

Research Article

List of Zooplankton Taxa in the Caspian Sea Waters of Iran

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A total of 61 zooplankton taxa were found in the southwestern Caspian Sea between 1996 and 2010. Thirteen of them were meroplankton taxa and forty-eight were holoplankton taxa. The occurrence of 14 freshwater taxa indicated the influence of the Anzali wetland and river inflows. The decrease in zooplankton taxa was detected since 1996-1997 and continued till 2010. *Pleopis polyphemoides*, the only one out of the nine recorded Cladocera species in 1996-1997, was found after 2001. Similarly, of the five Copepoda species recorded in 1996-1997, only one, *Acartia tonsa*, was found abundant during the 2001-2010 sampling period. It was striking that many species which were abundant in the Caspian Sea in 1996-1997 were not found after 2000. Many reasons could have contributed to the changes in the zooplankton composition of the southern Caspian Sea, notably the serious environmental degradation since the early 1990s. It is also possible that invasive species might play a role in wiping out some sensitive endemic species.

1. Introduction

The Caspian Sea is a large inland water body. It is called a sea even though not being directly connected to any marine system due to its large size [1]. Water is mainly sourced from the big river Volga in the north (almost 76.3% of the total), and other rivers like Kura, Ural, Terek, and Sefidrood [2]. In the Iranian coast, the Sefidrood river is the largest river pouring into the Caspian Sea with 67,000 km² of catchment area and an average discharge of 4,037 million m³ per year [3, 4]. The Caspian Sea has undergone significant ecological alteration during the past 30 years. This could be linked to dramatic changes in the southern Caspian Sea due to increased pollution: sewage, industry effluent, and agricultural waste water discharges into the river as well as deforestation of the river's watersheds [5, 6].

Zooplankton is recognized among the best indicators to be particularly useful to investigate and document environmental changes [7]. Main zooplankton taxa have short life cycle and the community structure is able to reflect real-time scenario as it is less enforced by the stability of individuals

from previous years [8]. Besides this, zooplankton is also the food of choice for many fishes and as such plays a very significant role in pilaring the upper stages of the food chain [9].

Bagirov [10] reported that the number of zooplankton taxa was almost 200 in the northern Caspian Sea with 70 taxa of Protista, 50 taxa of Rotatoria, 30 taxa of Cladocera, and 20 taxa of Copepoda. Meroplankton, represented mainly by larvae of bivalves and crustaceans, contributed to the biodiversity of plankton communities in the North. Whereas in the South of Caspian Sea, Hossieni et al. [11] documented that zooplankton community consisted of 36 taxa, including Cladocera (24 taxa), Copepoda (7 taxa), and meroplankton (2 taxa) along the Iranian coastal area of the Caspian Sea in 1996. Subsequently in 1999, Sabkara et al. [12] reported over 50 zooplankton taxa with holoplankton comprising >80% of the taxa sampled and Rotifera (22 species) dominating. Meroplankton accounted for the remaining diversity. Recently, Roohi et al. [13] noted that only 18 zooplankton taxa were observed in the southern Caspian Sea, of which five taxa belonged to holoplankton (four Copepoda and one Cladocera) and 13 to meroplankton.

TABLE 1: “×” denotes sampling done based on season in the Caspian Sea waters of Iran during 1996–2010.

Year	Season			
	Winter	Spring	Summer	Autumn
1996		×	×	×
1997	×			
2001	×		×	×
2002	×	×	×	×
2003	×			×
2004	×	×	×	×
2005	×	×	×	×
2006	×		×	×
2008	×	×	×	×
2009			×	×
2010	×	×		×

