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Biological Invasions
Research Article

Occurrence of Two Non-indigenous Alien Sea Slugs, *Bursatella leachii* (Blainville, 1817) and *Melibe viridis* (Kelaart, 1858) (Gastropoda: Heterobranchia), from the Çanakkale Strait, Turkish Straits System

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Abstract: This study reports the heterobranch mollusks *Bursatella leachii* (Blainville, 1817) and *Melibe viridis* (Kelaart, 1858) for the first time from the Dardanelles (Çanakkale Strait), Turkey. Individuals of these two species were observed in January 2020 on a sandy and seagrass bed of *Cymodocea nodosa* (Ucria) Ascherson and in groups among the algae *Caulerpa racemosa* (Forsskål) J. Agardh. Although the Dardanelles is one of the biodiversity hotspots in Turkish Seas and the abundance of marine invertebrates in particular regions is significantly high, the inventory of the sea slugs in the region is limited. This study improves the existing knowledge on the molluscan fauna of the Turkish Straits System, the species abundance in the region and their ecological characteristics. The current finding also represents the northernmost records in an invaded area at the Çanakkale Strait of Aegean Sea.

Key words: Mollusca, alien species, ecology, Dardanelles, Turkish Straits System.

Introduction

Invasive species have been among the most common group of target marine animals in recent investigations worldwide. Adapting behaviours of these non-native species, changing ecology of habitats as well as warming events, have recently become a focusing subject for marine scientists. Since changing in the natural environmental conditions is irrepressible, continuous monitoring on effects and improving the knowledge of this threat are the primary aims of recent investigations. By 2018, 957 alien species (established and non-established) had been documented in the Mediterranean Sea (Zenetos 2019) while, by end 2019, 666 species were established (Zenetos & Galanidi 2020). Despite the knowledge related to sea slug species in the Black Sea, Mediterranean and Aegean Sea coasts of Turkey (Öztürk et al. 2014), there is a lack of distributional and ecological information in the Turkish Strait's habitats and in the Dardanelles in particular. Relevant literature from the area includes the articles by Türker et al. (2020), Tunçer et al. (2017), Yokeş (2009), Türkmen & Demirsoy (2009) and Colombo (1885).

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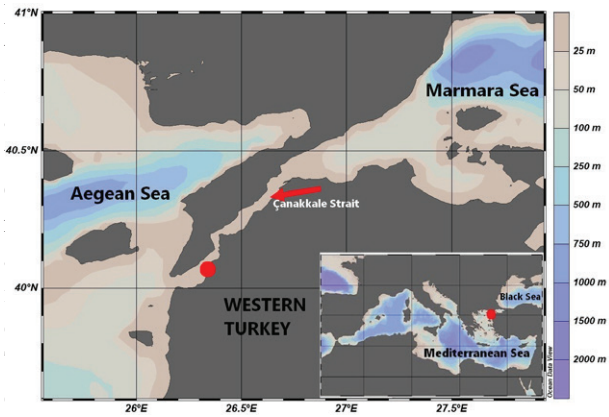

Fig. 1. Survey area (map illustration from Schlitzer 2018).

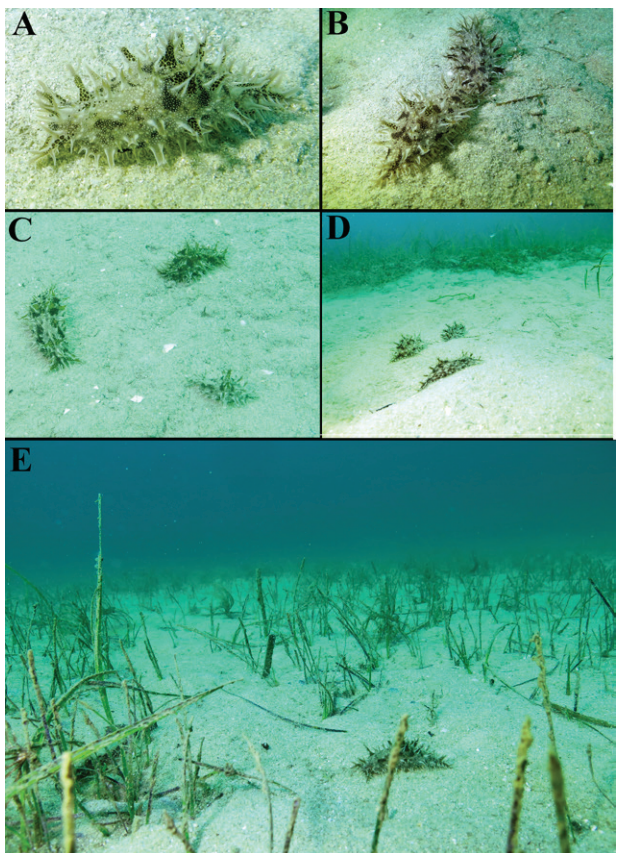

Fig. 2. *Bursatella leachii* recorded in Çanakkale Strait, including coupling individuals (B) observed on sandy bottom around seagrass bed (Photo by Özalp, 2020).

sent study, focusing mainly on sea slug fauna in the Çanakkale Strait, reports the occurrence of two non-indigenous alien sea slugs in the region.

