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NEW DATA ON THE OCCURRENCE AND MORPHOLOGY OF THE ARMLESS SNAKE EEL, *DALOPHIS IMBERBIS* (OPHICHTHIDAE), FROM THE NORTHEASTERN MEDITERRANEAN SEA

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ABSTRACT

The armless snake eel, Dalophis imberbis*, is an ophichthid eel widely distributed in the Mediterranean Sea, but comparatively rare in the eastern basin. This study examined three specimens from Iskenderun Bay (northeastern Mediterranean Sea, Türkiye), which were identified based on standard morphological diagnostic characters and measured for key morphometric traits. The individuals were captured at shallow coastal depths, contributing new distributional and ecological data for the species in the eastern Levant Basin. Morphometric results are consistent with previously published Mediterranean data, although minor variations were observed among selected proportional measurements. These findings provide additional evidence for the presence of* D. imberbis *in Turkish waters and support the view that the species forms part of the established ichthyofauna of the eastern Mediterranean.*

Key words: Anguilliformes, Ophichthidae, Levant Basin, occurrence

NUOVI DATI SULLA PRESENZA E LA MORFOLOGIA DELLA BISCIA DI MARE, *DALOPHIS IMBERBIS* (OPHICHTHIDAE), NEL MEDITERRANEO NORD-ORIENTALE

SINTESI

La biscia di mare, Dalophis imberbis*, è un'anguilla della famiglia Ophichthidae ampiamente distribuita nel Mediterraneo, ma relativamente rara nel bacino orientale. In questo studio gli autori hanno esaminato tre esemplari provenienti dalla baia di Iskenderun (Mediterraneo nord-orientale, Türkiye), identificati sulla base dei caratteri diagnostici morfologici standard e misurati per i principali parametri morfometrici. Gli individui sono stati catturati in acque costiere poco profonde, fornendo nuovi dati distributivi ed ecologici per la specie nel bacino levantino orientale. I risultati morfometrici sono coerenti con i dati mediterranei precedentemente pubblicati. L'articolo fornisce ulteriori prove della presenza di* D. imberbis *nelle acque turche e supporta l'ipotesi che la specie faccia parte dell'ittiofauna stabilmente insediata del Mediterraneo orientale.*

Parole chiave: Anguilliformes, Ophichthidae, Bacino del Levante, presenza

INTRODUCTION

The family Ophichthidae includes 62 genera and 374 species, among which is the armless snake eel, *Dalophis imberbis* (Delaroche, 1809) (Fricke *et al*., 2026). The distribution range of *D. imberbis* extends from Mauritania to Spain and throughout the Mediterranean Sea (Froese & Pauly, 2026), where the species occurs at depths ranging from 5.4 m (Sabrina Lo Brutto, pers. comm.) to 115 m (Busalacchi *et al*., 2010). *D. imberbis* is considered an established member of the Mediterranean anguilliform fauna (Kovačić *et al.,* 2021) and has been found in the Turkish Aegean and Mediterranean waters (Bilecenoğlu, 2024). However, most occurrence records originate from the western and central Mediterranean basins (*e.g.*, Italian waters, Bonifazi *et al.,* 2019; Libyan waters, Elbaraasi *et al.,* 2019; Adriatic Sea, Soldo & Bakiu, 2021; Algerian waters, Alkhalili *et al.,* 2025). In contrast, its presence in the eastern Mediterranean has been documented only through sporadic records (*e.g.*, Israeli waters, Golani, 2005; Syrian waters, Capapé *et al.,* 2021). Despite the species' broad distribution in the Mediterranean Sea, information on its occurrence and biological characteristics in the eastern Mediterranean remains limited. Therefore, the present study provides new data on the distribution and morphometric characteristics of *D. imberbis* in the northeastern Mediterranean Sea based on three specimens collected from Iskenderun Bay.

