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Diversity of Bryozoa along the coasts of Türkiye

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Abstract: The current status of bryozoan species distributed along the coast of Türkiye was revised, and an updated checklist including 185 species (24 cyclostomatids, 20 ctenostomatids, and 141 cheilostomatids) was presented. Cheilostomes largely prevail (141 species, 87 genera, and 50 families), followed by cyclostomes (24 species, 15 genera, and nine families) and ctenostomes (20 species, nine genera, and eight families) in the bryozoan fauna of Türkiye. The distribution of species and genera highlights the Aegean Sea as the most diverse, hosting 146 species. In this study, *Hornera frondiculata* (Lamarck, 1816), *Amathia verticillata* (delle Chiaje, 1822), *Bugulina fulva* (Ryland, 1960), *Tricellaria inopinata* d'Hondt and Occhipinti-Ambrogi, 1985, *Parasmittina egyptiaca* (Waters, 1909), *Watersipora arcuata* Banta, 1969, *Watersipora subtorquata* (d'Orbigny, 1852), *Celleporaria aperta* (Hincks, 1882), and *Rhynchozoon neapolitanum* Gautier, 1962 were recorded after the first checklist was prepared for the coasts of Türkiye. A total of eight alien species, mainly introduced via shipping and the Suez Canal, were reported in this study.

Key words: Bryozoa, taxonomy, alien species, diversity, Türkiye

1. Introduction

Bryozoan species are among the main components of benthic communities colonizing various types of hard substrate in different environmental conditions. Bryozoans play a role in the food web, and some of them can act as bioengineers, promoting habitat heterogeneity for other invertebrates and fishes (McKinney et al., 2003; Lombardi et al., 2014). The Mediterranean mesophotic zone hosts coralligenous habitats in which bryozoans are the most diverse secondary bio-constructors, and species´ composition varies among studied localities within the basin (Rosso and Di Martino, 2016; Çınar et al., 2020; Giampaoletti et al., 2020). Associated erect bryozoans in the canopy also support richer epibiont communities than fleshy algae (Rosso et al., 2023). This particular ecosystem is important for biodiversity and ecosystem functions.

Bryozoan diversity in the Mediterranean Sea accounts for 9.1% of the number of bryozoan species described globally, comprising 588 species, 220 genera, and 99 families (Rosso and Di Martino, 2023). Long-term monitoring of sensitive groups such as bryozoans and long-living species may allow for a better understanding of changes occurring at the community level (Betti et al., 2017).

In the Mediterranean, alien bryozoans have been recorded more frequently on artificial substrates (Ferrario et al., 2018). However, invasive alien bryozoan species negatively impact aquaculture due to competition for resources and fouling, which are the main common mechanisms of impact (Tsirintanis et al., 2022). The main pathways in transporting alien species to the Mediterranean are the Suez Canal, shipping, and aquaculture (Öztürk, 2021). Alien bryozoan species have been commonly introduced into new areas through fouling organisms attached to boat hulls (Ferrario et al., 2018). In the Mediterranean, a total of 32 alien bryozoan species have been found; the highest number (30 alien bryozoan species) was recorded in the Levantine Sea (Galanidi et al., 2023).

In the Mediterranean, bryozoan fauna consists of endemic, tropical, and Indo-Pacific species, plus a group of species with wide Atlantic-Mediterranean distribution due to the complex evolution of the basin (Rosso and Di Martino, 2016). The regional richness of both native and alien warm water species is related to seawater temperature. These species expand their distribution from the southern region, where a rapid increase in the Lessepsian species has been frequently recorded, to the northwards (Parravicini et al., 2015; Ulman et al., 2017; Ferrario et al., 2018; Zenetos and Galanidi, 2020).

Along Türkiye's coast, comprehensive faunal researches on bryozoans were conducted by Forbes (1844), Colombo

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(1885), Ostroumoff (1894, 1896), and Marion (1898). In the following years, systematic and ecological studies with illustrations of registered species in various habitats and depths were performed (Demir, 1952; Geldiay and Kocataş, 1972; Pınar, 1974; Ünsal, 1975; Ünsal and d'Hondt, 1978-1979; Nicoletti et al., 1995; Chimenz et al., 1997; Koçak, 2007; Koçak, 2008; Koçak and Aydın-Önen, 2014a). These studies have provided useful information for preparing the previous list, in which a total of 185 bryozoan species were recorded. These species were mostly represented by the Cheilostomatid order, containing 141 species (Koçak and Aydın-Önen, 2014b).

After the checklist on bryozoans was published in 2014, several others have been conducted in the previous decade, mostly in shallow sampling stations, such as ports and marinas. Ulman et al. (2017) focused on non-indigenous species in 34 marinas in different Mediterranean subregions, including six marinas on the coast of Türkiye, i.e., İstanbul, Bodrum, Datça, Marmaris, Fethiye, and Finike. In that study, four non-indigenous species, i.e., *Amathia verticillata*, *Hippopodina* sp. A, *Parasmittina egyptiaca*, and *Watersipora arcuata* were recorded, and *Tricellaria inopinata* found on boat hulls was included in the list. The relationship between fouling bryozoan species and environmental parameters were studied to determine the effects of environmental factors on bryozoan species (Koçak et al., 2019). Five species from the Bugulidae order were recorded in seven shallow and one deep stations, and *Bugulina fulva* was first reported on the Mediterranean coast of Türkiye (Koçak and Bakal, 2019). *Rynchozoon neapolitanum* and *Hornera frondiculata* were recorded in Özalp et al. (2022), which examined invertebrate assemblages and bryozoan species associated with *Cladocora caespitosa* reef in the Çanakkale Strait. Alien and cryptogenic species that have settled on artificial substrates in ports and marinas were investigated in Koçak (2023); the author recorded *T. inopinata*, *Watersipora subtorquata*, and *Celleporaria aperta* for the first time on the coast of Türkiye.

In the present study, the composition of bryozoan fauna along the coast of Türkiye was updated to supply additional and useful knowledge for future biodiversity studies.

2. Materials

In order to update the checklist of bryozoan species from Türkiye, information originating from recent investigations which include taxonomic studies, previously unavailable papers, research carried out in various habitats and locations in the last decade, and studies on alien bryozoans along the coast of Türkiye, was used. In the cases the author's or authors' names were not included while citing a species, the taxon was not inserted in the list. In the updated list, references are only given for newly added bryozoan species, as previously recorded species were mentioned in Koçak and Aydın-Önen (2014b). Species distributed outside of the Mediterranean Sea, along with alien, newly added, and protected species, are indicated in Table 1. Species whose actual names or origins are doubtful or those with taxon inquirendum were excluded from the updated checklist and listed in Table 2.

The taxonomy of bryozoans was checked, and the nomenclature and classification were updated following the Bryozoa Homepage (Bock, 2020)[1] and the World Register of Marine Species (2024)[2] websites. The status of the species in Table 1 was assessed considering some recently published papers on the Mediterranean Sea (Rosso et al., 2015; Gerovasileiou and Rosso, 2016; Rosso and Di Martino, 2016; Rosso et al., 2019; Achilleos et al., 2020; Rosso et al., 2020a; Rosso et al., 2020b; Pica et al., 2022; Rosso and Di Martino, 2023). Alien species and their pathways were grouped according to Zenetos et al. (2010), Çinar et al. (2021), and Galanidi et al. (2023). The current status (Casual, Establish, Invasive), pathways (Co: Corridor, T-C: Transport-Contaminant, TS: Transport Stowaway, U: Unaided), origins, and references, including the earliest record of the taxa from the coast of Türkiye, are presented in Table 3.

