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Abstract

This Collective Article compiles information on nineteen (19) species recorded in seven (7) Mediterranean countries (Croatia, Cyprus, Italy, Malta, Slovenia, Syria, and Türkiye) and across four major sub-basins (Adriatic, Western, Central, and Eastern Mediterranean). The documented taxa represent eight (8) phyla: Annelida (four species), Arthropoda (three), Bryozoa (one), Chordata (two), Cnidaria (two), Mollusca (five), Chlorophyta (one), and Ochrophyta (one). Observations originated from both dedicated scientific surveys (including trawl sampling, van Veen grabs, and harbor-wall scraping) and citizen science initiatives by divers, shell collectors, and recreational fishers.

Significant first records include *Notomastus aberans* (Slovenia), *Paraprionospio coora* (Italy), *Polydora cornuta* (Tyrrhenian Sea), *Coleusia signata* (Cyprus), *Penaeus aztecus* (Malta), *Pleopis schmackeri* (Syria), *Pteragogus trispilus* (Italy), *Triacanthus biaculeatus* (Türkiye), *Oculina patagonica* (Syria), and *Watersipora subatra* (Slovenia). In the Mollusca group, *Conomurex per-*

sicus extends its known range westward to the Messina Strait (southern Italy), and *Sepioteuthis lessoniana* is recorded for the first time in Italian waters. Additional first reports for Türkiye include *Alveinus miliaceus* and *Retusa desgenettii* in the Turkish Levantine Sea. The species *Uroteuthis (Photololigo) arabica* represents a first record for the entire Mediterranean basin. Finally, *Colpomenia peregrina* (Chlorophyta) and *Caulerpa taxifolia* (Ochrophyta) highlight ephemeral "boom-and-bust" occurrences in Croatia, raising questions about transient invasive dynamics. These collective findings underscore the importance of coordinated monitoring efforts, inclusive of both scientific and citizen-based approaches, to better understand and manage marine biodiversity shifts in the Mediterranean.

Introduction

The Mediterranean Sea, recognized globally as a critical hotspot for marine biodiversity, is undergoing accelerated ecological shifts influenced by climate change and anthropogenic pressures. It has also been identified as the most heavily invaded marine region worldwide (Bailey *et al.*, 2020), hosting over 1000 multicellular non-indigenous species (NIS), an increase of 40% in just the last decade (Zenetos *et al.*, 2022). This trend underscores the urgent need for robust and cost-effective surveillance methods, early detection tools, and adaptive management strategies. Yet, practical challenges remain, particularly around consistent monitoring, species-specific data availability, and effective transnational collaboration (Kleitou *et al.*, 2021; Garcia-Lozano *et al.*, 2025). Publishing first records of NIS distributions as short notes in peer-reviewed journals can be challenging. As a result, many initial country or regional records within the Mediterranean often remain unpublished, hindering their documentation unless part of extensive collaborative efforts that consolidate multiple observations (Katsanevakis *et al.*, 2020).

In response, Mediterranean Marine Science has been publishing its "Collective Article A'" series since 2011, aiming to remedy gaps in the documentation of marine invasions. Adopting classification criteria from Gerovasileiou *et al.* (2022), this series categorizes introduced species as (i) non-indigenous (NIS), (ii) cryptogenic (unclear origin), (iii) crypto-expanding (uncertain whether expansion is natural or human-mediated), or (iv) species of questionable status. This multifaceted framework acknowledges that many newly reported "introduced" species may be cryptic or long overlooked, complicating their placement within standard invasion paradigms.

Here, we present nineteen (19) new or noteworthy records spanning eight phyla: Annelida (four species), Arthropoda (three species), Bryozoa (one), Chordata (two), Cnidaria (two), Mollusca (five), Chlorophyta (one), and Ochrophyta (one); collected across seven Mediterranean countries: Croatia, Cyprus, Italy, Malta, Slovenia, Syria, and Türkiye (Fig. 1, Table 1). These include two cryptogenic species (*Paraprionospio coora* and *Watersipora subatra*) and 17 classified as NIS. Notably, five of these records emerged through citizen science initiatives including diver sightings (*Coleusia signata* and *Pteragogus trispilus*), recreational and trammel net fishing captures (*Triacanthus biaculeatus*, *Penaeus aztecus*, and *Sepioteuthis lessoniana*), and shell collecting (*Alveinus miliaceus* and *Retusa desgenettii*). The remaining 14 were documented using scientific sampling methods such as trawl surveys (*Uroteuthis (Photololigo) arabica*), van Veen grabs (*Paraprionospio coora* and *Prionospio pulchra*), and zooplankton net sampling (*Pleopis schmackeri*). Such involvement of trained volunteers continues to prove pivotal for early detection.

Notable highlights include:

i. New records of polychaetes in national waters: *Notomastus aberans* in Slovenian ports (subsection 1.1) and spionids expanding their known distributions in Italy, such as *Polydora cornuta*, previously confined to the Adriatic but now established in the Tyrrhenian Sea, and *Paraprionospio coora*, newly classified as cryptogenic in Italy (subsection 1.2).
ii. Range expansion of crustaceans: *Coleusia signata* recorded for the first time in Cyprus and filling a gap in the eastern Mediterranean (subsection 2.1), *Penaeus aztecus* caught for the first time in Maltese waters (subsection 2.2) and *Pleopis schmackeri* discovered off the Syrian coast (subsection 2.3), highlighting vectors like ballast water and shipping pathways.
iii. First in-country fish records: The Indo-Pacific *Triacanthus biaculeatus* recorded in northern Levantine Türkiye (subsection 4.2) and *Pteragogus trispilus* confirmed for the first time in Italian waters (subsection 4.1), expanding the list of Lessepsian fishes colonizing the central-western Mediterranean basin.
iv. Hard-bottom invertebrates: The cryptogenic bryozoan *Watersipora subatra* newly reported in Slovenia (subsection 3.1), and the invasive coral *Oculina patagonica* documented for the first time in Syria (subsection 5.2), suggesting ongoing anthropogenic transport and climate-driven range expansions.
v. Cephalopod introductions: Among molluscan records, *Sepioteuthis lessoniana* was caught in Lampedusa (subsection 6.2), and most strikingly, *Uroteuthis (Photololigo) arabica* represents the first record in the entire Mediterranean (subsection 6.4), pointing to the Suez Canal as a key dispersal route for squid species. Other Mollusca records include *Alveinus miliaceus* and *Retusa desgenettii* collected 13 years ago in 2012 by a shell collector, constituting the first detections in Türkiye and first record from the Levantine area of Türkiye, respectively (subsection 6.3). The species *Conomurex persicus* extends its western distribution in the Mediterranean and is recorded for the first time from Messina Strait, Calabria, Italy (subsection 6.1).
vi. Ephemeral macroalgae: *Colpomenia peregrina* (Chlorophyta) and *Caulerpa taxifolia* (Ochrophyta) were documented in Croatian waters but vanished in subsequent years (subsection 7.1 and 8.1). Such "boom-

Fig. 1: Locations of records for the species presented in the current article. Location numbers (LN) correspond to those listed on Table 1.

Table 1. Information about species records by phylum. Basin (EMED = eastern Mediterranean (i.e., Aegean and Levantine), CMED = central Mediterranean (i.e., Central and Ionian Sea), ADRIA = Adriatic, WMED = western Mediterranean), Region (*sensu* Spalding *et al.*, 2007), country, and location number as in Figure 1 (LN). SC: the subsection of this article in which the species' record appears.

Taxon	Basin	Region	Country	Location	SC	LN
Phylum Annelida						
Notomastus aberans Day, 1957	ADRIA	Adriatic Sea	Slovenia	Front of the port of Koper	1.1	13
Paraprionospio coora Wilson, 1990	WMED	Western Mediterranean	Italy	Latium coast	1.2	14
Polydora cornuta Bosc, 1802	WMED	Western Mediterranean	Italy	Commercial Port of Civitavecchia	1.3	14
Prionospio pulchra Imajima, 1990	ADRIA	Adriatic Sea	Italy	Foce Reno and Lido Adriano	1.4	14
Phylum Arthropoda						
Coleusia signata (Paulson, 1875)	EMED	Levantine Sea	Cyprus	Protaras	2.1	5
Penaeus aztecus Ives, 1891	CMED	Ionian Sea	Malta	Saint Paul's Bay	2.2	11
Pleopis schmackeri (Poppe, 1889)	EMED	Levantine Sea	Syria	Ras Al Basit	2.3	4
Phylum Bryozoa						
Watersipora subatra (Ortmann, 1890)	ADRIA	Adriatic Sea	Slovenia	Front of the port of Koper	3.1	12
Phylum Chordata						
Pteragogus trispilus Randall, 2013	CMED	Tunisian Plateau / Gulf of Sidra	Italy	Pelagie Islands	4.1	16
Triacanthus biaculeatus (Bloch, 1786)	EMED	Levantine Sea	Türkiye	Hatay	4.2	1
Phylum Cnidaria						
Cassiopea cf. *andromeda* (Forskål, 1775)	CMED	Ionian Sea	Italy	Augusta	5.1	10

Continued

Table 1 continued

Taxon	Basin	Region	Country	Location	SC	LN
Oculina patagonica de Angelis D'Ossat, 1908	EMED	Levantine Sea	Syria	Ibn Hani	5.2	2
Phylum Mollusca						
Conomurex persicus (Swainson, 1821)	CMED	Western Mediterranean	Italy	Calabria	6.1	9
Sepioteuthis lessoniana R. P. Lesson, 1831	CMED	Tunisian Plateau / Gulf of Sidra	Italy	Lampedusa	6.2	15
Alveinus miliaceus (Issel, 1869)	EMED	Levantine Sea	Türkiye	Iskenderun Gulf	6.3	3
Retusa desgenettii (Audouin, 1826)	EMED	Levantine Sea	Türkiye	Iskenderun Gulf	6.3	3
Uroteuthis (Photololigo) arabica (Ehrenberg, 1831)	EMED	Levantine Sea	Türkiye	Anamur coast	6.4	6
Phylum Ochrophyta						
Colpomenia peregrina Sauvageau 1927	ADRIA	Adriatic Sea	Croatia	Vira Cove fishing shelter	7.1	8
Phylum Chlorophyta						
Caulerpa taxifolia (M.Vahl) C.Agardh, 1817	ADRIA	Adriatic Sea	Croatia	Stari Grad Bay	8.1	7

and-bust" patterns may indicate pathogens, local environmental stressors, or insufficient conditions for long-term establishment, offering valuable case studies of ephemeral invasions.

Organized alphabetically by Kingdom and Phylum (Table 1), contributions in this collective article highlight the important role of collaborative research efforts, including citizen science and targeted scientific surveys. The combination of morphological analyses, genetic tools (where available), and careful field observations has shed light on the taxonomic intricacies and expansion dynamics of species that might otherwise remain undetected or misidentified.

1. ANNELIDA

1.1 First record of the polychaete *Notomastus aberans* Day, 1957 (Annelida, Capitellidae) in Slovenian waters

Lisa SANDRI and Valentina PITACCO

The polychaete *Notomastus aberans* Day, 1957, is a capitellid distributed from the Indian Ocean to the Red Sea (Day, 1957; Çinar, 2009). Today it is considered a Lessepsian migrant and is colonizing the Mediterranean (Çinar, 2009). It has spread from the southern part of the Aegean and the Adriatic to the Tyrrhenian and Ligurian Seas, the Gulf of Lion, the Iberian Mediterranean coasts and the Alboran Sea (Parapar *et al*., 2015 and citation therein). It has also been reported in the northern Adriatic Sea, in Italy (Cabrini *et al*., 2016) and Croatia (Mikac, 2015), but it has never been reported in Slovenia.

