| Determination of Metals and Metalloids Levels of Striped Venus (*Chamelea gallina L.*, 1758) in the Southern Black Sea Coast<br><br>*(Ali Alkan, Nigar Alkan, Ufuk Akbaş, Murat Dağtekin)* | "Cercetări Marine" Issue no. 47<br><br>Pages 148-156 | 2017 |
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# DETERMINATION OF METALS AND METALLOIDS LEVELS OF STRIPED VENUS (*Chamelea gallina L.*, 1758) IN THE SOUTHERN BLACK SEA COAST

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## ABSTRACT

Striped venus has an important role in the Turkish fisheries. Recently, the average amount of catching has about 20000 tons in the Black Sea. In this study, concentrations of B, V, Cr, Mn, Co, Ni, Cu, Zn, As, Se, Mo, Cd, Pb were determined in economically important bivalve species (Chamelea gallina L., 1758) distributed throughout the coastal areas in the southwestern Black Sea. Samples were collected from five sites in Sinop (Türkeli, Ayancık, Sarıkum) and Kastamonu (İnebolu, Cide). The elemental compositions of the striped venus were determined by ICP-MS after freeze-drying and digestion of microwave system. Average length, height and width of bivalve samples measured as 18.01±2.45 cm, 9.47±1.21 cm, and 16.26±2.18 cm respectively. Metals and metalloids concentrations were measured as for B:4.86±2.05; V:3.45±0.84; Cr:6.84±3.88; Mn:30.35±10.30; Co:2.27±0.36; Ni: 6.92±1.31; Cu:1.91±2.21; Zn:74.54±12.83; As:21.58±4.34; Se:4.31±0.57; Mo:1.14±0.53; Cd:3.99±0.91 and Pb:0.82±0.27 mg/kg dry weight. When wet weight/dry weight conversion ratio was applied, it was determined that the concentrations of all the measured elements were lower than the maximum limits set by European legislation.

**Key-Words:** Striped venus, Chamelea gallina, metal, metalloid, Black Sea

## AIMS AND BACKGROUND

Mussels are filter-feeding organisms and they can accumulate toxic substances. For this reason, they are used as indicator bio organism in pollution research in aquatic environments.

Striped venus (Chamelea gallina L., 1758) is found in large populations on the sandy grounds up to a depth of 20 m around the Black Sea and the Marmara

Sea. It is the predominant species in the benthic habitat of the Black Sea. It is known that striped venus was abundant and fishing on the Italian coast in the 1800s. The amount of striped venus taken from Italian coast has been reached the level of 105 thousand tons in the mid-1980s. But unplanned and over-fishing has caused great disruption in stocks. Following this destruction, the fishing was regulated and the quota application was started. On the Turkish coast, the fishing began in 1986 and the average annual hunting is now 30 thousand tons. Spawning period of striped venus is May to June in the Black Sea. Fishing is carried out on the coast between Akçakoca and Sinop by means of dredge. From 1 May to 31 August there is a banned season (Dalgıç et al. 2006).

There are many studies about *Mytilus galloprovincialis* which is one of these species with commercial importance, on the far south of the Croatian Adriatic coast (Ujevic et al. 2015) and Boka Kotorska Bay, Montenegro in the **Adriatic Sea** (Jovic et al. 2011), coast of the Romanian (Rosioru et al. 2016), Sinop Coast of the Black Sea, Turkey (Bat et al. 1999, Bat and Öztekin 2016), hot points (harbours and river mouths) Southern Black Sea, Turkey (Balkis et al. 2012) and mid-Black Sea coast of Turkey (Bakan and Özkoç 2007) in the **Black Sea**, Homa Lagoon (Bilgin and Uluturhan-Suzer 2017), Izmir Bay (Turkey) (Yabanlı et al. 2015) in the **Aegean Sea** and Bosphorus and Golden Horn (Kilic and Belivermis 2013), Turkish Straits (Bosphorus and Dardanelles) (Topçuoğlu et al. 2004) and **Marmara Sea** (Özden et al. 2010, Ergül and Aksan 2013) and Elefsis bay Saronikos gulf, Greece (Strogyloudi et al. 2012).

Research on Striped Venus is relatively limited in the Black Sea. Proximate and elemental composition (Arik Colakoglu et al. 2011), seasonal variations in the macronutrient mineral and proximate composition (Ozden et al. 2009), the striped Venus processing industry (Dalgıç et al. 2006) in the Black Sea and concentrations of contaminants with Regulatory Limits in Samples of Clam (Visciano et al. 2015) are among the studies that have been conducted.

