Mar. Sci. Tech. Bull. (2021) 10(3): 224-227
e–ISSN: 2147–9666
info@masteb.com

dergipark.org.tr/en/pub/masteb
www.masteb.com
DOI: 10.33714/masteb.795884

Marine Science and Technology Bulletin

RESEARCH ARTICLE

First record of gravid female American blue crab (*Callinectes sapidus* Rathbun 1986) from the Black Sea

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ARTICLE INFO

Article History:
Received: 16.09.2020
Received in revised form: 09.01.2021
Accepted: 15.01.2021
Available online: 26.01.2021

Keywords:
Black Sea
Blue crab
Callinectes sapidus
Gravid female
Mediterranization

ABSTRACT

The occurrence of American blue crab, *Callinectes sapidus* Rathbun 1896, has been reported from the Black Sea, however, no gravid female has previously observed. Here, we record the first gravid female blue crab from the Black Sea. One individual of Atlantic blue crab was caught at 2 m depth using trammel net on 24th June 2020. The carapace width, carapace length, and the wet body weight of the crab were 200 mm, 81.03 mm, and 406.22 g, respectively. We also counted the eggs and measured the egg size. We further determined that the majority of the eggs were eyed, suggesting potential adaptation of the blue crabs to the Black Sea ecosystem.

Please cite this paper as follows:

Gül, M., Bodur, B., & Aydın, M. (2021). First record of gravid female American blue crab (*Callinectes sapidus* Rathbun 1986) from the Black Sea. *Marine Science and Technology Bulletin*, *10*(3), 224-227. https://doi.org/10.33714/masteb.795884

Introduction

Introductions of American blue crab have been reported from different localities on the coast of Europe including France, North Sea, Mediterranean Sea, Baltic Sea, Sea of Azov, and as well as Black Sea (Nehring, 2011). The species has reached a notable density in the Mediterranean and Aegean Seas (Holthuis & Gottlieb, 1955; Williams, 1974; Castriota et al., 2012), however, its existence in the Black Sea has been rare (Bulgurkov, 1968; Shaverdashvili & Ninua, 1975; Monin, 1984; Zaitsev, 1998; Bashtannyy et al., 2002; Diripasko et al., 2009; Khvorov, 2010; Pashkov et al., 2012; Aydın, 2017) (Figure 1), suggesting a low adaptation ability of the species to the low temperature values of the Black Sea (Nehring, 2011). This hypothesis might further be supported by the recent increase in the number of reports showing existence of the blue crabs from the Black Sea as the water temperature increases in the Black Sea during the "Mediterranization" process (Micu & Todorova, 2009). Besides the reports showing the occurrence of the American blue crabs, no report has yet indicated reproductive capability of this species in the Black Sea including gravid females.

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Material and Methods

We have collected a single gravid female of American blue crab from the mid of the Turkish coast of Black Sea (Figure 1). The individual was found at 2 m depth using a trammel net on 24th June 2020 in the Fatsa port, Ordu (41°02'45.81"'N and 37°29'31.83"'E). The individual was brought to the laboratory alive and was euthanized in ice. We then measured the carapace width and carapace length using a digital Vernier caliper to the nearest 0.01mm. We also measured the wet body weight of the crab. We collected three 1 g of subsamples from the clutch and counted the number of eggs. We finally measured the egg size (e.g. egg diameter) of 50 eyed eggs under a dissecting microscope.

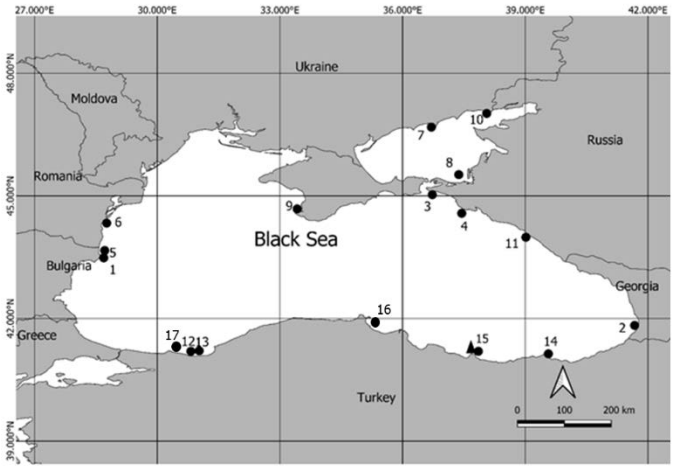

Figure 1. Map for the locations in the Black Sea where American blue crabs (*Callinectes sapidus*) have been reported. Locations are labeled chronologically from 1 to 15. The triangle indicates the site for the present study. Bulgurkov (1968)[1], Shaverdashvili & Ninua (1975)[2], Zaitsev (1998)[3,5], Monin (1984)[4], Bashtannyy et al. (2002)[6], Diripasko et al. (2009)[7,8,10], Khvorov (2010)[9], Pashkov et al. (2012)[11], Yağlıoğlu et al. (2014)[12, 13], Ak et al. (2015)[14], Aydın (2017)[15], Bilgin (2019)[16], Ceylan (2020)[17].