As part of the Slovenian National Monitoring Programme, a field sampling campaign was carried out in May and September 2024. A total of five specimens of *N. aberans* were collected at 3 stations (Site 1: 45.559650° N, 13.719983° E, 16 m; Site 2: 45.591667° N, 13.666667° E, 22.4 m; Site 3: 45.590000° N, 13.632167° E, 24.7 m) in front of the port of Koper (Slovenia, northern Adriatic).

The specimens were identified as *N. aberans*, based on morphological traits, in agreement with the descriptions by Day (1957) and Parapar *et al.* (2015). All specimens were broken but still showed the main morphological features to identify them (Fig. 2A). The prostomium of *N. aberans* is conical with rather undefined eyespots. The peristomial ring is achaetous, followed by 11 thoracic segments. The first chaetiger has only notopodial capillaries, chaetigers 2-11 have capillaries in both rami (Fig. 2B). The transition from thorax to abdomen does not show any significant change in size. The hooks are long and thin with a slightly curved handle. The species differs from *Notomastus formianus* Eisig, 1887 because the main tooth is topped by four rows of denticles instead of 5-6 rows of denticles, thoracic branchiae are absent and the genital pore is not well developed. Instead, the other morphologically closest species, *Notomastus mossambicus* (Thomassin, 1970), has two rows of denticles above the main tooth of the hook, a prostomium with blunt anterior end and first thoracic segments slightly bi-annulated.

The occurrence of *N. aberans* in commercial ports in the northern Adriatic Sea has been previously documented and its introduction explained *via* ship ballast waters (Cabrini *et al*., 2016). The vicinity of our sites to the Port of Koper confirms that commercial ports can serve as hotspots for biological invasions. Nevertheless, the presence of *N. aberans* in Slovenia could also be the result of range expansion from other Adriatic populations previously recorded.

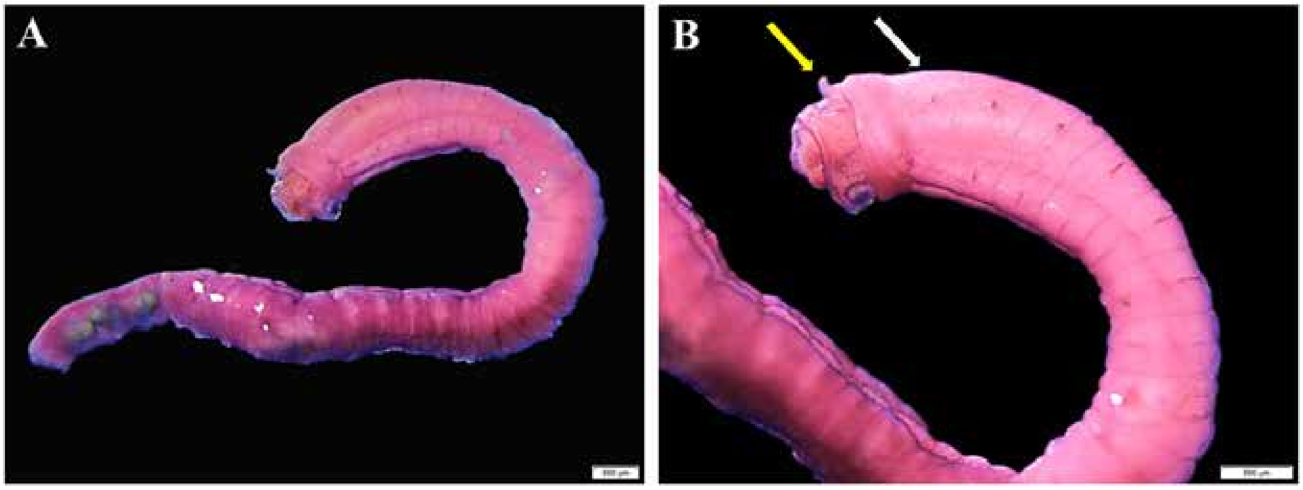

Fig. 2: (A) Identified specimen of *Notomastus aberans*; (B) Anterior region with first abdominal segment side view; the white arrow indicates the first chaetiger with only notopodial capillaries, the yellow arrow indicates the prostomium.

1.2. New records of non-indigenous and cryptogenic spionids (Annelida, Spionidae) in Italian waters

Andrea BONIFAZI, Emanuele MANCINI, and Marco LEZZI

Spionidae Grube, 1850 is one of the most diverse and widespread families of polychaetes in the seas worldwide. In this study, we report the first record of *Paraprionospio coora* Wilson, 1990 in Italian waters, the first record of *Polydora cornuta* Bosc, 1802 in the Tyrrhenian Sea and we confirm the presence of *Prionospio pulchra* Imajima, 1990 in Italian waters. To date, in Italy seven non-indigenous spionid species have been reported, but five of these are considered questionable (Langeneck *et al*., 2020).

Paraprionospio coora was described from the Pacific coast of Australia and it has been reported along the western Pacific coasts, the European Atlantic coasts (Bay of Biscay), and in the Mediterranean Sea (in Spain, Greece and Türkiye) (Martínez & Adarraga, 2013). Although initially considered an alien species, it is currently classified as a cryptogenic species in the Mediterranean basin (Yokoyama *et al*., 2010). *Polydora cornuta* is considered an opportunistic and highly invasive species; its abilities to rapidly colonise disturbed and polluted environments (Çinar *et al*., 2005) and to spread to new areas using ballast water and fouling as transport vectors makes it one of the most invasive species in the Mediterranean (Bertasi, 2016). In the Mediterranean Sea, it was recorded in Italy, Spain, Türkiye and Greece; however, in Italian waters, *P. cornuta* has only been recorded in three lagoons in the northern Adriatic Sea (Bertasi, 2016). *Prionospio pulchra*, which was originally described from Japanese waters, has been reported as an invasive non-indigenous species in both the Eastern Atlantic Ocean and the Eastern Mediterranean Sea (Dağlı & Çinar, 2011; Langeneck *et al*., 2020).

A total of 12 specimens of *P. coora* were collected on mud-sandy substrata in the Tyrrhenian Sea: seven specimens in April 2023 in the southern Latium coast at 44 m depth (41.166943° N, 13.701504° E, Central Tyrrhenian Sea) and five in July 2024 in the northern Latium coast at 25 m depth (42.223923° N, 11.664415° E, Central-Northern Tyrrhenian Sea). *Paraprionospio coora* was identified following Yokoyama *et al.* (2010): prostomium with two pairs of black eyes; brown pigment patch on the lateral side of the peristomium (Fig. 3A); three pairs of branchiae on setigers 1–3, with the first and second pairs of branchiae of approximately equal length and third branchiae shortest (Fig. 3B); hooded hooks with 3–4 rows of accessory teeth above the main fang (Fig. 3C). In July 2024, 22 individuals of *P. cornuta* were sampled in the same coastal area, within the Commercial Port of Civitavecchia (42.093768° N, 11.787712° E). The individuals were sampled within the Commercial Port of Civitavecchia (2 m deep, on the harbour walls), in an area characterised by intense naval traffic which promotes the deposition of fine sediment on harbour walls (port tug mooring area) (42.093768° N, 11.787712° E). The identification of *P. cornuta* was carried out following Bertasi (2016): prostomium distally expanded and incised at the frontal edge, with 4 eyes and a short occipital antenna (Fig. 3D); a caruncula extending to the third chaetiger (Fig. 3D); chaetiger 1 without notochaetae; presence of falcate spines and feather-like companion chaetae in chaetiger 5 (Fig.

3E); bidentate hooded hooks from chaetiger 7 (Fig. 3F). A total of about 40 specimens of *P. puchra* were found in December 2019, collected off Foce Reno (44.595487° N, 12.286136° E), and in November 2021, 500 meters off the coasts of Lido Adriano (44.401971° N, 12.327511° E). *Prionospio pulchra* was identified following Dağlı & Çınar (2011): rounded prostomium with 3–5 peaks (Fig. 3H, I); branchiae distinctly longer (at least 4–5 times) than the notopodial lamellae (Fig. 3G, H).

The species *P. coora* and *P. pulchra* were collected by using an 18 L Van Veen grab; *Polydora cornuta* was sampled by scraping on the harbour walls at 2 m depth. All three species have probably been confused with other species (Bertasi, 2016). *Paraprionospio coora* was previously misidentified as *P. pinnata* (Yokoyama *et al*., 2010), but it can be differentiated by the presence of pigment patches on peristomium (Fig. 3A), a small papilla on posterior margin of peristomium (Fig. 3B), and a very long first and second pair of branchiae. *Polydora cornuta* was previously misidentified as *Polydora ciliata* (Johnston, 1838) (Bertasi, 2016), but it can be distinguished from the latter by the presence of both the median antenna and feather-like companion chaeta (Çinar *et al*., 2005). It is important to note that the specimens of *P. cornuta* were sampled within the layer of fine mud (approximately 2 cm) that covered the biofouling of the harbour walls. Although *P. cornuta* is typically associated with mobile substrates (Çinar *et al*., 2005; Bertasi, 2016), previous studies have demonstrated that this species can also colonise hard substrates in anthropized environments (Karhan *et*