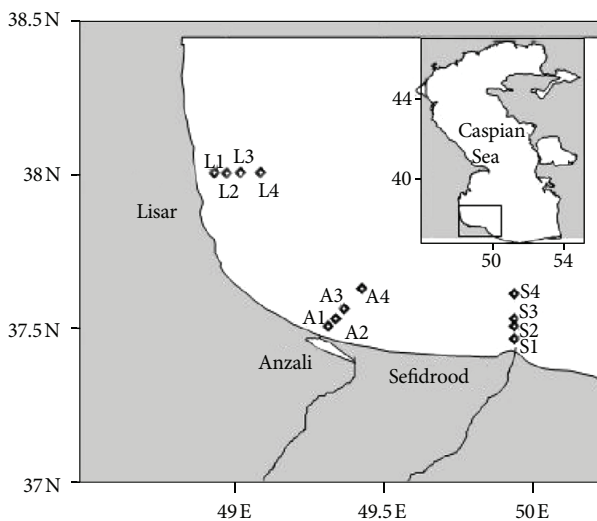


FIGURE 1: Study sites sampled 1996 to 2010 in the Caspian Sea waters of Iran. L = Lisar, A = Anzali, S = Sefidrood, 5 m (L1, A1, S1), 10 m (L2, A2, S2), 20 m (L3, A3, S3), and 50 m (L4, A4, S4).

In recent years, few studies have been conducted on the distribution and abundance of zooplankton in the southern Caspian Sea [11–14], while there was hardly any work done to look at the composition of zooplankton taxa. In order to investigate the state of ecological condition of the Caspian Sea, an eleven-year study of the zooplankton community in the Caspian Sea waters of Iran was compiled between 1996 and 2010.

2. Materials and Methods

2.1. Study Area. The area under investigation is located at the southwestern corner of the Caspian Sea. The identification of zooplankton taxa was carried out along three transects along the mouth of the Anzali wetland, Lisar and Sefidrood rivers. The sampling was performed at 5 m, 10 m, 20 m, and 50 m depths during 1996–2010 (Figure 1). Table 1 shows the seasonal sample collection done in between 1996–2010. In

some years, sampling was unable to be carried out due to logistic problems. In total, a collection of 132 samples were carried out during these periods (Table 1).

2.2. Data Collection. Zooplankton was sampled using a Juday net (opening diameter: 36 cm, mesh size: 100 μm). At every station, a vertical haul with a Juday net was carried out from bottom to surface using a handle pulley for heaving the net. Zooplankton samples were preserved in neutral 4% formaldehyde and analyzed in the laboratory. Samples were divided into subsamples using a 1 mL Hensen-Stempel pipette and transferred to a Bogorov chamber for identification. At least 100 individuals were counted per sample and identified to species, and life-cycle stages were determined using an inverted microscope [15]. Zooplankton taxonomic classification was performed based on Birshstein et al. [16], Kasimov [17], and James and Covich [18].

3. Results

A total of 61 zooplankton taxa belonging to 48 taxa of holozooplankton were found in the area of investigation (Tables 2 and 3). Fourteen of them, *Pleroxus trigenellus* O.F. Mueller, *Chydorus* sp. Leach, *Moina* sp. Baird, all Cladocera, the copepod *Cyclops* sp. Risso, *Cyclops* sp. nauplii and the rotifers *Filinia* sp. Vincent, *Keratella cochlearis*, *Lecane* sp. Nitzsch, *Notholca acuminata* Ehrenberg, *Philodina* sp. Ehrenberg, *Polyarthra dolichoptera* Idelson, *Testudinella patina* Hermann, *Trichocerca* sp. Lamarck, and *Trichocerca caspia* Tschugunoff are freshwater species in the area.

Thirteen meroplankton taxa consisted of individuals of water spiders (Arachnida), crab (*Rhithropanopeus harrisi* Gould), Foraminifera, Ostracoda larvae, *Asteromeyenia* sp. Weltner, *Pseudocuma* sp. G.O. Sars, and larvae of Bivalvia, Nematoda, Polychaeta (*Hediste diversicolor* O.F. Muller, *Hypania* sp. Ostroumouw), Pisces (egg and larvae), and multitudinous Cirripedia (*Balanus* sp. Costa) represented by nauplii and cypris larvae (Table 2).

