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REVIEW DERLEME

A checklist for zooplankton (Rotifera, Copepoda, Cladocera) of European Turkey inland waters

Türkiye Avrupası'nın iç sularında yaşayan zooplankton (Rotifera, Copepoda, Cladocera) türlerinin listesi

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Özet: Türkiye'nin Avrupa kısmı, Avrupa ile Asya kıtalar arasında geçiş bölgesi oluşturması nedeniyle her iki kıtanında türlerine ev sahipliği yapmaktadır. Ancak şu ana kadar Anadoludan ayrı olarak Türkiye Avrupası zooplanktonik organizmaların tür listesi çıkarılmamıştır. Bu nedenle bölgede bu güne kadar bu konuda yapılan araştırmaların tümü incelenmiştir. 1940'tan bu yana yapılan araştırmaların incelenmesi sonucunda 138 Rotifera, 53 Copepoda ve 65 Cladocera olmak üzere 256 tür listelenmiştir.

***Anahtar kelimeler*:** Tür listesi, Zooplankton, içsular, Türkiye Avrupası

Abstract: The European part of Turkey, which constitutes a transitional region between Europe and Asia hosts species of both continents. But, the zooplankton checklist in the European part of Turkey has not been published so far as a separate checklist from that of Turkey as a whole. Therefore, a checklist was presented in this study based on compilation of previous zooplankton studies carried out at European Turkey inland waters. As a result of the studies conducted since 1940 to date, a total of 256 taxa belonging to 138 Rotifera, 53 Copepoda and 65 Cladocera were listed.

***Keywords*:** *Checklist, Zooplankton, inland waters, EuropeanTurkey*

INTRODUCTION

Zooplanktonic organisms are not only the main food source of fishes that live in fresh water ecosystems, but also they include indicator species which is used as an indication of water quality, pollution and the state of eutrophication. For his reason, many researches have been conducted in terms of both taxonomical and ecological aspects of zooplanktonic organisms.

Studies performed in order to determine the zooplankton fauna of Turkey continued over the years without stopping. Some of these studies focused on Rotifera and Cladocera or Copepoda. The first checklist on Cladocera was published by Gündüz (1997) and the second one on Rotifera was published by Ustaoglu *et al*. (2012a). In addition, the checklist for zooplankton of Turkish inland waters listed 229 Rotifera, 92 Cladocera and 106 Copepoda species previos in studies (Ustaoğlu, 2004) and this list was updated by Ustaoğlu (2014). Moreover, checklist for zooplankton of Eastern and Souteastern Anatolia Regions (Turkey) was published by Bulut and Saler (2014). But, the zooplankton checklist in the European part of Turkey has not been published so far as a separate checklist from that of Turkey as a whole.

Inventory works on zooplankton diversity of European Turkey inland waters were carried out within the past 75 years and the first research began in the 1940. However, these researches progressed slowly and gained acceleration after 1990.

This study aims to present a current checklist of zooplankton (Rotifera, Copepoda, Cladocera) in European Turkey inland waters, based on compilation of previous inventory studies carried out so far.

MATERIALS AND METHODS

European part of Turkey covers an area of 23.764 km^2 and creates a crossing point between Europe and Asia continents. Kırklareli, Edirne and Tekirdag province are located in the region and Çanakkale and Istanbul are partly represented (Figure1).

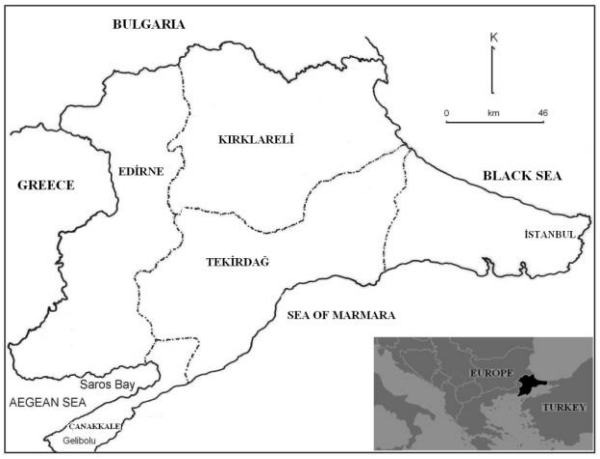

Figure 1. Map of European Turkey.