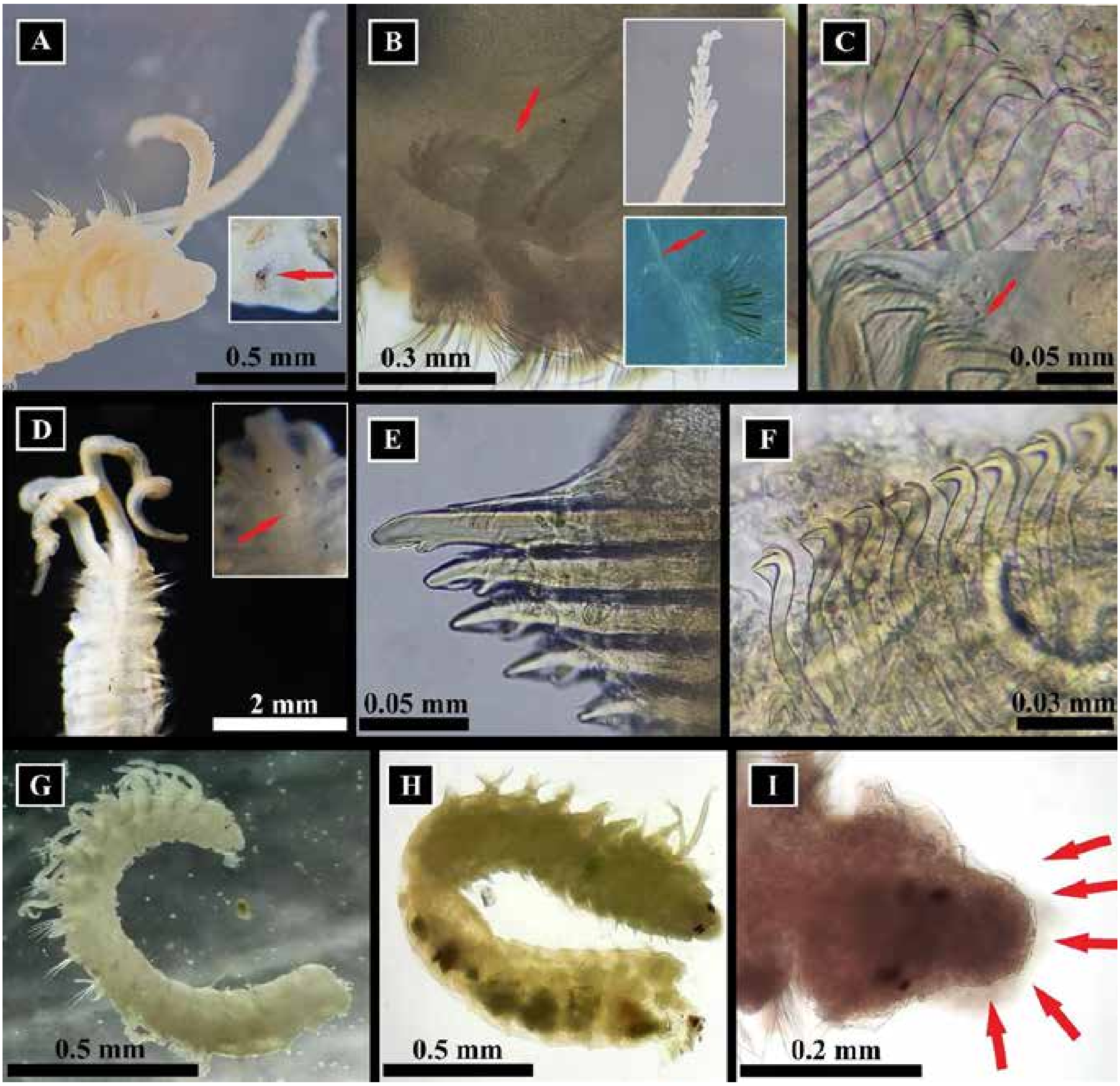

Fig. 3: *Paraprionospio coora*: (A) Prostomium, peristomium and a focus on the brown pigment patch on its lateral side; (B) focus on the first branchiae and on the small papilla on posterior margin of peristomium; (C) uncini. *Polydora cornuta*: (D) Prostomium and focus on the four eyes and the short occipital antenna; (E) falcate spines in chaetiger 5; (F) bidentate hooded hooks from chaetiger 7. *Prionospio pulchra*: (G)-(H) branchiae distinctly longer than the notopodial lamellae; (I) rounded prostomium with 3–5 peaks (scales = 2 mm for D; 0.5 mm for A, G, H; 0.3 mm for B; 0.2 mm for I; 0.05 mm for C, E; 0.03 mm for F).

al., 2008). Dağlı & Çınar (2011) suggested that the morphotype of *Prionospio cirrifera* Wirén, 1883 identified in Italian brackish environments corresponds to *P. pulchra*. This work increases the knowledge of the distribution of non-indigenous and cryptogenic polychaetes in the Mediterranean Sea, reporting the first record o *P. coora* in Italian waters, the first record of *P. cornuta* in the Tyrrhenian Sea, and confirming the presence of *P. pulchra* in Italian waters.

2. ARTHROPODA

2.1 First record of *Coleusia signata* (Paulson, 1875) (Decapoda: Leucosiidae) in Cyprus through citizen science

Periklis KLEITOU and Fabio CROCETTA

Positioned approximately 400 km north of the Suez Canal, Cyprus is strategically significant for the early detection and study of non-indigenous species (NIS) before they proliferate throughout the Mediterranean. Despite its location and proximity to major pathways of NIS, Cyprus reports fewer NIS compared to neighbouring countries. In the last decade, recent enhancements in social media and citizen science initiatives have led to the finding of several new NIS, suggesting that the previously noted paucity may have been mostly due to insufficient research efforts (Kleitou *et al.*, 2019).

The Indo-Pacific brachyuran *Coleusia signata* (Paulson, 1875) is a member of the family Leucosiidae Samouelle, 1819, first detected in Israel in the Mediterranean in 1953 and then further documented in Egypt, Lebanon, Türkiye, Syria, and Greece (Holthuis, 1956; Galil, 2006). It has a nearly hemispherical carapace, smooth and markedly convex, with a frontal region narrowed and upturned. Its epibranchial margin is thickened, milled, and continuous with finely-milled crest that forms the posterior margin of the dorsum of the carapace. Its chelipeds are massive, carinated in the upper margin of the chela, and ornamented with fungiform granules at the base, while the walking legs are short and slender. These distinctive morphological traits facilitate its reliable and accurate identification in the Mediterranean Sea (Galil, 2006).

During nocturnal SCUBA dives conducted on infralit-

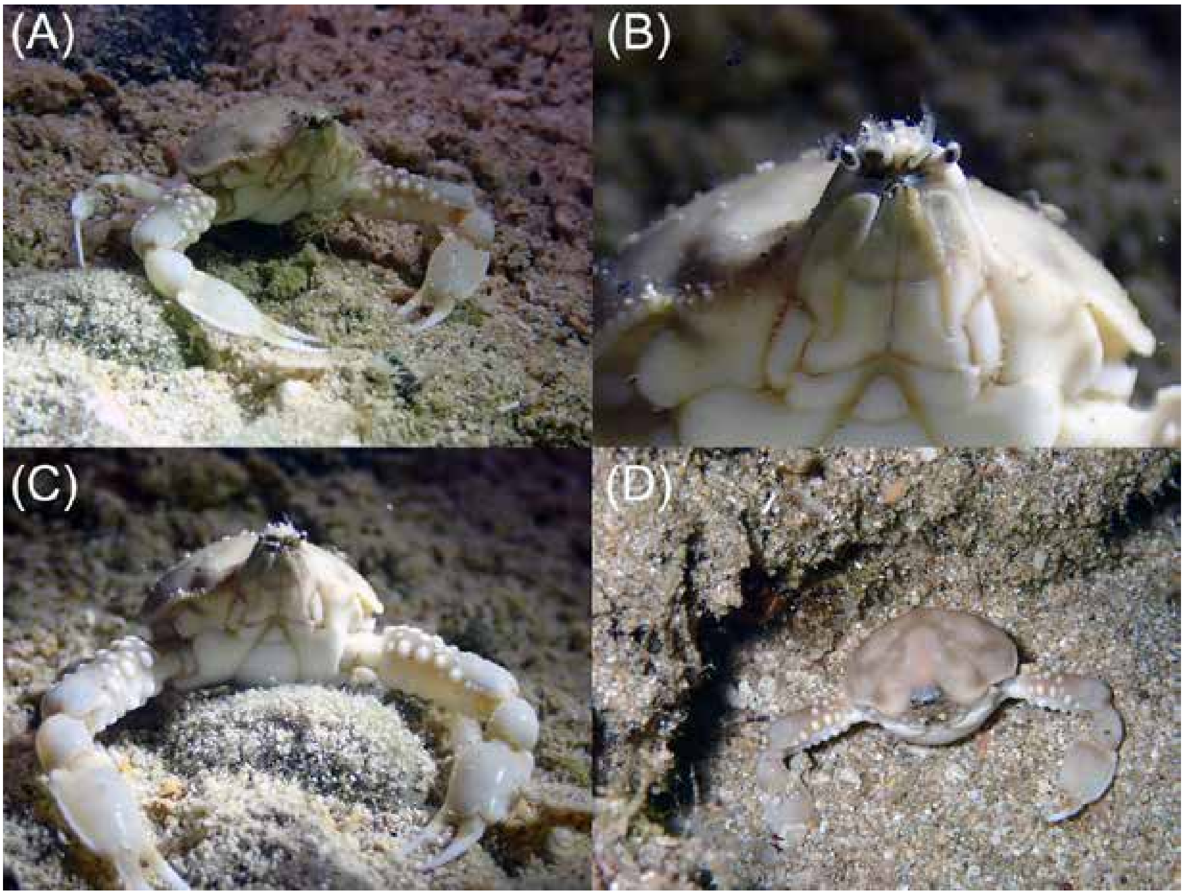

Fig. 4: *Coleusia signata* from Green Bay, eastern Cyprus. Photo credits, Figs A, B, C: Gareth Griffiths, 05/09/2023; Fig. D: Maria Siokouros-Oscarsson, 28/08/2024.

toral waters below 10 m depth, in sandy gravel substrates in eastern Cyprus (Green Bay: ~35.0010° N, 34.0683° E), the species was first observed on 5th September 2023, (Fig. 4A-C), and then on 28th August 2024 (Fig. 4D). In both cases, the specimen remained stationary under the dive lights, thus facilitating the observation. They were soon photographed and reported directly to the authors of this note as part of the citizen science initiative *"Is it alien to you? Share it!!!"*. These sightings constitute for the first records for Cyprus, increasing the inventory of reported non-indigenous decapod species in Cyprus to 21 taxa (Michail *et al*., 2024). They also highlight the importance of nocturnal surveys in detecting NIS that may otherwise go unnoticed.

2.2. First record of *Penaeus aztecus* Ives, 1891 (Decapoda, Penaeidae) from Maltese waters

Daryl AGIUS and Luca PISANI

The brown shrimp *Penaeus aztecus* Ives, 1891 is native to the western Atlantic (Williams, 1984) and was first recorded in the Mediterranean Sea in 2009 in the Gulf of Antalya (Deval *et al*., 2010) following records from the Black Sea (Khvorov *et al*., 2006), where it was misidentified as *Penaeus semisulcatus* De Haan, 1844. As sightings have increased, an eastern and western spread has become evident, with new records emerging from the Aegean, Adriatic, Ionian, and even Tyrrhenian Seas (Froglia & Scanu, 2023 and references therein). The main vector of introduction of this species into the Mediterranean is thought to be through ballast waters associated with shipping (Deval *et al*., 2010) but escapee from confinement is suspected to be a secondary vector, responsible for its rapid spread across the Mediterranean. Besides *Penaeus aztecus*, other non-indigenous species of the genus *Penaeus* have been recorded in the Mediterranean Sea, including *P. semisulcatus, P. hathor* Burkenroad, 1959, *P. japonicus* Spence Bate, 1888 and *P. pulchricaudatus* Stebbing, 1914 (Galanidi *et al*., 2023). The native *P. kerathurus* (Forskål, 1775) remains frequently observed in Maltese waters.

A single female specimen of *P. aztecus* was caught on 6th November 2024, off the northeast coast of Malta (35.959617° N, 14.412233° E) through a trammel net fishery at around 30 m depth. The specimen was olive-brown in colour with a red tinge at the extremities of the pereiopods, pleopods, and uropods (Fig. 5A). The carapace length was measured at 41 mm, with a total weight of 49.9 g.

The species was identified following the guidelines in Froglia & Scanu (2023). The adostral groove and crest were found to reach the full length of the carapace (Fig. 5B), the ventral rostrum had two teeth present (Fig. 5C), the telson was without spines or teeth, an ischial tooth on the first pereopod was present, and a well-defined dorsolateral sulcus could be observed on the last abdominal somite (Fig. 5D).

