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Comprehensive checklist and distribution analysis of marine harpacticoids in Türkiye coastal waters

Alper KABACA*

Balıkesir University, Necatibey Faculty of Education, Department of Biology Education, Balıkesir

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Abstract

This study aims to provide a comprehensive checklist of marine harpacticoid copepod species found in Turkish coastal waters. The study encompasses a detailed list comprising 247 species/subspecies, 34 families, and 113 genera. Families with the highest number of species are Miraciidae (43 species), Ameiridae (37 species), Laophontidae (31 species), Ectinosomatidae (23 species), and Paramesochridae (12 species). The remaining families contain fewer than 10 species each. The distribution of species and genera highlights the Aegean Sea as the most diverse, hosting 195 species/subspecies. It is followed by the Sea of Marmara (107 species), the Mediterranean (43 species), and the Black Sea (30 species). Notably, five species including Canuella perplexa, Ectinosoma melaniceps, Eoschizopera (Praeoschizopera) gligici, Euterpina acutifrons, and Microsetella rosea are recorded across all four seas of Türkiye. In conclusion, this study presents a resource that could contribute to faunistic and ecological studies aiming to comprehend marine harpacticoid diversity along Turkish coasts.

Keywords: *Taxonomy, biodiversity, copepoda, meiofauna*

Türkiye kıyı suları denizel harpaktikoidlerinin kapsamlı kontrol listesi ve dağılım analizi

Öz

Bu çalışma, Türkiye kıyı sularında bulunan denizel harpaktikoid kopepod türlerinin kapsamlı bir kontrol listesini sağlamayı amaçlamaktadır. Çalışma, 247 tür/alt tür, 34 familya ve 113 cinsten oluşan ayrıntılı bir liste içermektedir. En fazla tür içeren familyalar Miraciidae (43 tür), Ameiridae (37 tür), Laophontidae (31 tür), Ectinosomatidae (23 tür) ve Paramesochridae'dir (12 tür). Kalan familyaların her biri 10'dan az tür içerir. Türlerin ve cinslerin dağılımı, 195 tür/alt tür barındıran Ege

*Alper KABACA, alper.kabaca.10@gmail.com, https://orcid.org/0000-0001-8090-471X

Denizi'nin en çeşitli olduğunu göstermektedir. Bunu Marmara Denizi (107 tür), Akdeniz (43 tür) ve Karadeniz (30 tür) izlemektedir. Türkiye'nin dört denizinde Canuella perplexa, Ectinosoma melaniceps, Eoschizopera (Praeoschizopera) gligici, Euterpina acutifrons ve Microsetella rosea olmak üzere beş tür kayda değerdir. Sonuç olarak bu çalışma, Türkiye kıyılarındaki denizel harpaktikoid çeşitliliğini anlamaya yönelik faunistik ve ekolojik çalışmalara katkı sağlayabilecek bir kaynak sunmaktadır.

Anahtar kelimeler: *Taksonomi, biyoçeşitlilik, kopepoda, mayofauna*

1. Introduction

Faunal checklists play a role in facilitating taxonomic studies by offering up to date data. These data include the latest and most precise scientific nomenclature for organisms within the targeted taxonomic group. Additionally, they encompass a comprehensive evaluation of the undertaken research thus far. Moreover, these checklists often encompass tools for identification, such as identification keys [1], accompanied by a variety of photographs [2] and illustrations [3] designed to simplify the identification process. These resources are further enriched with novel findings [4] and taxonomic revisions [5].

The main purpose of most checklists is to compile an inventory of species belonging to the focal organism group within a specific geographic region [6-10]. This attempt fosters a deeper comprehension of ecological dynamics [11] and extends support to the foundational framework essential for conservation biology research. Therefore, establishing comprehensive faunal checklists assumes paramount importance in strategizing species conservation initiatives at local and regional scales [12].

Copepods are a group of micro-crustaceans that live abundant in aquatic ecosystems, encompassing free-living, parasitic, and symbiotic forms in association with various organisms. Among the free-living copepods, the order Harpacticoida assumes prominence in marine benthic habitats, showcasing a remarkable array of body adaptations modified for diverse environmental conditions [13]. Notably, Wells [5] provided an identification key detailing around 4400 harpacticoid species, encompassing 671 genera within 58 families. Subsequently, Ahyong et al., [14] observed a significant growth in taxonomic richness, reporting approximately 6000 harpacticoid species distributed across 645 genera within 59 families in their investigation conducted five years later.

Faunistic studies of marine harpacticoids along the coasts of Türkiye have primarily focused on specific regions e. g., [6-10, 15]. The primary aim of these studies is to elucidate the diversity of harpacticoids inhabiting these areas. These investigations yield valuable materials that contribute not only to identifying new records along the Turkish coastlines [8, 10] but also to the description of novel species [16, 17]. In addition to faunistic studies, taxonomic revisions have been undertaken concerning marine harpacticoids in Türkiye [18, 19], encompassing redescriptions of previously characterized species [20, 21]. Also, ecological investigations along the Turkish coasts have furnished insights into the ecological attributes of harpacticoid copepods [22, 23].

