

## **Review of Fish Fauna of the Sea of Marmara**

### **Marmara Denizi Balık Faunası**

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#### **Abstract.**

This study was carried out to present the species list of the fish fauna in the Sea of Marmara in the light of the previously conducted research. It was seen that totally 230 fish species belonging to 75 families had been recorded from the Sea of Marmara. In addition, zoogeographical origin, abundance and habitat are given for each one of species in the Sea of Marmara.

**Key words.** Sea of Marmara, fish species list, zoogeographical origin, abundance, habitat, similarity.

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#### **Introduction**

The Sea of Marmara is a small basin (size:~70 km x250 km, surface area:11500 km<sup>2</sup>, maximum depth 1390 m) located between the continents of Europe and Asia (Beşiktepe *et al.*, 1995), and forms the "Turkish Straits System" along with the Bosphorus (İstanbul Boğazı) and the Dardanelles (Çanakkale Boğazı) (Ünlüata *et al.*, 1990). It is a semi-enclosed basin which has been subject to considerable human use and influence and connects the Black Sea through the Bosphorus in the NE the Aegean Sea via Dardanelles in the SW. Though the Sea of Marmara has the smallest surface area and volume of the seas surrounding Turkey, it holds the second position, after the Black Sea, in terms of fishing. Fish may enter from the Aegean Sea through the Dardanelles to the Sea of Marmara and also some fish may continue there from through the Bosphorus to the Black Sea. Especially during

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their seasonal migrations, some fish provide an abundant catch in the Sea of Marmara.

Previous published data on the fisheries in the Sea of Marmara are related to species diversity of demersal and pelagic fish and their biologies. Some of the publications dealing with the fish in the Sea of Marmara are those by Ninni (1923), Devedjian (1926), Erazi (1941,1942 a-b, 1943), Sözer (1941), Slastenenko (1956), Mengi (1971), Whitehead *et al.*, (1986, 1989), Fischer *et al.*, (1987), Akşiray (1987), Kocataş *et al.*, (1993), Meriç (1994, 1995), Mater and Meriç (1996), Uysal *et al.*, (1997), Meriç *et al.*, (1997), Bilecenoğlu and Taşkavak (1999), Eryılmaz (2000, 2001, 2002), Mater *et al.*, (2002) and Bilecenoğlu *et al.*, (2002). In addition, the presence of some fish species in the Sea of Marmara has been confirmed by research on fish eggs and larvae by Arım (1957), Demir (1958, 1959 a-b, 1961, 1969). There are few studies on the situation of the fish stocks in the Sea of Marmara. Some of these studies are by Kosswig and Türkmen (1955), Artüz (1957-a), Artüz (1957-b). Bök *et al.*, (2000) studied the most frequent fish in the catches of the Sea of Marmara. Karakulak *et al.*, (2000) examined the status of the demersal fish stocks of the Northern Marmara Sea. Zengin and Mutlu (2000) reviewed the data of Marmara's fisheries for the past 20 years.

The Aegean Sea waters pass through the Dardanelles and flow into the Sea of Marmara at 20 m depth, and show the characteristics of the Mediterranean water with its 38-39‰ salinity (Pektaş, 1954). Black Sea waters with low salinity coming through the Bosphorus mix with the surface waters of the Sea of Marmara and meet with a gradual increase in salinity. The salinity of the Black Sea waters in the northern Marmara is around 22 ‰ (Yüce and Türker 1991).

The main purposes of this study are to present the species list of the fish fauna in the Sea of Marmara in the light of the previously conducted research and to provide an analysis of the fish fauna composition of surrounding Turkey.

## Material Sources

During the analysis of the fish, the taxonomic order suggested by Nelson (1994), species names suggested by Eschmeyer (1998) were used. After the scientific name and next to the authors, the zoogeographical origin of each species is given in brackets: Atlanto - Mediterranean [A-M], Cosmopolitan [C], Mediterranean endemic [M], (the only exception is for *Mugil soiyu* Basilwesky, 1855). *Mugil soiyu* lives in Amur River flowing to the Pacific Ocean. Introduced by humans for aquaculture in the Sea of Azov and the Black Sea before entering to the Mediterranean (Aegean Sea until Foça shores) via the Sea of Marmara. Ünsal (1992) firstly reported it from the Black Sea. Abundance: rare (+), prevalent (++) , common (+++); Habitat: BP – batipelagic, B – benthic, Bp – benthopelagic, C – coastal waters, EP – epipelagic, G – gravel, MP – mesopelagic, M – muddy, P – pelagic, R – rocky, S – sandy, SP – semipelagic, V – vegetation. The Sorensen similarity matrix (Sorensen, 1948) was calculated in order to group the seas according to species they involve.