A synthesis of collected data showing the number of bryozoan species found in the Black Sea, the Sea of Marmara, the Aegean Sea, and the Levantine Sea is given in Figure 1.

3. Results

3.1. Updated checklist

Bryozoan fauna from the coast of Türkiye (Table 1) consists of two classes, three orders, 67 families (nine cyclostomatids, eight ctenostomatids, and 50 cheilostomatids), and 185 species (24 cylostomatids, 20 ctenostomatids, and 141 cheilostomatids). The Cheilostomatida order accounts for the greatest part of the diversity. Taking into consideration all taxa additions and removals, the number of species was found to be 8, 62, 109, and 56 for cheilostomatids in the Black Sea, the Sea of Marmara, the Aegean, and the Levantine Sea, respectively. Moreover, the number of species in the Marmara, Aegean, and Levantine Seas was recorded as 9, 18, and 4 for ctenostomatids and 15, 19, and 6 for cyclostomatids, respectively.

The Celleporidae family, belonging to the Cheilostomatida order, is the most species-rich and is represented by 13 species. It is followed by other families

[1]Bock (2020). International Bryozoological Association (IBA), Bryozoa Homepage (online). Website <https://www.bryozoa.net> (accessed 28 May 2024).

[2]World Register of Marine Species 2024. (online). Website< https://www.marinespecies.org> (accessed 28 May 2024).

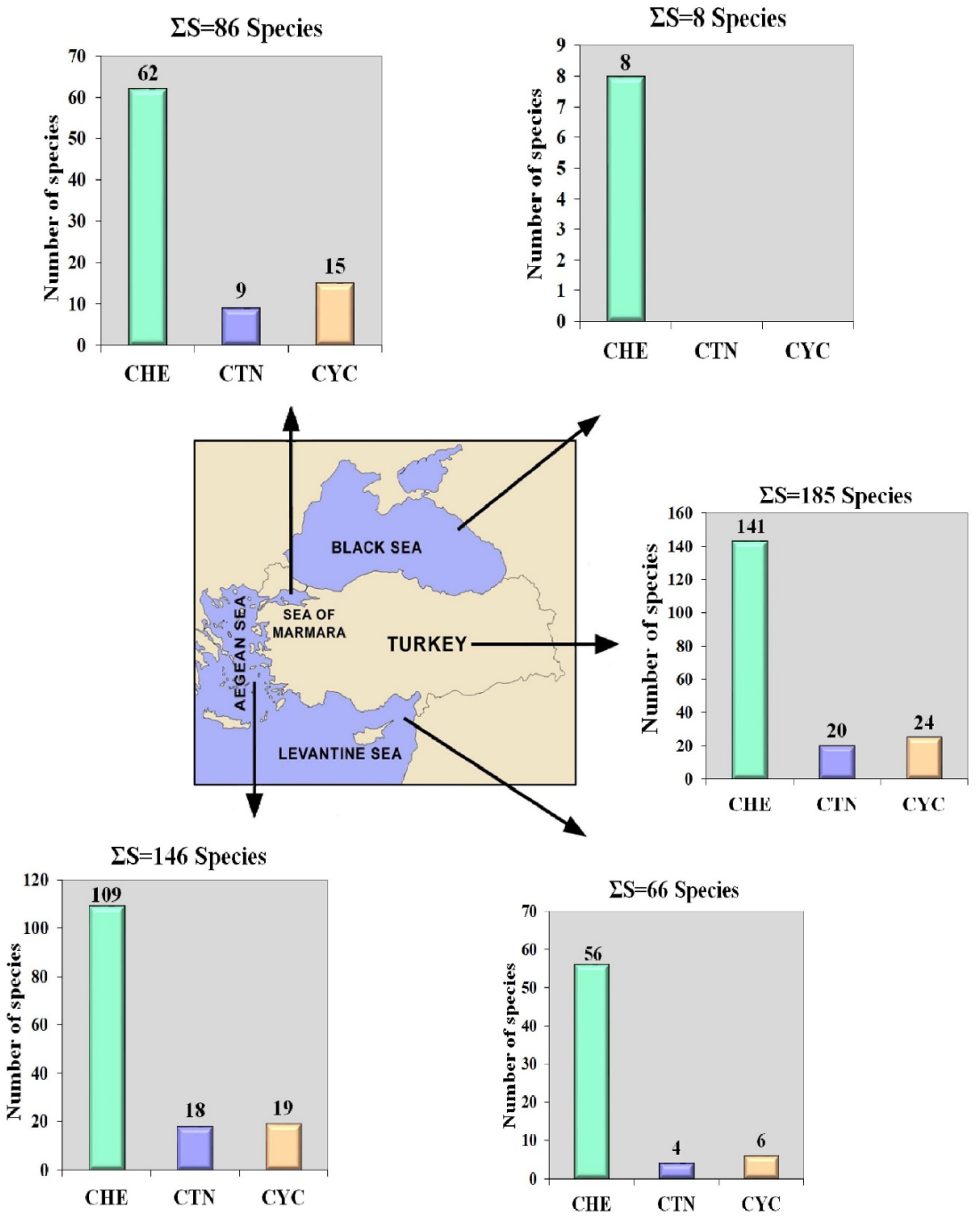

Figure 1. Number of bryozoan species recorded along Turkish coasts (CHE: Cheilostomatida; CTN: Ctenostomatida; CYC: Cyclostomatida).

Table 1. Checklist of the marine bryozoans of Türkiye. 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, sponge, mussels, etc.; Ss: Soft substratum, including all phanerogams). Known distribution areas of species generally outside the Mediterranean Sea are indicated with a "†", and documented distribution of the species are given in the notes; alien species are designated with an "*", newly added species with an "▪", and protected species with an "•".