Apart from these diverse studies, a singular checklist study has embraced the marine harpacticoids of Türkiye [24]. This comprehensive effort documented a total of 146 harpacticoid species/subspecies distributed along the Turkish coasts. Subsequent to 2014, a plethora of new articles has surfaced, contributing over a hundred novel records to the Turkish faunal compilation. Furthermore, taxonomic revisions have prompted updates to the systematic classification of species documented in earlier studies. Consequently, an updated checklist of Turkish marine harpacticoids emerges as a relevant effort aimed at enhancing our understanding of the local biodiversity.

2. Materials and methods

2.1 Data collection

Data compilation encompassed a comprehensive review of 52 previously published articles centred on marine harpacticoids in Türkiye. These articles were meticulously obtained and categorized based on their primary focus. Fourteen of these studies contributed to faunistic insights [6-10, 15, 25-32], while thirteen studies were dedicated to the description of novel species from Turkish waters [16-18, 33-42]. Four studies were dedicated to revisions [19, 43-45], two for redescriptions [20, 21] and two explored ecological dimensions [22, 23].

In Table 1, species are accurately arranged in alphabetical order within the taxonomic hierarchy. Corresponding seas where these species were identified are documented in the adjacent column. The final column provides the relevant reference for each species. Notably, this checklist exclusively features species-level records from the pertinent literature, thereby omitting genus-level entries.

2.2 *Data analysis*

Türkiye's coasts are surrounded by four distinct seas: the Black Sea, the Sea of Marmara, the Aegean Sea, and the Mediterranean Sea. To acquire knowledge about the distribution patterns of marine harpacticoids in Türkiye, illustrative pie, and column charts, depicting the species count within these seas, have been incorporated.

3. Results

The checklist comprises 247 marine harpacticoid copepod species/subspecies, encompassing 34 families and 113 genera (Table 1). In terms of genera, the family Miraciidae was found to be the most diverse group (20 genera), followed by Ameiridae (14 genera), Laophontidae (10 genera), Ectinosomatidae (9 genera), Leptastacidae (7 genera), Paramesochridae (6 genera), Parastenheliidae (4 genera), Arenopontiidae, Canthocamptidae, Dactylopusiidae, Peltidiidae, Tetragonicipitidae, Thalestridae, and Tisbidae (3 genera each). Moreover, Cletodidae and Idyanthidae encompass 2 genera each, while the remaining families are represented by only 1 genus.

In terms of species diversity (Fig. 1), the family Miraciidae maintains its distinction as the most diverse family, housing 43 species/subspecies. Following this, Ameiridae presents 37 species/subspecies, Laophontidae accounts for 31 species/subspecies, and Ectinosomatidae records 23 species. The remaining families contain fewer than 10 species/subspecies each. Among genera, *Ameira* exhibits the highest diversity with 9 species/subspecies, succeeded by *Harpacticus* (8 species), *Laophonte* and *Nitokra* (7

species each), *Heterolaophonte*, *Sarsamphiascus*, and *Phyllopodopsyllus* (6 species each). The remaining genera encompass 4 or fewer species/subspecies.

Table 1. Checklist of marine harpacticoid copepods of Türkiye: key references; AS: Aegean Sea; SM: Sea of Marmara; BS: Black Sea; MS: Mediterranean Sea.

