

Rapid Communication**One of the most invasive alien species, *Penaeus aztecus* Ives, 1891 reached the Black Sea coasts**Onur Gönülal^{1,*} and Pelin Saliha Çiftçi Türetken²¹Istanbul University Faculty of Aquatic Sciences, Gokceada Marine Research Department, Canakkale, Turkey²Istanbul University Faculty of Aquatic Sciences, Istanbul, TurkeyAuthor e-mails: ogonulal@istanbul.edu.tr (OG), pciftci@istanbul.edu.tr (PSÇT)

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Received: 15 February 2019**Accepted:** 2 July 2019**Published:** 30 September 2019**Thematic editor:** Cynthia McKenzie**Copyright:** © Gönülal and TüretkenThis is an open access article distributed under terms of the Creative Commons Attribution License ([Attribution 4.0 International - CC BY 4.0](https://creativecommons.org/licenses/by/4.0/)).**OPEN ACCESS****Abstract**

Five specimens of *Penaeus aztecus* was caught from the Turkish waters of the Aegean Sea and one specimen was caught from the Turkish waters of the Middle Black Sea, Turkey. The current paper reports a new location for the Aegean Sea. Within approximately eight years, the species has been recorded from the southeastern Levant to the Gulf of Lion, the Aegean Sea, and finally from the Black Sea. This is the first report of the species from the Black Sea. Presumably, the species migrated to the Black Sea by swimming through the Turkish Strait System.

Key words: the brown shrimp, distribution records, middle black sea, ecological corridor, Aegean Sea

Introduction

The northern brown shrimp, *Penaeus aztecus* Ives, 1891 is a penaeid shrimp native to the western Atlantic Ocean. It is distributed along the east coasts of the USA and Mexico, but also recorded in Canada and has been introduced in Oceania (New Caledonia and French Polynesia) for aquaculture purposes (Tavares 2002).

The first record of *P. aztecus* in the Mediterranean was given by Deval et al. (2010), from Antalya Bay. From that date until today, it has expanded its' distribution in several areas across the Mediterranean coasts. The species has been highlighted among the most invasive ones in the ESENIAS area (Trichkova et al. 2017; Karachle et al. 2017).

The present study gives additional data on the presence of *P. aztecus* in the North Aegean Sea and reports its presence for the first time from the Middle Black Sea region, coasts of Turkey.

Materials and methods

A total of 5 specimens (2 female, 3 male) were caught by trammel net in the Ibrice (40°36'38"N; 26°33'25"E), Aegean Sea, from 80 m depth on May 2016. Their total length ranged from 10,5 cm to 14 cm. Also, only one female

