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A PRELIMINARY CHECKLIST OF MARINE HETEROBRANCHS (MOLLUSCA: GASTROPODA: HETEROBRANCHIA) OF SYRIA

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ABSTRACT

The surge in research of marine biodiversity in Syria, particularly with a focus on non-native species, along with the involvement of amateur free-diving enthusiasts, has facilitated the documentation of additional species, including Heterobranchia (Mollusca: Gastropoda). Between 2016 and 2023, several Heterobranchia species were observed by SCUBA divers along the Syrian coast at depths ranging from 2 to 12 meters. Additional specimens were manually collected on rocky shores from 2020 to 2023. In total, 16 species of Heterobranchia were identified in Syrian marine waters. Among them, 6 are non-indigenous, 2 are cryptogenic, and some are invasive. The study also highlights the presence of rare species, such as Fiona pinnata *and* Berthella stellata albocrossata*, recorded in Syria for the first time. The prevalence of the cryptogenic species* Aplysia dactylomela *and the invasive* Elysia grandifolia *is notable across most locations.*

Key words: Nudibranchia, mollusca, new record, rare species, Eastern Mediterranean

LISTA PRELIMINARE DEGLI ETEROBRANCHI MARINI (MOLLUSCA: GASTROPODA: HETEROBRANCHIA) DELLA SIRIA

SINTESI

L'aumento della ricerca sulla biodiversità marina in Siria, con un'attenzione particolare alle specie non autoctone, insieme al coinvolgimento di appassionati di immersione libera amatoriale, ha facilitato la documentazione di ulteriori specie, tra cui gli Heterobranchia (Mollusca: Gastropoda). Tra il 2016 e il 2023, diverse specie di Heterobranchia sono state osservate da subacquei lungo la costa siriana a profondità comprese tra 2 e 12 metri. Altri esemplari sono stati raccolti manualmente sulle coste rocciose dal 2020 al 2023. In totale, sono state identificate 16 specie di Heterobranchia nelle acque marine siriane. Tra queste, 6 sono non indigene, 2 sono criptogenetiche e alcune sono invasive. Lo studio evidenzia anche la presenza di specie rare, come Fiona pinnata e Berthella stellata albocrossata*, segnalate per la prima volta in Siria. La prevalenza della specie criptogenetica* Aplysia dactylomela e *dell'invasiva* Elysia grandifolia è *notevole nella maggior parte delle località.*

Parole chiave: Nudibranchia, molluschi, nuove segnalazioni, specie rare, Mediterraneo orientale

INTRODUCTION

The Syrian coastline, stretching 183 km along the central eastern Mediterranean Sea, is a rich tapestry of environmental habitats, each distinct and delicate. Its seabed features a diverse mosaic of rocky, sandy, gravel, mixed, and coralligenous substrates. These traits create an ideal environment for the proliferation, reproduction, and settlement of a wide array of organisms from varied biogeographic origins. Due to its geographical position and proximity to the Suez Canal, the Syrian coast serves as a gateway for migrants from tropical and subtropical regions, including the Atlantic Ocean, the Red Sea, and the Indo-Pacific Ocean. Consequently, there has been a notable increase in the number of species in recent decades, as highlighted in studies by Ammar (2019; 2023a). Another crucial aspect is the presence of major ports like Latakia, Tartus, and Baniyas on the Syrian coast. Especially the international hubs of Latakia and Tartus, but also Baniyas for oil transportation, could play a crucial role in facilitating the introduction of alien species and potentially altering the ecosystem in the future (Ammar, 2023a).

The Mollusca phylum stands out as the most prominent among invertebrates inhabiting the Syrian sea, with a recorded tally of 404 species up to June 2023 (Ammar, 2024; Arabia, 2011; Ammar, 1995), including 250 gastropod species. Among these, heterobranchs emerge as the least diverse and rather underrepresented group in Syria. However, recent documentation has shed some more light on the sea slugs and sea snails in Syrian waters, some of which were mentioned in earlier works (Katsanevakis *et al.*, 2014; Ammar, 2019), and revealed that their existence had been observed by divers and marine enthusiasts years before formal records were produced.