Group/Species	**Locality**	**References**
HARPACTICOIDA (Order)	-	-
AMEIRIDAE Boeck, 1865	-	-
Ameira aff. spinipes Nicholls, 1939	AS	[23]
Ameira atlantica mediterranea Kunz, 1975	AS, SM	[9, 10]
Ameira atlantica Noodt, 1958	AS	[7, 8]
Ameira divagans Nicholls, 1939	SM	[9]
Ameira longipes Boeck, 1865	AS, SM	[6]
Ameira minuta Boeck, 1865	AS	[10]
Ameira parvula (Claus, 1866)	AS, SM, BS	[6-10, 15, 22, 23]
Ameira reducta Petkovski, 1954	AS, SM	[9]
Ameira tenuicornis Scott T., 1902	AS	[8, 32]
Ameiropsis reducta Apostolov, 1973	AS	[7, 10]
Filexilia attenuata (Thompson I.C., 1893)	AS	[6, 10]
Filexilia brevipes (Kunz, 1954)	AS	[9, 10, 23]
Filexilia intermedia (Galhano, 1970)	MS	[9]
Filexilia marinovi Conroy-Dalton & Huys, 1997	AS, SM	[8-10, 23]
Interleptomesochra attenuata (Scott A., 1896)	AS	[6]
Leptomesochra eulitoralis Noodt, 1952	AS	[10, 23]
Leptomesochra infima Monard, 1928	AS	[32]
Nitokra affinis Gurney, 1927	AS, SM	[7, 9, 10]
Nitokra cari Petkovski, 1954	AS, SM	[9, 23]
Nitokra hibernica (Brady, 1880)	MS	[46]
Nitokra pontica Jakubisiak, 1938	AS	[10]
Nitokra sewelli Gurney, 1927	AS	[9]
Nitokra spinipes Boeck, 1865	AS, SM	[6, 10, 15]
Nitokra typica Boeck, 1865	AS, SM	[8-10, 23]
Parevansula elegans (Marinov, 1974)	AS	[7]
Parevansula mediterranea Guille & Soyer, 1966	AS	[10]
Proameira psammophila Wells, 1963	AS	[23]
Pseudameira breviseta Klie, 1950	AS	[9, 32]
Pseudoameiropsis suphankaraytugi Sönmez, 2019	MS	[41]
Pseudoleptomesochrella halophila (Noodt, 1952)	AS, SM, BS	[9, 10, 20, 23]
Pseudoleptomesochrella marina (Chappuis & Rouch, 1961)	AS	[32]
Psyllocamptus eridani Ceccherelli, 1988	AS, SM	[8-10, 32]
Psyllocamptus minutus Sars G.O., 1911	SM	[6, 10, 15]
Psyllocamptus propinquus (Scott T., 1895)	AS	[8]
Psyllocamptus tahuesensis Gómez, 2002	AS	[8]
Sarsameira parva (Boeck, 1873)	BS	[47]

Sicameira leptoderma Klie, 1950	AS	[23]
ANCORABOLIDAE Sars G.O., 1909		
Bicorniphontodes bicornis (Scott A., 1896)	SM	[15]
ARENOPONTIIDAE Martínez Arbizu & Moura, 1994	-	-
Arenopontia nesaie Cottarelli, 1975	AS, SM	[8-10, 19, 23]
Arenopontia subterranea Kunz, 1937	AS, SM	[7, 15]
Neoleptastacus acanthus Chappuis, 1954	AS	[7-9, 32]
Psammoleptastacus barani Sak, Huys & Karaytuğ, 2008	AS, SM, BS	[8-10, 19]
CANTHOCAMPTIDAE Brady, 1880	-	-
Mesochra aestuarii Gurney, 1921	BS	[48, 49]
Mesochra pygmaea (Claus, 1863)	AS, SM	[8-10, 15]
Nannomesochra arupinensis (Brian, 1925)	AS, SM	[7, 15]
Nannomesochra erythraiensis Alper, Karaytuğ & Sak, 2023	AS	[45]
Nannomesochra gebekumensis Alper, Karaytuğ & Sak, 2023	AS	[45]
Nannomesochra giziri Alper, Karaytuğ & Sak, 2023	MS	[45]
Taurocletodes tumenae Karaytuğ & Huys, 2004	AS, BS	[10, 18, 23]
CANUELLIDAE Lang, 1944	-	-
Canuella furcigera Sars G.O., 1903	AS, MS	[31, 50]
Canuella perplexa Scott T. & Scott A., 1893	AS, SM, BS, MS	[6, 31, 46, 51]
CLETODIDAE Scott T., 1904	-	-
Cletodes longicaudatus (Boeck, 1872)	AS	[23]
Cletodes spinulipes Por, 1967	AS	[7]
Enhydrosoma propinquum (Brady, 1880)	SM	[15]
Enhydrosoma serdarsaki Sönmez, Yıldız & Karaytuğ, 2019	BS	[42]
CLETOPSYLLIDAE Huys & Willems, 1989	-	-
Isocletopsyllus tertius (Por, 1964)	AS	[31]
CYLINDROPSYLLIDAE Sars G.O., 1909	-	-
Stenocaris gracilis Sars G.O., 1909	AS	[23]
Stenocaris minor (Scott T., 1893)	AS	[23]
DACTYLOPUSIIDAE Lang, 1936	-	-
Dactylopusia micronyx Sars G.O., 1905	AS	[6]
Dactylopusia tisboides (Claus, 1863)	AS, SM	[7, 8, 15, 27]
Diarthrodes aegidaeus (Brian, 1927)	AS	[8]
Diarthrodes brevipes Wells & Rao, 1987	AS	[7]
Diarthrodes ponticus (Krichagin, 1877)	AS	[7, 8]
Diarthrodes pygmaeus (Scott T. & Scott A., 1895)	SM	[15]
Paradactylopodia brevicornis (Claus, 1866)	AS, SM	[8, 15, 27]
DARCYTHOMPSONIIDAE Lang, 1936	-	-
Leptocaris biscayensis (Noodt, 1955)	AS, SM, MS	[8-10, 23, 32, 35]
Leptocaris emekdasi Köroğlu, Kuru & Karaytuğ, 2015	AS, MS	[35]
Leptocaris igneus Cottarelli & Baldari, 1982	AS, MS	[35]
Leptocaris insularis (Noodt, 1958)	AS	[10]
ECTINOSOMATIDAE Sars G.O., 1903	-	-
Arenosetella germanica Kunz, 1937	AS, SM, MS	[6, 7, 9, 10, 23, 29]

