

ANNALES

*Analì za istrske in mediteranske študije
Annali di Studi istriani e mediterranei
Annals for Istrian and Mediterranean Studies
Series Historia Naturalis, 32, 2022, 2*



UDK 5

ISSN 1408-533X
e-ISSN 2591-1783



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Annali di Studi istriani e mediterranei
Annals for Istrian and Mediterranean Studies

Series Historia Naturalis, 32, 2022, 2

KOPER 2022

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Založništvo PADRE d.o.o.

Izdajatelja/Editori/Published by:

Zgodovinsko društvo za južno Primorsko - Koper / Società storica del Litorale - Capodistria[®]

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Redakcija te številke je bila zaključena 23. 12. 2022.

**Sofinancirajo/Supporto finanziario/
Financially supported by:**

Javna agencija za raziskovalno dejavnost Republike Slovenije (ARRS) in Mestna občina Koper

Annales - Series Historia Naturalis izhaja dvakrat letno.

Naklada/Tiratura/Circulation: 300 izvodov/copie/copies

Revija Annales, Series Historia Naturalis je vključena v naslednje podatkovne baze / La rivista Annales, series Historia Naturalis è inserita nei seguenti data base / Articles appearing in this journal are abstracted and indexed in: BIOSIS-Zoological Record (UK); Aquatic Sciences and Fisheries Abstracts (ASFA); Elsevier B.V.: SCOPUS (NL); Directory of Open Access Journals (DOAJ).

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received: 2022-04-19

DOI 10.19233/ASHN.2022.26

NEW DATA ON THE OCCURRENCE OF TWO LESSEPSIAN MARINE HETEROBRANCHS, *PLOCAMOPHERUS OCELLATUS* (NUDIBRANCHIA: POLYCERIDAE) AND *LAMPROHAMINOEA OVALIS* (CEPHALASPIDEA: HAMINOEIDAE), FROM THE AEGEAN SEA

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ABSTRACT

The authors have recently collected two Lessepsian heterobranchs from Turkey, namely Plocamopherus ocellatus Rüppell & Leuckart, 1828 and Lamprohaminoea ovalis (Pease, 1868), both of which were found significantly out of their known distribution ranges. The single individual of P. ocellatus collected at Akbük Cove is a new addition to the Aegean Sea malacofauna, while several individuals of L. ovalis observed from the Ayvalık Islands Nature Park and Saros Bay represent the northernmost occurrence limit of the species. Present findings suggest that P. ocellatus is currently a casual alien species in the region, while L. ovalis has established a breeding population in the northern Aegean Sea.

Key words: Aegean Sea, Lessepsian species, Heterobranchia

NUOVI DATI SULLA PRESENZA DI DUE ETEROBRANCHI MARINI LESSEPSIANI, *PLOCAMOPHERUS OCELLATUS* (NUDIBRANCHIA: POLYCERIDAE) E *LAMPROHAMINOEA OVALIS* (CEPHALASPIDEA: HAMINOEIDAE) NEL MAR EGEO

SINTESI

Gli autori hanno recentemente raccolto in Turchia due eterobranchi lessepsiani, ovvero Plocamopherus ocellatus Rüppell & Leuckart, 1828 e Lamprohaminoea ovalis (Pease, 1868), entrambi trovati significativamente al di fuori dei loro areali di distribuzione noti. Il singolo individuo di P. ocellatus trovato ad Akbük Cove è una nuova aggiunta alla malacofauna dell'Egeo, mentre diversi individui di L. ovalis osservati nel Parco Naturale delle Isole Ayvalık e nella Baia di Saros rappresentano il limite più settentrionale di presenza della specie. I risultati attuali suggeriscono che P. ocellatus sia una specie aliena attualmente casuale nella regione, mentre L. ovalis abbia stabilito una popolazione riproduttiva nell'Egeo settentrionale.

Parole chiave: Egeo, specie lessepsiane, Heterobranchia

INTRODUCTION

Considering the quantitative occurrence of alien species in the Mediterranean Sea, Turkey can be placed in the centre of marine bioinvasions. Alien species diversity has increased almost twofold since 2005, currently reaching well over 500 species, which represents an immense biodiversity change (Çınar et al., 2005; 2021). The Levantine shores of Turkey are typically liable to a heavier invasion impact due to the proximity to the Suez Canal, but a considerable number of thermophilic alien species have also penetrated the Aegean Sea, primarily as a result of the fast warming of surface waters (Katsanevakis et al., 2020). While the number of documented occurrences of alien taxa has increased by 25.2% in the north-

ern Levant over the past decade, the corresponding diversity in the Aegean Sea denotes a drastic rise of 53.3% (from 165 to 253 species) (Çınar et al., 2011; 2021). The prominent evolution of Aegean Sea biota certainly requires an in-depth analysis of the impact of biological invasions and greater research effort, in which close monitoring of new species introductions is of utmost importance.