This record confirms the first known occurrence of *P. aztecus* in Maltese waters, bridging a gap previously

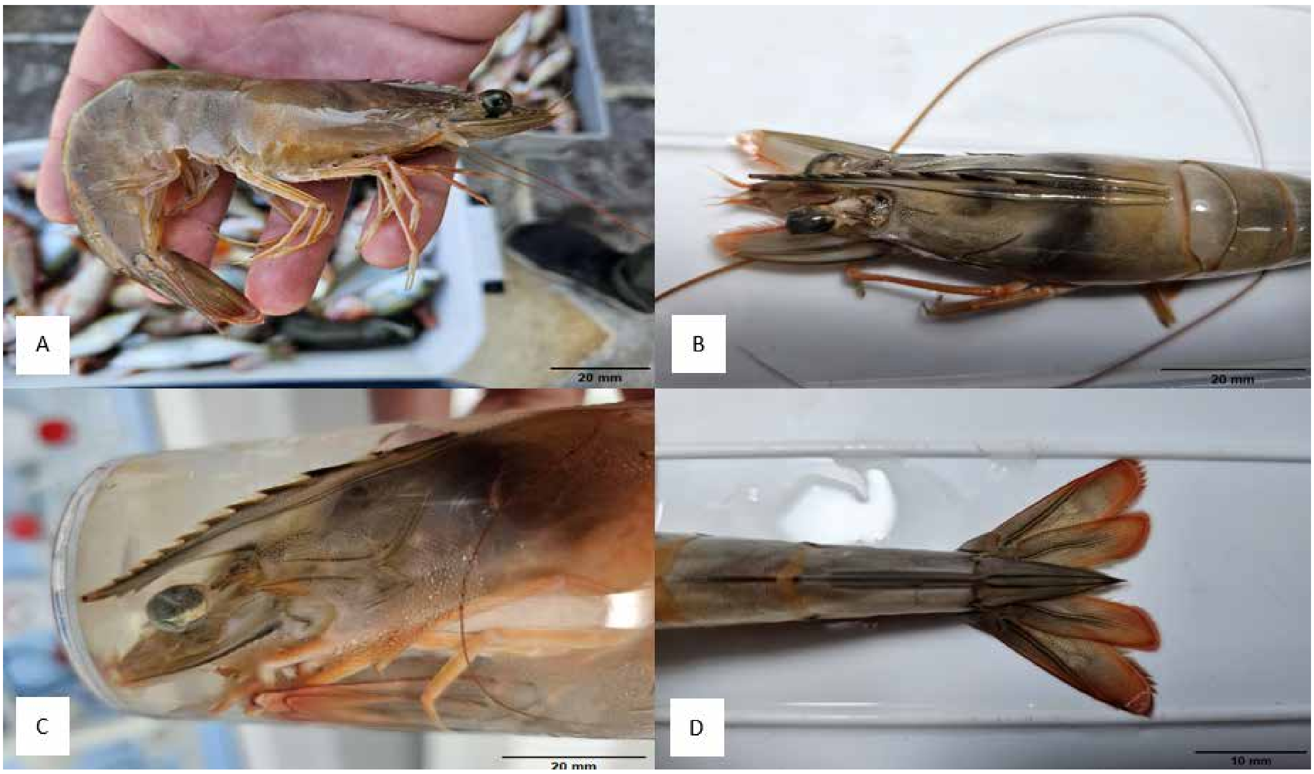

Fig. 5: Freshly caught *Penaeus aztecus* individual (A); the adostral groove and crest reaching the full length of the carapace (B); two (2) teeth on the ventral side of the rostrum (C); the well-defined dorsolateral sulcus on the last abdominal somite (D).

observed in the distribution of this species in the Central Mediterranean Sea. Whilst only one specimen has been successfully verified to date, fishers have stated that this was not their first encounter with a penaeid specimen exhibiting similar colouration, however one cannot exclude the possibility of misidentifications.

2.3. First record of *Pleopis schmackeri* (Poppe, 1889) from Syria (NE Levantine Sea, Eastern Mediterranean)

Haidar Bassam HASAN, Adib Hasan ZIENI and Wassim Mahmoud MAYYA

In this note, *Pleopis schmackeri* (Poppe, 1889) was observed for the first time in the coastal waters of Syria (Latakia basin). This alien cladoceran species was first recorded in southeastern coast of Türkiye (Iskenderun Bay, Cilician basin) in the Mediterranean Sea (Terbiyik Kurt & Polat, 2018), and later it was observed in Kuşadası, Güllük and Gökova Bays in the southeastern coast of Aegean Sea (Bariche *et al*., 2020). Originally, it was described in waters extending from the South China Sea to the Northeast of Honshu (Japan) (Kim & Onbe, 1989). There are also sporadic records of its presence in Aqaba Bay (Red Sea) (Gurney, 1927), Madagascar (Indian Ocean) (Onbé, 1999), and along the Brazilian coasts (Rocha, 1985).

Zooplankton sampling was carried out on 23rd July 2024 in Ras Al Basit region, north of Latakia, Syria (35.5103° N, 35.4711° E). Vertical hauls were performed at one station using WP2 Closing Net with 200 µ mesh size, from six water layers to a depth of 500 m (0-10, 10-25, 25-50, 50-100, 100-200, 200-500 m), accompanied by measurements of temperature and salinity (30.1°C and 39.3‰ respectively in the surface water; 16.8°C and 35.2‰ at 500 m depth). *Pleopis schmackeri* was found in all samples taken from all studied layers very rarely (varied between 0.2 ind/m^3 at 200-500 m and 1.9 ind/m^3 at 10-25 m), and the average abundance was 0.9 ind/m^3 (±0.66 ind/m^3, N=6) .

Pleopis schmackeri is described as an euryhaline species that prefers warm waters (Rocha, 1985). It has a hemispherical body (Fig. 6), four setae on exopods of thoracic limbs 1-3 (Fig. 6B), clearly distinguishing it from *Pleopis polyphemoides*, which has only three setae on exopods of thoracic limbs. The body length of this species varied between 388 and 494 µm. *Pleopis schmackeri* may have entered the eastern Mediterranean as a Lessepsian migrant from the Red Sea via the Suez Canal and was then transported north by alongshore currents towards Syrian coasts until reaching the Aegean Sea.

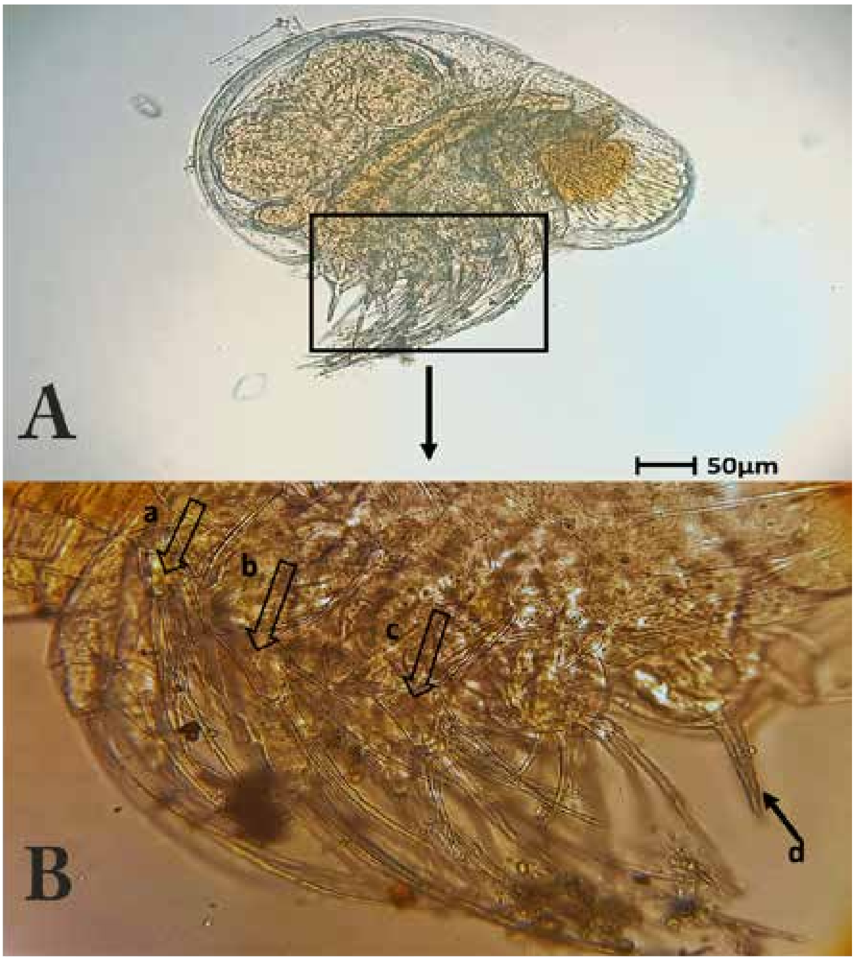

Fig. 6: (A) *Pleopis schmackeri*, Latakia (Syria), Body appearance, (B) a, b, c: setae exopod of Thoracic limbs, d: Caudal furca.

3. BRYOZOA

3.1. On the presence of the introduced *Watersipora subatra* (Bryozoa) and other watersiporid species along the Slovenian coast (northern Adriatic)

Ana FORTIČ and Petra SLAVINEC

Species within the bryozoan family Watersiporidae are encrusting with a putative cosmopolitan distribution. They are commonly found thriving in ports and marinas, due to their tolerance to copper and other pollutants, coupled with their short life cycle (McKenzie *et al*., 2012). In Slovenia, the presence of three species within this family was documented until 2020: the non-indigenous *Watersipora arcuata* Banta, 1969 (first recorded in 2017), the cryptogenic *Watersipora subtorquata* (d'Orbigny, 1852) (identified in 2019) (Mavrič *et al*., 2023) and the native *Terwasipora complanata* (Norman, 1864).

On 20th November 2020, a fourth species was discovered at the municipal beach in the city of Koper (45.549625° N, 13.725125° E). The beach is located near the Port of Koper −the largest port in the region. Several colonies were observed on exposed intertidal rocks during low tide (Fig. 7A) and subsequently collected for laboratory analyses. Initial observations under a stereomicroscope were followed by detailed identification using a scanning electron microscope (SEM), with the support of an expert taxonomist. The species was confirmed as part of the cryptogenic *Watersipora subatra* (Ortmann, 1890) complex, based on diagnostic features such as the presence of latero-oral intrazooidal septulae, the shape and dimensions of the orifice, and the size of the pseudopores (Vieira *et al*., 2014) (Fig. 7B, C, D). Due to its close resemblance to *W. subtorquata* and the taxonomic inconsistencies in genetic databases, the identifi-