Arenosetella lanceorostrata Sönmez, Sak & Karaytuğ, 2016	AS, SM, MS	[9, 23, 38]
Arenosetella tenuissima (Klie, 1929)	AS	[7]
Bradyellopsis subniger Brian, 1925	SM	[15]
Ectinosoma dentatum Steuer, 1940	SM	[15]
Ectinosoma melaniceps Boeck, 1865	AS, SM, BS, MS	[6, 9, 10, 15, 22, 29, 46]
Ectinosoma normani Scott T. & Scott A., 1896	SM	[15]
Ectinosoma reductum Bozic, 1955	AS, SM, MS	[8-10, 29]
Ectinosoma soyeri Apostolov, 1975	AS, SM, MS	[7-10, 23, 29]
Glabrotelson bodini (Apostolov, 1974)	AS, MS	[7, 8, 10, 29]
Glabrotelson bozici (Soyer, 1974)	AS, MS	[23, 29]
Glabrotelson leptoderma (Klie, 1929)	AS	[23]
Glabrotelson psammae (Noodt, 1955)	AS, SM	[6]
Halectinosoma herdmani (Scott T. & Scott A., 1896)	AS, BS, MS	[10, 22, 29]
Microsetella norvegica (Boeck, 1865)	AS, SM, MS	[7-10, 23, 29, 31, 50, 52, 53, 54]
Microsetella rosea (Dana, 1847)	AS, SM, BS, MS	[9, 29, 52, 54-57]
Noodtiella enertha Lindgren, 1975	AS	[9]
Noodtiella intermedia Wells, 1967	SM	[9]
Noodtiella wellsi Apostolov, 1974	SM	[9]
Pseudobradya beduina Monard, 1935	SM	[15]
Pseudobradya pelobates Jakobi, 1954	AS	[32]
Pseudobradya robusta Sars G.O., 1910	AS	[32]
Sigmatidium kunzi Mielke, 1979	AS	[23]
HARPACTICIDAE Dana, 1846	-	-
Harpacticus aff. obscurus T. Scott, 1895	AS	[8, 31]
Harpacticus aff. tenellus G. O. Sars, 1920	AS	[8]
Harpacticus compsonyx Monard, 1926	AS, SM	[7, 9]
Harpacticus flexus Brady & Robertson, 1873	SM	[15]
Harpacticus gracilis Claus, 1863	AS, SM	[6, 15]
Harpacticus littoralis Sars G.O., 1910	AS, SM	[6-9, 31]
Harpacticus pacificus Lang, 1965	AS	[8]
Harpacticus pulex Humes, 1964	AS	[32]
IDYANTHIDAE Lang, 1948	-	-
Idyella tenuis (Brady, 1910)	AS	[7]
Tachidiella minuta Sars G.O., 1909	BS	[47]
LAOPHONTIDAE Scott T., 1904	-	-
Afrolaophonte pori Masry, 1970	AS	[7-10, 23, 32]
Asellopsis hispida Brady & Robertson, 1873	SM	[15]
Asellopsis intermedia (Scott T., 1895)	SM	[9]
Asellopsis sarmatica Jakubisiak, 1938	BS	[28]
Echinolaophonte armiger (Gurney, 1927)	AS	[32]
Echinolaophonte hystrix (Brian, 1928)	AS	[8]
Esola longicauda Edwards, 1891	SM	[15]
Heterolaophonte brevipes Roe, 1958	SM	[9]
Heterolaophonte curvata (Douwe, 1929)	AS, BS	[8, 28]