Taxon	BS	SM	AS	LS	DR	H	Notes
Phylum: BRYOZOA							
Class: STENOLAEMATA Borg, 1941							
Order: CYCLOSTOMATIDA Busk, 1852							
Family: Tubuliporidae Johnston, 1837							
Exidmonea triforis (Heller, 1867)	-	+	+	-	III	?	
Platonea stoechas Harmelin, 1976	-	-	+	-	III	Ss	
†*Tubulipora biserialis* Canu & Bassler, 1925	-	-	+	-	I	?	North-East Atlantic
†*Tubulipora flabellaris* (O. Fabricius, 1780)	-	-	+	-	I-III	?	Eastern China Sea, North Atlantic
Tubulipora liliacea (Pallas, 1766)	-	+	+	+	I-III	Hs	
Tubulipora ziczac Harmelin, 1976	-	-	+	-	II	?	
Plagioeciidae Canu, 1918							
Diplosolen obelium (Johnston, 1838)	-	+	+	+	I-III	Ss	=*Diplosolen obelia* (Johnston, 1838)
Entalophoroecia deflexa (Couch, 1842)	-	-	+	-	III	?	
Plagioecia patina (Lamarck, 1816)	-	-	+	-	II, III	?	
Plagioecia sarniensis (Norman, 1864)	-	-	+	-	III	?	
Terviidae Canu & Bassler, 1920							
Tervia irregularis (Meneghini, 1844)	-	+	+	-	III	Hs	
Annectocymidae Hayward & Ryland, 1985							
Annectocyma cf. *major* (Johnston, 1847)	-	-	+	-	II	Ss	
Entalophoridae Reuss, 1869							
Mecynoecia delicatula (Busk, 1875)	-	+	-	-	III	Hs	
Mecynoecia proboscidea (Milne Edwards, 1838)	-	+	-	-	III	Hs	
Frondiporidae Busk, 1875							
Frondipora verrucosa (Lamouroux, 1821)	-	4	+	+	II, III	Hs, Ss	
Crisiidae Johnston, 1838							
Crisia denticulata (Lamarck, 1816)	-	+	+	+	I-III	?	
Crisia eburnea (Linnaeus, 1758)	-	+	5	+	I-III	Hs	
Crisia fistulosa (Heller, 1867)	-	+	-	-	III	Hs	
Crisidia cornuta (Linnaeus, 1758)	-	+	+	+	I-III	Hs	
Horneridae Smitt, 1867							
▪*Hornera frondiculata* (Lamarck, 1816)	-	4	-	-	I	Hs, Ss	
•*Hornera lichenoides* (Linnaeus, 1758)	-	-	+	-	I-III	?	
Lichenoporidae Smitt, 1867							
Disporella hispida (Fleming, 1828)	-	+	-	-	II	Hs	
Patinella radiata (Audouin, 1826)	-	+	+	-	I-III	Hs	
Patinella verrucaria (Linnaeus, 1758)	-	+	+	-	I, II	?	=*Lichenepora verrucaria* (Fabricius, 1780)
Class: GYMNOLAEMATA Allman, 1856							
Order: CTENOSTOMATIDA Busk, 1852							
Family: Alcyonidiidae Johnston, 1837							
Alcyonidium gelatinosum (Linnaeus, 1761)	-	-	+	-	I, II	?	
Alcyonidium mamillatum Alder, 1857	-	+	+	-	I-III	Hs	
Alcyonidium polyoum (Hassall, 1841)	-	-	+	-	I-III	?	

Table 1. (Continued.)

Pherusellidae Osburn & Soule, 1953							
Pherusella tubulosa (Ellis & Solander, 1786)	-	-	+	+	II-IV	Ss	
Nolellidae Harmer, 1915							
Nolella dilatata (Hincks, 1860)	-	-	+	+	II, III	Ss	
Nolella stipata Gosse, 1855	-	-	+	-	I, II	Ss	
Vesiculariidae Johnston, 1838							
†*Amathia citrina* (Hincks, 1877)	-	+	+	-	II, III	?	North Atlantic, West Pacific
Amathia gracilis (Leidy, 1855)	-	-	5	-	I–II	Hs, Ss,	=*Bowerbankia gracilis* Leidy, 1855
Amathia imbricata (Adams, 1800)	-	+	-	-	I–II	Hs	=*Bowerbankia imbricata* (Adams, 1798)
Amathia lendigera (Linnaeus, 1758)	-	-	+	-	I	?	
Amathia pruvoti Calvet, 1911	-	+	+	+	I-III	?	
Amathia semiconvoluta Lamouroux, 1824	-	+	+	-	II	?	
*▪*Amathia verticillata* (delle Chiaje, 1822)	-	-	5	-	I	Hs	
Amathia vidovici (Heller, 1867)	-	-	+	-	III	?	
Buskiidae Hincks, 1880							
Buskia nitens Alder, 1857	-	-	+	-	I	Hs	
Buskia socialis Hincks, 1887	-	-	+	-	I	Hs	
Triticellidae Sars, 1874							
Triticella flava Dalyell, 1848	-	+	-	-	VI, VII	?	
Walkeriidae Hincks, 1877 emend. Bassler, 1953							
Walkeria uva (Linnaeus, 1758)	-	+	+	+	II, III	Hs, Ss,	
Mimosellidae Hincks, 1877							
Bantariella verticillata (Heller, 1867)	-	+	+	-	I-III	Hs, Ss,	
Mimosella gracilis Hincks, 1851	-	+	1	-	I-IV	Hs	
Order: CHEILOSTOMATIDA Busk, 1852							
Membraniporidae Busk, 1852							
Membranipora membranacea (Linnaeus, 1767)	-	-	+	-	I, II	Hs, Ss	
Electridae Stach, 1937 (1851)							
Conopeum reticulum (Linnaeus, 1767)	-	+	-	-			
Conopeum seurati (Canu, 1928)	-	+	+	-	I	Hs	
Einhornia crustulenta (Pallas, 1766)	+	-	+	-	I, II	?	
Electra monostachys (Busk, 1854)	+	-	1	-	I-IV	?	
Electra pilosa (Linnaeus, 1767)	+	+	+	+	I-III	?	
Electra posidoniae Gautier, 1954	+	+	+	+	I-II	Ss	
Electra repiachowi Ostroumoff, 1886	-	-	+	-	?	Ss	
Aeteidae Smitt, 1868							
Aetea anguina (Linnaeus, 1758)	-	+	-	-	I-III	Hs, Ss	
Aetea lepadiformis Waters, 1906	-	-	-	+	II	Ss	
Aetea sica (Couch, 1844)	-	+	+	+	I-II	Hs	
Aetea truncata (Landsborough, 1852)	-	+	5	+	I, II	Hs, Ss	
Tendroidea Vigneaux, 1949							
Tendra zostericola de Nordmann, 1839	-	+	-	-	I-III	Hs, Ss	
Scrupariidae Gray, 1848							
Scruparia ambigua (d'Orbigny, 1841)	-	-	+	-	?	?	
Scruparia chelata (Linnaeus, 1758)	-	+	-	-	II	Hs	

Table 1. (Continued.)