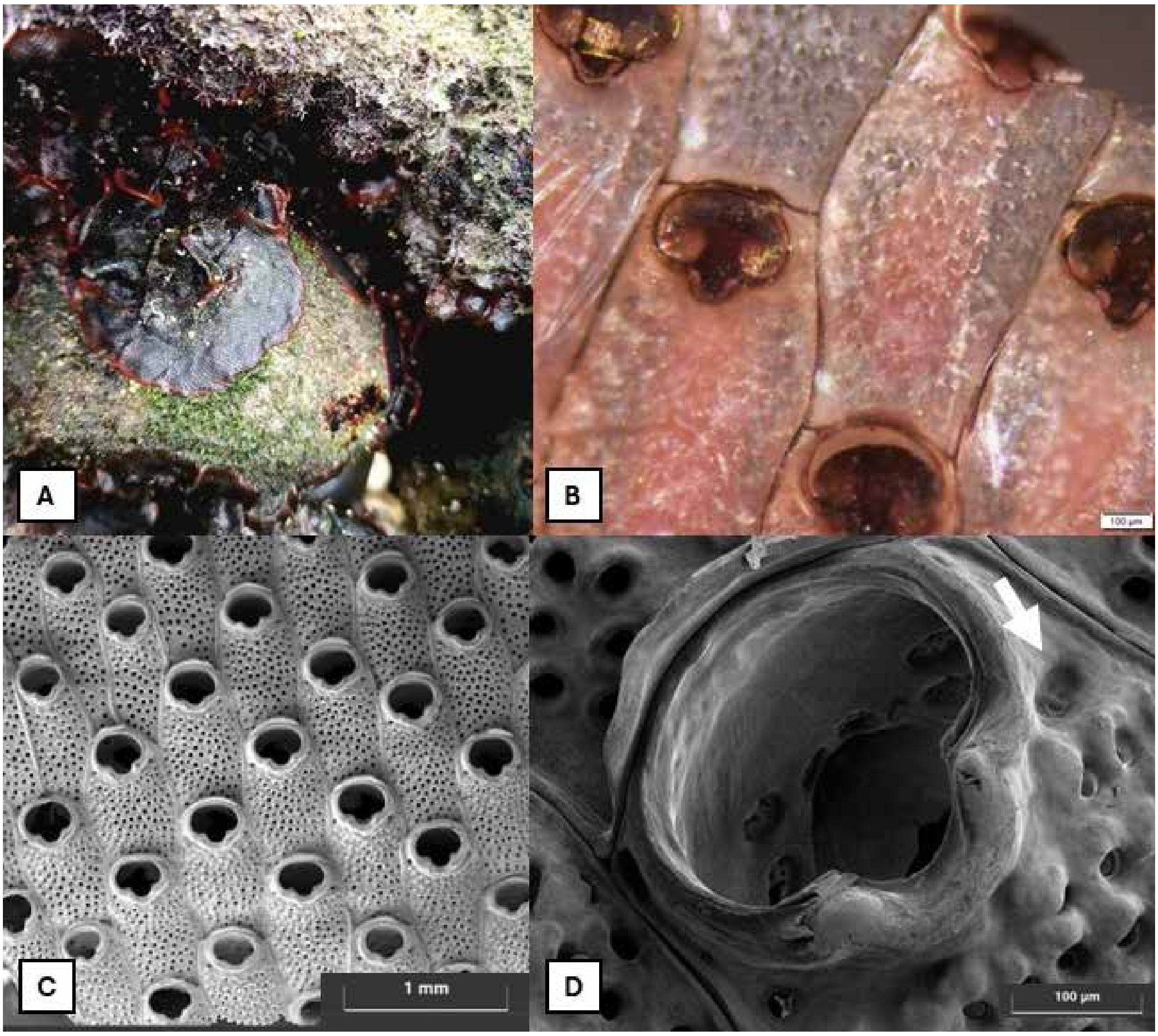

Fig. 7: A) Colonies belonging to the *Watersipora subatra* species complex observed in the lower intertidal belt in Koper, Slovenia. B) Autozooids viewed with stereomicroscope and SEM at different enlargements C), D) showing the latero-oral intrazooidal septula -white arrow.

cation of *W. subatra* in the Mediterranean Sea has only been recently confirmed (Gauff *et al*., 2023). However, the species is likely an established introduced species in the region. Beyond the Mediterranean, *W. subatra* is also found in the Pacific Ocean and has been reported as introduced into north Atlantic European waters, although its origin remains unknown (Reverter-Gil *et al*., 2019; Gauff *et al*., 2023).

Subsequent monitoring of introduced species along the Slovenian coast, targeted on non-indigenous species hotspots, such as ports, marinas, aquaculture facilities, and coastal wetlands in 2022 and 2023, recorded all four watersiporid species at various surveyed locations (Fig. 8). Rapid assessment methods included rapid scanning of the conspicuous species at the selected sites and selective qualitative sampling of the fouling community to look for smaller organisms. These organisms were identified in the laboratory and species identification of the watersiporids was carried out using SEM. The map in Figure 8 shows how the non-indigenous, cryptogenic and native watersiporid species are distributed along the Slovenian coast, which changes from east to west, with the greatest diversity observed in the marina Izola. *Watersipora subatra* was observed in the wider area around Koper and neighbouring Izola, which suggests that its introduction could be related to maritime traffic via the Port of Koper. Colonies of this bryozoan were frequently found in the intertidal zone, attached to the shells of non-indigenous oyster *Magallana gigas*, present in the Gulf of Trieste since the seventies of the last century (Lipej *et al*., 2012), on vertical concrete walls, as well as in the upper infralittoral zone.

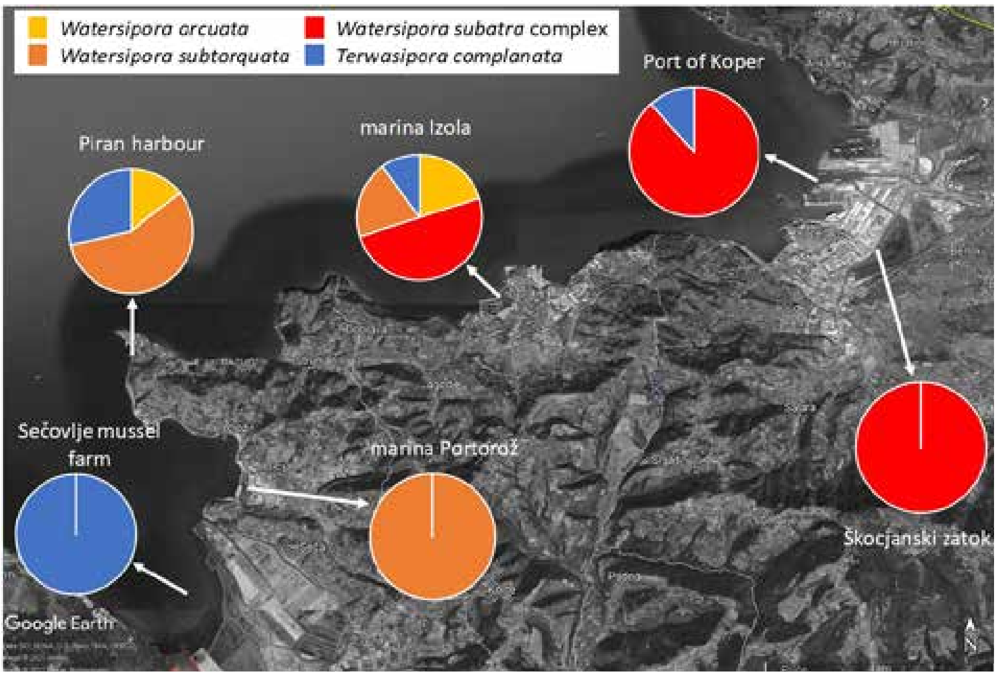

Fig. 8: Distribution of species of the family Watersiporidae found along the Slovenian coast during a survey on introduced species conducted in 2022-2023.

4. CHORDATA

4.1. On the occurrence of *Pteragogus trispilus* Randall, 2013 in Italian waters

Ernesto AZZURRO, Sylvaine GIAKOUMI and Lucio BELLOMO

Pteragogus trispilus Randall, 2013 is a small coastal fish of the Labridae family that entered the Mediterranean from the Red Sea via the Suez Canal. The species was first recorded in 1991 along the Israeli coast under the name of *Pteragogus pelycus* (Golani & Sonin, 1992) and quickly colonized several countries in the eastern Mediterranean, establishing permanent populations in Israel, Lebanon, Syria, Türkiye, Cyprus, Greece, Egypt, and Libya. In 2022, it was reported in Malta (Tiralongo *et al*., 2022).

On 8th August 2023, an individual of this species was filmed by one of the authors (LB) while scuba diving for his association ‘Sailing Bubbles’, at a depth of 7 meters in *Posidonia oceanica* meadows near Lampione (Pelagie Islands, Sicily, 35.5505° N, 12.3933° E). The video, available at this link https://www.youtube.com/watch?v=1ossHRoFRW8, clearly shows the wrasse, with selected frames presented in Figure 9. One year later, on 29th July 2024, another individual was observed at less than 300 m from the previous location, in a small patch of *Posidonia* in a rocky habitat at a depth of 6.5 meters (35.5479° N, 12.3169° E). Both individuals were estimated to be 8–10 cm in total length, displaying a yellowish-brown body with elongated dark spots along the lateral line, and a distinctive black blotch on the operculum encircled by a yellow ring near its edge. These traits clearly distinguish the species from all other Mediterranean wrasses (Golani *et al*., 2021), including *Symphodus ocellatus* (Forsskål, 1775).

Our findings provide the first confirmed presence of *P. trispilus* in Italian waters, further extending its non-native distribution in the Mediterranean Sea (Azzurro *et al*., 2023). Notably, these observations were made at a shallower depth than the previously reported range in FishBase (Froese & Pauly, 2024).

Fig. 9: Frames of the videos of *Pteragogus trispilus* recorded in Lampione Island at a depth of 7 m. The video is available at https://www.youtube.com/watch?v=1ossHRoFRW8

4.2. The first record of *Triacanthus biaculeatus* (Bloch, 1786) from the northern Levant, Mediterranean Sea, Türkiye

Mustafa Tunca OLGUNER and Alper YILDIZ

Triacanthus biaculeatus (Bloch, 1786), commonly known as the Shortnose Tripodfish, is widely distributed across the Indo-West Pacific, ranging from the Persian Gulf to South Africa (Matsuura, 2001; Santini & Tyler, 2002). Despite its wide distribution, *Triacanthus biaculeatus* (Bloch, 1786) has been rarely documented, with previous records limited to the eastern Levant Sea off the Gaza Strip (Abd Rabou *et al.*, 2024) and the Red Sea (Goutham-Bharathi *et al.*, 2024). However, our study represents the first recorded occurrence of this species in the northern Levant, specifically in Türkiye.

A single *specimen* of *Triacanthus biaculeatus* was

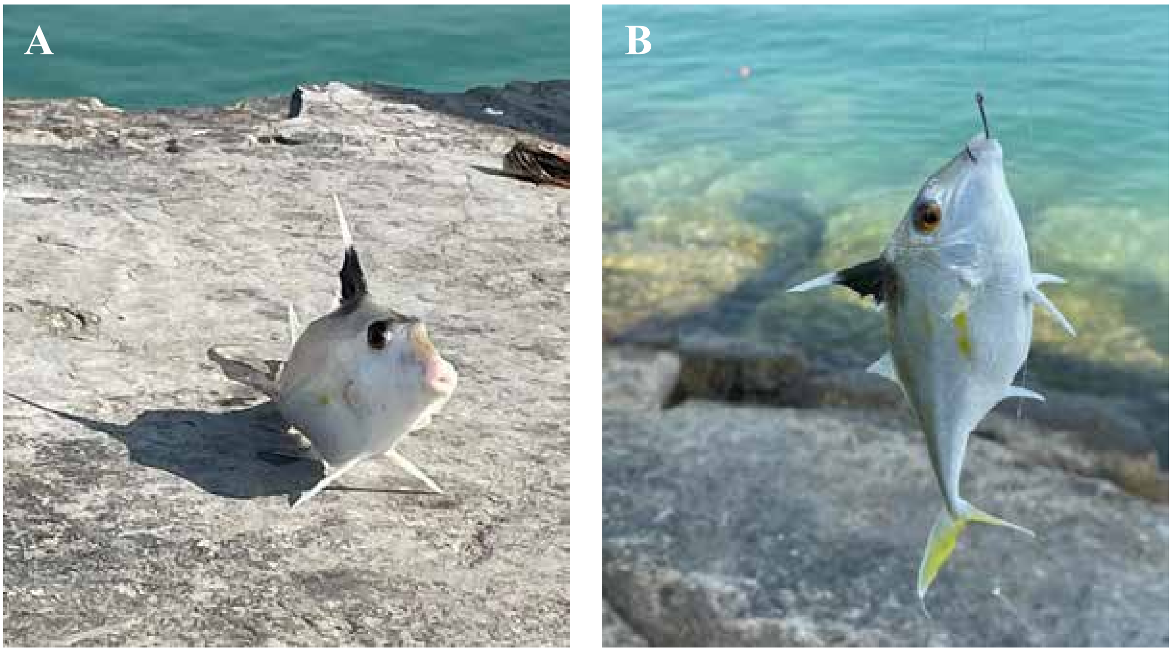

Fig. 10: *Triacanthus biaculeatus* (Shortnose Tripodfish) individual caught from Hatay, Northern Levant, Türkiye. Photo credits: E. Guler.