Thirty-four holoplankton taxa belong to Ctenophora (*Mnemiopsis leidyi* A. Agassiz), Ciliata (*Codonella* sp. Haeckel, *Codonella relictata* Minikiewich, *Tintinnopsis* sp. Lamarck,

TABLE 2: Checklist of zooplankton taxa in the Caspian Sea waters of Iran during 1996–2010.

Holoplankton taxa	After appearance of <i>Mnemiopsis leidyi</i>								
	1996-1997	2001	2002	2003	2004	2005	2006	2008	2009-2010
Macrozooplankton									
Ctenophora:									
* <i>Mnemiopsis leidyi</i> A. Agassiz, 1865	-	+	+	+	+	+	+	+	+
Mesozooplankton									
Cladocera:									
<i>Cercopagis pengoi</i> Ostroumov, 1891	+	-	-	-	-	-	-	-	-
<i>Cercopagis prolongata</i> G.O. Sara, 1897	+	-	-	-	-	-	-	-	-
<i>Chydorus</i> Leach, 1843	-	-	-	-	-	-	-	+	-
<i>Evaden anonyx</i> G.O. Sars, 1897	+	-	-	-	-	-	-	-	-
<i>Moina</i> Baird, 1850	-	-	-	-	-	-	-	+	-
<i>Pleroxus trigonellus</i> O.F. Muller, 1785	-	-	-	-	-	-	-	+	-
<i>Podonevadne</i> Gibitz, 1922	-	-	-	-	-	-	-	+	-
<i>Podonevaden angusta</i> G.O. Sars, 1902	+	-	-	-	-	-	-	-	-
<i>Podonevaden camptonyx</i> G.O. Sars, 1897	+	-	-	-	-	-	-	-	-
<i>Podonevaden trigona</i> G.O. Sars, 1897	+	-	-	-	-	-	-	-	-
<i>Podon intermedius</i> Lilljeborg, 1853	+	-	-	-	-	-	-	-	-
* <i>Pleopis polyphemoides</i> Leuckart, 1859	+	-	+	-	+	+	+	+	+
<i>Polyphemus exiguus</i> G.O. Sars, 1897	+	-	-	-	-	-	-	-	-
Copepoda:									
* <i>Acartia tonsa</i> nauplii	+	+	+	+	+	+	+	+	+
* <i>Acartia tonsa</i> Dana, 1849	+	+	+	+	+	+	+	+	+
* <i>Calanipeda aquae dulcis</i> nauplii	+	-	-	-	-	-	-	-	-
* <i>Calanipeda aquae dulcis</i> Kritchagin, 1873	+	-	-	-	-	-	-	-	-
<i>Cyclops</i> nauplii	-	-	-	-	-	-	-	+	-
<i>Cyclops</i> Risso, 1826	+	+	-	+	+	+	-	+	+
<i>Eurytemora grimmi</i> nauplii	+	-	-	-	-	-	-	-	-
<i>Eurytemora grimmi</i> G.O. Sars, 1897	+	-	-	-	-	-	-	-	-
<i>Halicyclops sarsi</i> Akatova, 1935	+	-	+	-	-	-	-	-	+
<i>Ectinosoma concinnum</i> Akatova, 1935	+	-	-	-	-	-	-	+	-
<i>Limnocalanus grimaldii grimaldii</i> nauplii	+	-	-	-	-	-	-	-	-
<i>Limnocalanus grimaldii grimaldii</i> Guerne, 1886	+	-	-	-	-	-	-	-	-
Rotifera:									
<i>Brachionus</i> Pallas, 1766	-	-	-	-	+	+	-	-	-
<i>Brachionus angularis</i> Gosse, 1851	-	+	+	-	-	-	-	-	-
<i>Brachionus calyciflorus</i> Pallas, 1766	-	-	+	-	+	+	+	-	+
<i>Brachionus plicatilis</i> Muller, 1786	-	+	+	-	-	-	-	+	+
<i>Filinia</i> Bory de St. Vincent, 1824	-	-	+	-	-	-	-	-	-
<i>Keratella cochlearis</i> Gosse, 1851	-	+	+	+	-	-	-	+	+
<i>Lecane</i> Nitzsch, 1827	-	+	-	-	-	-	-	-	-
<i>Notholca acuminata</i> Ehrenberg, 1832	-	-	+	-	-	-	-	-	-
<i>Philodina</i> Ehrenberg, 1830	-	-	-	-	-	-	-	-	+
<i>Polyarthra dolichoptera</i> Idelson, 1925	-	-	+	-	-	-	-	-	+
<i>Synchaeta</i> Ehrenberg, 1832	+	+	+	+	+	+	+	-	+
<i>Synchaeta stylata</i> Wierzejski, 1893	+	-	-	-	-	-	-	-	-
<i>Synchaeta vorax</i> Rousselet, 1902	+	-	-	-	-	-	+	-	-
<i>Testudinella patina</i> Hermann, 1783	-	-	-	-	-	-	-	-	+
<i>Trichocerca</i> Lamarck, 1801	-	-	+	-	-	-	-	-	-
<i>Trichocerca capica</i> Tschugunoff, 1921	-	-	+	-	-	-	-	-	-
Microzooplankton									
Ciliata:									
<i>Codonella</i> Haeckel, 1873	-	-	+	-	-	-	-	-	-