Materials and Methods

During a monitoring survey of invertebrates conducted in the Dardanelles in January 2020 by SCUBA-equipped scientific divers, two alien mollusks,

Fig. 3. *Melibe viridis* recorded in Çanakkale Strait (Photo by Özalp, 2020)

i.e. *Bursatella leachii* (Blainville, 1817) and *Melibe viridis* (Kelaart, 1858) found among algae and seagrass facies at the main sandy substratum. The survey area is on the southern coast of the Dardanelles (Çanakkale Strait) (Fig. 1), which is known as a habitat character whose marine life and ecology reflect both the Mediterranean and Black Sea conditions (Culha & Sahin 2018). Because of the availability of ultrahaline waters, invertebrate biodiversity is significantly higher and creates crucial hotspot areas at some particular locations, which are the largest critical habitats in the Strait (Özalp 2016).

Results

Totally, 18 individuals of *B. leachii*, including some coupling (Fig. 2), were recorded at different locations during the scientific dives. The mean abundance of *B. leachii* in the area determined by three-replicated quadrant (1 m × 1 m) estimations resulted in 5 ind./m^2 as the highest density of individuals. During the sea slug surveys in the strait, *Melibe viridis* (Fig. 3) was observed as only one individual among dense algae bed at shallow waters (Table 1).

Discussion

In this study, we present the first reports of *Bursatella leachii* and *Melibe viridis* from the Dardanelles, representing the northernmost region of the Mediterranean Sea regarding marine fauna and flora. A study conducted in Florida, high-density occurrence (6600 ind/m^2) of *Bursatella leachii pleii* was demonstrated, considered as a massive shoreward migration, has been recorded in January (Lowe & Turner 1976). In a recent investigation from Mediterranean Morocco, Selfati et al. (2017)

Table 1. Alien species observed in the study area. N: number of individuals observed.

Species	Date	Area	Habitat	N	Coordinates
Bursatella leachii	12.01.2020	Dardanos	Sandy bottom, 4-6 m	18	40.09000° N 26.30722° E
Melibe viridis	12.01.2020	Dardanos	Sandy – algae bottom, 3 m	1	40.09000° N 26.30722° E

reported the maximum abundance as 50 ind/m^2. *Melibe viridis* has been observed as only one individual in the shallow waters of Çanakkale region by us. In a recent study conducted in western India, the first spawning aggregation of this species has been reprted, including information on a maximum density of 23 ind./m^2, with a total number of 48 individuals in the area (Parasharya & Patel 2014). We believe that the late increase of invasions in the Turkish Straits System is a likely effect of the recent expansion of invasive ranges from both Mediterranean and Northern Aegean Sea. Both species have frequently been reported in the Northern Aegean (Crocetta et al. 2017, Katsanevakis et al. 2020).

These observations are in agreement with the suggestions that a process of tropicalization of the Çanakkale Strait is ongoing. This region, known as a biological corridor for many marine species, along with the North-Aegean island ecosystems of Turkey and the enclosed Marmara Sea, should be regularly monitored. These examinations will fill the gap of knowledge on marine invertebrate ecology and distributional features in order to better understand and predict the future of the Turkish coastal ecosystems.

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References

Artüz M. L., Tunçer S. & Poursanidis D. 2018. Contributions to the biodiversity of sea slugs and shelled relatives of the Sea of Marmara (Mollusca: Gastropoda). Cahiers Biologie de Marine 59: 267–276.

Colombo A. 1885. Raccolte Zoologiche Eseguite dal R. Piroscafo Washington Nella Campagna Abissale Talossografica dell'anno 1885. Riviste Marittima 18: 22–53.

Crocetta F., Gofas S., Salas C., Tringali L. P. & Zenetos A. 2017. Local ecological knowledge versus published literature: a review of non-indigenous Mollusca in Greek marine waters. Aquatic Invasions 12 (4): 415–434.