Calloporidae Norman, 1903							
†*Aplousina gigantea* Canu & Bassler, 1927	+	+	-	-	I	Hs	West Atlantic
Callopora dumerilii (Audouin, 1826)	-	+	+	-	II, III	Hs	
Copidozoum planum (Hincks, 1880)	-	-	-	+	II	Ss	
Copidozoum tenuirostre (Hincks, 1880)	-	+	+	-	I-III	Ss	
Ellisinidae Vigneaux, 1949							
Retevirgula akdenizae Chimenz, Nicoletti & Lippi Boncambi, 1997	-	-	-	+	I	Hs	
Flustridae Fleming, 1828							
Chartella papyrea (Pallas, 1766)	-	-	+	-	II, III	?	
Securiflustra securifrons (Pallas, 1766)	-	+	+	-	I-IV	Hs, Ss	
Bugulidae Gray, 1848							
Bugula neritina (Linnaeus, 1758)	-	-	5	+	I	Hs	
Bugulina flabellata (Thompson in Gray, 1848)	-	+	5	-	I-III	Hs	=*Bugula flabellata* (Thompson in Gray, 1848)
▪*Bugulina fulva* (Ryland, 1960)	-	-	3	-	III	?	
Bugulina simplex (Hincks, 1886)	-	+	5	-	I, II	Hs	=*Bugula simplex* Hincks, 1886
Bugulina stolonifera (Ryland, 1960)	-	-	5	+	I, II	Hs	=*Bugula stolonifera* Ryland, 1960
Crisularia gracilis (Busk, 1858)	-	-	+	-	II	?	=*Bugula gracilis* Busk, 1858
Crisularia plumosa (Pallas, 1766)	+	+	+	+	I-III	Hs	=*Bugula plumosa* (Pallas, 1766)
Beaniidae Canu & Bassler, 1927							
Beania cylindrica (Hincks, 1886)	-	-	+	-	III	?	=*Beania hirtissima cylindrica* (Hincks, 1886)
Beania hirtissima (Heller, 1867)	-	-	+	-	I-III	Ss	
Beania magellanica (Busk, 1852)	-	4	+	-	II, III	Hs	
Beania mirabilis Johnston, 1840	-	-	+	+	I-III	Ss	
Epistomiidae Gregory, 1893							
Synnotum aegyptiacum (Audouin, 1826)	-	-	+	-	II	?	
Candidae d'Orbigny, 1851							
Caberea boryi (Audouin, 1826)	-	+	1	-	I-IV	Hs	
Cradoscrupocellaria bertholletii (Audouin, 1826)	-	+	5	+	I, II	Hs	
Cradoscrupocellaria reptans (Linnaeus, 1758)	-	+	+	-	I-III	Hs	=*Scrupocellaria reptans* (Linnaeus, 1758)
Scrupocaberea maderensis (Busk, 1860)	-	+	-	-	III	?	
Scrupocellaria delilii (Audouin, 1826)	-	-	+	-	III	?	
Scrupocellaria scrupea Busk, 1851	-	+	+	-	I-III	Hs	
Scrupocellaria scruposa (Linnaeus, 1758)	-	+	+	+	I-III	Hs, Ss	
*▪*Tricellaria inopinata* d'Hondt & Occhipinti Ambrogi, 1985	-	5	-	-	I	Hs	
Microporidae Gray, 1848							
Calpensia nobilis (Esper, 1796)	-	4	1	+	I-IV	Ss	
Mollia circumcincta (Heller, 1867)	-	+	+	-	I-III	Hs	

Table 1. (Continued.)

Mollia patellaria (Moll, 1803)	-	-	+	-	III	?	
Setosellidae Levinsen, 1909							
Setosella vulnerata (Busk, 1860)	-	-	+	-	III	?	
Onychocellidae Jullien, 1882							
†*Onychocella antiqua* (Busk, 1858)	-	-	-	+	III	?	North Atlantic
Onychocella marioni Jullien, 1882	-	-	-	+	III	?	
Onychocella vibraculifera Neviani, 1895	-	-	+	+	I-III	Ss	
Chlidoniidae Busk, 1884							
Chlidonia pyriformis (Bertoloni, 1810)	-	-	+	+	I-III	Ss	
Cellariidae Fleming, 1828							
Cellaria fistulosa (Linnaeus, 1758)	-	+	-	-	II, III	Hs	
Cellaria salicornioides Lamouroux, 1816	-	+	+	+	II, III	Hs	
Monoporellidae Hincks, 1882							
Monoporella bouchardii (Audouin & Savigny, 1826)	-	-	+	+	I, II	Ss	
Cribrilinidae Hincks, 1879							
Collarina balzaci (Audouin, 1826)	-	-	+	-	I, II	?	
Cribrilaria innominata (Couch, 1844)	-	-	-	+	II	Ss	=*Puellina (Cribrilaria) innominata* (Couch, 1844)
Cribrilaria radiata (Moll, 1803)	-	-	+	+	I-III	?	=*Puellina (Cribrilaria) radiata* (Moll, 1803)
Membraniporella nitida (Johnston, 1838)	-	-	+	+	II, III	?	
Puellina gattyae (Landsborough, 1852)	-	+	+	-	I, II	?	
Savignyellidae Levinsen, 1909							
Savignyella lafontii (Audouin, 1826)	-	+	+	-	I-III	Hs	
Hippothoidae Busk, 1859							
Hippothoa flagellum Manzoni, 1870	-	+	+	+	I, II	?	
Chorizoporidae Vigneaux, 1949							
Chorizopora brongniartii (Audouin, 1826)	-	+	+	+	I, II	Ss	
Trypostegidae Gordon, Tilbrook & Winston, 2005							
Trypostega venusta (Norman, 1864)	-	-	-	+	II	Ss	
Haplopomidae Gordon in De Blauwe, 2009							
Haplopoma impressum (Audouin, 1826)	-	-	+	+	I-III	Ss	
Exechonellidae Harmer, 1957							
Anarthropora monodon (Busk, 1860)	-	-	+	-	III	?	
Adeonidae Busk, 1884							
Adeonella pallasii (Heller, 1867)	-	-	+	+	I-III	?	
Reptadeonella violacea (Johnston, 1847)	-	4	+	+	I-III	Hs, Ss	
Bryocryptellidae Vigneaux, 1949							
Porella concinna (Busk, 1854)	-	4	-	-	II, III	Hs	
Exochellidae Bassler, 1935							
Escharoides coccinea (Abildgaard, 1806)	-	+	+	+	I-III	?	
Escharoides megarostris (Canu & Bassler, 1928)	-	-	+	-	IV	?	
Escharellidae Levinsen, 1909							
Neolagenipora collaris (Norman, 1867)	-	-	-	+	III	?	
Umbonulidae Canu, 1904							

Table 1. (Continued.)

