et al., 2009; Çınar et al., 2018) are noteworthy, and the characteristic features (eutrophic conditions and suitable habitat structures) of the northern Aegean Sea seem to support its establishment in the region. However, reports of the species are sporadic and its actual population in the region is largely unknown.

In the northern Aegean Sea and the Sea of Marmara, where gorgonians form relatively dense beds, colonies of *P. clavata* and *Eunicella* spp. have been adversely affected by various factors, such as mucilage, anchoring, climate change (particularly in the Aegean Sea), and siltation. In the Saroz Bay (northern Aegean Sea), the majority of *E. singularis* colonies (almost 80%) and all *Alcyonium acaule* populations were severely damaged or killed in 2000–2002 due to pollution of unknown origin (Arda et al., 2004), and highly necrosed white and yellow gorgonians were later reported from the area along with healthy populations (Topçu Eryalçın, 2017). The widespread and massive outbreak of mucilage in the Sea of Marmara in late 2020 and the middle of 2021 led to the death of many sessile and vagrant species, especially gorgonians (Topçu and Öztürk, 2021; Topçu et al. 2023). It appeared that *P. clavata* was severely affected by the mucilage, but *Eunicella* spp. showed some degree of resistance. Close to the metropolis of İstanbul, the gorgonian populations in the northern Sea of Marmara were largely damaged by construction (siltation/sedimentation) and sediment dumping (Topçu et al., 2018, 2019). The survival of these slow-growing species is threatened by uncontrolled and unregulated anthropogenic activities.

In the Çanakkale Strait, an area of about 2000 m^2 was designated as a marine protected area in August 2021 to protect the endangered scleractinian *Cladocora caespitosa*, where it is abundant (almost 80 healthy colonies) and forms a reef-like structure (Özalp and Alparslan, 2016; Topçu and Özalp, 2016; Özalp et al., 2022, Özalp, 2023) in such a way that it builds up in some specific areas of the western Mediterranean and the Adriatic Sea (Kersting and Linares, 2012; Macic et al., 2019). However, this species is sensitive to thermal anomalies and overgrowth by invasive alien species such as *Caulerpa cylindracea*, resulting in widespread bleaching of this coral throughout the Mediterranean region, including the Çanakkale Strait (Kersting et al., 2014; Kružić et al., 2014; Guresen et al., 2015). More efforts and new approaches are needed to protect this Mediterranean heritage.

The changes in the number of cnidarian species in the last decade (i.e. between 2014 and 2024) suggest that the species number known from the coasts of Türkiye will increase further when more scientific efforts are made. The lack of experts, especially for anthozoans, in Türkiye seems to be a major factor in the gap between the numbers

of species known from Türkiye and other well-studied parts of the Mediterranean. When they are studied in more detail by experts, new species are being reported from these regions. The discovery of new anthozoan genera and new species in the Sea of Marmara is a good example of this (see Ocaña and Çinar, 2018). In addition, more scientific expeditions to different depths (e.g., deep sea) and habitats (e.g., coralligenous and maerl beds) are needed to determine the true diversity of Cnidaria and Ctenophora along the coasts of Türkiye.

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