Heterolaophonte stroemii (Baird, 1837)	AS	[7, 8, 10]
Heterolaophonte stroemii paraminuta Noodt, 1955	SM	[15]
Heterolaophonte stroemii stroemii (Baird, 1934)	AS	[6]
Heterolaophonte uncinata (Czerniavski, 1868)	AS, BS	[7, 9, 28, 31]
Klieonychocamptus kliei (Monard, 1935)	AS, SM	[6, 10, 23, 32]
Klieonychocamptus kliei adriaticus (Petkovski, 1954)	AS, SM, BS	[7, 9, 28, 32]
Klieonychocamptus kliei confluens Noodt, 1958	AS	[9]
Klieonychocamptus ponticus (Serban & Plesa, 1957)	AS, SM, BS	[8-10, 23, 28]
Laophonte cornuta Philippi, 1840	AS	[8, 27, 31, 32]
Laophonte elongata barbata Lang, 1934	AS	[10]
Laophonte inornata A. Scott, 1902	AS, SM	[6, 9, 15]
Laophonte lignosa Hicks, 1988	AS, SM	[8, 9]
Laophonte plana Fiers, 1986	AS	[8, 31]
Laophonte setosa Boeck, 1865	SM, BS	[9, 15, 28]
Laophonte triarticulata Monard, 1928	BS	[28]
Lipomelum adriaticum (Petkovski, 1955)	AS	[8-10, 32]
Paralaophonte (Loureirophonte) cesareae (Por, 1964)	AS	[7]
Paralaophonte (Paralaophonte) asellopsiformis Lang, 1965	AS	[10]
Paralaophonte (Paralaophonte) brevirostris (Claus, 1863)	AS, SM	[6-10, 15, 27, 32]
Paralaophonte (Paralaophonte) quaterspinata (Brian, 1917)	AS	[7, 8, 27, 31]
Pseudechinolaophonte minuta (Cottarelli & Forniz, 1991)	AS	[23]
Pseudechinolaophonte mordoganensis (Kuru, Sönmez & Karaytuğ, 2019)	AS	[40]
LATIREMIDAE Božić, 1969	-	-
Delamarella obscura Huys, Karaytuğ & Cottarelli, 2005	AS, SM, BS	[6-10, 23, 33]
LEPTASTACIDAE Lang, 1948	-	-
Ciplakastacus mersinensis Sak, Karaytuğ & Huys, 2008	AS, SM	[9, 43]
Leptastacus laticaudatus Nicholls, 1935	BS	[25]
Leptastacus uncinatus Cottarelli & Venanzetti, 1989	AS	[23]
Minervella baccettii Cottarelli & Venanzetti, 1989	AS	[9, 23]
Paraleptastacus holsaticus Kunz, 1937	AS	[10]
Paraleptastacus kliei (Gagern, 1923)	AS	[6, 7]
Psammastacus confluens Nicholls, 1935	SM	[9]
Schizothrix pontica (Griga, 1963)	AS	[23]
Stereoxiphos operculatus (Masry, 1970)	AS	[9]
LEPTOPONTIIDAE Lang, 1948	-	-
Psammopsyllus ertunci Karaytuğ & Sak, 2005	BS	[16, 25]
Psammopsyllus operculatus Nicholls, 1945	SM, BS	[15]
LONGIPEDIIDAE Boeck, 1865	-	-
Longipedia coronata Claus, 1863	AS	[10]
Longipedia helgolandica Klie, 1949	AS	[31]
Longipedia minor Scott T. & Scott A., 1893	AS	[31]
Longipedia scotti Sars G.O., 1903	AS	[31]
Longipedia weberi Scott A., 1909	AS, SM	[6, 15]

LOURINIIDAE Monard, 1927	-	-
Lourinia armata (Claus, 1866)	AS	[44]
Lourinia gocmeni Karaytuğ, Sak, Alper & Sönmez, 2021	AS	[7, 44]
Lourinia wellsi Karaytuğ, Sak, Alper & Sönmez, 2021	AS	[8, 31, 44]
METIDAE Boeck, 1873	-	-
Metis ignea Philippi, 1843	AS, SM	[6, 9]
MIRACIIDAE Dana, 1846	-	-
Amonardia perturbata Lang, 1965	AS	[6, 7, 23]
Amonardia phyllopus (Sars G.O., 1906)	AS	[8, 30]
Amphiascoides brevifurca (Czerniavsky, 1868)	AS, SM, BS	[9, 10, 15, 30]
Amphiascoides subdebilis (Willey, 1935)	SM	[15]
Amphiascopsis cinctus (Claus, 1866)	AS	[6-8, 10, 30]
Amphiascus thalestroides Sars G.O., 1911	AS	[8, 31]
Bulbamphiascus imus (Brady, 1872)	AS, SM, MS	[6, 10, 30]
Delavalia normani Scott T., 1905	SM	[15]
Delavalia oblonga (Lang, 1965)	AS, BS	[7, 30]
Diosaccus tenuicornis (Claus, 1863)	AS, MS	[8, 30]
Diosaccus varicolor pentasetosus (Noodt, 1955)	SM	[15]
Eoschizopera (Praeoschizopera) gligici (Petkovski, 1957)	AS, SM, BS, MS	[6, 8, 9, 23, 30]
Haloschizopera marmarae Noodt, 1955	AS, SM, MS	[15, 30, 31]
Macrosetella gracilis (Dana, 1846)	AS, SM, MS	[7, 56, 58]
Metamphiascopsis hirsutus bermudae (Willey, 1930)	AS, MS	[8, 30]
Oculosetella gracilis (Dana, 1849)	MS	[50]
Paramphiascella bulbifer Guille & Soyer, 1966	AS	[31]
Paramphiascella mediterranea Lang, 1948	AS	[7]
Paramphiascella robinsonii (Scott A., 1902)	AS, MS	[30]
Paramphiascella vararensis (Scott T., 1903)	SM	[15]
Psammotopa vulgaris Pennak, 1942	AS, SM, MS	[8-10, 30]
Pseudamphiascopsis attenuatus (Sars G.O., 1906)	AS, SM	[7, 9]
Pseudamphiascopsis attenuatus orientalis Noodt, 1955	AS, SM	[15, 23]
Robertgurneya oligochaeta (Noodt, 1955)	SM, BS	[15, 22]
Robertgurneya remanei (Klie, 1950)	AS	[31]
Robertgurneya rostrata (Gurney, 1927)	SM	[15]
Robertgurneya similis bulbamphiascoides Noodt, 1955	SM	[15]
Robertgurneya smithi (Hamond, 1973)	AS, MS	[8, 10, 30]
Robertsonia knoxi (Thompson I.C. & Scott A., 1903)	AS, SM, MS	[10, 15, 30]
Robertsonia monardi (Klie, 1937)	SM	[15]
Robertsonia normani (Brady, 1910)	SM	[15]
Sarsamphiascus angustipes (Gurney, 1927)	AS, SM, MS	[8, 10, 15, 23, 30, 32]
Sarsamphiascus kawamurai (Ueda & Nagai, 2005)	AS, MS	[8, 30]
Sarsamphiascus minutus (Claus, 1863)	AS, SM, MS	[6-10, 15, 30]
Sarsamphiascus parvus (Sars G.O, 1906)	SM	[15]
Sarsamphiascus tenuiremis (Brady & Robertson, 1876)	AS	[31]
Sarsamphiascus varians (Norman & Scott T., 1905)	SM	[15]