TABLE 2: Continued.

Holoplankton taxa	After appearance of <i>Mnemiopsis leidyi</i>								
	1996-1997	2001	2002	2003	2004	2005	2006	2008	2009-2010
<i>Codonella relict</i> Minikiewich, 1905	-	+	+	-	-	-	-	-	+
<i>Tintinnopsis</i> Stein 1867	-	+	+	-	-	-	-	-	-
<i>Tintinnopsis karajacensis</i> Brandt, 1896	-	+	-	-	-	-	-	-	-
<i>Tintinnopsis tubulosa</i> Levander, 1900	-	+	+	+	+	+	-	+	+
Meroplankton taxa (Mesozooplankton)									
Arachnida Larvae Cuvier, 1812	+	-	-	-	-	-	-	+	+
Cirripedia:									
* <i>Balanus</i> sp. cypris Costa, 1778	+	+	+	+	+	+	+	+	+
* <i>Balanus</i> sp. nauplii Costa, 1778	+	+	+	+	+	+	+	+	+
Crustacea:									
* <i>Rhithropanopeus harrisi</i> Gould, 1841	+	-	-	-	-	-	-	-	-
Foraminifera larvae	+	+	+	-	+	+	-	-	+
Bivalvia larvae Linnaeus, 1758	+	+	+	+	+	+	+	+	-
Nematoda larvae	-	-	-	-	+	+	+	+	+
Ostracoda larvae Latreille, 1802	-	-	+	-	-	-	-	-	-
Pisces larvae	+	+	+	-	+	+	+	+	+
Pisces ovae	+	+	-	-	+	+	+	+	+
Polychaeta:									
<i>Hypania</i> Ostroumouw, 1897	-	-	-	-	-	-	-	+	-
<i>Hediste diversicolor</i> O.F. Muller, 1776	-	+	+	+	+	+	+	+	+
Porifera:									
<i>Asteromeyenia</i> Weltner, 1913	-	-	-	-	-	-	-	+	-
Cumacea:									
<i>Pseudocuma</i> G.O. Sars, 1865	+	-	-	-	-	-	-	-	-

* Alien taxa; bold font: freshwater taxa indicated the influence by river inflow.

TABLE 3: Zooplankton number of taxa (holomeroplankton) in the Caspian Sea waters of Iran during 1996–2010.