In this study, all published literature, either papers or theses from 1940 to 2012 were examined. Taxonomical species and author names were written according to Segers (2007), Ustaoğlu (2004), Ustaoğlu *et al.* (2012a) and Gündüz (1997). The studies performed concerning the zooplankton of European Turkey inland waters are as follows: Mann (1940), Muckle (1951), Kiefer (1952, 1955), Lindeberg (1953), Demirhindi (1972), Fiers (1979), Ortak and Kırgız (1988), Güher and Kırgız (1989, 1992, 1994, 2004, 2007, 2008), Gündüz (1997), Güher (1999, 2000, 2002, 2003, 2004, 2012), Güher *et al.* (2004, 2011), Erdoğan and Güher (2005, 2008, 2012a, 2012b), Okgerman *et al.* (2007), Güher and Erdoğan (2008), Özçalkap and Temel (2011), Dorak and Albay (2011), Ustaoğlu *et al.* (2012b)

RESULTS AND DISCUSSION

As a result of the throughout investigation of the studies in European Turkey inland waters from 1940 to 2012, the presence of a total 256 taxa was reported. Among these, Rotifera was represented with 138 species belonging to 25 families, Copepoda with 53 species belonging to 11 families and Cladocera with 65 species belonging to 10 families. When the recorded taxa were grouped according to their presence in terms of province borders in the region, it appeared that 208 species existed in Edirne, 158 species in Kırklareli, 118 species in Tekirdağ and 107 species in Istanbul. Çanakkale is missing in this distribution because no study was performed in Gallipoli Peninsula (Çanakkale), the part of the province in European of Turkey. These species and their distributions have been shown at below (E: Edirne; K: Kırklareli; T: Tekirdağ: I: İstanbul).

Phylum: ROTIFERA

Classis: Eurotatoria De Ridder, 1957
Subclassis: Bdelloidea Hudson, 1884
Family: Philodinidae Ehrenberg, 1838
Dissotrocha aculeata (Ehrenberg, 1832): E,T
Philodina megalotrocha Ehrenberg, 1832: E, K, T
Rotaria neptunia (Ehrenberg, 1830): E, K, T
Rotaria rotatoria (Pallas, 1766): E
Family: Adinetidae Hudson & Gosse, 1889
Adineta sp.: K
Family: Habrotrochidae Bryce, 1910
Habrotrocha sp.: E, K, T
Subclassis: Monogononta Plate, 1889
Superorder: Pseudotrocha Kutikova, 1970
Order: Ploimia Hudson & Gosse, 1886
Family: Epiphanidae Harring, 1913
Epiphanes macroura (Barrois & Daday, 1894): E,I
Epiphanes senta (Müller, 1773): E
Proalides subtilis Rodewald, 1940: E
Proalides tentaculatus De Beauchamp, 1907: E
Family: Brachionidae Ehrenberg, 1838
Anuraeopsis coelata De Beuchamp, 1932: K, I
Anuraeopsis fissa Gosse, 1851: E, K, T, I