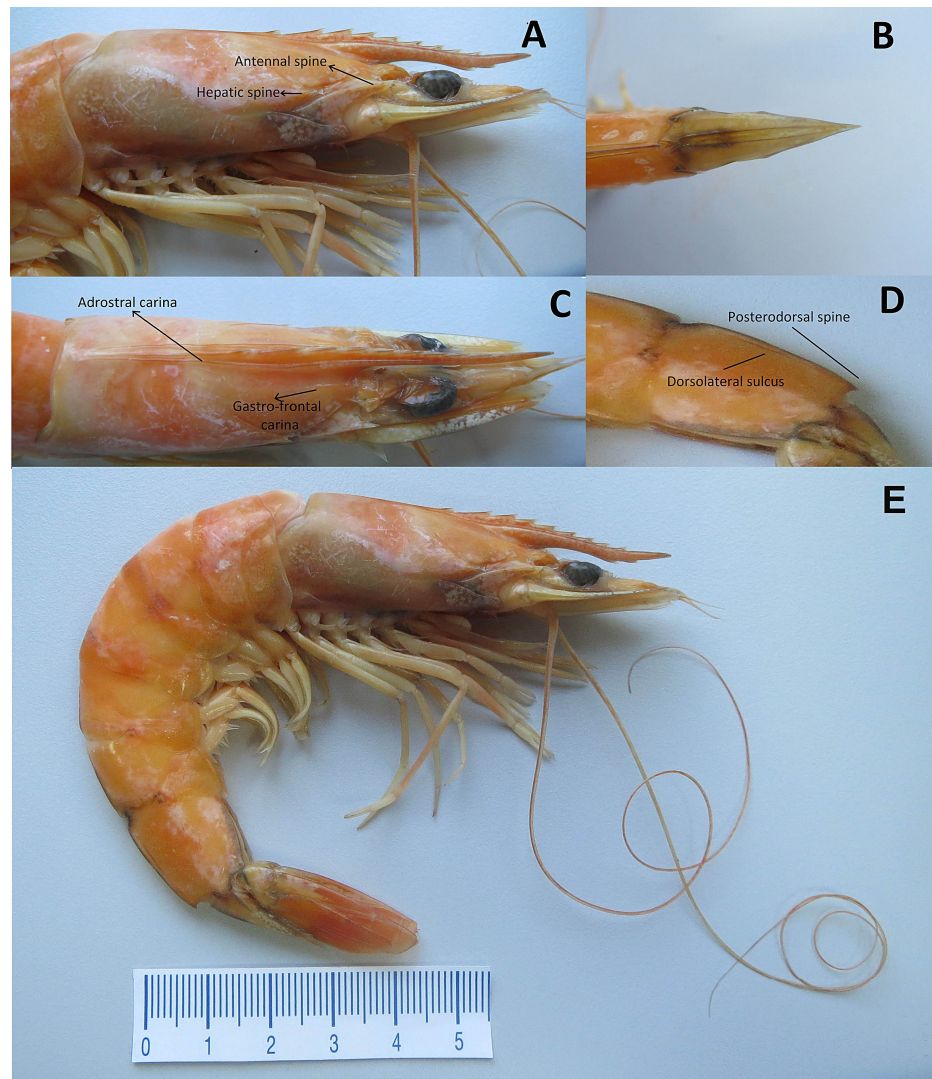


Figure 1. *Penaeus aztecus* (Ives, 1891) from Middle Black Sea, Turkey. A) lateral view of carapace, B) telson, C) dorsal view of carapace, D) sixth abdominal segments, E) general view. Photo by Onur Gönülal.

individual (Figure 1) was caught from the Bozkurt (33°80'48"N; 41°85'56"E), Black Sea, on December 2017. It was captured by gillnet with a 34 mm mesh size at the depth of 10 m. The specimens was preserved in 80% ethanol, and deposited in the Istanbul University Gökçeada Marine Museum, Canakkale.

Results and discussion

Identification of *P. aztecus* was made according to keys in Perez and Kensley (1997) and Tavares (2002).

The rostrum bear 9 teeth on dorsal and 2 teeth on ventral margin (Figure 1A). Telson is triangular with a broad dorsal groove throughout its length and without a spine (Figure 1B). Antennal spine, hepatic spine and gastro-frontal carina are present (Figure 1A, C).

Adrostral sulcus and carina long, reaching much beyond epigastric tooth, almost to posterior margin of carapace. Gastrofrontal carina not turning

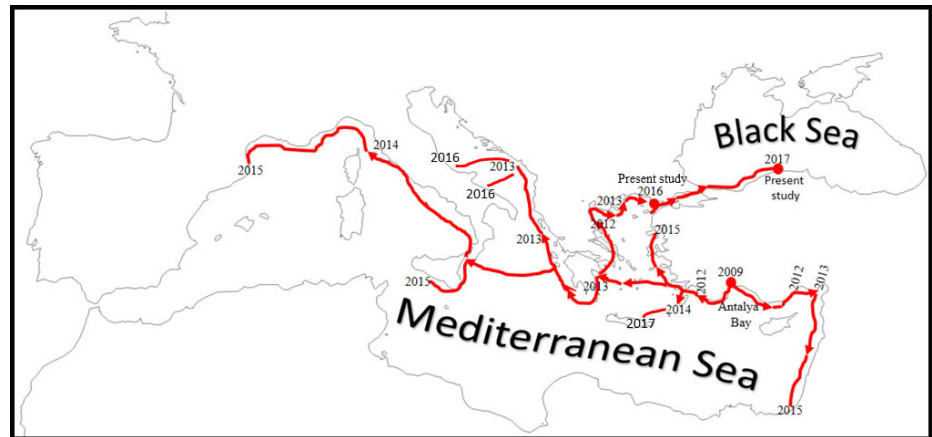


Figure 2. The map of possible pathway and showing locations of records for *Penaeus aztecus* in the Mediterranean Sea (modified from Trichkova et al. 2017 and Karachle et al. 2017, for details see Table S1)