Zooplankton taxa	After appearance of <i>Mnemiopsis leidyi</i>									Number of taxa
	1996-1997	2001	2002	2003	2004	2005	2006	2008	2009-2010	
Ctenophora	0	1	1	1	1	1	1	1	1	1
Ciliata	0	4	4	1	1	1	0	1	2	5
Cladocera	9	0	1	0	1	1	1	5	1	13
Copepoda	11	3	3	3	3	3	2	5	4	12
Rotifera	3	5	10	2	3	3	3	2	7	17
Total holoplankton	23	13	19	7	9	9	7	14	15	48
Arachnida	1	0	0	0	0	0	0	1	1	1
Cirripedia	2	2	2	2	2	2	2	2	2	2
Crustacea	1	0	0	0	0	0	0	0	0	1
Foraminifera	1	1	1	0	1	1	0	0	1	1
Bivalvia	1	1	1	1	1	1	1	1	0	1
Nematoda	0	0	0	0	1	1	1	1	1	1
Ostracoda	0	0	1	0	0	0	0	0	0	1
Pisces	2	2	1	0	2	2	2	2	2	2
Polychaeta	0	1	1	1	1	1	1	2	1	1
Porifera	0	0	0	0	0	0	0	1	0	1
Pseudocuma	1	0	0	0	0	0	0	0	0	1
Total meroplankton	9	7	7	4	8	8	7	10	8	13
Total zooplankton	32	20	26	11	17	17	14	24	23	61

TABLE 4: Seasonal list of zooplankton taxa in the Caspian Sea waters of Iran during 1996–2010.

Group	Zooplankton taxa	Season			
		Winter	Spring	Summer	Autumn
Arachnida	Arachnida larvae	+	–	–	+
Bivalvia	Bivalvia larvae	+	+	+	+
Ciliata	<i>Codonella</i> sp.	+	–	–	–
Ciliata	<i>Codonella relicta</i>	+	–	–	–
Ciliata	<i>Tintinnopsis</i> sp.	+	–	–	–
Ciliata	<i>Tintinnopsis karajacensis</i>	+	–	–	+
Ciliata	<i>Tintinnopsis tubulosa</i>	+	–	+	+
Cirripedia	<i>Balanus</i> sp. cypris	+	+	+	+
Cirripedia	<i>Balanus</i> sp. nauplii	+	+	+	+
Cladocera	<i>Cercopagis pengoi</i>	–	–	–	+
Cladocera	<i>Cercopagis prolongata</i>	–	–	–	+
Cladocera	<i>Chydorus</i> sp.	+	–	–	–
Cladocera	<i>Evaden anonyx</i>	–	+	–	+
Cladocera	<i>Moina</i> sp.	–	–	–	+
Cladocera	<i>Pleroxus trigonellus</i>	–	–	–	+
Cladocera	<i>Podonevadne</i> sp.	–	+	–	–
Cladocera	<i>Podonevaden angusta</i>	+	–	–	+
Cladocera	<i>Podonevaden camptonyx</i>	–	+	–	–
Cladocera	<i>Podonevaden trigona</i>	+	+	+	+
Cladocera	<i>Podon intermedius</i>	+	–	–	–
Cladocera	<i>Pleopis polyphemoides</i>	+	+	–	+
Cladocera	<i>Polyphemus exiguus</i>	+	+	+	+
Copepoda	<i>Acartia tonsa</i> nauplii	+	+	+	+
Copepoda	<i>Acartia tonsa</i>	+	+	+	+
Copepoda	<i>Calanipeda aquae dulcis</i> nauplii	+	+	+	+
Copepoda	<i>Calanipeda aquae dulcis</i>	+	+	+	+
Copepoda	<i>Cyclops</i> nauplii	+	–	–	+
Copepoda	<i>Cyclops</i> sp.	+	–	–	+
Copepoda	<i>Eurytemora grimmeri</i> nauplii	+	+	+	+
Copepoda	<i>Eurytemora grimmeri</i>	+	+	+	+
Copepoda	<i>Halicyclops sarsi</i>	+	+	+	+
Copepoda	<i>Ectinosoma concinnum</i>	+	+	+	+
Copepoda	<i>Limnocalanus grimaldii grimaldii</i> nauplii	+	+	+	+
Copepoda	<i>Limnocalanus grimaldii grimaldii</i>	+	+	+	+
Ctenophora	<i>Mnemiopsis leidyi</i>	+	+	+	+
Crustacea	<i>Rhithropanopeus harrisi</i>	+	–	–	+
Cumacea	<i>Pseudocuma</i> sp.	–	–	–	+
Foraminifera	Foraminifera larvae	–	+	+	–
Nematoda	Nematoda larvae	+	+	–	+
Ostracoda	Ostracoda larvae	+	–	–	–
Pisces	Pisces larvae	+	–	+	–
Pisces	Pisces ovae	+	+	–	–
Polychaeta	<i>Hypania</i> sp.	–	–	+	+
Polychaeta	<i>Hediste diversicolor</i>	+	+	+	+
Porifera	<i>Asteromeyenia</i> sp.	–	+	–	+
Rotifera	<i>Brachionus</i> sp.	+	+	–	+
Rotifera	<i>Brachionus angularis</i>	+	+	–	+
Rotifera	<i>Brachionus calyciflorus</i>	+	+	–	+
Rotifera	<i>Brachionus plicatilis</i>	+	+	–	+
Rotifera	<i>Filinia</i> sp.	+	–	–	–
Rotifera	<i>Keratella cochlearis</i>	+	–	–	–
Rotifera	<i>Lecane</i> sp.	+	–	–	–