caught in the eastern Mediterranean coastal waters near Hatay, Türkiye (36.03850° N, 35.96272° E) in December 2024. This specimen had a total length of 14.8 cm and a total weight of 55 g. It was caught using a fishing rod by an amateur fisher from the shore (Fig. 10A, B). The identification of the specimen was based on its characteristic morphological features, including a deep, laterally compressed body, two prominent dorsal spines, and a short snout. The distinct colouration, with yellowish markings along the lateral line and a small, rounded mouth, further confirmed its taxonomic identity. These diagnostic traits are consistent with descriptions provided in Carpenter & Niem (2001). Photographs of the specimen were taken on-site, with permission granted by the fisher (Fig. 10A, B). The occurrence of *T. biaculeatus* is part of a growing trend in the establishment of non-native species in the Mediterranean Sea. Our literature review indicates that this species has not been recorded in the northern Levant or Türkiye. Therefore, this represents the first documented record of *T. biaculeatus* in the northern Levant, specifically along the Turkish coast.

5. CNIDARIA

5.1. Documenting the invasion: First well-documented record of *Cassiopea* cf. *andromeda* in the Italian Ionian Sea

Francesco TIRALONGO and Francesco LASPINA

Cassiopea cf. *andromeda*, a non-indigenous jellyfish considered to be Lessepsian in the Mediterranean, first entered the basin in 1903, with Maas (1903) documenting its migration from the Red Sea to Cyprus. Subsequently, the species was later reported in the Aegean Sea in 1955 and then in several other countries of the eastern and central Mediterranean (Deidun *et al*., 2018), as well as in Spanish waters in more recent times (Rubio, 2017). In Italy, Cillari *et al.* (2018) provided the first documented record in Palermo in 2014 (Tyrrhenian Sea), while Servello *et al.* (2019) reported an unpublished record of the species in the Bay of Augusta (Ionian Sea). However, no estimates were provided regarding the abundance of the species or details concerning the precise location of the sighting were provided in the latter case. In this work, we photographically documented the presence of the species for the first time from the Italian Ionian Sea (Fig. 11A), inside the salt pans of Augusta (37.24709° N, 15.21569° E).

On 15th September 2024, a very high number of specimens (estimated density of about 10 individuals/m^2) belonging to the genus *Cassiopea* and attributable to *Cassiopea* cf. *andromeda* were observed covering the seabed of Augusta salt pans (Fig. 11B). Individuals had an estimated size ranging from 10 to 20 cm in diameter. The observations took place in the morning under favorable weather conditions. The salt pans, characterized as semi-enclosed and eutrophic environments with minimal water exchange, seem to offer ideal conditions for the proliferation of this invasive jellyfish species. The high tolerance of *Cassiopea* to environmental fluctuations, combined with its prolific asexual reproduction, suggests that the species may continue to expand its range in these sheltered habitats (Deidun *et al*., 2018). The dense aggregation observed in the Augusta salt pans highlights the presence of a new hotspot for *Cassiopea* within the Italian Ionian Sea, which may have significant ecological implications. In particular, the spread of this species could result in shifts in local food webs, with potential

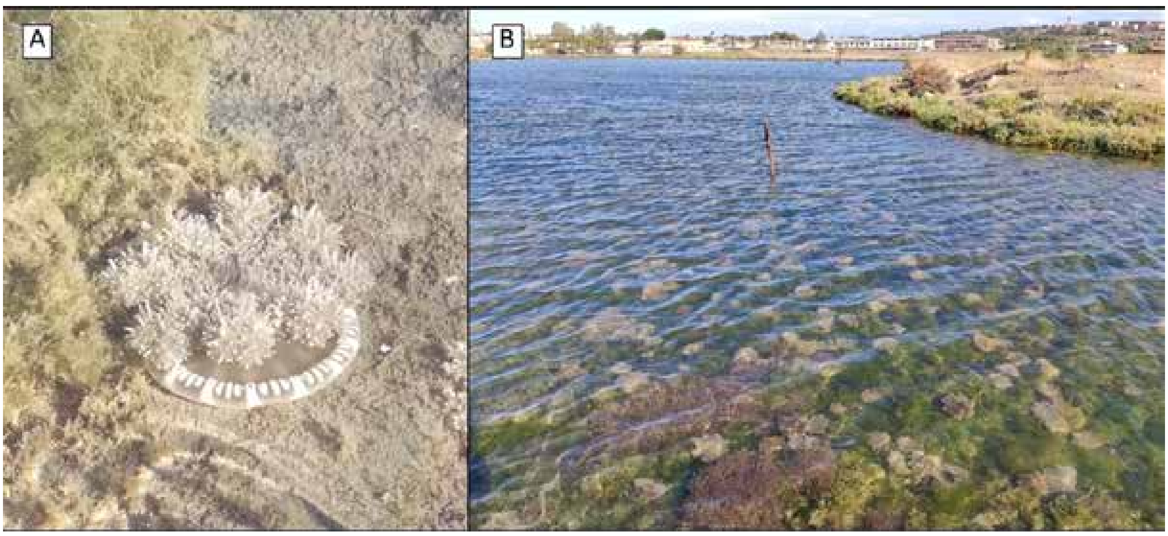

Fig. 11: Specimens of *Cassiopea* cf. *andromeda* observed in the salt pans of Augusta on 15th September 2024. A: detail of a single specimen; B: a photo demonstrating the high density of the species in Augusta.

impacts on fish larvae, plankton, and other invertebrates that compete for the same resources. *Cassiopea* may contribute to the proliferation of jellyfish blooms, which can result in increased organic matter deposition, altered sediment characteristics, and reduced oxygen levels in benthic habitats (Cillari *et al*., 2018). These changes could exert further stress on the local ecosystems, especially in semi-enclosed environments like the salt pans, harbors and coastal lagoons, where water circulation is limited. Continued monitoring and studies on the long-term effects of *Cassiopea* cf. *andromeda* proliferation in the Augusta salt pans are essential in order to predict and mitigate potential ecological and economic consequences in the region.

5.2. The status of invasive coral *Oculina patagonica* De Angelis, 1908 along the Syrian coast

Izdihar Ali AMMAR

Oculina patagonica is one of ten species of the genus *Oculina* mostly found in the Caribbean Sea and the Gulf of Mexico (Cairns, 2000). It was first discovered in the Mediterranean Sea in 1966 near the port of Genova (Zibrowius, 1974) in Italy, and recorded shortly thereafter in the port of Alicante in Spain (Zibrowius, 1974). This invasive coral has spread across the Mediterranean reaching Levantine Basin, most likely fouling on vessels (for distribution details see Serrano *et al*., 2023). Its status as alien species has been discussed by Leydet & Hellberg (2015) who suggested that Mediterranean populations of *O. patagonica* have long been isolated from the western Atlantic either in undetectable numbers or overlooked and undersampled sites and habitats, and have only recently been expanding to invasive levels as a result of environmental changes.

Consequently, the species may have arrived in Syrian waters long ago but went unnoticed. This is the first record of this alien coral on the Syrian coast, where a colony was found in the form of a crust covering a rock with a diameter of 50 cm in the Ibn Hani Marine Protected Area (35.5927° N, 35.74191° E). It was detected in March 2020 at a depth of 3 m, by an amateur diver (Fig. 12A). Additional colonies were also observed at the Al-Samra site, far north Syria (35.927828° N, 35.915995° E) during the same period, and at its presence was well documented in Ibn Hani site north of Lattakia city (35.593462° N, 35.750667° E), at a depth of 3 m on 3rd June 2024, (Fig. 12B & C). Bleaching in two adjacent colonies of *O. patagonica* observed in the intertidal zone at Ras al-Basit (35.848972° N, 35.811500° E) (Fig. 13) on 1st April 2022, each colony measuring approximately 80 cm in diameter.

Further monitoring and research are required in the future to decide the trend of this coral on Syrian coasts.

Fig. 13: Bleaching of *Oculina patagonica* colony at Ras al-Basit (Syria).

Fig. 12: *Oculina patagonica* colony at Ibn Hani (north of Latakia, Syria).

6. MOLLUSCA

6.1. The Indo-Pacific conch *Conomurex persicus* (Mollusca: Gastropoda) reached the Messina Strait

Francesco TURANO and Daniele GRECH

On 11th September 2024, nine live specimens of *Conomurex persicus* (Swainson, 1821) (Fig. 14A, B) were found by FT in Pellaro (38.0198° N, 15.6353°E); southern Calabria side, Messina Strait (Italy). The finding spot was in a sandy area of 5 meters depth close to the breakwaters. Here many specimens of the Indo-Pacific conch were laying on sand and on the rocks. Sea water temperature was 27°C and in presence of pulse current typical of the area (Bignami & Salusti, 1990). Specimens presented the typical cony shaped shell and sharped (Fischer *et al.*, 2023 and references therein) which only slightly resembles the native *Conus ventricosus* Gmelin, 1791. A few days later, after more extensive searches, eight additional specimens were found, near the first site and in the same habitat. One of the specimens was first photographed underwater with a reflex digital camera by FT. Further pictures of the live collected specimens were made outside the water.

The species is native to the southern coast of Arabia and part of the Persian Gulf and presumably arrived in the Mediterranean through shipping (Zenetos *et al.*, 2004), but accidental, volunteer introduction or subsequent larvae dispersal from other existing sites is possible. The first Mediteranean record dates back 1978 in southern Türkiye. *Conomurex persicus* has spread from its first discovery on the Turkish Mediterranean coast both westwards (Aegean and then Ionian Sea) both eastwards to the Syrian and Israeli coasts, and from there westwards to Egypt, Syria in the eastern Mediterranean. It was also recently reported in Tunisia and Italy (Fischer *et al.*, 2023). It is currently widely distributed and even invasive in Greek soft bottoms (Crocetta *et al.*, 2017) and an arrival through larvae dispersal seems to be highly possible.

In Italy, apart from the unique confirmed recent record

Fig. 14: A, C: Macro photo of the head and eye of *Conomurex persicus*; B: dorsoventral view. Scale bar is 1 cm.

of Linosa (central Mediterranean Sea, Tunisian Plateau) a few empty shells were found off Muggia (Trieste, Italy), but the record could be misleading. All the specimens reported until now are from the Eastern and Central Mediterranean Sea and the Adriatic Sea. This current report is in the extreme proximity to the western Mediterranean Sea, that up to date has no record of this species. The species is particularly palatable and has been exploited in Rodos Island (Greece) over recent years and sporadically offered for human consumption in fish restaurants (Katsanevakis *et al.*, 2008). Colour and shape of the species are extremely attractive for citizens, so if properly boosted by rise awareness campaign and training it is a good candidate for alien species citizen science projects (Gerovasileiou *et al.*, 2017).