In this paper, we present novel information on the distribution of two Lessepsian marine heterobranchs from the Aegean coasts of Turkey. One of them, *Plocamopherus ocellatus* Rüppell & Leuckart, 1828, is a nudibranch native to the Red Sea and the Arabian Gulf, which penetrated the Mediterranean Sea by way of the Suez Canal during the late 1970s (Rothman & Galil, 2015). Almost two decades after its first record

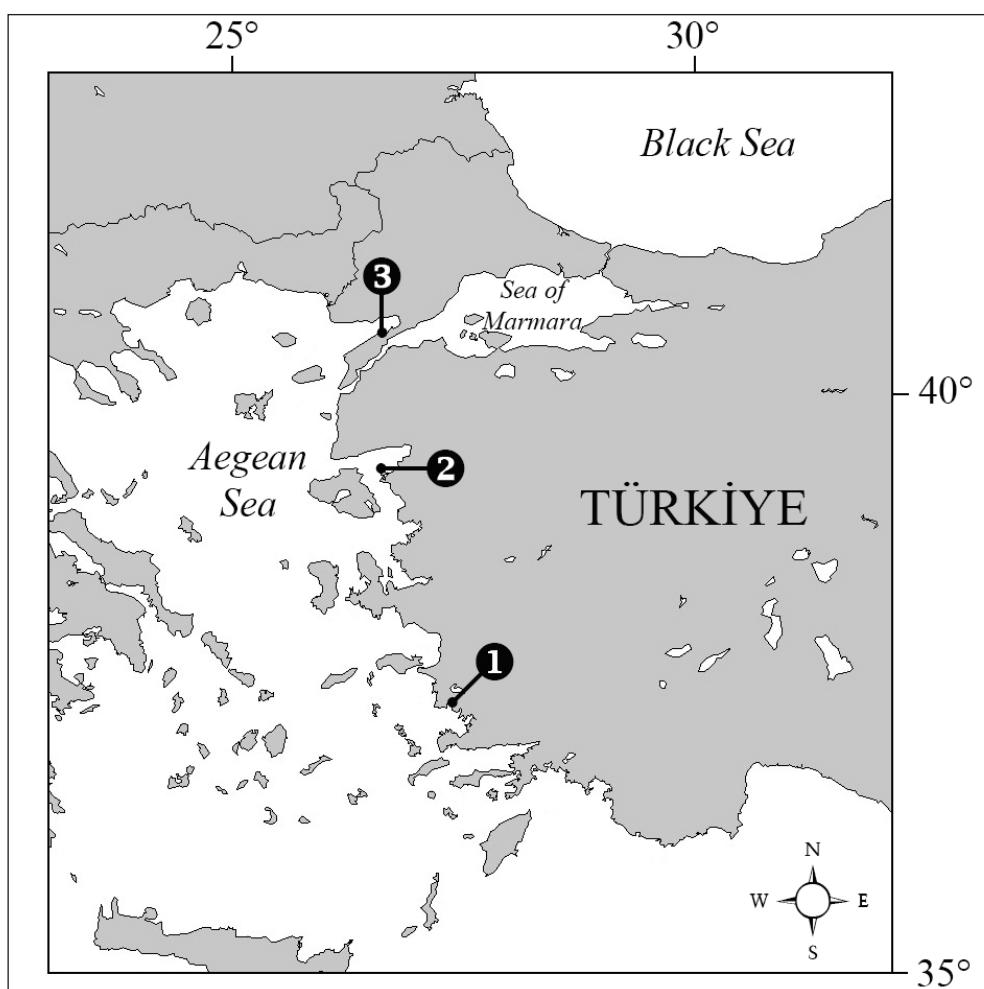


Fig. 1. Capture and observation localities of the two Lessepsian heterobranchs from the Aegean Sea. 1) *Plocamopherus ocellatus* (Akbük Cove), 2) *Lamprohaminoea ovalis* (Ayvalık Islands Nature Park), 3) *L. ovalis* (Saros Bay).