## Results and Discussion

In this study, 230 species were identified belonging to 75 families in total. The previous literature on the Sea of Marmara was examined (reviewed), Erazi (1942) reported 181 fish species and Slastenenko (1956) reported 166. Akşıray (1987) reported 443 fish species along the coasts of Turkey without indicating the seas which they lived in. Kocataş *et al.*, (1993) listed 161 fish species, Mater and Meriç (1996) listed 191 fish species and Bilecenoğlu and Taşkavak (1999) mentioned 196 fish species (belonging to 64 families). In addition, Mater *et al.*, (2002) mentioned 199 fish species and Bilecenoğlu *et al.*, (2002) mentioned 249 fish species including the results of Ninni (1923) and Slastenenko (1956). But, some fish reported in Ninni (1923), and Slastenenko (1956) were obtained from İstanbul Fish Market, unfortunately, hunting localities of these fish are unclear. Therefore, these 19 questionable species were not included in the fish fauna of the Sea of Marmara in this study.

Cluster analysis (Fig.1) made to combine the seas according to species they involve, showed two distinct groups. The first group included the Mediterranean and Aegean Sea with 91% similarity. The second group included the Sea of Marmara and the Black Sea with 72% similarity. The % values of similarity matrix were given below (Table 1). the sea of Marmara basin is occupied by two distinctly different water masses throughout the year: one is the brackish waters (22-26% salinity) of Black Sea origin, forming a relatively thin surface layer (10-15 m thick) with a mean residence time of ~4-5 months, and the other is the subhalocline waters of Mediterranean origin (38.5-38.6% salinity) separated from the former by a sharp interface ~10-20 m thick (Ünlüata *et al.*, 1990). Because of the large volume of water inflow from the adjacent Black Sea (~600 km<sup>3</sup>) into the relatively small upper layer volume (~225 km<sup>3</sup>) of the Sea of Marmara, the upper layer ecosystem of the latter has been influenced to a large extent.

Table 1: The % values of similarity matrix according to seas.

Seas	Similarity (%)
Mediterranean - Sea of Marmara	68
Mediterranean - Black Sea	46
Mediterranean - Aegean Sea	91
Sea of Marmara - Black Sea	72
Sea of Marmara - Aegean Sea	73
Black Sea - Aegean Sea	50

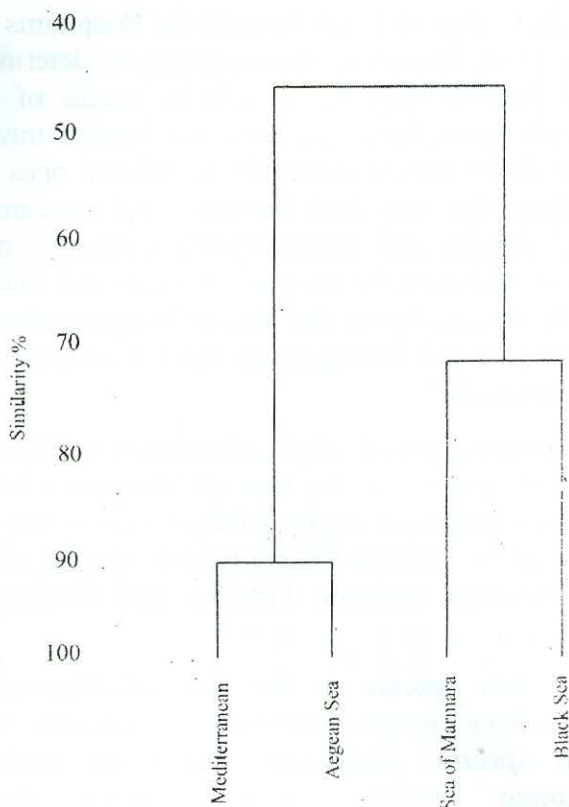


Figure 1: Dendrograms constructed from Sorensen similarity matrix between the seas.

The chemical oceanography of the Sea of Marmara is significantly influenced by the biochemistry of the Black Sea and Aegean Sea. While the Mediterranean, Aegean Sea, the Sea of Marmara are oligotrophic, the Black Sea is eutrophic in nature (Balkis, 2003).

After 1980, a substantial increase is observed in fishing, number of fishing boats and their capacities (Kocataş *et al.*, 1993). Although this increase initially generated a positive effect on fishing, later on, adversely affected significantly the yield per boat. Beside that, it can be said that the rise of pollution in the Sea of Marmara, because of the increase in land development works, discharge of domestic and industrial wastes into the sea, gradually increasing international maritime transport and carrying polluted waters of the River Danube