MATERIAL AND METHODS

Three specimens of *Dalophis imberbis* were captured in Iskenderun Bay (Fig. 1) by a commercial otter trawler (M/V Faik Baba; 400 hp) fitted with a net with a cod-end mesh size of 44 mm (stretched mesh, knot-to-knot) and a net opening width of 20 m. Trawling operations were conducted over a mixed mud–sand bottom at depths ranging from 54 to 69 m, at towing speeds of 2.2 to 2.8 knots. The specimens were captured at the following locations and depths: specimen no. 1 was caught at a depth of 63 m (36°47′4.5″–36°41′15.7″ N; 36°6′43.2″–36°5′19.7″ E); specimen no. 2 at 61 m (36°41′43.8″–36°44′47.0″ N; 36°4′52.3″–36°3′30.7″ E); and specimen no. 3 at 55 m (36°34′1.5″–36°34′57.8″ N; 36°1′9.7″–36°3′14.4″ E). Sampling was performed on 25 and 26 February 2013.

After capture, the specimens were kept frozen at –18 °C on board until fixation and were subsequently preserved in a 5% borax-buffered formalin solution. Species identification followed Bauchot (1986) and the scientific nomenclature conforms to the Fricke *et al*. (2026). Previous records of *D. imberbis* covering the period 1845-2026 were obtained from the Global Biodiversity Information Facility (GBIF, 2026), available at the following web page: https://www.gbif.org/species/2405106. The coordinates of these records were plotted using cartographic software QGIS version 3.40 to generate a distribution map of the species throughout the Mediterranean Sea (Fig. 1). The present description is based on the examination of the three specimens from Iskenderun Bay, which are deposited in the museum of the Department of Hydrobiology, Istanbul University, under catalogue numbers 2013-1052, 2013-1053, and 2013-1054.

RESULTS AND DISCUSSION

Description of the examined specimens (nos. 1–3, Fig. 2): body extremely cylindrical and elongated, snout pointed, lower jaw symphysis closer to the anterior border of the eye than to the tip of the snout, eyes minute and covered by skin; anterior nostrils short and tube-shaped, posterior nostrils located above upper lip; teeth conical and slightly curved, uniserial in both jaws, five premaxillary teeth forming a V-shape, small teeth present on vomer; gill openings ranging from midlateral to entirely ventral, crescent-shaped; all fins absent; caudal tip hardened; lateral line with 62–63 preanal pores and 7–8 prebranchial pores; body depth 2.2–2.5% of total length, head length 7.5–8.0% of total length; snout length 18.2–21.2%, eye diameter 5.9–8.1%, and interorbital width 8.0–10.2% of head length; colouration: dorsal surface brownish, tip of upper jaw dark brown, ventral surface whitish. The characteristics of the examined specimens match those reported in the literature, confirming the identification of the collected individuals as *Dalophis imberbis* (Delaroche, 1809). Their length measurements are presented in Tab. 1.

In light of the available literature, *D. imberbis* is considered a native member of the Mediterranean ichthyofauna, exhibiting a broad but highly patchy distribution across the basin. The apparent scarcity of records in several areas is most likely attributable to the species' cryptic behaviour, burrowing lifestyle, and the limited efficiency of conventional sampling methods targeting benthic eel-like species, rather than reflecting true absence. *D. imberbis* is rarely reported off the French coast (Bauchot & Pras, 1980; Béarez *et al*., 2017), while it appears relatively more frequently in Italian waters (Bonifazi *et al*., 2019). In the Adriatic Sea, it occurs at low densities (Likić *et al*., 2015). Further south, spawning activity for the species has been reported from the Bay of Algiers (Bauchot, 1986), whereas its presence along the Maghreb coast remains poorly documented, including in Algeria (Refes *et al*., 2010) and Tunisia (Bradaï *et al*., 2004). This likely reflects undersampling rather than true ab-