The subclass Heterobranchia, the focal point of this study, comprises a diverse array of gastropods thriving in marine, brackish, freshwater, and terrestrial habitats. This subclass encompasses six infraclasses, with Opisthobranchia being the most significant. Opisthobranchia sea snails and sea slugs are further categorized into nine orders: lower Heterobranchia, Acteonimorpha, Ringipleura, Umbraculida, Cephalaspidea, Runcinida, Aplysiida, Pteropoda, and Sacoglossa (WoRMS, 2024). Presently, there are 8471 marine species within this subclass, inhabiting both intertidal and sublittoral zones, and exhibiting diverse ecological behaviors such as burrowing in soft substrates, grazing on seagrass, and foraging on rocky shores (Wigham, 2022).

Heterobranchia play a vital environmental role as indicators of water warming, climate change, pollution, and habitat loss (Mehrotra *et al.*, 2020). Moreover, they contribute significantly to the biochemical cycle of nutrients, particularly silicates (Cruz *et al.*, 2013; López-Acosta *et al.*, 2023). Additionally, these mollusks harbor bioactive compounds with medicinal properties, serving as potential sources for analgesic, anti-inflammatory, antiviral, and anticancer drugs (Winters *et al.*, 2018; Eisenbarth *et al.*, 2018).

The growth in research of marine biodiversity in Syria, coupled with the involvement of amateur free-diving enthusiasts looking for alien species and documenting them in social media, has facilitated the recording of newly-observed marine life species, including the captivating and colorful group of mollusks.

The impact of climate change and rising water temperatures in the Eastern Mediterranean, attributed to global warming and heatwaves during the period 2016–2021 (Garrabou *et al.*, 2022), is evidenced by the increase in the number of non-native, tropical sea slug species and their expanding distribution along the southern Syrian coast and beyond. This phenomenon, which is not unique to Syria but extends to other regions of the Eastern Mediterranean, such as Turkey, the Levantine Basin, and the Aegean Sea, has been particularly affecting the Nudibranchia group (Grech *et al.*, 2023). Researchers have underscored the role of climate change and global warming in the proliferation of these species (Rothman *et al.*, 2017; Mioni & Furfaro, 2022). In the broader context of the Mediterranean Sea, approximately 550 species of sea slugs have been recorded, with 270 belonging to Nudibranchia (Trainito & Doneddu, 2014; Furfaro *et al.*, 2020). In the Adriatic Sea, the total number of Opisthobranchia species reaches 233 (Zenetos *et al.*, 2016), with as many as 160 species of Heterobranchia recorded in the Salento Peninsula in Italy alone (Furfaro *et al.*, 2020). Although these numbers may appear modest compared to those of other global seas and oceans, the presence of alien species is notable. The Atlas of Mollusks produced by CIESM records 21 alien Opisthobranchia species (Zenetos *et al.*, 2003), with additional alien species documented in subsequent research across various Mediterranean countries, including Greece, Turkey, Cyprus, Lebanon, and the central Mediterranean region (Crocetta *et al.*, 2013, 2015a,b; Kleitou *et al.*, 2019; Manousis, 2021; Manousis *et al.*, 2020; Riccardi *et al.*, 2022; Lombardo & Marletta, 2023a,b). In comparison, until 2016, a total of seven species, along with one potentially alien species and three cryptogenic species, had been documented from the Adriatic Sea (Zenetos *et al.*, 2016). There has been an observable rise in the number of Nudibranchia in Turkey, the Levantine Basin, and the Aegean Sea which researchers attribute to the effects of climate change and global warming (Rothman *et al.*, 2017; Mioni & Furfaro, 2022; Grech *et al.*, 2023; Garrabou *et al.*, 2022).