SI. 1: Lokalitete, kjer sta bili lesepski vrsti ujeti in opazovani v Egejskem morju.
1) *Plocamopherus ocellatus* (zaliv Akbük), 2) *Lamprohaminoea ovalis* (naravni park v okviru otočja Ayvalık), 3) *L. ovalis* (zaliv Saros).

from the Israeli coast (Barash & Danin, 1982), in 1998, the species was encountered by underwater photographers at Kaş (Antalya Bay, Turkey) (Rudman, 2002; Yokeş & Rudman, 2004), with further reports following from Lebanon and Cyprus (Valdés & Templado, 2002; Crocetta et al., 2013; Hoeksema & Yonov, 2021) and hereby for the first time from the Aegean Sea. The other species, *Lamprohaminoea ovalis* (Pease, 1868), is a cephalaspid of Indo-West Pacific origin. Its occurrence records from the Mediterranean Sea, dating to the early 2000s (as *Haminoea cyanomarginata*), are based on underwater photographs taken almost synchronously in the Gulf of Corinth (Greece), and in the Çeşme Peninsula and Antalya Bay (Turkey) (Rudman, 2003; Yokeş & Rudman, 2004). During the last two decades, the species has been reported from Cyprus, Croatia, Italy, Malta, Libya, and Spain (Lombardo & Marletta, 2021), and can be currently observed in Ayvalık Islands Nature Park and Saros Bay, showing a significant northern range expansion.

MATERIAL AND METHODS

On 24 October 2021, a single individual of *P. ocellatus* (80 mm in length) was collected from Akbük Cove (37.413782°N, 27.411052°E, Fig. 1, site 1) located along the southern Aegean Sea coast of Turkey. The specimen was found on a small rock over a sandy/muddy bottom, amid patches of *Cymodocea nodosa* (Ucria) Asch. just below the water surface (about 30 cm in depth). It was collected by hand, fixed later in 70% alcohol and preserved in AMBRD Laboratories for further analysis. Identification of the species was made according to descriptions given by Rudman (2002), Zenetos et al. (2004) and Rothman & Galil (2015).

During field excursions carried out at the Ayvalık Islands Nature Park (consisting of 19 islands of different dimensions), we were able to collect a total of eight *L. ovalis* during daytime scuba dives from Gunes Island (39.325855°N, 26.543048°E; 3 individuals; 8 April 2021; 4–5 m depth range), Alibey Island (39.386142°N, 26.646606°E; 3 individuals; 9 September 2021; 25–30 m depth range) and Ciplak Island (39.276091°N, 26.581306°E; 2 individuals; 9 December 2021; 5–10 m depth range) (Fig. 1, site 2). *Lamprohaminoea ovalis* was sampled exclusively at rocky substrates mostly covered by filamentous algae. In addition, several underwater photographs of six different *L. ovalis* individuals were taken on 27 October 2019 by a scuba diver in the vicinity of Kömür Harbor located in Saros Bay, northeastern Aegean Sea (40.458241°N, 26.511067°E; Fig. 1, site 3). The photographs were taken at a very shallow depth (1 to 2 m) over algae-covered rocks. Identification of the species was made according to Zenetos et al. (2004) and Oskars & Malaquias (2020).

RESULTS AND DISCUSSION

The sampled *P. ocellatus* individual (Fig. 2) had an elongated body, convex dorsum, branched appendages on the oral veil, small and ramified papillae along the mantle edge, lamellate rhinophores, a prominent keel in the posterior dorsal midline, and three pairs of laterodorsal processes, which are characteristic features of the species (Rudman, 2002; Zenetos et al., 2004). Body colour was brownish mauve with unevenly spread yellow spots of different sizes and shapes (some bearing dark-coloured flecks in the centre), in accordance with the description by Rothman & Galil (2015). Although previously believed to be a rare species, a total of 23 observations are available from 16 different localities throughout the eastern Levant, with Kaş shores off the Turkish coastline representing the westernmost occurrence limit (Hoeksema & Yonov, 2021). Until now, *P. ocellatus* has not been documented from the Aegean Sea and we report herein a significant northward range expansion of the species by more than 200 nautical miles from Kaş. The source and introduced population of *P. ocellatus* have been reported from a variety of depths (1.5–50 m) and habitat types (shipwrecks, rocks, mud, cave, marina wall, rock pool, etc.) (Hoeksema & Yonov, 2021). The present observation fits well with previous habitat descriptions, whereas the depth appears to be the shallowest hitherto recorded. The sampling site was examined thoroughly but neither an additional individual nor an egg capsule attached to hard substrates was found, so the recent observation indicates *P. ocellatus* to be a casual species in the Aegean Sea.