Umbonula ovicellata Hastings, 1944	-	-	+	-	I, II	?	
Jaculinidae Zabala, 1986							
Jaculina parallelata (Waters, 1895)	-	-	+	-	IV	?	
Smittinidae Levinsen, 1909							
*▪*Parasmittina egyptiaca* (Waters, 1909)	-	-	-	2	I	Hs	
Parasmittina raigii (Audouin, 1826)	-	-	+	-	II	?	
Parasmittina rouvillei (Calvet, 1902)	-	-	+	-	I, II	?	
Parasmittina trispinosa (Johnston, 1838)	-	-	+	-	II	?	
Prenantia cheilostoma (Manzoni, 1869)	-	-	+	-	I, II	?	
Smittina cervicornis (Pallas, 1766)	-	4	+	-	I-III	Hs	
Smittina landsborovii (Johnston, 1847)	-	+	-	+	III	?	
Smittoidea marmorea (Hincks, 1877)	-	+	-	-	I	?	
Smittoidea reticulata (MacGillivray, 1842)	-	+	+	-	I-III	?	
Bitectiporidae MacGillivray, 1895							
Hippoporina pertusa (Esper, 1796)	-	-	+	-	III	?	
Pentapora fascialis (Pallas, 1766)	-	+	-	-	III	Hs	
Pentapora ottomuelleriana (Moll, 1803)	-	-	-	+	II	Ss	
Schizomavella (*Schizomavella*) *auriculata* (Hassall, 1842)	-	+	+	-	II	?	=*Schizomavella auriculata* (Hassal, 1842)
Schizomavella (Schizomavella) hastata (Hincks, 1862)	-	-	+	-	I, II	?	=*Schizomavella hastata* (Hincks, 1862)
Schizomavella (Schizomavella) linearis (Hassall, 1841)	+	+	+	+	I-III	Hs	=*Schizomavella linearis* (Hassall, 1841)
Watersiporidae Vigneaux, 1949							
Terwasipora complanata (Norman, 1864)	-	-	+	-	I	Hs	=*Watersipora complanata* (Norman, 1864)
*▪*Watersipora arcuata* Banta, 1969	-	-	2	2	I	Hs	
Watersipora cucullata (Busk, 1854)	-	-	+	-	I-III	Hs	=*Watersipora subovoidea* (d'Orbigny, 1852)
Watersipora subtorquata (d'Orbigny, 1852)	-	-	5	-	I	Hs	
Schizoporellidae Jullien, 1883							
Schizobrachiella sanguinea (Norman, 1868)	-	4	5	-	I–III	Hs, Ss	
Schizoporella dunkeri (Reuss, 1848)	-	+	5	-	I–II	Hs	
Schizoporella errata (Waters, 1878)	-	-	5	+	I	Hs	
Schizoporella magnifica Hincks, 1886	-	+	+	-	III	Hs	
Schizoporella unicornis (Johnston in Wood, 1844)	-	+	+	+	I–III	Hs	
Fenestrulinidae Jullien, 1888							
Fenestrulina malusii (Audouin, 1826)	-	+	+	-	I–III	?	
Margarettidae Harmer, 1957							
†*Margaretta buski* Harmer, 1957	-	-	+	-	I–III	?	West Atlantic,
Myriaporidae Gray, 1841							
Myriapora truncata (Pallas, 1766)	-	+	+	+	I–IV	Hs	
Escharinidae Tilbrook, 2006							
Escharina johnstoni (Quelch, 1884)	-	-	-	+	III	?	
Escharina protecta Zabala, Maluquer & Harmelin, 1993	-	+	-	-	II	?	
Escharina vulgaris (Moll, 1803)	-	+	+	+	I-III	Ss	
Herentia hyndmanni (Johnston, 1847)	-	-	-	+	III	?	=*Escharina hyndmanni* (Johnston, 1847)

Table 1. (Continued.)

†*Phaeostachys spinifera* (Johnston, 1847)	-	+	+	+	II, III	Hs	North-East Atlantic
Fatkullinidae Grischenko, Gordon & Morozov, 2018							
†*Stomacrustula sinuosa* (Busk, 1860)	-	-	+	-	III	?	North-West Atlantic
Cryptosulidae Vigneaux, 1949							
Cryptosula pallasiana (Moll, 1803)	+	+	5	+	I-III	Hs	
Cheiloporinidae Bassler, 1936							
Hagiosynodos latus (Busk, 1856)	-	-	+	+	III	?	=*Hagiosynodos kirchenpaueri* (Heller, 1867)
Phoceanidae Vigneaux, 1949							
Phoceana tubulifera (Heller, 1867)	-	+	+	+	I-III	Hs	
Hippaliosinidae Winston, 2005							
Hippaliosina depressa (Busk, 1854)	-	-	1	+	I-IV	Hs, Ss	
Microporellidae Hincks, 1879							
Microporella ciliata (Pallas, 1766)	-	+	5	-	II, III	Hs, Ss	
**Microporella coronata* (Audouin, 1826)	-	-	-	+	II	Ss	=*Microporella umbracula* (Audouin, 1826)
Microporella joannae Calvet, 1902	-	-	+	+	I, II	Ss	=*Fenestrulina joannae* (Calvet, 1902)
Microporella marsupiata (Busk, 1860)	-	-	+	-	III	?	
Microporella verrucosa (Peach, 1868)	-	+	+	+	III, IV	?	=*Diporula verrucosa,* (Peach, 1868)
Lacernidae Jullien, 1888							
Arthropoma cecilii (Audouin, 1826)	-	+	+	-	II-III	Hs	
Cleidochasmatidae Cheetham & Sandberg, 1964							
Cleidochasmidra portisi (Neviani, 1895)	-	-	+	-	III	?	=*Cleidochasmidra canakkalense* Unsal & d'Hondt, 1979
Celleporidae Johnston, 1838							
†*Buskea billardi* (Calvet, 1906)	-	-	+	-	III	?	North-East Atlantic
Buskea nitida Heller, 1867	-	-	+	-	III	?	
†*Cellepora birostrata* Canu & Bassler, 1928	-	-	+	-	II, III	?	West Atlantic
Cellepora posidoniae (Hayward, 1975)	-	-	+	-	I	Ss	=*Rhamphostomellina posidoniae* Hayward, 1975
Cellepora pumicosa (Pallas, 1766)	-	+	+	+	I-III	Hs Ss	
**Celleporaria aperta* (Hincks, 1882)	-	-	5	-	I	Hs	
**Celleporaria brunnea* (Hincks, 1884)	-	-	5	-	I	Hs	
Celleporina boryi (Audouin, 1826)	-	+	-	-	II	Hs	
Celleporina caminata (Waters, 1879)	-	-	-	+	II	Ss	
†*Celleporina costata* (MacGillivray, 1869)	-	+	-	-	II, III	Hs	West Pasific
Celleporina mangnevillana (Lamouroux, 1816)	-	-	+	-	I	?	
Omalosecosa ramulosa (Linnaeus, 1767)	-	-	-	+	III	?	
Palmicellaria elegans Alder, 1864	-	-	+	-	III	?	
Turbicellepora coronopus (Wood, 1844)	-	-	+	+	III, IV	?	
Hippoporidridae Vigneaux, 1949							
Hippoporella hippopus (Smitt, 1868)	-	-	+	-	III	?	
Phidoloporidae Gabb & Horn, 1862							

Table 1. (Continued.)

Dentiporella sardonica (Waters, 1879)	-	-	+	-	II	?
Plesiocleidochasma mediterraneum Chimenz Gusso & Soule, 2003	-	-	-	+	II	Ss
Reteporella beaniana (King, 1846)	-	+	+	-	I-III	Hs
Reteporella couchii (Hincks, 1878)	-	-	+	+	I-III	?
Reteporella sudbournensis (Gautier, 1962)	-	-	+	-	I-II	?
**Rhynchozoon larreyi* (Audouin, 1826)	-	-	+	-	I, II	Ss
▪*Rhynchozoon neapolitanum* Gautier, 1962	-	4	-	-	I, II	Hs, Ss
Schizotheca fissa (Busk, 1856)	-	+	+	-	II, III	Hs
Stephanollona armata (Hincks, 1862)	-	-	+	-	III, IV	?
Triphyllozoon hirsutum (Busk, 1884)	-	-	+	-	III	?

+: for the reference, see Koçak and Aydın Önen (2014), 1. Gönülal and Güreşen, 2014, 2. Ulman et al., 2017, 3. Koçak and Bakal, 2019, 4. Özalp et al., 2022, 5. Koçak, 2023.

Table 2. Species excluded from the checklist.