Overall, the presence of sea slugs in the Mediterranean remains uncommon (Schubert & Smith, 2020), however, new and rare species continue to be discovered in Syria and other Mediterranean countries, often

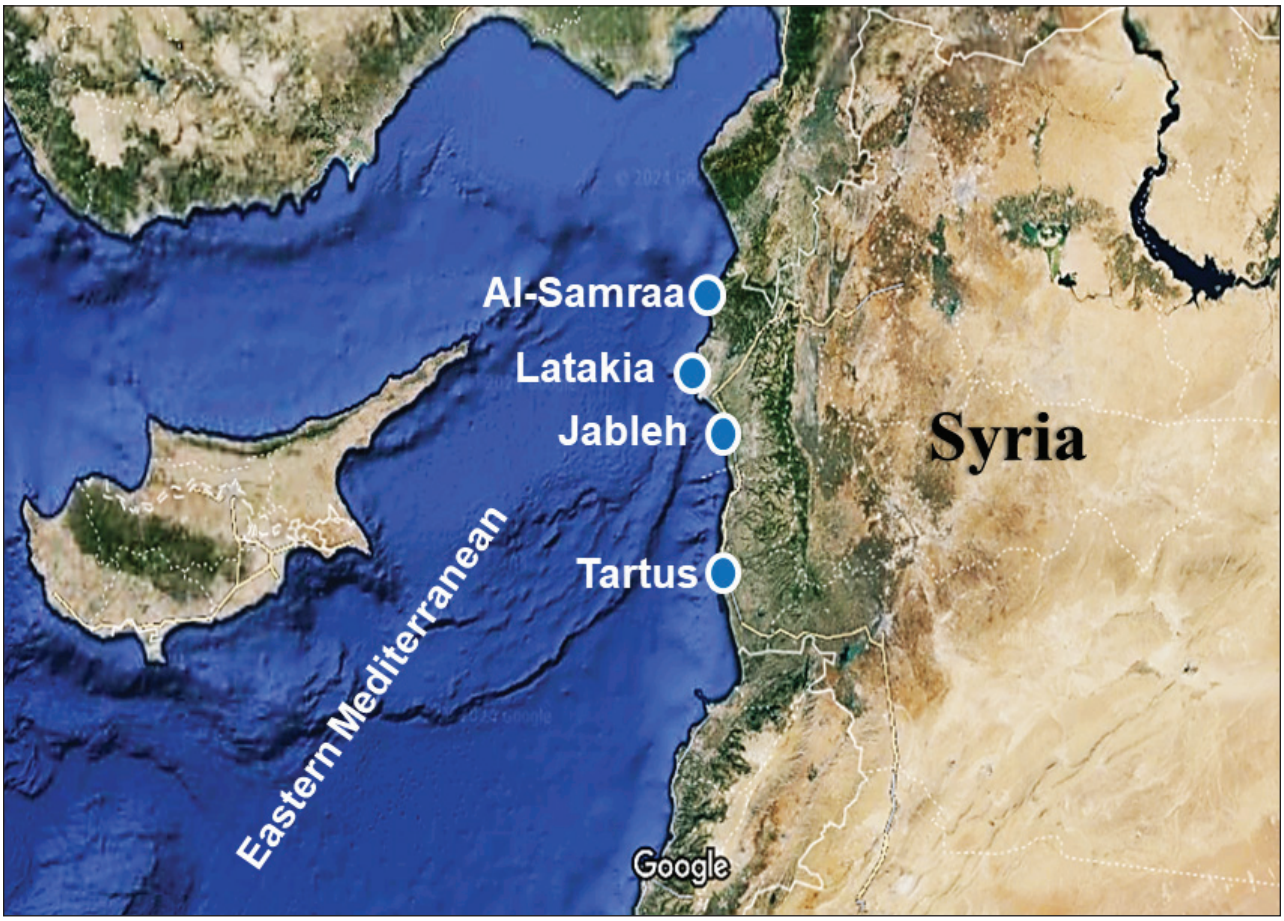

Fig. 1: Study areas in the Syrian coast.
Sl. 1: Zemljevid obravnavanega območja ob sirski obali.

through the efforts of amateur divers (Kleitou *et al.*, 2019; Ammar, 2023c). The primary objective of this study is to compile a preliminary inventory of marine Heterobranchia species in Syria, concurrently documenting new findings for the region.