anterodorsally upon itself at posterior end. Sixth abdominal somite with well defined dorsolateral sulcus. Posterodorsal spine and well defined dorsolateral sulcus present on six abdominal segments. Median sulcus is long and continuous (Figure 1D).

P. aztecus has spread rapidly to westward and northward in the Mediterranean Sea since its first appearance in the Gulf of Antalya (Turkey) in 2009 (Figure 2, Supplementary material Table S1). Minos et al. (2014) confirmed the species expansion range in the Eastern Mediterranean, indicating that it has established a new population in the northern coasts of the Aegean Sea. According to Deval et al. (2010) and Kevrekidis (2014) the most likely vector for the introduction of *P. aztecus* in the eastern Mediterranean is from ships' ballast waters. According to Poulain et al. (2012) the rapid expansion of *P. aztecus* may be related to dispersal and transportation of shrimp eggs and larvae along the main paths of surface water circulation in the Eastern and the Central Mediterranean Sea.

Cruscanti et al. 2015 voiced many of the Mediterranean populations issue from illegal introductions. Because, areas where the last recorded specimen such as Antalya, Thermaikos gulf, Tyrrhenian coast of Italy, Follonica etc. are used for fish and shellfish farming.

P. aztecus is an active swimmer and burrower. It is considerably more active at night in open waters than during the daylight hours (Williams 1984). Plus, it can travel great distances (over 300 km in three months) (Klima 1963). It is more certain that the new finding in the Black Sea area results from unaided natural expansion of the well established by now North Aegean populations of the species. A more prudent proposition is that it has made this migration by swimming. Figure 2 shows the locations of records of *P. aztecus* in the Mediterranean Sea. The map represents that the locations are related to each other.

The introduction of alien species cause a number of major changes, especially enclosed or semi-enclosed marine ecosystems such as the Black

Sea which has become a major recipient of alien species (Ivanova et al. 2017). Aleksandrov et al. (2017) mentioned that 261 non-indigenous species have been registered in a database of Black sea Commission. According to Çınar et al. (2011) the Black Sea represents the lowest number of the alien species (20 species) in Turkish seas. Anthropogenic activities may also explain the increases in the number of alien species (with the increased shipping traffic, aquaculture, etc.). The potential impacts of *P. aztecus* to native biodiversity and economic value is the likely co-introduction of pathogens and parasites. In most of penaeid shrimp the spread of diseases through stock movements has been prevalent (WB/NACA/WWF/FAO 2001).

P. aztecus was first reported from the Black Sea while there isn't any records from the Turkish Straits System. There may be two possible reasons for this: the lack of detailed research in recent years or misidentification of *P. aztecus* with autochthonous species, *Melicertus kerathurus*.

During the laboratory studies, *P. aztecus* was observed to burrow as temperatures fell below 12–17 °C range. Postlarval growth rates vs. salinity, growth did not differ significantly when salinity ranged between 5–40 ppt (Zein-Eldin and Aldrich 1965). Larvae and juveniles are known to withstand a wide range of salinities and temperatures (Re et al. 2005). That could be a reason for the successful distribution of the species in the Black Sea.

This study gives an updated data on the distribution of *P. aztecus* from the Mediterranean and Black seas.

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Supplementary material

The following supplementary material is available for this article:

Table S1. Records of *P. aztecus* in the Mediterranean Sea.

Appendix 1. References for Table S1.

This material is available as part of online article from:

http://www.reabic.net/journals/bir/2019/Supplements/BIR_2019_Gonulal_Ciftci_SupplementaryMaterial.xlsx