Schizopera brusinae Petkovski, 1954	AS, BS, MS	[6-10, 30]
Schizopera karanovici Sönmez, Sak & Karaytuğ, 2015	AS, MS	[9, 30]
Schizopera minuta Noodt, 1955	AS, SM	[9]
Schizopera pontica Chappuis & Serban, 1953	AS	[10]
Schizopera pratensis Noodt, 1958	AS	[10, 30]
Typhlamphiascus confusus (Scott T., 1902)	AS	[31]
NORMANELLIDAE Lang, 1944	-	-
Normanella reducta Noodt, 1955	SM	[15]
ORTHOPSYLLIDAE Huys, 1990	-	-
Orthopsyllus linearis (Claus, 1866)	AS, SM	[6, 9]
Orthopsyllus linearis bulbosus Noodt, 1955	SM	[15]
Orthopsyllus sarsi Klie, 1941	AS	[32]
PARAMESOCHRIDAE Lang, 1944	-	-
Apodopsyllus arenicolus (Chappuis, 1954)	AS, SM	[9, 10]
Apodopsyllus perplexus (Wells, 1963)	SM	[6]
Diarthrodella ergeneae Sönmez, Karaytuğ & Sak, 2015	AS, MS	[10, 36]
Diarthrodella orbiculata Klie, 1949	AS	[23]
Diarthrodella secunda Kunz, 1954	AS	[23]
Emertonia constricta (Nicholls, 1935)	AS, SM	[6, 7, 8, 10, 15, 23]
Emertonia constricta orotavae (Noodt, 1958)	AS, SM	[9]
Emertonia holsatica (Klie, 1929)	AS, SM	[6]
E*mertonia masryi* (Bodin, 1979)	AS	[10]
Leptopsyllus punctatus Mielke, 1984	AS, SM	[7-9, 23]
Paramesochra helgolandica Kunz, 1936	AS	[8, 32]
Wellsopsyllus (Scottopsyllus) robertsoni (Scott, T. & Scott A., 1895)	AS	[6, 7]
PARASTENHELIIDAE Lang, 1936	-	-
Karaytugia aydini (Kuru & Karaytuğ, 2015)	MS	[37]
Parastenhelia hornelli Thompson I.C. & Scott A., 1903	AS, SM	[6, 15]
Parastenhelia spinosa (Fischer, 1860)	AS, SM	[7-10, 32]
Penicillicaris pectinimana (Car, 1884)	AS, BS, MS	[21]
Thalestrella ornatissima Monard, 1935	AS	[23]
PELTIDIIDAE Claus, 1860	-	-
Alteutha depressa (Baird, 1837)	AS	[8]
Clytemnestra scutellata Dana, 1847	MS	[57]
Goniopsyllus rostratus Brady, 1883	AS, SM	[52, 53, 57, 59]
PORCELLIDIIDAE Boeck, 1865	-	-
Porcellidium fimbriatum Claus, 1863	AS, SM	[8, 9]
PSEUDOTACHIDIIDAE Lang, 1936	-	-
Dactylopodella flava (Claus, 1866)	SM	[15]
RHIZOTRICHIDAE Por, 1986	-	-
Tryphoema gallipoliensis Alper, Sak & Metin, 2018	AS	[10, 39]
TACHIDIIDAE Sars G.O., 1909	-	-
Euterpina acutifrons (Dana, 1847)	AS, SM, BS, MS	[23, 26, 51, 60-62, 59]
TEGASTIDAE Sars G.O., 1904	-	-