Culha M. & Sahin M. E. 2018. Distribution and ecology of prosobranch gastropods (Mollusca) in the coastal waters of the north Aegean Sea (Edremit Bay-Dardanelles). Indian Journal of Geo Marine Sciences 47 (4): 877–883.

Çinar M. E., Bilecenoglu M., Öztürk B., Katağan T., Yokeş B., Aysel V., Dağli E., Açik S., Özcan T. & Erdoğan H. 2011. An updated review of alien species on the coasts of Turkey. Mediterranean Marine Science 12 (2): 257–315.

Karachle P. K., Zenetos A. & Xentidis N. J. 2017a. The ESENIAS countries' marine alien species experts: an updated inventory. Acta Zoologica Bulgarica 9: 261–282.

Karachle P., Foka M. C., Crocetta F., Dulčić J., Dzhembekova N., Galanidi M. & Zenetos A. 2017b. Setting-up a billboard of marine invasive species in the ESENIAS area: current situation and future expectancies. Acta Adriatica 58(3): 429–458.

Katsanevakis S., Poursanidis D., Hoffman R., Rizgalla J., Rothman S. B. S., Levitt-Barmats Y. A. & Zenetos A. 2020. Unpublished Mediterranean records of marine alien and cryptogenic species. BioInvasions Records 9 (2): 165–182.

Lowe E. F. & Turner R. L. 1976. Aggregation and trail-following in juvenile *Bursatella leachii pleii* (Gastropoda: Opisthobranchia). Veliger 19: 153-155.

Özalp H.B. & Alparslan M. 2016. Scleractinian diversity in the Dardanelles and Marmara Sea (Turkey): morphology, ecology and distributional patterns. Oceanological and Hydrobiological Studies 45 (2): 259–285.

Öztürk B., Doğan A., Bitlis-Bakir B. & Salman A. 2014. Marine Molluscs of the Turkish coasts: an updated checklist. Turkish Journal of Zoology 38: 832–879.

Parasharya D. & Patel B. 2014. Spawning aggregation of *Melibe viridis* (Kellart, 1858) from Gulf of Kachchh-Western India. International Journal of Scientific and Research Publications 4 (3): 1–5.

Schlitzer R. 2018. Ocean Data View, https://odv.awi.de.

Selfati M., El Ouamari N., Crocetta F., Mesfioui A., Boissery P. & Bazairi H. 2017. Closing the circle in the Mediterranean Sea: *Bursatella leachii* Blainville, 1817 (Mollusca: Gastropoda: Anaspidea) has reached Morocco. Bioinvasions Record 6 (2): 129–134.

Tanrikul T. T. & Akyol O. 2012. First report on reproduction of Lessepsian Ragged Sea Hare *Bursatella leachii* (De Bleinbille, 1817) (Mollusca: Gastropoda) in Izmir Bay (Aegean Sea, Turkey). Journal of Fisheries Sciences 6 (2): 96–98.

Trainito E. & Doneddu M. 2015. Contribution to the knowledge of the molluscan fauna in the Marine Protected Area Tavolara-Punta Coda Cavallo: Ordo Nudibranchia. Bollettin Malacologia 51 (2): 54–70.

Türker A., Yalgin F. & Yapici S. 2020. Addition to the distribution of Opisthobranchia in the Turkish Aegean coasts. Mugla Journal of Science and Technology 6 (1): 27–31.

Türkmen A. & Demirsoy A. 2009. Contributions to the Eastern Mediterranean Opistobranchia (Mollusca, Gastropoda) Fauna of Turkey. Turkish Journal of Zoology 33: 57–69.

Tunçer S., Artüz L., Cengiz Ö., Önal U. & Poursanidis D. 2017. First record of the side gill slug *Pleurobranchaea meckeli* (Blainville, 1825) (Gastropoda: Heterobranchia) from Dardanelles (Çanakkale Strait) and new records from the Sea of Marmara, Turkey. Studia Marina 30 (1): 1–5.

Yokeş M. B. 2009. Addition to the knowledge of Opisthobranchia from Turkey. Triton 20: 5–19.

Zenetos A. 2019. Mediterranean Sea: 30 Years of Biological Invasions (1988-2017). In: Langar H. & Ouerghi A. (Eds.): Proceedings of the 1st Mediterranean Symposium on the Non-Indigenous Species (Antalya, Turkey, 18 January 2019). SPA/RAC, Tunis, pp. 13–19.

Zenetos A. & Galanidi M. 2020. Mediterranean non-indigenous species at the start of the 2020s: recent changes. Marine Biodiversity Records 13 (1): 1–17.

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