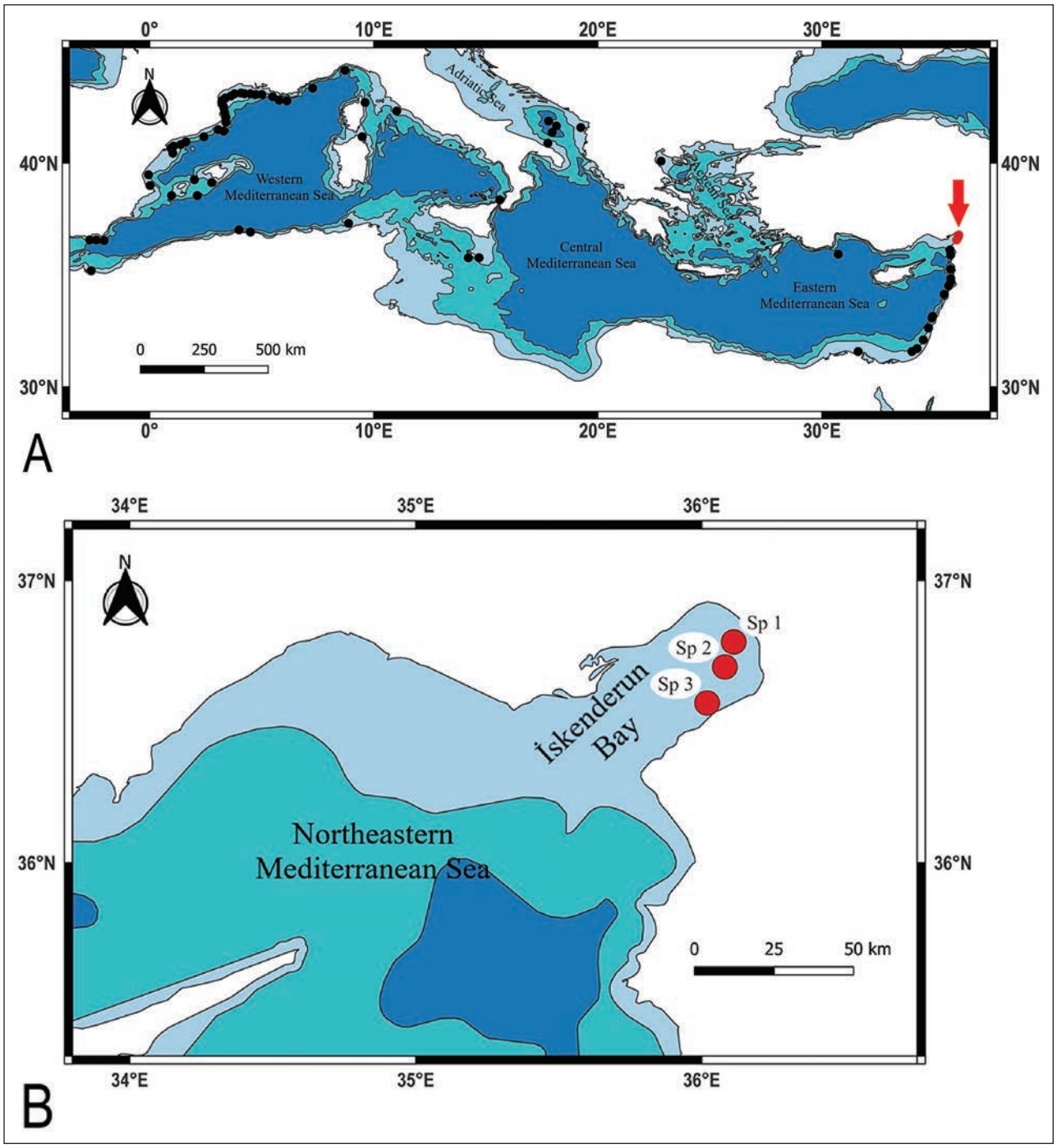

Fig. 1: Previous records (solid black circles) and present specimens (solid red circles, indicated by a solid red arrow) of *Dalophis imberbis* ***throughout the Mediterranean Sea (a), and a detailed map of the capture localities of the present specimens in Iskenderun Bay (b). The blue bathymetric colour gradient represents depth variation from 0 to 1000 m, from light to dark blue. The isobaths indicate depth contours at 200 m and 1000 m, progressing from the outer to the inner limits of the mapped area.***
Sl. 1: Prejšnji zapisi o pojavljanju vrste *Dalophis imberbis* ***po celotnem Sredozemskem morju (polni črni krogi) in pričujoči osebki (polni rdeči krogi, označeni s polno rdečo puščico) (a) ter podroben zemljevid lokacij ulova pričujočih osebkov v zalivu Iskenderun (b). Modri batimetrični barvni gradient predstavlja spreminjanje globine od 0 do 1000 m, od svetlo do temno modre. Izobate označujejo globinske konture pri 200 m in 1000 m, ki potekajo od zunanjih proti notranjim mejam usmerjenega območja.***