The aim of this study is to determine metal and metalloid levels in the Striped venus catches from the western Black Sea coast of Turkey where a major part of products assessed for human consumption limits.

## EXPERIMENTAL

Striped venus samples were collected from five different locations on the shores of Sinop (Türkeli, Ayancık, Sarıkum) and Kastamonu (İnebolu, Cide) located on the Black Sea Turkish coasts with hydraulic dredging (Fig.1). The sampling carried out between November 2011 and July 2012 periods. A group of samples were randomly separated. Biometric measurements were made by separating the small and large size groups in the collected sample.

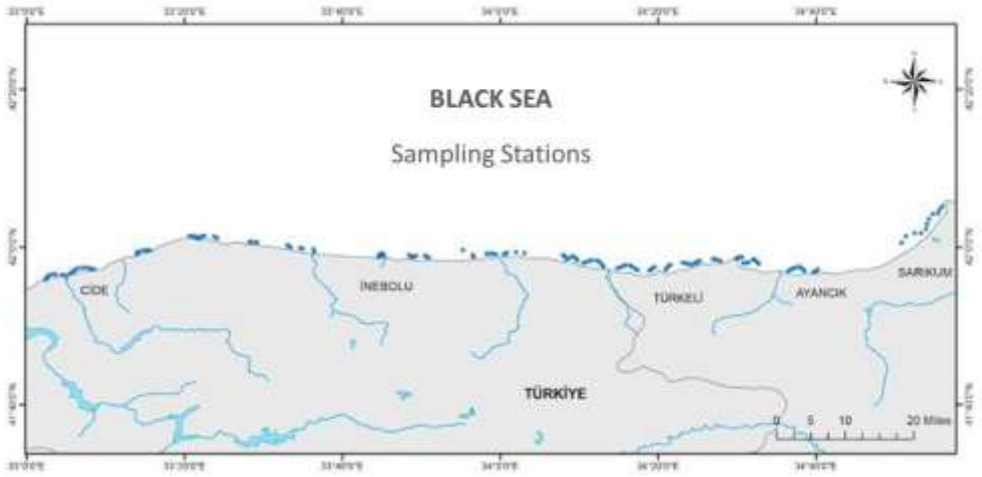


**Fig. 1.** Sampling stations.

The meat tissue of the Striped Venus samples, which were biometrically measured, were pooled and the total wet weight was recorded. Moisture content was determined at 105 °C with a part of the pooled sample. The other part was installed with freeze dryer. The dried samples were homogenized and then about 0.5 g was taken and digested with a mixture of nitric acid (7 mL) and peroxide (1mL). The solution was diluted to 25 mL with ultrapure water obtained from deionized water system following digestion. Metal and metalloids measurements were performed using Varian 820 model ICP-MS. Scandium (Sc) and Indium (In) elements were used as internal standard in the measurements.

## RESULTS AND DISCUSSION

Metal pollution is considered one of the most important problems of the aquatic environment due to the toxicity and high accumulation potential by marine organisms. The effect of pollution may depend on various factors such as geographical/environmental features, pollutant type, and organism species.

In this study average length, height and width of bivalve samples measured as 20.52±0.41 cm, 10.61±0.22 cm and 18.47±0.57 cm for large size group and 16.00±1.23 cm, 8.52±0.87 cm and 14.50±1.09 cm small size group respectively (Fig. 2). The amount of water in mussel samples was 89.4±0.94 % for the large size group and 89.4±1.38 % for the small size group. Çolakoğlu et al. (2011) have reported water content in the range between 82.17 and 85.56 % and Özden et al. (2009) have reported 82.7 and 86.57 % in striped venus samples at the Marmara Sea. Metal and metalloid levels of bivalves determined in this study were given Fig.2-5 (Mean±std.dev). There were no statistically significant differences between large and small size group of Striped venus in terms of metal and metalloid accumulation (Fig. 6). The most abounded element was Zn in all stations and all seasons.