Anuraeopsis navicula Rousselet, 1911: E, K
Brachionus angularis Gosse, 1851: E, K, T, I
Brachionus bidentatus Anderson, 1889: E, I
Brachionus budapestinensis Daday, 1885: E, K, I
Brachionus calyciflorus Pallas, 1766: E, K, T, I
Brachionus diversicornis (Daday, 1883): E, K, T, I
Brachionus falcatus Zacharias, 1898: E, K, T, I
Brachionus forficula Wierzejski, 1891: E
Brachionus leydigii Cohn, 1862: E, K, T
Brachionus plicatilis Müller, 1786: E, K, I
Brachionus quadridentatus Hermann, 1783: E, K, T, I
Brachionus urceolaris Müller, 1773: E, K, T, I
Kellicottia longispina (Kellicott, 1879): E, K
Keratella cochlearis (Gosse, 1851): E, K, T, I
Keratella quadrata (Müller, 1786): E, K, T, I
Keratella tecta (Gosse, 1851): E, K, T
Keratella tropica (Apstein, 1907): E, K, T
Notholca acuminata (Ehrenberg, 1832): E, K, T, I
Notholca salina Focke, 1961: E
Notholca squamula (Müller, 1786): E, K, T, I
Plationus patulus (O.F.Müller, 1786): E, K
Platyias quadricornis (Ehrenberg, 1832): E, K
Family: Euchlanidae Ehrenberg, 1838
Euchlanis deflexa (Gosse, 1851): E, K, T
Euchlanis dilatata Ehrenberg, 1832: K, T, I
Euchlanis incisa Carlin, 1939: E, K, T
Euchlanis lyra Hudson, 1886: E, K, T
Euchlanis meneta Myers, 1930: E, K
Family: Mytilinidae Harring, 1913
Lophocharis salpina (Ehrenberg, 1834): E, K, T
Mytilina mucronata (Müller, 1773): E, K
Mytilina ventralis (Ehrenberg, 1830): E
Family: Trichotriidae Harring, 1913
Trichotria pocillum (Müller, 1776): E, K
Trichotria tetractis (Ehrenberg, 1830): E, K, T
Family: Lepadellidae Harring, 1913
Colurella adriatica Ehrenberg, 1831: E, K, T, I
Colurella colurus (Ehrenberg, 1830): E, K, T, I
Colurella obtusa (Gosse, 1886): E
Colurella uncinata (Müller, 1773): E, K, T
Lepadella (Heterolepadella) ehrenbergi (Perty, 1850): T
Lepadella (Lepadella) acuminata (Ehrenberg, 1834) : E, K
Lepadella (Lepadella) patella (Müller, 1773): E, K, T, I
*Lepadella (Lepadella) triptera (*Ehrenberg, 1832): E
Lepadella(Lepadella) ovalis (Müller, 1786): E, K
Squatinella rostrum (Schmarda, 1846): E
Family: Lecanidae Remane, 1933
Lecane bulla (Gosse, 1886): E, K, T
Lecane closterocerca (Schmarda, 1859): E, K, T
Lecane donneri Chengalath & Mulamoottil, 1974: E
Lecane flexilis (Gosse, 1886): E
Lecane furcata (Murray, 1913): E, K, T
Lecane hamata (Stokes, 1896): E, K, T
Lecane hastata (Murray, 1913): E, T
Lecane inermis (Bryce, 1892): E
Lecane lamellata (Daday, 1893): E, K
Lecane luna (Müller, 1776): E, K, T, I
Lecane lunaris (Ehrenberg, 1832): E, K, T