Results

The carapace width (including the longest spines) and length of the crab was 200 mm and 81.03 mm, respectively. The wet body weight was 406.22 g and the wet clutch weight was 33.84 g. The female was carrying a total of 1166879 eggs. The majority of the eggs were eyed (Figure 2) and the diameter of the eyed eggs varied between 261.7 µm and 309.5 µm (average=281±18.26 µm).

Discussion

This is the first record of a gravid female American blue crab in the Black Sea. Low water temperatures have been hypothesized to be the main causation for the unsuccessful establishment of the American blue crab in the Black Sea ecosystem (Nehring, 2011), since larval development and size at maturity are inversely related to the water temperatures (Hines et al., 2010) and no blue crab larvae can develop at water temperatures lower than 21°C (Hill et al., 1989). However, Black Sea ecosystem experiences strong consequences of the global changes, which is defined as the "Mediterranization" process, meaning that the Black Sea ecosystem is resembling to the Mediterranean character (Micu & Todorova, 2009). This transformation in the Black Sea ecosystem has led to increase in water temperatures and the salinity, which overlaps with the increased number of records showing introduced species to the Black Sea including the American blue crab. Our finding here shows that the increased water temperatures of the Black Sea allow blue crab eggs to develop and allow females to carry eyed eggs and potentially release them, thought we do not have any information on the survival of the larvae.

Aquatic species are often transported to new localities unintentionally via ballast waters of the ships. However, the species itself or life form of the species must be small enough to pass through the ballast water pump and intake ports, thus the species that are carried in the ballast water are often limited to phyto- and zooplankton, and other planktonic larvae belonging to a variety of macroinvertebrates and fish (Minchin & Gollasch, 2002). Therefore, it is reasonable to conclude that the gravid female that we collected was not transported to the Black Sea as an adult, and the coupling has happened in the Black Sea. Another potential explanation for the presence of the gravid female in the Black Sea was the migration of the blue crabs from

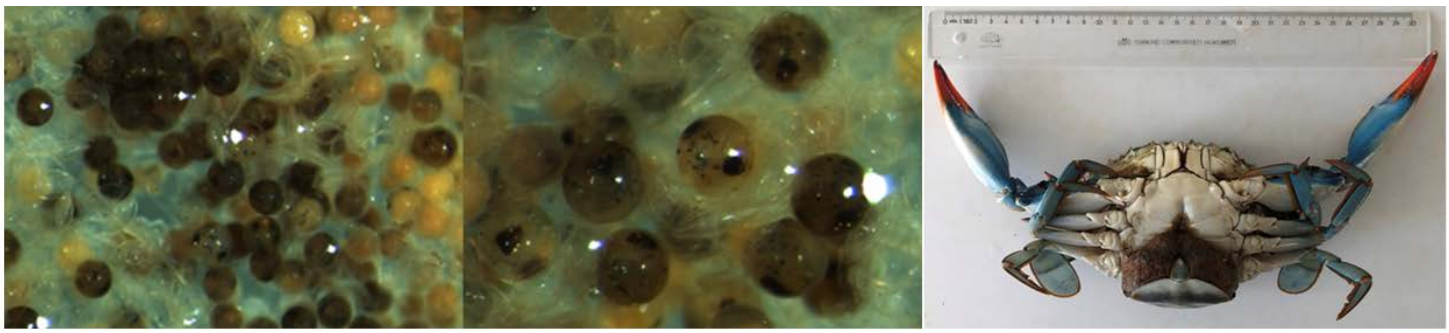

Figure 2. The views of the gravid female American blue crab (*Callinectes sapidus*) and the eyed eggs

the Aegean Sea (Öztürk et al., 2020), suggesting that coupling might happen in the Aegean Sea and the female individual migrated to the Black Sea. If this is correct for the blue crabs from the Black Sea, the idea of eggs and potentially larvae development of the blue crabs in the Black Sea should be true. In conclusion, our finding here has shown that American blue crabs are able to reproduce and develop eggs in the Black Sea.

Conclusion

Individuals of American blue crab (*Callinectes sapidus*) have long been reported from different coastal areas of the Black Sea. However, there has been a doubt about whether the species has a durable settlement in the Black Sea due to the lack of evidence for the reproduction. Our finding here shows that American blue crab has adapted to the Black Sea system by gaining the ability of reproduction.

Compliance with Ethical Standards

Conflict of Interest

The authors declare that they have no conflict of interest.

Ethical Approval

For this study, all applicable international, national, and/or institutional guidelines for the care and use of animals were followed.

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