Fig. 2: Lateral view of** Dalophis imberbis**; scale (tape measure units) = 10 mm (a). Lateral view of the head of the same specimen; scale (tape measure units) = 10 mm (b). Dentition of the lower jaw; scale bar = 1 mm (c). Photo: Cem Dalyan.
Sl. 2: Stranski pogled na primerek** Dalophis imberbis**; merilo (enote na merilnem traku) = 10 mm (a). Stranski pogled na glavo istega primerka; merilo (enote na merilnem traku) = 10 mm (b). Zobovje spodnje čeljusti; merilo = 1 mm (c). Foto: Cem Dalyan.

sence. Eastwards, records from Greek (Papaconstantinou, 2014) and Turkish waters (Bilecenoğlu, 2024) confirm a continuous occurrence of the species, with the Levant Basin representing the easternmost extent of its distribution (Golani, 2005; El Sayed *et al.*, 2017; Bariche & Fricke, 2020). Therefore, *D. imberbis* should be regarded as a native but under-detected species in the eastern Mediterranean, with long-term monitoring occasionally revealing previously unrecorded occurrences in the region (Saad, 2005; Ali, 2018; Capapé *et al.*, 2021).

However, records derived from citizen science observations, particularly those including georeferenced photographs accessible through the GBIF platform (GBIF, 2026), have significantly improved the resolution of the known distribution of *D. imberbis* in recent years. Still, these opportunistic data cannot replace systematic scientific surveys, which remain essential to address persistent gaps in knowledge regarding the species' life history and population ecology. In this context, the most detailed morphometric study of *D. imberbis* to date has been conducted by Bonifazi *et al.* (2019), who reported selected measurements of 20 specimens out of approximately 200 stranded individuals in the central Tyrrhenian Sea. More recently, Capapé *et al.* (2021) presented morphometric data based on a single specimen from Syrian waters. Although the specimens presented in this study were collected several years prior to their detailed examination, their morphometric data remain valuable for the understanding of *D. imberbis* populations in the eastern Mediterranean. In fact, by reporting measurements of three further specimens captured in the eastern Mediterranean Sea, this study contributes additional morphometric information and enhances knowledge of the species' morphology and distribution in the region.

Although based on a limited number of specimens, the morphometric results of this study provide comparative data for *D. imberbis* from the eastern Mediterranean. Overall, proportional measurements show a high degree of consistency with previous studies, particularly for head length (7.50% TL in the present study vs. 7.03% in Bonifazi *et al.* (2019) and 7.73% in Capapé *et al.* (2021)) and eye diameter (0.52% TL vs. 0.41% and 0.50%, respectively). Similarly, body depth values (2.34% TL) closely match those reported by Bonifazi *et al.* (2019) (2.26% TL), suggesting limited morphological

Tab. 1: Morphometric data of the examined** Dalophis imberbis **specimens (nos. 1–3), presented as individual measurements and percentages of total length (TL). Data from relevant literature are also included for comparison. SE: standard error of the mean; N/A: not available.
Tab. 1: Morfometrični podatki preučenih primerkov vrste** Dalophis imberbis **(št. 1–3), predstavljeni kot posamezne meritve in odstotki celotne dolžine (TL). Za primerjavo so vključeni tudi podatki iz ustrezne literature. SE: standardna napaka aritmetične sredine; N/A: ni na voljo.