Taxa	Reason for exclusion	First record	Related references
Adeonella lichenoides (Lamarck, 1816)	Doubtful species	Ostroumoff, 1896	Heller, 1867; Novosel and Požar-Domac, 2001
Adeonella polystomella (Reuss, 1848)	Fossil Species	Ünsal 1975	Rosso and Novosel, 2010
Alecto repens Busk. var. *vitriensis* Waters	Taxon inquirendum	Ostroumoff, 1896	Waters, 1879; Harmelin, 1976
Cardioecia watersi (O'Donoghue & de Watteville, 1939)	Taxon inquirendum	Ünsal and d'Hondt, 1978-1979	Bock, 2024[1]
Cellaria ceremioides	Anonymous	Forbes, 1844	
Diplosolen latomarginatum (d'Orbigny, 1853)	Doubtful species	Ostroumoff, 1896	WoRMS, 2024[2]
Idmidronea bidenkapi (Kluge, 1955)	Doubtful species	Aslan Cihangir, 2007	Denisenko, 2022
Lepralia foraminifera (Heller, 1867)	Taxon inquirendum	Ostroumoff, 1896	Rosso and Di Martino, 2016
Lagenipora tubulifera Hincks, 1881	Doubtful species	Ostroumoff, 1896	Bock, 2020
MemMembranipora rostrata (Heller, 1867)	Doubtful species	Ostroumoff, 1896	Novosel and Požar-Domac, 2001; Rosso and Di Martino, 2016
Palmicellaria aff. *aviculifera* Canu & Bassler, 1928	Doubtful species	Ünsal and d'Hondt, 1978-1979	
Polytrema corallinum, Risso	It is position is in Foraminifera	Ostroumoff, 1896	Allman, 1870

[1]Bock (2024). World List of Bryozoa. *Cardioecia watersi* (O'Donoghue & de Watteville, 1939). Accessed through: World Register of Marine Species (online). Website <https://www.marinespecies.org/aphia.php?p=taxdetails&id=111710|> (accessed 1 August 2024).

[2]WoRMS (2024). *Diplosolen latomarginatum* (d'Orbigny, 1853). Accessed through: World Register of Marine Species (online). Website <https://www.marinespecies.org/aphia.php?p=taxdetails&id=852906> (accessed 1 August 2024).

Table 3. Alien species along the Turkish coast (T-C: Transport-contaminant; TS: Transport Stowaway; Co: Corridor; U: Unaided; IP: Indo-Pacific; RS: Red Sea; PO: Pacific Ocean; AT: Atlantic Ocean; SM: Sea of Marmara; LS: Levantine Sea; AS: Aegean Sea).

Alien species	Sampling Locality	Status	Origin	Pathway	References
†*Amathia verticillata*	AS	I	AT	TS	Ulman et al., 2017
Celleporaria aperta	AS	E	IP	T-C; TS	Koçak, 2023
Celleporaria brunnea	AS	I	PO	TS	Koçak, 2007
Microporella coronata	LS	E	IP-RS	TS; Co	Nicoletti et al., 1995
Parasmittina egyptiaca	LS	E	RS	TS; Co	Ulman et al., 2017
Rhynchozoon larreyi	AS	E	RS-IP	Co	Ünsal and d'Hondt, 1978-1979
Tricellaria inopinata	SM	C	IP	T-C; TS; U	Koçak, 2023
Watersipora arcuata	AS	E	PO	TS	Ulman et al., 2017

†The species has a wide distribution; it is native to the Caribbean and considered an invasive alien species elsewhere, including the Mediterranean Sea (Galil and Gevili, 2014).

such as Phidoloporidae (10), Smittinidae (9), and Candidae (8). The Vesiculariidae family has the greatest number of species (8) within the ctenostomatids.

Among the genera, species diversity is the highest for *Amathia* Lamouroux, 1812, followed by *Microporella* Hincks, 1877 and *Tubulipora* Lamarck, 1816. A total of nine new species, i.e., the cyclostomatid *Hornera frondiculata* (Lamarck, 1816), which is cited in Özalp et al. (2022), the ctenostomatid *Amathia verticillata* (delle Chiaje, 1822), cited in Ulman et al. (2017), the cheilostomatids *Bugulina fulva* (Ryland, 1960), mentioned in Koçak and Bakal (2019), *Tricellaria inopinata* d'Hondt and Occhipinti-Ambrogi, 1985 from Koçak (2023), *Parasmittina egyptiaca* (Waters, 1909) and *Watersipora arcuata* Banta, 1969, cited in Ulman et al. (2017), *Watersipora subtorquata* (d'Orbigny, 1852) and *Celleporaria aperta* (Hincks, 1882), cited in Koçak (2023), and *Rhynchozoon neapolitanum* (Gautier, 1962), from Özalp et al. (2022), were added to the revised bryozoan checklist. Images of *B. fulva* and *T. inopinata* and SEM images of *C. aperta* and *W. subtorquata* can be found in several studies mentioned above.

Retevirgula akdenizae Chimenz, Nicoletti and Lippi Boncambi, 1997 was previously included in Calloporidae and *Stomacrustula sinuosa* (Busk, 1860) in the Escharinidae family. These species were displaced into the families Ellisinidae and Fatkullinidae, respectively. Moreover, *Fenestrulina malusii* (Audouin, 1826), which was placed in Microporellidae, was transferred to the Fenestrulinidae family (Rosso and Di Martino, 2023).

3.2. Species excluded from the updated checklist

In the species recorded from the coasts of Türkiye, 12 were excluded from the new version of the checklist. Among them, seven species were doubtful, two had uncertain taxonomic validity, one was anonymous, one was mentioned in the fossil record, and another was placed in a different group (Table 2). Most of the species removed from the list were included in Ostroumoff (1896), which consists of sampling stations in the Sea of Marmara, the Bosphorus, and the Dardanelles Strait.

3.3. Alien species

Marine alien species from the coast of Türkiye have been investigated, and bryozoans were represented by five established (i.e. *Microporella coronata*, *Parasmittina egyptiaca*, *Celleporaria aperta*, *Rhynchozoon larreyi*, *Watersipora arcuata*), two invasive (*Amathia verticillata*, and *Celleporaria brunnea*), and one casual alien species (*Tricellaria inopinata*). In a recent study by Koçak (2023), two additional alien species, *Tricellaria inopinata* and *Celleporaria aperta*, were identified for the first time on the coasts of Türkiye.

Alien bryozoan species were reported with the number of 5, 2, and 1 from the Aegean Sea, the Levantine Sea, and the Sea of Marmara, respectively. Most of the reported alien species came from the Red Sea and the Pacific Ocean. Of the alien bryozoan species recorded until now, only *A. verticilata* has an Atlantic Ocean origin. The main pathway for the introduction of alien bryozoan species into the Mediterranean Sea is through corridor and shipping transport (Table 3).

3.4. Protected species

In the Mediterranean Sea, *Hornera lichenoides* (Linnaeus, 1758), mostly found in the Northern and Arctic Seas, is the only bryozoan species included in the list of endangered or threatened species, according to the Barcelona Convention, Annex II (UNEP/MAP-SPA/RAC, 2018). In the checklist, *H. lichenoides* was recorded by Ünsal (1975) in the Aegean Sea. *Hornera frondiculata* was commonly observed on hard substrate at a depth range of 4–28 m in Dardanos Coral Marine Protected Areas (Özalp et al., 2022).