Tegastes satyrus (Claus, 1860)	AS	[7]	
TETRAGONICIPITIDAE Lang, 1944	-		-
Odaginiceps korykosensis Karaytuğ, Sak & Alper, 2010	MS	[34]	
Phyllopodopsyllus berrieri Monard, 1936	SM	[9]	
Phyllopodopsyllus bradyi (Scott T., 1892)	AS	[8]	
Phyllopodopsyllus briani Petkovski, 1955	AS, SM	[6, 9, 10, 32]	
Phyllopodopsyllus gracilipes Wells & Rao, 1987	AS	[8]	
Phyllopodopsyllus pauli Crisafi, 1960	AS	[6]	
Phyllopodopsyllus thiebaudi Petkovski, 1955	AS, SM	[6, 9, 32]	
Pteropsyllus plebeius furcatus Kunz, 1938	AS	[9]	
THALESTRIDAE Sars G.O., 1905	-		-
Eudactylopus latipes (Scott T., 1893)	SM	[15]	
Eudactylopus robustus (Claus, 1863)	AS	[8, 31]	
Eudactylopus spectabilis (Brian, 1923)	AS	[7, 8]	
Parathalestris harpactoides (Claus, 1863)	SM	[15]	
Phyllothalestris mysis (Claus, 1863)	AS	[27, 31]	
TISBIDAE Stebbing, 1910	-		-
Paraidya occulta Humes & Ho, 1969	AS	[7]	
Scutellidium arthuri Poppe, 1884	AS	[6]	
Scutellidium ligusticum (Brian, 1920)	AS, SM	[8, 9]	
Scutellidium longicaudum (Philippi, 1840)	AS, SM	[7, 9, 23]	
Scutellidium longicaudum acheloides Itô Tat, 1976	AS	[8]	
Tisbe angusta (Sars G.O., 1905)	AS	[7]	
Tisbe furcata (Baird, 1837)	AS, SM	[6, 8, 15]	
Tisbe perplexa Volkmann, 1979	AS	[7]	

It is also possible to examine the harpacticoid copepod species in the checklist in terms of the seas in which they are distributed (Fig. 2). Among these, the Aegean Sea possesses the highest species diversity, hosting 194 species/subspecies (96 genera in 30 families). The Sea of Marmara's coasts are documented to have 107 species/subspecies (65 genera in 26 families), while the Mediterranean coasts record 43 species/subspecies (33 genera in 9 families).

On the other hand, the Black Sea coasts feature 30 species/subspecies (26 genera in 12 families). Intriguingly, only 5 species (*Canuella perplexa*, *Ectinosoma melaniceps*, *Eoschizopera (Praeoschizopera) gligici*, *Euterpina acutifrons*, *Microsetella rosea*) are encountered along the coasts of all four seas, making up a mere 2.02% of the total recorded species. Moreover, 25 species (equivalent to 10.12% of the reported species) are found along coasts of three seas, whereas 65 species (constituting 26.31%) are distributed across two seas, and 152 species (accounting for 61.53%) are exclusively documented from the coasts of a single sea.

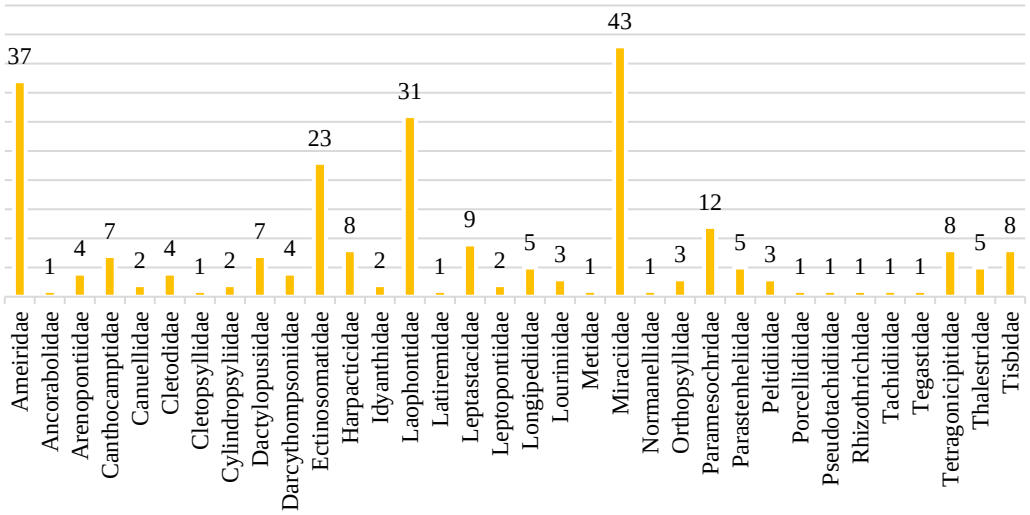

Figure 1. Distribution of marine harpacticoid copepod species across families in Türkiye.