Lecane nana (Murray, 1913): E, K, I
Lecane pyriformis (Daday, 1905): E, K, T
Lecane quadridentata (Ehrenberg, 1830): E, T
Lecane rugosa (Harring, 1914): E
Lecane stenroosi (Meissner, 1908): E, K, T
Lecane stichaea Harring, 1913: K
Lecane ungulata (Gosse, 1887): E, K, T
Family: Proalidae Harring & Myers, 1924
Proales fallaciosa Wulfert, 1937: E, K, T
Family: Notommatidae Hudson & Gosse, 1886
Cephalodella catellina (Müller, 1786): E, I
Cephalodella forficula (Ehrenberg, 1830): E, K
Cephalodella gibba (Ehrenberg, 1830): E, K, T, I
Cephalodella megalocephala (Glascott, 1893): E, T
Eosphora ehrenbergi Weber & Montet, 1918: K
Monommata sp.: E, K
Notommata copeus Ehrenberg, 1834: E
Notommata glyphura Wulfert, 1935: E, K, T
Pleurotrocha petromyzon (Ehrenberg, 1830): E, K, T
Family: Ituridae Sudzuki, 1964
Itura myersi Wulfert, 1935: E, K, T
Family: Scaridiidae Manfredi, 1927
Scaridium longicaudum (Müller, 1786): E
Family: Trichocercidae Harring, 1913
Trichocerca bicristata (Gosse, 1887): E, K
Trichocerca capucina (Wierjeski & Zacharias, 1893): E, K, T
Trichocerca cylindrica (Imhof, 1891): E, K, T, I
Trichocerca elongata (Gosse, 1886): E
Trichocerca iernis (Gosse, 1887): K
Trichocerca insignis (Herrick, 1885): K
Trichocerca longiseta (Schrank, 1802): K
Trichocerca obtusidens (Olofsson, 1918): E
Trichocerca porcellus (Gosse, 1851): E, K, T, I
Trichocerca pusilla (Jennings, 1903): E, K, T
Trichocerca rattus (Müller, 1776): E, K
Trichocerca similis (Wierzejski, 1893): E, K
Trichocerca tenuior (Gosse, 1886): E, K
Trichocerca tigris (Müller, 1786): E, K
Family: Gastropodidae Harring, 1913
Ascomorpha ecuadis Petry, 1850: I
Ascomorpha ovalis (Bengendahl, 1892): E, I
Ascomorpha saltans Bartsch, 1870: E
Gastropus minor (Rousselet, 1892): E
Gastropus stylifer (Imhof, 1891): I
Family: Synchaetidae Hudson and Gosse, 1886
Polyarthra dolichoptera Idelson, 1925: E, K, T, I
Polyarthra euryptera Wierzejski, 1891: E
Polyarthra major Burckhardt, 1900: I
Polyarthra remata Skorikov,1896: E, K, T
Polyarthra vulgaris Carlin, 1943: E, K, T, I
Synchaeta oblonga Ehrenberg, 1832: E, K, T, I
Synchaeta pectinata Ehrenberg, 1832: E, K, T, I
Synchaeta stylata Wierzejski, 1893: K, I
Family: Asplanchnidae Eckstein, 1883
Asplanchna girodi de Guerne, 1888: E
Asplanchna priodonta Gosse, 1850: E, K, T, I
Asplanchna sieboldi (Leydig, 1854): E, K, T, I
Asplanchnopus hyalinus Harring, 1913: E
Family: Dicranophoridae Harring, 1913
Dicranophoroides caudatus (Ehrenberg, 1834): K
Dicranophorus grandis (Ehrenberg, 1832): E, K, T
Encentrum kulmatyckii Wiszniewski, 1953: E
Encentrum saundersiae (Hudson, 1885): E, K
Erignatha clastopis (Gosse, 1886): K
Paradicranophorus hudsoni (Glascott, 1893): E, K, T
Superordo: Gnesiotrocha Kutikova, 1970
Order: Flosculariacea Harring, 1913
Family: Flosculariidae Ehrenberg, 1838
Floscularia sp.: E, K, T
Family: Testudinellidae Harring, 1913
Pompholyx sulcata Hudson, 1885: E, K, T, I
Testudinella elliptica (Ehrenberg, 1934): E
Testudinella emarginula (Stenroos, 1898): E, K
Testudinella mucronata (Gosse, 1886): E
Testudinella parva (Ternetz, 1892): T
Testudinella patina (Hermann, 1783): E, K, T, I
Family: Filiniidae Harring & Myers, 1926
Filinia cornuta (Weisse, 1847): E
Filinia longiseta (Ehrenberg, 1834): E, K, T, I
Filinia opoliensis (Zacharias, 1898): E, K, T
Filinia terminalis (Plate, 1886): E, K, T, I
Family: Conochilidae Harring, 1913
Conochilus (Conochiloides) dossuarius Hudson, 1885: E, K, T
Conochilus (Conochilus) unicornis Rousselet, 1892: K, T
Family: Hexarthridae Bartos, 1959
Hexarthra fennica (Levander, 1892): E, T
Hexarthra intermedia (Wiszniewski, 1929): I
Hexarthra mira (Hudson, 1871): E, K, T, I
Order: Collothecaceae Harring, 1913
Family: Collothecidae Harring, 1913
Collotheca ornata (Ehrenberg, 1832): E, K, T