4. Discussion

4.1. Updated checklist

In the current checklist, several species names were revised and updated based on information about their taxonomic affiliation according to WoRMS; the previous names of the species are given in the notes section in Table 1. Additionally, species with a known distribution generally outside the Mediterranean are shown in Table 1.

The recorded species at different stations or a single station in the studies performed along the coast of Türkiye have not yet been reported in other studies conducted in the Mediterranean Sea, which may be explained by misidentification of the species or the presence of alien species. The Mediterranean occurrences of these species are uncertain, and revision is needed to ascertain their validity so that the species can be examined to clarify their status (Rosso and Di Martino, 2016). Additionally, some species can be composed of different species complex, and further investigation is required to reveal additional details about them.

Scrupocellaria reptans specimens comprise more than four species and have a geographically restricted distribution in western Britain and the North Atlantic (Vieira and Spencer Jones, 2012). *Cradoscrupocellaria reptans* was reported in different localities and depths from the Sea of Marmara to the Aegean Sea (Demir, 1952; Ünsal, 1975). However, no SEM images of this species exist. Specimens belonging to *C. reptans* were collected from the coast of Türkiye, and all species belonging to the genus need verification, according to several recent studies (Vieira et al., 2013; Vieira et al., 2014).

Schizomavella (Schizomavella) auriculata (Hassall, 1842) was identified at a depth of between 36–44 m in the southern part of the Sea of Marmara (Ünsal, 1975). This species was also recorded as a commonly occurring one on the coast of Chios and Milos (Hayward, 1974; Morri et al., 1999). However, Reverter-Gil et al. (2016) emphasized that *S. auriculata* is an Atlantic species absent in the Mediterranean Sea. Its diagnostic characteristics could be confused with other *Schizomavella* species. In bryozoan diversity studies, members of the genus should be investigated more accurately.

The *Microporella* genus has high species diversity and significant similarities between species. Numerous records of *M. ciliata* were often wrongly attributed (Kuklinski and Taylor, 2008; Harmelin et al., 2011) to different *Microporella* species. In the revision of *M. ciliata* species collected from the Mediterranean Sea, only one colony corresponded to the neotype (Di Martino and Rosso, 2021). Therefore, *Microporella* samples collected from the coast of Türkiye can show significant variability and need revision using SEM images to identify them correctly.

Beania magellanica has a widespread distribution and can be transported by human activities. However, two new species, *Beania serrata* from the Atlantic coast and *Beania mediterranea* from the Mediterranean coast, which are very similar to *B. magellanica*, were described by Souto et al. (2019). Therefore, species determined as *B. magellanica* from the coast of Türkiye must be revised.

Species commonly distributed outside the Mediterranean Sea and also reported as found on Türkiye's coast are emphasized in Table 1, along with their geographical distribution. One of these species, *Idmonea atlantica* Forbes in Johnston, 1847, was recorded in Ünsal (1975) in Lebedos Bay (Sığacık/Türkiye) at a depth range of 80–92 m. It was noted as *Idmidronea atlantica* in the checklist prepared in 2014 (Koçak and Aydın-Önen, 2014b). In Rosso et al. (2010), both Mediterranean and Atlantic specimens of *Idmidronea atlantica* (Forbes in Johnston, 1847) and *I. atlantica* Auctt were accepted as a new combination of *Idmidronea triforis* (Heller, 1867) with the accepted name *Exidmonea triforis* (Heller, 1867).

Onychocella marioni and *Onychocella vibraculifera* are endemic species in the Mediterranean Sea. Although *Onychocella antiqua* was recorded in the Levantine Sea at a depth of 98 m (Ünsal, 1975), the species was described from living specimens collected from Madeira (Atlantic Ocean) (Rosso et al., 2020a). The occurrence of *O. antiqua* was interpreted as misidentified or as an introduced species by Rosso and Di Martino (2016).

Cellepora retusa Manzoni, 1875 was recorded at a depth of 41 m near Sedef Island in the Sea of Marmara by Ostroumoff (1896). *Cellepora retusa* is an unaccepted synonym of *Celleporina costata* (MacGillivray, 1869); hence, in the revised checklist, *C. retusa* is labeled *C. costata*. However, its distribution is limited to southeastern Australia (Bock, 2024)[3].

In the previous list, *Scrupocellaria macandrei* Busk, 1852, which was assigned to *Scrupocellaria maderensis* (Busk, 1860), was replaced with *Scrupocabarea maderensis* Busk, 1860 in Vieira et al. (2008). However, *Scrupocellaria maderensis* was identified as a distinct taxon because of its morphologic differences and generic status (Vieira et al., 2012). Later it has been placed in the new genera, *Scrupocaberea* Vieira, Spencer Jones, Winston, Migotto and Marques, 2014, and renamed *Scrupocabarea maderensis* (Vieira et al., 2014).

Shizoporella ansata (Johnston, 1847) was first reported in Türkiye by Ostroumoff (1896) and collected in different localities, ranging from shallow-water region with a depth of approximately 75 m in the Sea of Marmara. It was listed in the previous version of the checklist as *S. unicornis* (Johnston in Wood, 1844). Two species, *S. ansata* and *S. unicornis*, are synonymous (Ryland, 1968).

[3]Bock (2024). World List of Bryozoa. *Celleporina costata* (MacGillivray, 1869). Accessed through: World Register of Marine Species (online). Website <https://www.marinespecies.org/aphia.php?p=taxdetails&id=469540> (accessed 28 May 2024).

Radiopora hispida Hincks, 1880 was found in the southern part of Paşalimanı Island at a depth of 34 m in the Sea of Marmara (Ostroumoff, 1896). This species has been synonymized with *Disporella hispida* (Fleming, 1828) by Hayward and McKinney (2002).

The morphological characters of two species, *Hagiosynodos latus* (Busk, 1856) and *Hagiosynodos kirchenpaueri* (Heller, 1867), were given in Hayward and McKinney (2002). Although a pair of distolateral teeth are absent in *H. kirchenpaueri*, unlike *H. latus,* these two species are conspecific (Lippi Boncambi et al., 1997; Pica et al., 2022). Thus, in the recent checklist, *H. kirchenpaueri* was changed to its accepted name, *H. latus*.

4.2. Species excluded from the updated checklist

Cellaria ceremioides, listed in Forbes (1844), is omitted from the present checklist because of the absence of an authority. The genus *Adeonella* has a widespread geographic distribution in tropical and subtropical waters (Hayward and Cook, 1979; Rosso and Novosel, 2010). *Adeonella lichenoides* Hincks was reported by Ostroumoff (1896) in two localities in the Sea of Marmara and the Dardanelles at a 73–75-m depth range. The validity of *A. lichenoides* in the Sea of Marmara and the Mediterranean need further investigations (Novosel and Požar-Domac, 2001; Rosso and Di Martino, 2016).

The genus *Lagenipora* Hincks, 1877 does not include the species *Lagenipora tubulifera* Hincks which was reported in Ostroumoff (1896) (Bock, 2020)[4]. Hence, it is a doubtful species. In the checklist prepared by Kocak and Aydın-Önen (2014b), *Lagenipora tubulifera* was erroneously called *Corbulipora tubulifera* (Hincks, 1881), which was removed from the present revision. *Membranipora rostrata* (Heller, 1867), recorded at a 41 m depth in the eastern part of the Sea of Marmara (Ostroumoff, 1896), requires a revision of type material to verify its status in the Mediterranean Sea (Heller, 1867; Novosel and Požar-Domac, 2001; Rosso and Di Martino, 2016). *Lepralia foraminifera* (Heller, 1867) is another doubtful species that requires further investigation. It was collected by Ostroumoff (1896) at a depth of 73–77 m in the southern part of Marmara Island in the Sea of Marmara.