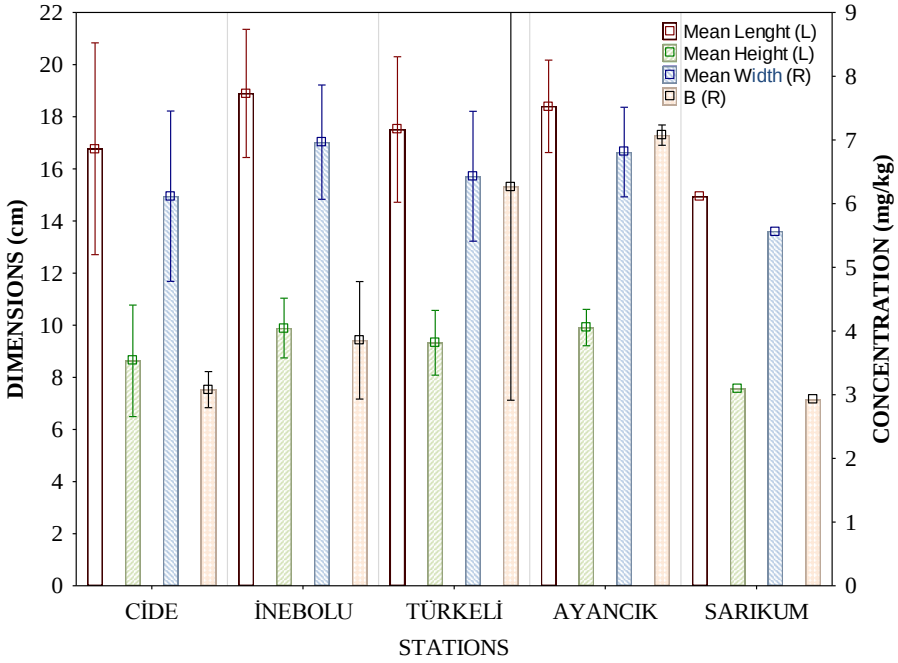


**Fig. 2.** Average biometric value and B (mg/kg dry weight) concentrations.

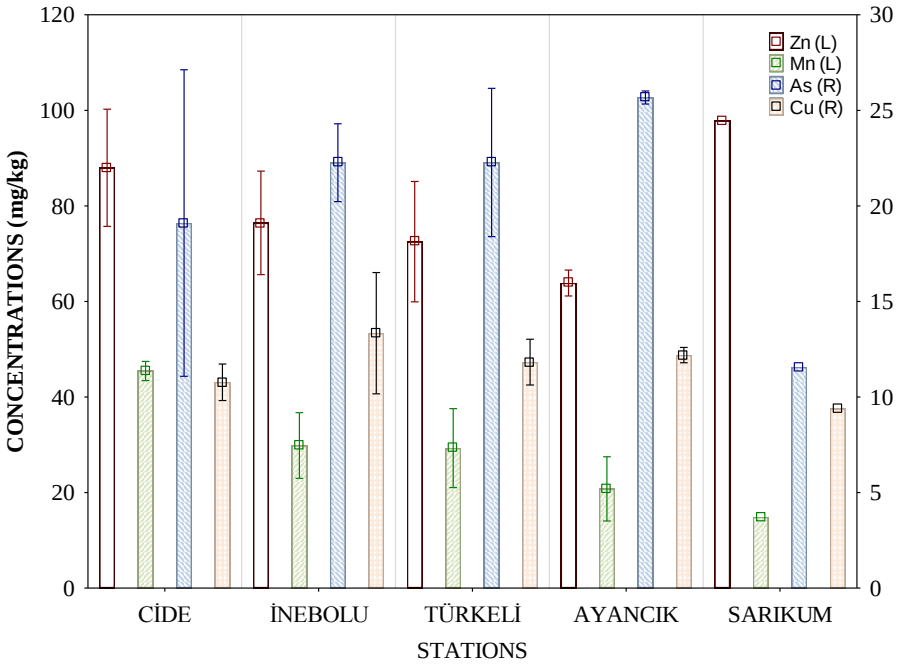


**Fig. 3.** Concentration of Zn, Mn, As and Cu according to sampling stations.

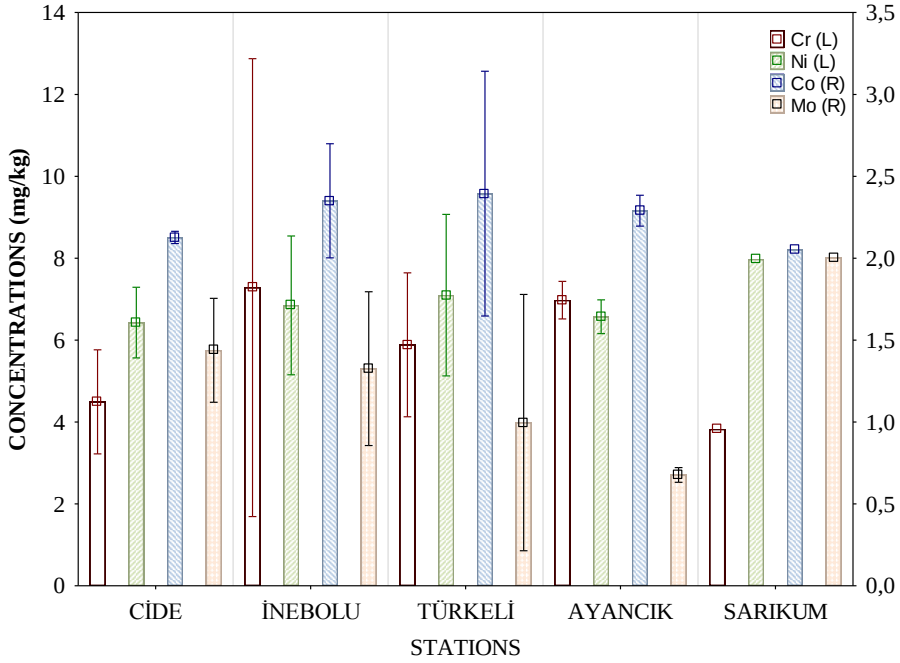


**Fig. 4.** Concentration of Cr, Ni, Co and Mo according to sampling stations.

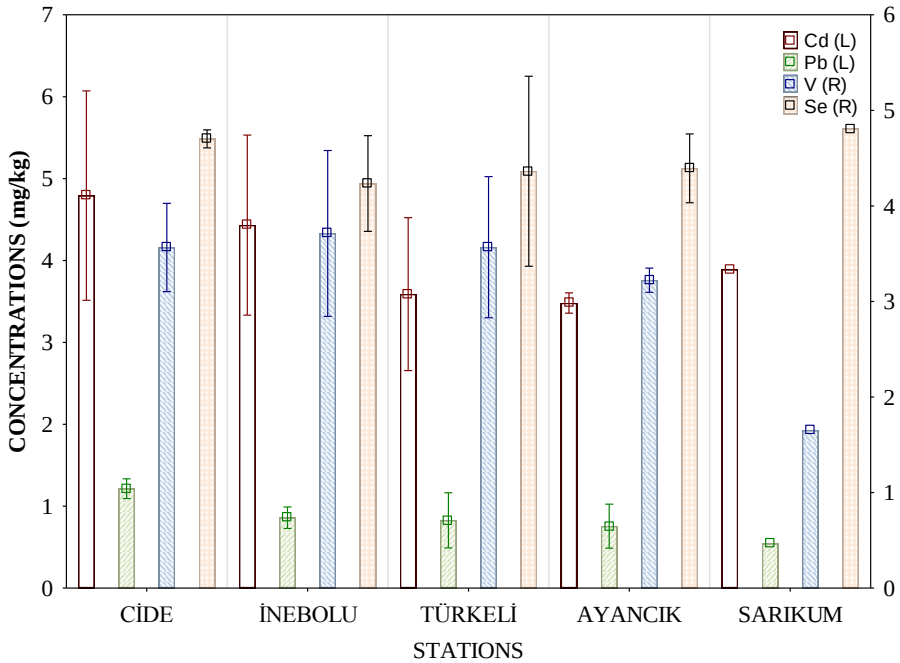


**Fig. 5.** Concentration of Cd, Pb, V and Se according to sampling stations.

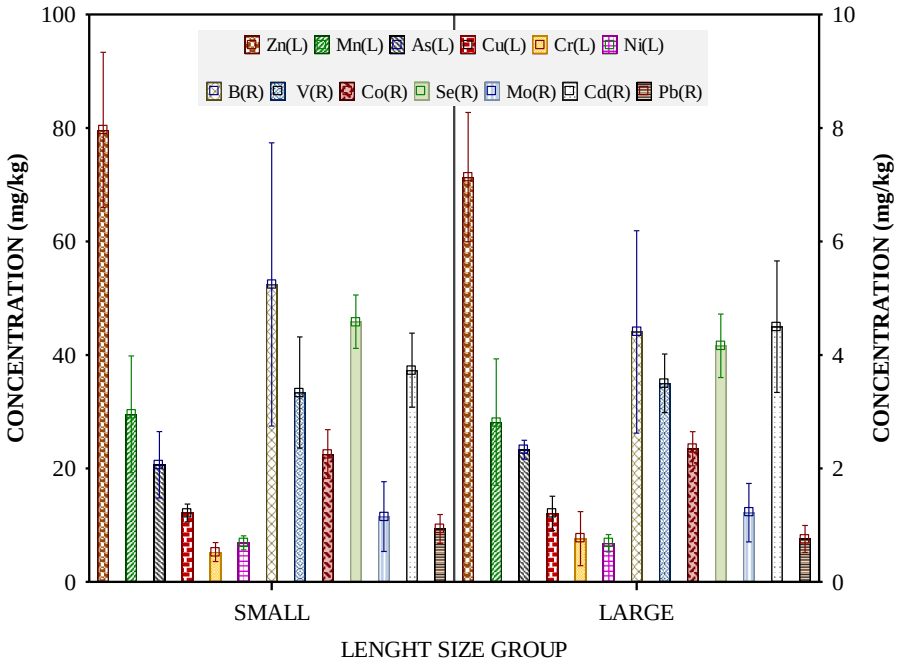


**Fig. 6.** Metal and metalloid concentrations according to the size of groups.

The differences of metal accumulation in the Striped venus by sampling location were not statistically significant ($p>0.05$). But Mn concentrations determined in Cide station (45.45 mg/kg dw) were relatively high and as concentrations determined in Sarıkum station (11.56 mg/kg dw) were relatively low from other stations.

The seasonal differences in metal and metalloid accumulation levels of the Striped venus were not statistically significant ($p>005$) except B and Mo elements. The B concentrations were determined as 6.67 mg/kg dw in summer and 3.54 mg/kg dw in winter respectively. The mean accumulation levels of Mo for Striped venus were determined as 0.76 mg/kg dw in summer and 1.49 mg/kg in winter.