MATERIAL AND METHODS

The study encompassed various areas along the Syrian coast, specifically Tartus and Latakia (Fig. 1). Most of the sites, ranging in depth from 0 to 12 meters, featured rocky bottoms with patches of sand. Notably, two sites on the northern coast stood out for their coralligenous seabed: the Ibn Hani reserve and Al-Samra.

Benthic organisms inhabiting these areas face numerous challenges and pressures. In addition to the encroachment of alien species, they must contend with the impacts of climate change, warming waters, pollution, and extensive fishing. Over the period from 2020 to 2023, the region experienced a marked increase in water temperatures, with surface seawater temperatures fluctuating between 16.9 °C in winter and 31.4 °C in summer. Similarly, salinity levels varied from 36.4‰ in winter to 39.8‰ in summer. Syrian waters also have low primary production, with chlorophyll (a) concentrations ranging from 0.0 to 6.7 mg/m3 (Ammar & Arraj, 2023; Darwish & Alakash, 2022).

Individuals of Heterobranchia species were observed in shallow waters at the Ibn Hani site (northern Latakia) and the Al-Samraa site from 2016 to 2023, primarily during free diving at depths ranging from 2 to 12 meters. Additionally, specimens were manually collected from the rocky shores of other locations north of Tartus and Jableh between 2020 and 2023, at depths ranging from 0 to 3 meters. Many of these specimens were photographed at the sites by two amateur photographers, Nouh Abbas and Mahmoud Halhal.

Due to technical challenges, genetic analysis could not be conducted. Therefore, species identification of the samples was based on field photographs and observation of external morphological

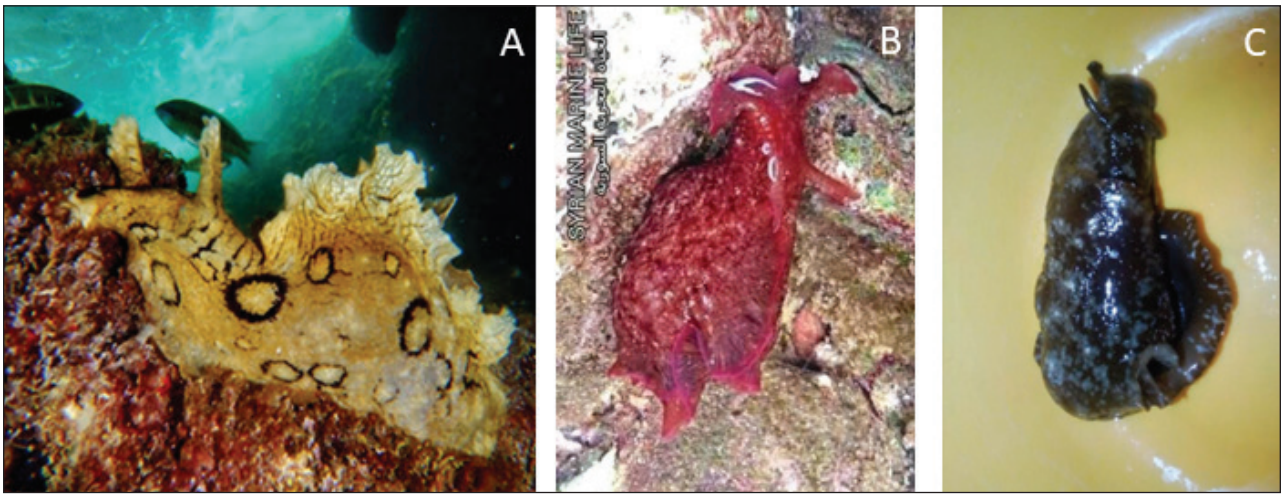

Fig. 2/Sl. 2: (A) *Aplysia dactylomela*, ***(B)*** *Aplysia punctata*, ***(C)*** *Aplysia fasciata*.

characteristics and coloration, following taxonomic references provided by Zenetos *et al*. (2003), Yonow (2008), Riedl (2011), Trainito & Doneddu (2014), as well as assistance from other experts and sources. The nomenclature adhered to the guidelines of the WoRMS Editorial Board (2024). A few specimens were preserved in formalin for further examination.