6.2. First record of the Indo-Pacific oval squid *Sepioteuthis lessoniana* Lesson, 1831 from Lampedusa Island (Central Mediterranean Sea)

Marco ALBANO and Gioele CAPILLO

The oval squid or bigfin reef squid *Sepioteuthis lessoniana* Lesson, 1831, is a squid of the genus *Sepioteuthis* Blainville, 1824 which currently contains three species, belonging to the family Loliginidae Lesueur, 1821 of the order Myopsida. The taxonomy and systematics of these taxa are currently under definition, as confirmed by the huge number of synonymous species, and probably this species represents a pool of similar ones (Okutani, 2005). This cephalopod is a pelagic species, with both diurnal and nocturnal habits, commonly inhabiting coral reefs in several oceans (Roper & Jereb, 2010). Commonly reported at a depth range of 0-100 m, *S. lessioniana* preys on small fish and crustaceans with an opportunistic behaviour. It reproduces in the late spring/early autumn in native waters, mainly depending on temperature regime (Ikeda *et al.*, 2009). It is reported to reach a maximum length of 38 cm for the bigger males, presenting an oval-shaped body, eight arms armed with two rows of suckers, and a colour from brownish to pinky-violet. Its distribution comprises mainly the Pacific Ocean and Indian Ocean, where it represents an important commercial resource, but also far areas of these basins such as New Zealand and the Red Sea. From the latter area, recently, this species migrated to the Mediterranean Sea though the Suez Canal, as described by Lefkaditou *et al.* (2009).

Here we report a specimen caught in Lampedusa Island (Italy, Central Mediterranean Sea, 35.501914° N, 12.589783° E) on 24th November 2024, by a recreational fisher (Fig. 15). The oval squid was caught from the shore during nighttime by a jigging line with artificial lure, specifically using the eging technique that stimulates active predation on lures mimicking a small fish/prawn. It was an adult female of about 175 mm in mantle length and 205 g in weight.

To the best of our knowledge, this is the first record of *S. lessioniana* documented from Lampedusa Island and Italian waters. This finding, combined with previous records from Libya and Tunisia (Galanidi *et al.*, 2023), indicate the establishment of the species in the central Mediterranean.

The active predatory behaviour of *S. lessoniana*, coupled with its expansion across the Mediterranean basin, might enhance this species' interaction with fishers and lead to more records in the coming years. Indeed, as in this case, recreational fishers represent an essential resource for their accurate and selective techniques, which often attract rare and elusive species. Further studies are required for the molecular and biometric evaluation of *S. lessoniana*, based on multiple samples. We hope that this report will enhance the attention regarding this species in the central Mediterranean Sea.

Fig. 15: *Sepioteuthis lessoniana* specimen described in this study. (a, b) live specimen soon after capture on 24th November 2024, from Lampedusa Island, Italy; (c, d) details of specimen length and weight. Photo credits: Giacomo Sanguedolce (a, c) and Giovanni La Magra (b).

6.3. New records of *Alveinus miliaceus* and *Retusa desgenettii* from the Levantine coasts of Türkiye

Argyro ZENETOS and Panayotis OVALIS

The Levantine coast of Türkiye hosts a high number of non-indigenous molluscan species (122 species) (Öztürk *et al*., 2024) versus the 43 species in the Aegean coasts of Türkiye (Zenetos *et al*., 2025). The Gulf of İskenderun, located in its eastern part, is characterised by intensive maritime traffic and appears to be a hot spot area for marine non-indigenous Mollusca species (Öztürk *et al*., 2023). Here we report the presence of two micromolluscs new to the Levantine coast of Türkiye namely the bivalve *Alveinus miliaceus* (Issel, 1869) and the gastropod *Retusa desgenettii* (Audouin, 1826).

Twelve articulate dead valves of *Alveinus miliaceus* (Fig. 16) were found in shell grit collected on the Burnaz Beach Erzin (36.922555° N, 36.029499° E), Iskenderun Gulf, in August 2012. Until now *A. miliaceus* is only known from Israel (Steger *et al*., 2018) where it was detected in 2016. Its presence along the Israeli costs was further confirmed by Albano *et al.* (2024) who identified a live specimen dating to the year 2009 and more in the period 2014-2018. Our finding consists not only the first record for the Levantine coast of Türkiye but also for Türkiye. The present record attributed to P.O. (shell collector) confirms the role and significant contribution of shell collectors in reporting non-indigenous species (Zenetos *et al*., 2024).

Nine empty shells of *Retusa desgenettii* were found in shell grit collected by scuba diving at Samandağ (36.081671° N, 35.939185° E), İskenderun Gulf in August 2012 (Fig. 17). The species is widely distributed in the eastern Mediterranean (Egypt, Israel, Lebanon, Cyprus and Türkiye). For details on its distribution in the Mediterranean see Crocetta & Tringali (2015). In Türkiye *R. desgenettii* is known from its Aegean coasts (Bozburun: Crocetta & Tringali, 2015) but was until now unreported from the Levantine coast of Türkiye.

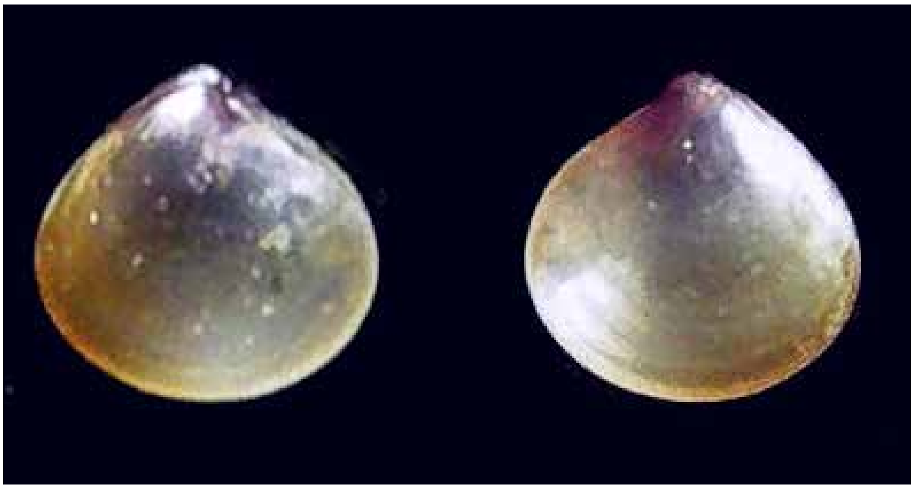

Fig. 16: *Alveinus miliaceus* (Issel, 1869) collected from the Burnaz Beach; height: 0.95 mm (left: right valve; right: left valve).

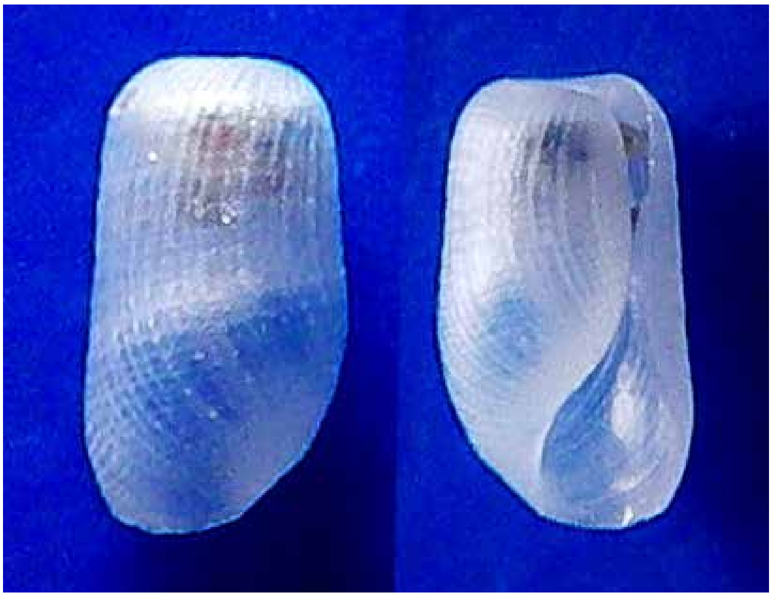

Fig. 17: *Retusa desgenettii* (Audouin, 1826) collected from Samandağ; height 1.63 mm.

6.4. The first record of the loliginid squid *Uroteuthis (Photololigo) arabica* (Ehrenberg, 1831) in the Mediterranean

Alp SALMAN, Sencer AKALIN and Coşkun Menderes AYDIN

Loliginid squids are mainly small to medium-sized cephalopods living along coastal and continental shelves in warm and temperate waters, and they usually have commercial value (Jereb & Roper, 2010). In the Mediterranean Sea, the family Loliginidae Lesueur, 1821 is represented so far by five species (Salman *et al*., 2023): *Loligo forbesii* Steenstrup, 1856, *L. vulgaris* Lamarck, 1798, *Alloteuthis media* (Linnaeus, 1758), *A. subulata* (Lamarck, 1798), and the Lessepsian cephalopod *Sepioteuthis lessoniana* Ferussac *in* Lesson, 1830, recently introduced from the Red Sea (Salman, 2002). *Uroteuthis* (*Photololigo*) *arabica* (Ehrenberg, 1831), reported in this study, is the second Lessepsian loliginid species to have arrived via the Suez Canal into the Mediterranean Sea.

In August 2024, one maturing male specimen, which had gonads in stage 2b (the Needham's sac had structureless whitish particles without functional spermatophores) according to Follesa & Carbonara (2019), with a 174 mm mantle length (ML) and 62.7 g total weight, was caught during a scientific trawl survey at 45 meters depth off the Anamur coast (36.077° N – 32.933° E) on the Turkish Mediterranean coast. The sample was fixed on board in a

Fig. 18: General view of the specimen of *U.* (*P.*) *arabica* (A: Dorsal; B: Ventral).

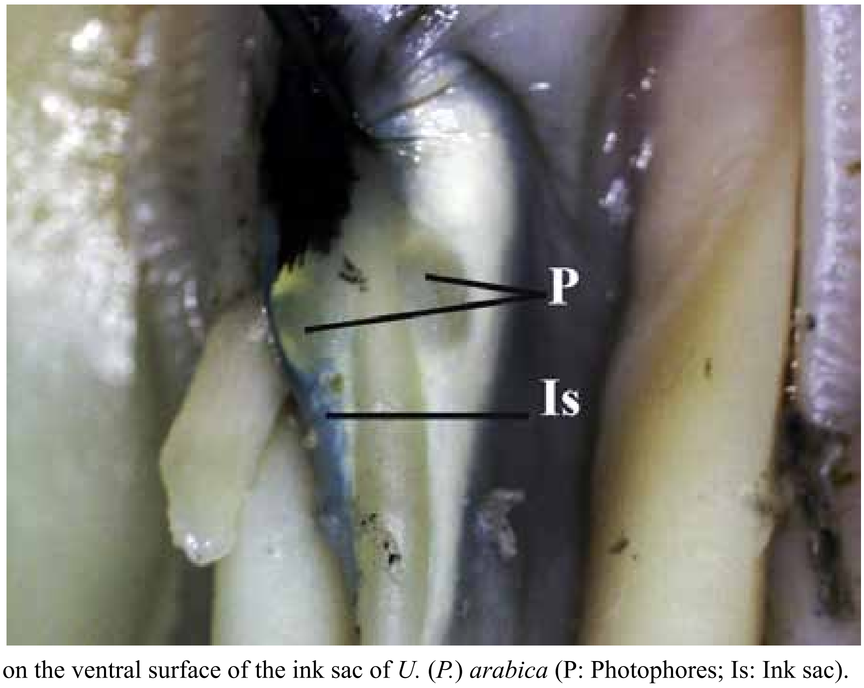

Fig. 19: Photophores on the ventral surface of the ink sac of *U.* (*P.*) *arabica* (P: Photophores; Is: Ink sac).