Measurements (mm)	Sp. no 1	Sp. no 2	Sp. no 3	Mean	±SE	% of mean TL	Bonifazi et al. (2019) % of mean TL	Capapé et al. (2021) % of mean TL
TL	234	261	208	234.3	12.5	100	100	100
Preanal length	100.7	117	88	101.9	6.9	**43.5**	N/A	**37.5**
Predorsal length	N/A	N/A	N/A	N/A	N/A	N/A	N/A	9.7
Prepectoral length	N/A	N/A	N/A	N/A	N/A	N/A	N/A	8.4
Body depth	5.9	5.6	4.9	5.5	0.3	**2.3**	**2.3**	**1.9**
Head length	18.6	18.6	15.5	17.6	0.8	**7.5**	**7.0**	**7.7**
Eye diameter	1.5	1.1	1.1	1.2	0.1	**0.5**	**0.4**	**0.5**
Preorbital length	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2.4
Snout length	3.4	3.9	3.3	3.5	0.2	**1.5**	**1.3**	N/A
Upper jaw length	6.3	6.6	4.4	5.8	0.6	**2.5**	**2.3**	N/A
Lower jaw length	5.3	5.8	3.6	4.9	0.6	**2.1**	N/A	**4.9**
Interorbital distance	1.8	1.5	1.6	1.6	0.1	**0.7**	N/A	**0.6**

variability across Mediterranean populations. Some differences, however, were observed in specific measurements, particularly preanal length, which was slightly higher in the present material (43.49% TL) compared to Capapé *et al*. (2021) (37.50% TL). Such variation may be a reflection of intraspecific variability, limited sample size, or methodological differences among studies, including measurement protocols and specimen preservation conditions. In particular, long-term preservation history, including prolonged freezing, may induce minor tissue shrinkage or deformation, potentially affecting linear morphometric ratios. The absence of several morphometric parameters in previous studies (*e.g.*, predorsal, prepectoral, and preorbital lengths in Bonifazi *et al*. (2019)) further limits direct comparisons but also highlights the added value of the present dataset in complementing the morphological knowledge of the species.

From a broader perspective, the limited availability of morphometric data for *D. imberbis* likely reflects its low economic importance and, consequently, the lack of research priority given to a species not targeted by commercial fisheries. Such situations often result in reliance on opportunistic sampling and incidental captures, with specimens frequently deposited in collections and examined only years later, when taxonomic or faunistic interest arises. In this context, a 13-year interval between collection and detailed analysis, as in the

present case, is not unusual for non-commercial, rarely studied benthic species. Museum and institutional collections are thus particularly important, as they provide essential material for retrospective morphological and faunistic studies of poorly known taxa. Such archived specimens allow the reconstruction of distributional and morphological baselines that would otherwise remain undocumented, especially for cryptic and low-priority species such as *D. imberbis*.

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NOVI PODATKI O POJAVLJANJU IN MORFOLOGIJI KAČASTE JEGULJE, *DALOPHIS IMBERBIS* (OPHICHTHIDAE), IZ SEVEROVZHODNEGA SREDOZEMSKEGA MORJA

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POVZETEK

Kačasta jegulja, Dalophis imberbis*, je vrsta iz družine kačastih jegulj (Ophichthidae), ki je široko razširjena v Sredozemskem morju, vendar razmeroma redka v njegovem vzhodnem bazenu. Avtorji so preučili tri osebke iz zaliva Iskenderun (severovzhodno Sredozemsko morje, Turčija), ki so jih določili na podlagi standardnih morfoloških diagnostičnih znakov, izmerjene pa so bile tudi njihove ključne morfometrične lastnosti. Primerke so ujeli v obalnih plitvinah, kar prinaša nove podatke o razširjenosti in ekologiji te vrste v vzhodnem Levantskem bazenu. Rezultati morfometričnih meritev so skladni s predhodno objavljenimi podatki za Sredozemlje, čeprav so bila med izbranimi proporcionalnimi meritvami opažena manjša odstopanja. Te ugotovitve zagotavljajo dodatne dokaze o prisotnosti vrste* D. imberbis *v turških vodah in podpirajo stališče, da ta vrsta predstavlja del ustaljene ihtiofavne vzhodnega Sredozemlja.*

Ključne besede: Anguilliformes, Ophichthidae, Levantski bazen, pojavljanje

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