The Aegean Sea individuals of *Lamprohaminoea ovalis* were characterized by the combination of purple or dark blue-bordered mantle, white body, a large bluish spot separating the narrowly spaced eyes, and deeply bifurcated cephalic shield (Fig. 3), in accordance with Zenetos et al. (2004). The observed coloration fits the purple morph definition of Oskars & Malaquias (2020) and some individuals also bear vivid yellow round blotches along the body. In the Mediterranean Sea, the species has been observed both in the daytime and at night, from very shallow depths of 30 cm to as deep as 30 m on rocky surfaces covered by algae (Rudman, 2003; Zenetos et al., 2004; Rizgalla et al., 2018), which is consistent with our observations. The species is widely recorded in Mediterranean coastal ecosystems as one of the most invasive molluscans known (Lombardo & Marletta, 2021). In Turkey, *L. ovalis* has been intensively collected from all Levantine shores (except İskenderun Bay) and the whole southern Aegean Sea from Gökova Bay to the Çeşme Peninsula (Yokeş & Rudman, 2004; Yokeş et al., 2012). The recent findings from the Ayvalık Islands and Saros Bay considerably extend the distribution of *L. ovalis* northwards, by 50 and 100 nautical miles, respectively. This region was subjected to intense marine bio-



Fig. 2. The sampled individual of *Plocamopherus ocellatus* from Akbük Cove, Aegean Sea. (Photo: M. Bilecenoglu).

Sl. 2: Vzorčeni primerek vrste *Plocamopherus ocellatus* iz zaliva Akbük, Egejsko morje (Foto: M. Bilecenoglu).

diversity research a decade ago (Yokeş et al., 2013) and *L. ovalis* was almost certainly absent at the time, thus we may assume that the northern Aegean Sea occurrence of the species is a recent event. *Lamprohaminoea ovalis* displays a common mating ceremony involving unique trailing behaviour (M.B. Yokeş in Rudman, 2003) that we were able to observe both in the Ayvalık Islands and Saros Bay (Fig. 3). Based on this finding, we assume that the recently observed *L. ovalis* has established a breeding population in the northern Aegean Sea, but to determine whether an invasion process is underway at the moment or not, further focused underwater research is required.



Fig. 3. *Lamprohaminoea ovalis* individuals observed at a depth of 2 m in Saros Bay, northern Aegean Sea, displaying trailing behaviour. (Photo: O. Temizel).

Sl. 3: Sprevod primerkov vrste *Lamprohaminoea ovalis*, opazovanih na globini 2 m v zalivu Saros, severno Egejsko morje (Foto: O. Temizel).

ACKNOWLEDGEMENTS

We are indebted to Osman Temizel for giving permission of use of the *L. ovalis* photographs. This research has partially been financed by “Addressing Invasive Alien Species Threats at Key Marine Biodiversity Areas GEF VI Project” implemented by the Republic of Türkiye, Ministry of Agriculture and Forestry, the General Directorate of Nature Conservation and National Parks in cooperation with the United Nations Development Programme (UNDP) funded by the Global Environment Facility (GEF).

NOVI PODATKI O POJAVLJANJU DVEH LESEPSKIH MORSKIH POLŽEV
ZAŠKRGARJEV, *PLOCAMOPHERUS OCELLATUS* (NUDIBRANCHIA: POLYCERIDAE) IN
LAMPROHAMINOEA OVALIS (CEPHALASPIDEA: HAMINOEIDAE), IZ EGEJSKEGA MORJA

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POVZETEK

Avtorja sta pred kratkim v Turčiji našla dva lesepska polža zaškrgarja, in sicer vrsti *Plocamopherus ocellatus* Rüppell & Leuckart, 1828 in *Lamprohaminoea ovalis* (Pease, 1868). Vrsti sta bili najdeni povsem izven njunega znanega areala. Primerek vrste *P. ocellatus*, nabran v zalivu Akbük, predstavlja prvo najdbo za malakofavno Egejskega morja, medtem ko številni primerki vrste *L. ovalis* iz naravnega parka v okviru otočja Ayvalık in v zalivu Saros, predstavljajo najsevernejšo mejo razširjenosti vrste. Na podlagi najdb lahko sklepamo, da je *P. ocellatus* v regiji naključna tujerodna vrsta, medtem ko se vrsta *L. ovalis* v severnem Egejskem morju razmnožuje.

Ključne besede: Egejsko morje, lesepske selivke, Heterobranchia

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