TABLE 4: Continued.

Group	Zooplankton taxa	Season			
		Winter	Spring	Summer	Autumn
Rotifera	Notholca acuminata	+	–	–	–
Rotifera	Philodina sp.	–	+	–	–
Rotifera	Polyarthra dolichoptera	–	+	–	–
Rotifera	<i>Synchaeta sp.</i>	+	+	–	–
Rotifera	<i>Synchaeta stylata</i>	+	+	–	+
Rotifera	<i>Synchaeta vorax</i>	+	+	–	+
Rotifera	Testudinella patina	–	–	–	+
Rotifera	Trichocerca sp.	+	+	–	–
Rotifera	Trichocerca capica	+	–	–	–

Bold font: freshwater taxa indicated the influence by river inflow.

Tintinnopsis karajacensis Brandt, and *Tintinnopsis tubulosa* Levander), Rotifera (*Brachionus sp.* Pallas, *Brachionus angularis* Gosse, *Brachionus calyciflorus* Pallas, *Brachionus plicatilis* Mueller, *Synchaeta sp.* Ehrenberg, *Synchaeta stylata* Wierzejski, and *Synchaeta vorax* Rousselet), Cladocera (*Cercopagis pengoi* Ostroumov, *Cercopagis prolongata* G.O. Sars, *Evaden anonyx* Sars, *Podonevadne sp.* Gibitz, *Podonevaden angusta* G.O. Sars, *Podonevaden camptonyx* G.O. Sars, *Podonevaden trigona* G.O. Sars, *Podon intermedius* Lilljeborg, *Pleopis polyphemoides* Leuckart, and *Polyphemus exiguus* G.O. Sars), and Copepoda (*Acartia tonsa* Dana, *Calanipeda aquae dulcis* Kritchagin, *Eurytemora grimmeri* G.O. Sars, *Halicyclops sarsi* Akatova, *Ectinosoma concinnum* Akatova, and *Limnocalanus grimaldii grimaldii* Guerne).

The Copepoda (*Eurytemora grimmeri*, *Limnocalanus grimaldii grimaldii*, *Acartia tonsa*, *Ectinosoma concinnum*, and *Halicyclops sarsi*), Cladocera (*Podonevaden trigona*, *Pleopis polyphemoides*, *Polyphemus exiguus*), Cirripedia (*Balanus sp.*), Polychaeta (*Hediste diversicolor*), Bivalvia larvae, and Ctenophora (*Mnemiopsis leidyi*) dominated the zooplankton taxa in all seasons in the southwestern Caspian Sea (Table 4).