10% formalin solution and coded as ESFM-CEP/2024-1 at the Ege University Faculty of Fisheries scientific collection. The specimen's mantle was long and narrow. Its mantle width (MW) was 26 mm, and its ratio to the mantle length was about 15%. The fin length and width were 113 and 62 mm, respectively, 65% and 35% of the mantle length (Fig. 18).

Uroteuthis (*P.*) *arabica* stands out from all other loliginids in the area due to a pair of bacterial bioluminescent organs (photophores) on the ventral face of the ink sac (Fig. 19). This unique feature is exclusive to the *Uroteuthis* genus in loliginids (Nesis, 1987). The genus includes 14 species, of which 12 are in 3 subgenera, two are in an undetermined subgenus category, and all live in the Indo-West Pacific Ocean. The significant difference between *U.* (*P.*) *arabica* and its congenerics is the mantle, which is long and narrow. Mantle width is between 12% and 20% of the mantle length, and the fin length is about 60-65% of the mantle length. Additionally, the number of teeth of the arm and club sucker rings and the hectocotylised arm sucker and papillae formation are different (Jereb & Roper, 2010).

With some exceptions, the distribution route and the probability of encountering any Indo-Pacific species in the Mediterranean ecosystem will start from the east and move towards the west. However, the fact that this record is from a relatively western location may indicate the possibility that *U.* (*P.*) *arabica* was previously confused with some native loliginid species, especially *L. vulgaris* and *L. forbesii* or its rare distribution in the Mediterranean. Further studies should clarify the actual status of the species' distribution in its new home.

7. OCHROPHYTA

7.1. First record of brown alga *Colpomenia peregrina* in the Adriatic Sea

Ivan CVITKOVIĆ and Ante ŽULJEVIĆ

Colpomenia peregrina Sauvageau 1927 originates from the Northwest Pacific but has become a worldwide distributed species as one of the most successful brown algal invaders (Green-Gavrielidis *et al*., 2019). The first record for the Mediterranean Sea was in Etang de Thau (France) in 1918. It was consecutively recorded throughout the Mediterranean basin except in its south-east part and in the Adriatic Sea (Verlaque *et al*., 2015) where it is not considered as an invasive species.

In April 2007 we recorded *C. peregrina* in the small fishing harbour in Vira Cove on the Island of Hvar (Middle Adriatic Sea, Croatia) (43.190555° N, 16.427867° E) which represents its first, still unpublished record for the Adriatic Sea. The species developed as a predominant

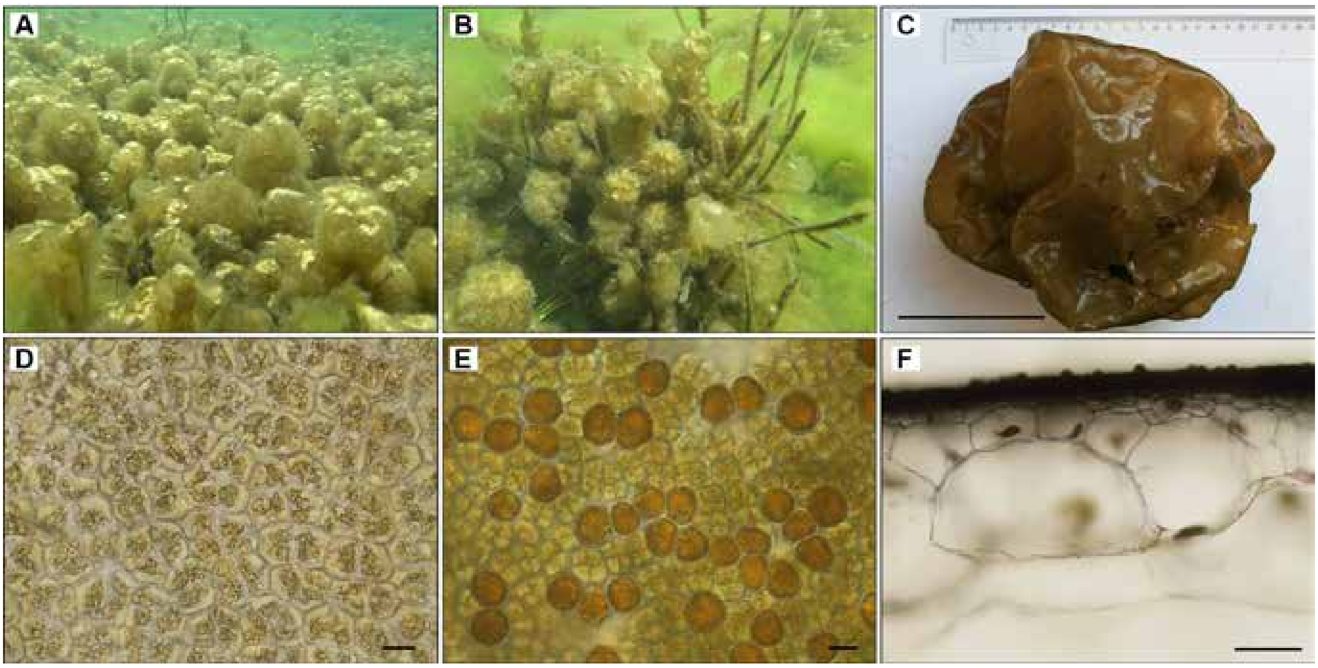

Fig. 20: *Colpomenia peregrina* from Croatia. Vira Cove (Hvar Island, Croatia, Adriatic Sea) in April 2007: A) *C. peregrina* developed on seagrasses *Cymodocea nodosa* (A) and *Posidonia oceanica* (B) at ca. 3 m depth. C) Large thallus of 25 cm in diameter collected in Kaštela Bay in April 2009. Microscopic photos of thalli from Vira Cove kept in formaldehyde: D) surface view of the cells, E) plurilocular sporangia and ascocysts, F) cross section with 3-4 layers of medullary cells. Scale bars: 10 cm (C), 10 µm (D, E), 100 µm (F).

epiphyte on the leaves of the seagrasses *Posidonia oceanica* (Linnaeus) Delile and *Cymodocea nodosa* (Ucria) Ascherson between 1 and 4 m depth. It was outstandingly abundant, developing several thalli on almost every seagrass shoot between 1.5 and 5 m depth (Fig. 20A and B). The affected area was restricted to the very end of the cove and covered approximately 0.3 km^2. The cove was eutrophic due to the discharge of bycatch from trawlers. Two years later (April 2009), the abundance and distribution of the alga was similar. In April 2009 we detected *C. peregrina* in a slightly eutrophic part of the Kaštela Bay (Croatia) (43.522582° N, 16.415487° E) where it was abundant as epiphytic and epilithic species on the rocky bottom between 1 and 4 m depth. Despite intensive inspection of the areas of Vira Cove and Kaštela Bay for the purposes of Croatian national monitoring of non-indigenous species and having *C. penegrina* as a target species, it has not been recorded again since 2009 in Croatian marine waters. Hence, to the best of our knowledge, records in Vira Cove and Kaštela Bay remain the only records of *C. peregrina* in the Adriatic Sea up to now.

Morphological, ecological and anatomic features of the collected specimens correspond to the published features of *C. peregrina* (Cormaci *et al*., 2012; Mathieson *et al*., 2016): hollow, spherical light brown thalli that develop epiphytically at 1 to 5 m depth, up to 25 cm in diameter, up to 4 layers of large medullary cells, cortical cells with single cup-shaped plastid, crowded plurilocular sporangia with scattered paraphysis (Fig. 20).

Since the nearest area where *C. peregrina* was recorded is in the Ionian Sea (Greece) (Tsiamis *et al*., 2010), we assume that propagule dispersal by currents served as the vector for spreading into the Adriatic Sea. The reason why it did not develop in different locations and the reason for its disappearance after successful expansion remain unknown.

8. CHLOROPHYTA

8.1. Discovery and disappearance of the last *Caulerpa taxifolia* (Chlorophyta, Bryopsidales) settlement in the Adriatic Sea

Petra LUCIC and Ivan CVITKOVIĆ

The green alga *Caulerpa taxifolia* (M. Vahl) C. Agardh is one of the most famous marine invaders. Its spread in the Mediterranean Sea, as well as in California and Australia, has been accompanied by numerous scientific publications, journal articles, books, documentary films, and four specialized international workshops (Deveney *et al*., 2008).

Around 2007 and 2008, *C. taxifolia* massively declined throughout the entire Mediterranean (Meinesz *et al*., 2010). This exceptionally interesting event in invasion biology was followed by only a few publications. The only existing site with *C. taxifolia* at that time in the Adriatic Sea was in Stari Grad Bay (Croatia), where a massive die-off also occurred in the winter of 2007/08. During this period, the colony, which had spread over 70 hectares, retreated by more than 90%, while a plant disease is suggested as the most likely cause of such a large-scale mass die-off (Žuljević *et al*., 2019).

Fig. 21: *Caulerpa taxifolia* in Stari Grad Bay (Croatia) in autumn 2020. Several thalli formed the last observed colony in the Adriatic Sea.

The very last thalli of *C. taxifolia* in Stari Grad Bay (43.182893° N, 16.582750° E) were detected in autumn 2020 (Fig. 21). *Caulerpa taxifolia* formed a scattered settlement approximately 2 m² in size, developing in a sparse *Posidonia oceanica* (Linnaeus) Delile meadow at a depth of 10 meters. Despite particular monitoring of the area where *C. taxifolia* previously thrived, no records have been noted since 2020, leading us to conclude that the "killer alga" probably no longer exists in Stari Grad Bay. Accordingly, no site with *C. taxifolia* is currently known in the entire Adriatic Sea.

Interestingly, this large-scale, massive, and highly synchronized vanishing of *C. taxifolia* did not occur in other non-native conspecific algae of the genus *Caulerp*a within the Mediterranean Sea, such as *Caulerpa cylindracea* Sonder. Support for the plant disease hypothesis (Žuljević *et al*., 2019) can be found in studies on diseases affecting *Caulerpa lentillifera* J. Agardh in Asian aquaculture facilities (Liang *et al*., 2019). Such a pathogen might have been introduced into the Mediterranean via ballast water and rapidly dispersed by currents. Similar large-scale mortality was demonstrated with *Pinna nobilis* Linnaeus, 1758, where a mortality outbreak was found to be caused by a pathogen, most likely *Haplosporidium pinnae*, which rapidly spread throughout the Mediterranean Sea, causing almost 100% mortality of the pen shell in the majority of the region (Catanese *et al*., 2018). Identifying algal pathogens is a challenge and requires frequent field monitoring to obtain samples once the disease occurs. Such research could provide tools for successful control of non-native species. *Caulerpa taxifolia*, at least in Croatia, represents a remarkable example of a boom-and-bust species, where a widely established invader undergoes a rapid collapse, usually with no reasonable explanation.

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