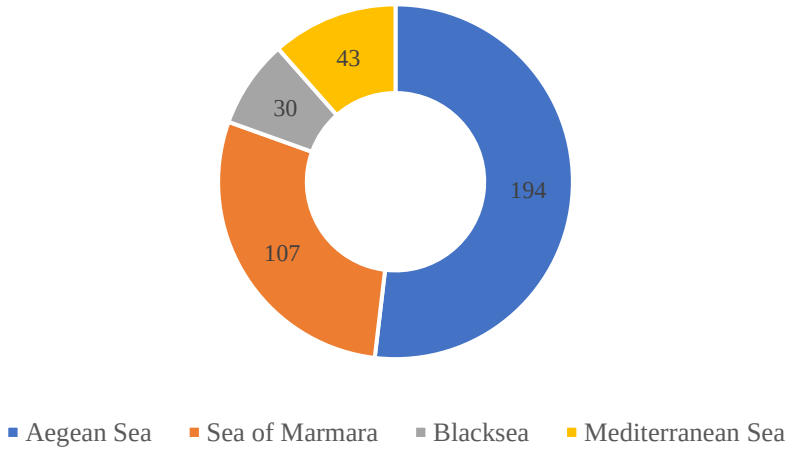

Figure 2. Species number of marine harpacticoid copepods of Turkish coasts.

4. Discussion

4.1 Faunal studies in Turkish coasts

The history of harpacticoid copepod research in Turkish seas traces back to Noodt's initial report in 1955. Subsequently, a total of 51 research articles have been published up to the present day. Despite the initiation of marine harpacticoid studies in Türkiye as early as 1955, the quantity remained limited, with a mere eight studies published until the turn of the millennium. However, the 21st century witnessed a marked acceleration in studies concerning marine harpacticoids along the Türkiye coast. These endeavours expanded beyond faunistic studies to encompass descriptions of new species, redescriptions, and taxonomic revisions, contributing to a comprehensive understanding of the local fauna. Moreover, a checklist encompassing Turkish marine harpacticoids was published [24]. However, the subsequent publication of 23 additional articles led to a significant increase in the reported marine harpacticoid species along the Turkish coast from 146 to 247

species. The infusion of more than a hundred new records, coupled with advancements in the classification of harpacticoid copepods found along Turkish coasts, underscores the necessity for an updated checklist for marine harpacticoid copepods in Türkiye.

4.2 Faunal distribution in Turkish coasts

Considering the number of marine harpacticoid copepods in Türkiye, the records unveil a total of 247 species/subspecies across 34 families and 113 genera (Table 1). Notably, the families Miraciidae, Ameiridae, Laophontidae, Ectinosomatidae, and Paramesochridae exhibit a notable presence, each encompassing over 10 species. The cumulative count of species within these families stands at 146, constituting 59.1% of the total species reported along Turkish coasts. These families collectively embody a substantial portion of the marine harpacticoid diversity in Türkiye, eclipsing more than half of the recorded species. In contrast, 10 out of the remaining 29 families are each represented by a single species (Fig. 1).

In the context of harpacticoid diversity across various seas in Türkiye, the Aegean Sea stands out, featuring a recorded total of 195 species/subspecies. This is followed by the Sea of Marmara with 107 species/subspecies, the Mediterranean with 43 species/subspecies, and the Black Sea with 30 species/subspecies. The high number of harpacticoid records along the Aegean Sea's coasts is perhaps attributable to the coastline's length and the heightened frequency of field studies conducted there. Interestingly, several species have been documented from multiple seas in Türkiye. Notably, *Canuella perplexa, Ectinosoma melaniceps, Eoschizopera (Praeoschizopera) gligici, Euterpina acutifrons*, and *Microsetella rosea* have been reported from all Turkish seas. Furthermore, 25 harpacticoid species have been identified from three seas, potentially indicating a broad distribution for these species. Conversely, the remaining species are primarily restricted to only one or two sea regions. However, it's important to note that the limited number of faunistic studies and samples available can hinder definitive conclusions. In summation, the exploration of marine harpacticoid diversity along Turkish coasts has yielded this comprehensive checklist. This resource is ready to enhance future faunistic and ecological studies. The true marine harpacticoid copepod diversity in Türkiye will likely become clearer through the combined efforts of various researchers focusing on diverse study areas.

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