There is no information about the maximum limits of the elements measured in this study except Pb and Cd in Turkish Legislation and European Commission regulations. The maximum metal concentrations permitted for bivalve molluscs are 1.5 mg/kg for Pb and 1.0 mg/kg for Cd according to the Turkish and European Community legislation. In this study, the mean concentrations were found as 0.82±0.27 (mg/kg dry weight) for Pb and 3.99±0.91 (mg/kg dry weight) for Cd respectively. Also, wet/dry weight ratio was found as 9.1 in the present research. When wet/dry weight conversion ratio was applied, it was determined that the concentrations of all the measured elements were lower than the maximum limits set by European and Turkish legislation.

The previous researches results of Striped venus metal levels are given in Table 1. According to our data, Zn has the highest concentration, followed by Mn, As and Cu. The minimum and maximum concentrations of Mo were determined as 0.54–2.00 mg/kg dw and V were determined as 1.65-5.12 mg/kg dw respectively.

The concentrations of Mo and V in Striped venus meat were not measured in any of the previous studies.

**Table 1.** Comparison of metal and metalloid concentrations of Striped venus caught in different seas.

| **Conc. (mg/kg)** | Black Sea (**This Study**) | | Marmara Sea (Arik Colakoglu et al. 2011) | Marmara Sea (Ozden et al. 2009) | Adriatic Sea (Visciano et al. 2015) |
|---|---|---|---|---|---|
| | Dry weight | Wet weight * | Wet weight | Wet weight | Wet weight |
| **B** | 2.88-9.73 | (0.32-1.07) | 2.37-4.24 | | |
| **V** | 1.65-5.12 | (0.18-0.56) | | | |