RESULTS AND DISCUSSION

The present study confirms the existence of sixteen species of Heterobranchia (Mollusca: Gastropoda) in various locations along the Syrian coast. These species are distributed among four orders and eight families. Notably, six of these species are classified as non-indigenous (NIS), two as cryptogenic, some as invasive, and a few as rare. Most of the specimens were observed and photographed between 2016 and 2023.

Table 1 presents a list of species with their respective taxonomic statuses following Riedl (2011), as well as locations, coordinates, and dates of occurrence and recording.

In the Mediterranean region in general, the Heterobranchia class has historically been regarded as the least diverse and underrepresented. Until 2013, the heterobranchs recorded in Syria were limited to native, Mediterranean species. However, new discoveries have since emerged, such as the cryptogenic *Aplysia dactylomela* Rang, 1828, and *Thecacera pennigera* (Montagu, 1813), calling for a shift in our understanding of their presence (Katsanevakis *et al*., 2014; Ammar, 2019).

Further exploration of biodiversity, including previously unstudied areas, has led to the identification of four additional non-native species: *Elysia grandifolia* (Kelaart, 1858), *E. ornata* (Swainson, 1840), *Goniobranchus obsoletus* (Rüppell & Leuckart, 1830), and *Hypselodoris infucata* (Rüppell & Leuckart, 1830). These species were observed in a beach pool in Jableh and at the Al-Massab site north of Tartus, southern Syria, where a citizen interested in marine life documented their presence and posted photographs on Facebook. It is worth noting that Al-Massab is a small marina primarily used for docking boats and ships involved in oil transport.

In the southern sector of Tartus, *Elysia grandifolia* has become increasingly common since 2020, with notable sightings in 2022 and 2023. Additionally, *Fiona pinnata* was spotted occasionally on driftwood near the Al-Massab basin.

In the more frequently studied northern sector of the Syrian coast, 12 species were documented between 2016 and 2023. Free diving and underwater photography conducted by local amateur explorers aided in the observations.

The order Aplysiida (Fig. 2) is represented by two local species, *Aplysia punctata* and *Aplysia fasciata*, along with the cryptogenic species *Aplysia dactylomela*. *A. fasciata* has been known in Syria since 1993 and remains widespread, while the occurrence of *A. punctata* was noted only once in Al-Massab in 2021. *A. dactylomela* was first documented in 2013 and continues to be observed in the northern sector, particularly near the Ibn Hani marine protected area.

One Sacoglossa species from the family Plakobranchidae, *Elysia grandifolia* (Kelaart, 1858), was initially sighted in 2016 near the Ibn Hani marine protected area (MPA), a hotspot for nocturnal free diving activities (Fig. 3A). Subsequently, its presence became more frequent, with a significant surge in number during 2023 in various regions of northern and southern Syria. Interestingly, the specimens photographed and collected exhibited some morphological variations, particularly regarding the presence of a white line along the mantle's edge. This difference has caused previous misclassifications, where specimens were erroneously identified as either

Tab. 1: Checklist list of native and non-native sea slugs (Gastropoda, Heterobranchia) from the Syrian coast.
Tab. 1: Seznam domorodnih in tujerodnih vrst polžev zaškrgarjev (Gastropoda, Heterobranchia) ob sirski obali.