Subclassis: COPEPODA

Order: Cyclopoida Sars, 1918
Family: Cyclopidae G.O. Sars, 1913
Subfamily: Eucyclopinae Kiefer, 1927
Ectocyclops phaleratus (Koch, 1838): E, K
Eucyclops macruroides (Lilljeborg, 1901): E, K
Eucyclops macrurus (G.O.Sars, 1863): E, T, I
Eucyclops serrulatus (Fischer, 1851): E, K, T, I
Eucyclops speratus (Lilljeborg, 1901): E, K, T
Macrocyclops albidus (Jurine, 1820): E, K, T, I
Macrocyclops fuscus (Jurine, 1820): E, K, T
Paracyclops affinis (G.O.Sars, 1863): E, K, T
Paracyclops fimbriatus (Fischer, 1853): T, I
Tropocyclops prasinus (Fischer, 1860): T, I
Subfamily: Cyclopinae Kiefer, 1927
Acanthocyclops kieferi (Chappuis, 1925): E
Acanthocyclops robustus (G.O.Sars, 1863): E, K, T, I
Acanthocyclops venustus (Norman & Scoott, 1906): E, K, T
Cyclops abyssorum G.O.Sars, 1863: E, K, T, I
Cyclops furcifer Claus, 1857: E
Cyclops insignis Claus, 1857: E
Cyclops kolensis Lilljeborg, 1901: K
Cyclops scutifer G.O.Sars, 1863: K, T, I
Cyclops strenuus Fischer, 1851: E, K, T, I
Cyclops vicinus Uljanin, 1875: E, K, T, I
Diacyclops bicupidatus odessanus (Schmankevitch, 1875): I
Diacyclops bicuspidatus (Claus, 1857): E, K
Diacyclops bisetosus (Rehberg, 1880): I
Megacyclops gigas (Claus, 1857): E, K, T
Megacyclops latipes (Lowndes, 1927): I
Megacyclops viridis (Jurine, 1820): E, K, T, I
Mesocyclops leuckarti (Claus, 1857): K, I
Metacyclops gracilis (Lilljeborg 1853): E, I
Metacyclops planus (Gurney, 1909): E
Thermocyclops crassus (Fischer, 1853): E, K, I
Thermocyclops dybowskii (Landé, 1890): E
Subfamily: Halicyclopinae Kiefer, 1927
Halicyclops neglectus Kiefer, 1935: E, K
Family: Oithonidae, Dana, 1853
Oithona nana Giesbrecht, 1893: E
Order: Calanoida Sars, 1930
Family: Acartiidae G.O.Sars, 1903
Acartia (Acartiura) clausi Giesbrecht, 1889: E
Family: Pseudodiaptomidae G.O.Sars, 1903
Calanipeda aquedulcis Kritschagin, 1873: E, K, T, I
Family: Diaptomidae G.O.Sars, 1903
Subfamily: Diaptominae Kiefer, 1932
Arctodiaptomus belgrati (Mann, 1940): I
Arctodiaptomus byzantinus Mann,1940: I

Arctodiaptomus pectinicornis (Wierzejski, 1887): I
Arctodiaptomus wierzejskii (Richard, 1888): E, K, T
Hemidiaptomus brehmi (Mann, 1940): I
Mixodiaptomus kupelwieseri (Brehm, 1907): K, I
Family: Temoridae G.O.Sars, 1903
Eurytemora velox (Lilljeborg, 1853): K, I
Order: Harpacticoida Sars, 1911
Family: Harpacticidae Dana, 1846
Harpacticus sp.: E
Family: Canthocamptidae Sars, 1906
Attheyella trispinosa (Brady, 1880): I
Attheyella wulmeri De Kerherve, 1914: I
Bryocamptus pygmaeus (G.O.Sars, 1863): I
Canthocamptus microstaphylinus Wolf, 1905: E, K, I
Family: Laophontidae T.Scott, 1904
Heterolaophonte stroemii (Baird, 1834): E
Onychocamptus mohammed (Blanchard, Rıchard, 1891): E, K, I
Family: Ameiridae (Monard, 1936)
Nitocra hibernica (Brady, 1880): E, K, T, I
Nitocra lacustris (Schmanevitsch, 1875): E
Family: Dacythompsoniidae Lang, 1936
Leptocaris brevicornis (Van Douwe, 1904): E
Leptocaris trisetosa (Kunz, 1935): E

