

## Comparison of the mesozooplankton composition the southwestern Black Sea, Sea of Marmara and eastern Aegean Sea.

### Güneybatı Karadeniz, Marmara ve Doğu Ege Denizi mesozooplankton kompozisyonlarının mukayesesi

H. Avni Benli<sup>1</sup>, A. Nuri Tarkan<sup>2</sup>, T. Murat Sever<sup>3</sup>

<sup>1</sup> Dokuz Eylul University, Institute of Marine Science and Technology, İnciraltı, 35340, İzmir, Turkey. <sup>2</sup> İstanbul University Faculty of Fisheries, İstanbul, Turkey, <sup>3</sup>Ege University, Faculty of Fisheries, İzmir, Turkey

---

#### Abstract

In the Black Sea, a total of 98 zooplankton species were determined. Copepods constituted 80% of the total biomass of zooplankton species in the spring. This ratio varied seasonally; 60% in the summer, 68% in the fall, and 72% in the winter. The dominant species were *Calanus helgolandicus*, *Paracalanus parvus*, *Pseudocalanus elongatus*, *Centropages ponticus*, *Acartia clausi*, *Oithona similis* and *O. minuta*.

In the Sea of Marmara, 17 Copepod species constituted over 75% of the total zooplankton biomass on the average for all the seasons. *Acartia* species were the most dominant. Other dominant species were from the genera *Centropages*, *Pseudocalanus*, *Metridia*, and *Paracalanus*, respectively.

In the northern Aegean Sea, seasonal percentage of Copepod species in the total zooplankton taxa were determined as follows; 50% in the fall, 84% in the winter, 83% in the spring and 58% in the summer. The similar figures for the southern Aegean Sea were 75% in the fall, 73% in the winter, 88% in the spring, and 74% in the summer.

**Key words:** Black Sea, Sea of Marmara, Aegean Sea, Zooplankton, Copepod.

---

## Introduction

The zooplankton plays a significant role in the productivity of the marine environment. It is an important food source available to fish, fish larvae and cephalopods. Copepods, that account for more than the half of the proportion of the zooplankton, are important to determine the productivity of the sea.

The research area covers three ecologically different marine environments continuously interacting with each other. The Black Sea organisms have three different origins related to water characteristics; sarmatic remnant of brackish water, fresh water and Mediterranean water coming from the Aegean Sea via the Straits undercurrent (Greze and Fedorina, 1979). The Sea of Marmara, a small intercontinental basin with a total volume of  $3378 \text{ km}^3$ , carries the less saline Black Sea (17-18 ppt) water into the Aegean Sea in the upper layer and the more saline Mediterranean Sea water (39 ppt) into the Black Sea in the lower layer via Turkish Straits. The Aegean Sea has four different water characteristics; the less saline cold surface water coming from the Black Sea, the Atlantic water coming via Gibraltar, the eastern Mediterranean middle depth water and deep water. Therefore, Aegean Sea is rich in species diversity and poor in biomass.

Southern winds drive low salinity surface waters of Black Sea to the Northern Aegean in winter, then flowing back through the Greece coast they reach to southern Aegean. In summer, it flows from Çanakkale strait to the Southern Aegean because of the northern winds. Furthermore, colder and higher salinity waters of the deeper Black Sea also move between the Aegean and Eastern Mediterranean. Hydrodynamic conditions play an effective role in this movement (Yüce, 1992).

The movement of different water masses in the study area determines the geographical and seasonal distribution of copepods. Salinity and temperature are also important parameters affecting this distribution.

Many workers have completed important studies on the zooplankton species of Black Sea, Sea of Marmara and Aegean Sea. The principal ones can be taken as: Nikitin, 1949; Greze and Fedorina, 1979; Benli, 1987; Ergün, 1994; Gücü, 1994;



Arashkevich *et.al.*, 1998; Beşiktepe *et.al.*, 1998; Beşiktepe and Ünsal, 2000; Kideys *et al.*, 2000 for the Black Sea, Demir, 1958-59; Cebeci and Tarkan, 1990 for Sea of Marmara and Pavlova, 1966; Kimor and Berdugo, 1967; Moraitou-Apostolopoulou, 1972-74-76 and 1977; Özel, 1992 for the Aegean Sea.