4. Discussion

In comparison with earlier surveys by Hossieni et al. [11] and Roohi et al. [13] which were carried out in the southern Caspian Sea, major changes in zooplankton community became obvious after 2000 (Tables 2 and 3). During the present study, 26 taxa including *Codonella sp.* and *Codonella relictia* (Ciliata); *Tintinnopsis sp.*, *Tintinnopsis karajacensis*, and *Tintinnopsis tubulosa* (Ciliata); *Brachionus sp.*, *Brachionus angularis*, *Brachionus calyciflorus*, and *Brachionus plicatilis* (Rotifera); *Filinia sp.* (Rotifera), *Keratella cochlearis* (Rotifera), *Lecane* (Rotifera), *Notholca acuminata* (Rotifera), *Philodina* (Rotifera), *Polyarthra dolichoptera* (Rotifera), *Synchaeta sp.* (Rotifera), *Synchaeta stylata*, *Synchaeta vorax* (Rotifera), *Testudinella patina* (Rotifera), *Trichocerca* (Rotifera), and *Trichocerca capica*; *Podonevadne sp.* (Cladocera); *Rhithropanopeus harrisi* (Crustacea); *Asteromeyenia sp.* (Porifera); *Pseudocuma sp.* (Cumacea) and *Hypania* larvae (Polychaeta) were documented. Hossieni et al. [11] and Roohi et al. [13] listed none of these taxa.

Hossieni et al. [11] did not list the following species, which were sampled in subsequent years: Ostracoda larvae, Arachnida larvae, Harpacticoida (*Ectinosoma concinnum*), Nematoda larvae, and *Hediste diversicolor*. Roohi et al. [13] listed Chironomidae, Nematidae, and Mysidacea ($n = 2$ in 2006), which were not observed in this study.

Hossieni et al. [11] listed 24 Cladocera species in the southern Caspian Sea (cited by Roohi et al., [13]). Three of these taxa were repeated twice under different names as *Apagis cylindrata* (*Cercopagis cylindrata*), *Apagis longicaudata* (*Cercopagis longicaudata*), and *Apagis ossiani* (*Cercopagis ossiani*). Additionally fourteen taxa cited were not recognized as validly published taxa by CSBP (Caspian Sea Biodiversity Project), ITIS (Integrated Taxonomic Information System), MarBEF (Marine Biodiversity and Ecosystem Functioning), and WoRNS (World Register of Marine Species), while there were nine Cladocera listed in the present study in 1996–1997 and only two of them (*Pleopis polyphemoides* and *Podonevadne sp.*) could be found after 2000. Five Copepoda species were present in 1996 [11] and the present study, but they were either absent or found in very low numbers during 2001 to 2010 (Table 2): *Calanipeda aquae dulcis*, *Limnocalanus grimaldii*, *Eurytemora minor*, and *Eurytemora grimmeri*.

It was striking that many species which were abundant in the Caspian Sea since 1996–1997 were not found after 2000 (Tables 3 and 4). However, a similar drastic decline in species numbers was not observed in other invaded seas [19]. Possible reasons could be twofold: the endemic Caspian Sea fauna is very sensitive to disruptions of invaders [5, 20], or it is a result of serious environmental degradation which started since the beginning of the 1990s [5]. Rodionov [21], Bilio and Niermann [22], and Polonskii et al. [23] theorized that hydrobiological changes in the Caspian Sea, Black Sea, and Baltic Sea during the 1990s and 2000s could definitely be correlated to these changes. Recent remarks on other seas indicated that the shifting plankton communities can also be related to climatic inconsistency [7, 24–26].

The survey helped to characterize the composition of the zooplankton taxa in the southwestern Caspian Sea between 1996 and 2010. In comparison with previous publications, the multiyear composition of zooplankton taxa was estimated for the first time. We call for a standardization in the result

presentation during future studies in this area. A comprehensive database including international participation should be launched to facilitate long-term comparisons of planktonic species to monitor anthropogenic and climatic effects on the Caspian Sea ecosystem.

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