Suborder: CLADOCERA

Family: Daphniidae Sars, 1865
Ceriodaphnia dubia Richard, 1894: E
Ceriodaphnia laticaudata P.E.Müller, 1867: E
Ceriodaphnia megops Sars, 1862: K
Ceriodaphnia quadrangula (O.F.Müller, 1758): E, K, T, I
Ceriodaphnia reticulata (Jurine, 1820): E, K, T, I
Daphnia (C.) atkinsoni Baird, 1859: E, I
Daphnia (C.) magna Straus, 1820: E
Daphnia (C.) similis Claus, 1876: E, K, T
Daphnia (C.) ulomskyi Benning 1914: E
Daphnia carinata King, 1852: I
Daphnia cucullata Sars, 1862: E
Daphnia curvirostris Eylmann, 1887: I
Daphnia galeata Sars, 1864: E
Daphnia hyalina Leydig, 1860: E,I
Daphnia longispina O.F.Müller, 1785: E, K, T, I
Daphnia obtusa Kurz, 1874: E, K, T, I
Daphnia parvula Fordyce, 1901: E
Daphnia pulex Leydig, 1860: E, K, T, I
Megafenestra aurita (Fischer,1849): E, K
Scapholeberis kingi Sars, 1903: E, K, T, I
Scapholeberis mucronata (O.F.Müller,1758): E, K, I
Simocephalus exspinosus (Koch, 1841): E, K, T
Simocephalus serrulatus (Koch, 1841): E, T, I
Simocephalus vetulus (O.F.Müller, 1776): E, K, T, I
Family: Sididae (Baird, 1850)
Diaphanosoma birgei Korinek, 1981: E, T
Diaphanosoma brachyurum, (Liévin, 1848): E, K, T, I
Diaphanosoma orghidani Negrea, 1982: E, T
Family: Bosminidae (Baird, 1845)
Bosmina coregoni Baird, 1857: E
Bosmina longirostris (O.F.Müller, 1785): E, K, T, I
Family: Chydoridae Stebbing, 1902
Acroperus harpae (Baird, 1835): K, I
Alona costata Sars, 1862: E, K, I
Alona guttata Sars, 1862: E, K, I
Alona protzi Hartwig, 1900: I
Alona rectangula Sars, 1862: E, K, T, I
Alonella excisa (Fischer, 1854): E, K, T
Biapertura affinis (Leydig, 1860): E, K, I
Biapertura intermedia (Sars, 1862): E
Camptocercus rectirostris Schoedler, 1862: K
Chydorus latus Sars, 1862: E, I
Chydorus sphaericus (O.F.Müller; 1776): E, K, T, I
Coronatella quadrangularis (O.F.Müller, 1785): E, K, T, I
Disparalona rostrata (Koch, 1841): E, T
Dunhevedia crassa King, 1853: E
Graptoleberis testudinaria (Fischer, 1848): K, I
Leydigia acanthocercoides (Fischer, 1854): E, I
Leydigia leydigi (Schoedler, 1863): E, K, T
Oxyurella tenuicaudis (Sars, 1862): E
Picripleuroxus laevis (Sars, 1862): K
Pleuroxus aduncus (Jurine, 1820): E, K, T, I
Pleuroxus truncatus (O.F.Müller, 1785): E, K
Tertocephala ambigua (Lilljeborg, 1900): E
Family: Moinidae Goulden, 1968
Moina brachiata (Jurine, 1820): E, K, T
Moina macrocopa (Straus, 1820): T
Moina micrura Kurz, 1874: E, K, T
Moina salina Daday, 1888: E, T
Family: Macrothricidae Norman & Brady, 1867
Ilyocryptus sordidus (Liévin, 1848): E, K, T, I
Lathonura rectirostris (O.F.Müller, 1785): I
Ilyocrptus agilis Kurz, 1878: E, K, T, I
Macrothrix hirsuticornis Norman & Brady,1867: E, K
Macrothrix laticornis (Fischer, 1851): E, K, T, I
Macrothrix rosea Lievin, 1848: E
Family: Leptodoridae Lilljeborg, 1861
Leptodora kindtii (Focke, 1844): E, I
Family: Polyphemidae Barid, 1845
Polyphemus pediculus (Linnaéus, 1761): K
Family: Cercopagidae Mordukhai-Boltovskoi, 1968
Cercopagis pengoi (Ostroumov, 1892): I
Family: Podonidae Mordukhai-Boltovskoi, 1968
Cornigerius meaticus (Pengo, 1879): I

In studies conducted in the Palaearctic Region, 1348 Rotifera, 245 Cladocera and 1204 Copepoda species were identified so far (Segers, 2008; Forro *et al*. 2008; Boxshall and Defaye, 2008) whereas these groups in Turkey are represented with 378, 98 and 135 species, respectively (Gündüz, 1997; Ustaoğlu 2004, 2014, Ustaoğlu *et al*. 2012a) (Table 1). The European part of Turkey, which constitutes a transitional region between Europe and Asia, hosts species of both sides which in turn leads to an increased diversity in this part of Turkey.

Table 1. Number of Rotifera, Cladocera and Copepoda species currently known in Palaearctic and Turkey.

	PALAEARCTIC		TURKEY		
	Number species	Reference	Number species	Reference	EUROPEAN TURKEY
Rotifera	1348	Segers (2008)	378	Ustaoğlu *et al.* (2012a) Ustaoğlu (2014)	138
Cladocera	245	Forro *et al.* (2008)	98	Gündüz (1997) Ustaoğlu (2004, 2014)	65
Copepoda	1204	Boxshall and Defaye (2008)	135	Ustaoğlu (2004, 2014)	53
Total	2797		611		256

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