| **Cr** | 3.60-17.20 | (0.40-1.89) | nd-0.76 | | |
| **Mn** | 13.26-46.87 | (1.46-5.15) | 0.08-9.2 | | |
| **Co** | 1.64-3.13 | (0.18-0.34) | 0.03-0.43 | | |
| **Ni** | 5.28-9.82 | (0.58-1.08) | 0.11-1.22 | 0.67-1.62 | |
| **Cu** | 8.29-16.57 | (0.91-1.82) | 0.71-5.30 | 0.59-3.55 | |
| **Zn** | 58.75-97.83 | (6.46-10.75) | 13.08-77.76 | 7.6-12.88 | |
| **As** | 11.56-26.12 | (1.27-2.87) | | 2.34-3.52 | |
| **Se** | 3.39-5.38 | (0.37-0.59) | | 0.77-3.41 | |
| **Mo** | 0.54-2.00 | (0.06-0.22) | | | |
| **Cd** | 2.56-5.70 | (0.28-0.63) | 0.04-0.69 | 0.20-0.43 | 0.070-0.250 |
| **Pb** | 0.37-1.30 | (0.04-0.14) | 0.18-3.24 | 0.16-1.34 | <0.027-0.180 |

*Values were calculated from dry weight concentrations using by 9.1 ratio

The maximum Pb concentrations measured in this study were very similar to the results obtained in the Adriatic Sea, but were much smaller than the maximum values obtained in the Marmara. The maximum Zn concentrations were similar to the maximum values obtained by Özden (2009), while below the values determined by Çolakoğlu (2011).

## CONCLUSIONS

It has been determined that the concentration of metals in the Striped venus caught in the Western Black Sea coast of Turkey is within the permissible limits are given in the legal regulations. As a result, Striped venus muscle tissue was found not to be harmful to human health in terms of metal/metalloid pollution.

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