### Materials and Methods

Zooplankton sampling was carried out with R/V K. Piri Reis in the Black Sea and the Aegean Sea, and with R/V Arar in the Sea of Marmara. The samples were taken seasonally as vertical hauls from bottom to surface (Fig.1) using a Bongo Net with 200  $\mu\text{m}$  mesh size in 1986-1990.

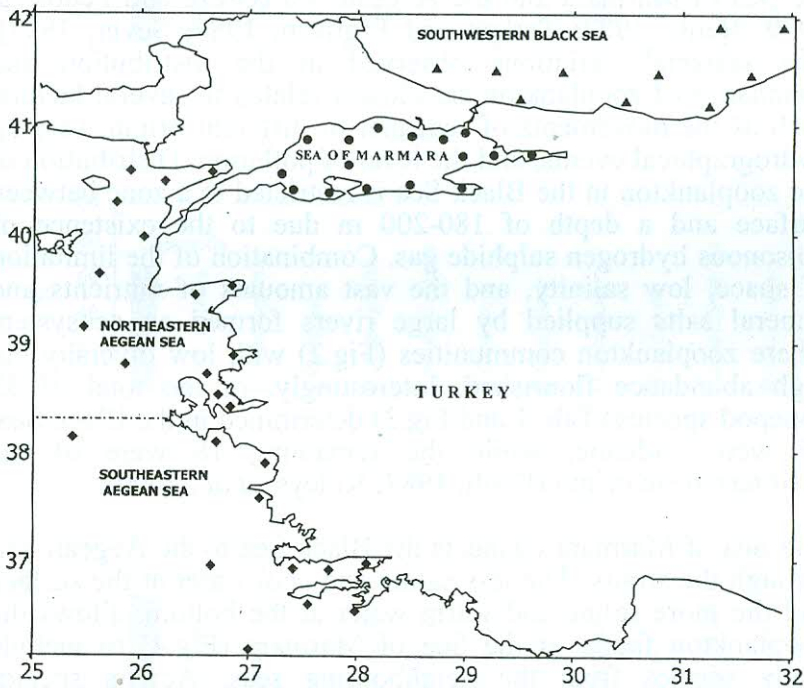


Figure 1. Sampling stations

The zooplankton samples taken from the collector were transferred to 5 L PVC jars and kept in 4% formaline solution. Collected samples were transferred to parallel lined (0.5 cm interval) petri holders via 1/10 sampling method by using a VMZ Olympus stereo binocular microscope.

## Result and Discussion

The primary productivity in the Aegean Sea is about 12-18 fold poorer than the Black Sea. However, the northern Aegean Sea is more productive than the southern Aegean Sea because of the nutrient rich Black Sea water flow from the Strait of Dardanelles.

Compared to all other zooplankton groups, copepods were determined to be the dominant zooplankters in the Black Sea, the Sea of Marmara and the Aegean Sea (Greze and Fedorina, 1979; Benli, 1987; Tarkan and Ergüven, 1988; Sever, 1997). The seasonal variations observed in the distribution and abundance of zooplankton are closely related to several factors, such as the movements of seawater of different origin, varying hydrographical events, and the level of pollution. Distribution of the zooplankton in the Black Sea is restricted to a zone between surface and a depth of 180-200 m due to the existence of poisonous hydrogen sulphide gas. Combination of the limitation of space, low salinity, and the vast amounts of nutrients and mineral salts supplied by large rivers formed an ecosystem where zooplankton communities (Fig.2) with low diversity but high abundance flourished. Interestingly, of the total of 33 copepod species (Tab. 1 and Fig.3) determined in the Black Sea, 15 were endemic, while the remaining 18 were of the Mediterranean origin (Benli, 1987; Kideys, *et.al.*, 2000).

The Sea of Marmara connects the Black Sea to the Aegean Sea through the straits. The less saline and cool water at the surface and the more saline and warm water at the bottom, allows the zooplankton fauna of the Sea of Marmara (Fig.4) to include many species from the neighbouring seas. *Acartia* species dominate the zooplankton in the Sea of Marmara in the spring, while in the winter (Fig.5), *Centropages typicus*, *Calanus* spp. and