In Ostroumoff (1896), *Alecto repens* Busk. var. *vitriensis* Wat. was recorded at depths of 73–75 m along the Marmara and Avsa Islands (Station 35). Coral, Brachiopods, and *Lithothamnion* communities were also found abundantly at this station. All specimens of *Alecto repens* var. *vitriensis* Waters collected from Naples were recorded with Brachiopod species *Terebratula vitrea* (Born, 1778) with its accepted name, *Gryphus vitreus* (Born, 1778). Waters (1879) proposed calling this variety "*vitriensis*"; however, the status of *Alecto repens vitriensis* Waters, 1879 in the Mediterranean Sea needs additional investigation. *Cardioecia watersi* (O'Donoghue and de Watteville, 1939) is another species specified in WoRMS as a taxon inquirendum.

Polytrema corallinum Risso has a coral-like body; for this reason, it was placed in either a coral or bryozoan category. After examination of specimens obtained from tropical seas and the Mediterranean, its position was confirmed in Foraminifera with the accepted name *Miniacina miniacea* (Pallas, 1766) (Allman, 1870).

Idmidronea bidenkapi (Kluge, 1955) is an Arctic endemic species (Denisenko, 2022), but no record of the species exists for the Mediterranean Sea except for samples collected by Aslan-Cihangir (2007) from Bozcaada Island.

4.3. Alien species

In marine ecosystems, the invasion of alien species is a direct driver of changes in biodiversity and ecosystem services. Alien marine species can cause the loss of native genotypes, modify habitats, affect the food web and ecosystem processes, impact ecosystem services and human health, and lead to substantial economic losses (Katsanevakis et al., 2014a; Katsanevakis et al., 2014b; Çinar et al., 2021). The introduction of alien species has recently grown intentionally and accidentally in the Mediterranean Sea (Zenetos and Galanidi, 2020; Galanidi et al., 2023). An action plan has been designed concerning the introduction of alien species and the prevention of invasive alien species (UNEP/MAP, 2017).

In Mediterranean countries, Israel and Türkiye have the highest number of alien species (457 and 437, respectively), including cryptogenic and data-deficient species (Galanidi et al., 2023). A total of 1006 alien species were reported in the Mediterranean Sea, among which 32 belong to bryozoans. The Mediterranean eastern subregion has the highest number of alien bryozoan species (30 species), and their general pathways of introduction to the Levantine Sea were determined to be corridor/interconnected waterway/basin/sea and shipping transport (Çinar et al., 2021; Galanidi et al., 2023). Bryozoans in fouling communities on boat hulls can disperse over large areas, although most have a short-living lecithotrophic larval stage (Ferrario et al., 2018).

After having been found in the Venice Lagoon in 1982, *T. inopinata* has been recorded at many points on the Mediterranean and the Atlantic coasts (d'Hondt and Occhipinti-Ambrogi, 1985; Dyrynda et al., 2000; Lodola et al., 2012). In Türkiye, *T. inopinata* was found on boat hulls moored in Kalamış Setur Marina and on pier piles in Kavaklı (Gölcük) in the Sea of Marmara (Ulman et al., 2017; Koçak, 2023). Almost all alien species recorded on the coast of Türkiye are established species. However, *T.*

[4]Bock (2020). International Bryozoological Association (IBA), Bryozoa Homepage Accessed through: *Lagenipora* Hincks, 1877 (online). Website <https://www.bryozoa.net/cheilostomata/celleporidae/lagenipora.html> (accessed 28 May 2024).

inopinata was considered casual because it was recorded on a boat in a marina in Türkiye (Ulman et al., 2017). Therefore, its presence on piers was considered the first record of the species in the country (Koçak, 2023). The alien species recorded from the coasts of Türkiye are mostly of Indo-Pacific, Pacific, and Red Sea origin. According to the classification in Galanidi et al. (2023), the main pathways of introduction are corridor and transport-contaminant, transport stowaway, and unaided (Table 2).

Total richness of alien species on boats was correlated with the richness recorded in marinas (Ulman et al., 2019). Although alien species' contribution to the fouling community is clearly different among Mediterranean subregions, it is higher in the eastern part. Two invasive species, *A. verticillata* and *C. brunnea*, were in constant category in seven selected marinas on the Aegean coast of Türkiye (Koçak, 2023). Ferrario et al. (2018) showed that *Amathia verticillata* and *Celleporaria brunnea* are the most common species due to their presence in 14 and eight Mediterranean countries, respectively. *Hippopodina feegeensis* (Busk, 1884) is an alien species found in the Mediterranean Sea, and it was reported in several studies (Powell, 1969; Corsini-Foka et al., 2015). Examination of Indo-West Pacific material of *H. feegeensis* showed a great variety in the shape of the primary orifice and size of avicularia; therefore, it is necessary to reexamine the species (Tilbrook, 2006). Thus, *Hippopodina* species found in the Setur-Finike marina (eastern Mediterranean Sea) is called *Hippopodina* sp. A (Ulman et al., 2017). However, the species is still formally undescribed (Rosso and Di Martino, 2023), so it was not included in the revised checklist. When *H. feegeensis* specimens collected from different localities were reexamined, more than one species was identified in the material (Tilbrook, 1999; Tilbrook, 2006).

4.4. Protected species

Hornera lichenoides (Linnaeus, 1758) is in the endangered or threatened category according to the Barcelona Convention, Annex II. In the genus, the morphologic characteristics of two Mediterranean species, *H. lichenoides* and *H. frondiculata*, were not clearly defined, and species' names were often incorrectly used (Harmelin, 2020). After an examination of the *Hornera* species, a better characterization of *H. frondiculata* and a description of a new species, *H. mediterranea*, were done by Harmelin (2020), and *H. mediterranea* replaced *H. lichenoides* Auctt. As a result, a revision is necessary in Annex II (endangered and threatened species) of the Barcelona Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean (Rosso and Di Martino, 2023).

5. Conclusion

Several bryozoan species in recently published studies have been added to the checklist (Ulman et al., 2017; Koçak et al., 2019; Koçak and Bakal, 2019; Özalp et al., 2022; Koçak, 2023). The fact that most of these studies have been carried out in marinas where fouling organisms are concentrated means that they are hot spot areas for identifying alien species introduced via maritime transportation. However, studies carried out in the eastern Mediterranean, where warm-water alien species coming through the Suez Canal are more intense, are fewer than those conducted in the western part. Both coralligenous and semi-dark cave biocenoses offer a wide range of microhabitats that encourage bryozoan settlement. The additional investigation of these unique habitats along the coasts will provide new information on bryozoan diversity. Furthermore, in biodiversity studies planned for the future, detailed descriptions of taxa with SEM images and genetic analysis will give more accurate information about taxa. These initiatives will contribute to support further researches to preserve bryozoan diversity on the coasts of Türkiye.

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