Order	Family	Species	Locality	North	East	Year(s)	Depth (m)	Substrate	Reference
Aplysiida	Aplysiidae	*Aplysia dactylomela* Rang, 1828	Latakia (Ibn Hani)	35.5922	35.7422	2013–2023	littoral	rocky	Katsanevakis *et al.* (2014)
			Latakia (Ibn Hani)	35.5930	35.7412	2016	2	rocky	Ammar *et al.*(2023)
			Al-Bassit	35.85077	35.84209	2021	3–4	rock and sand	unpublished data
			Al-Samraa	35.927828	35.915995	2023	2	rocky	This study
		Aplysia fasciata Poiret, 1789	Latakia (Ibn Hani)	35.5922	35.7422	1993–2023	littoral	rocky	Ammar (1995)
			Al-Massab (north of Tartus)	34.9684	35.8750	2021	littoral	rocky	Ammar (2023a)
			Al-Bassit	35.852528	35.821737	2021	2	rocky	unpublished data
		Aplysia punctata (Cuvier, 1803)	Al-Massab (north of Tartus)	34.9684	35.8750	2021	littoral	rocky	Ammar (2023a)
Sacoglossa	Plakobranchidae	*Elysia grandiflora* (Kelaart, 1858)	Jableh (Al-Rmayleh)	35.378485	35.920809	2019, 2020 & 2021	1-2	pond on rocky shore	Ammar *et al.* (2022)
			Tartus (Al Fawwar)	34.850385	35.89326	2020	shoreline	rocky	Ammar *et al.* (2022)
			Latakia (Ibn Hani MPA)	35.592743	35.741689	2017	4	rocky	Ammar *et al.* (2023)
				35.592939	35.750071	2023	4	rocky	This study
Pleurobranchida	Pleurobranchidae	*Berthella stellata albocrossata* Heller & T. E. Thompson, 1983	Latakia (Ibn Hani)	35.593043	35.741230	2022	7	rocky	Ammar (2023c)
			Latakia (Ibn Hani)	35.596254	35.75708	2022	12	artificial reef	unpublished data
		Berthella sp.	Al-Bassit	35. 852528	35.821737	2023	shallow water	rocky	unpublished data
		Pleurobranchus testudinarius Cantraine, 1835	Ibn Hani	35.592939	35.750071	2019	2	rocky beds	Ammar (2023b)
			Al-Samraa	35.927828	35.915995	2019	2	rocky beds	Ammar (2023b)
Nudibranchia	Aeolidiidae	*Spurilla neapolitana* (Delle Chiaje, 1823)	Tartus	34.968416	35.875922	2019–2020	0.5	rocky	Ammar (2023a)
	Fionidae	*Fiona pinnata* (Eschscholtz, 1831)	Tartus (Al-Massab)	34.968416	35.875922	2021	0	floating piece of wood	this study
	Polyceridae	*Plocamopherus ocellatus* Rüppell and Leuckart, 1828	Latakia (Ibn Hani)	35.591589	35.743336	2022	5–6	rocky	Ammar (2023c)
		Thecacera pennigera (Montagu, 1813)	Latakia	35.3559	35. 4444	2013	100	muddy	Ammar (2019)
	Chromodorididae	*Goniobranchus annulatus* (Eliot, 1904)	Tartus	34.87395	35.880702	2018	10	rocky	Ammar (2019)
			Latakia (HIMR)	35.5927	35.74191	2016	2	rocky	Ammar *et al.* (2023)
			Latakia (Ras-Alkhedr)	35.5451	35.7571	2022	5	rocky	this study
		Goniobranchus obsoletus (Rüppell & Leuckart, 1830)	Jableh	35.378494,	35.917967	September 2019	1–2	pond on rocky shore	Ammar *et al.* (2022)
			Tartus (Al-Masab)	34.9684	35.8750	April 2021.	rocky shoreline	small marina	Ammar (2023a)
			Latakia (HIMR)	35.5927	35.74191	2016	2	rocky	Ammar *et al.* (2023)
		Hypselodoris infucata (Rüppell & Leuckart, 1830)	Jableh	35.378494,	35.917967	2020 & 2021	1–2	pond on rocky shore	Ammar *et al.* (2022)
			Tartus (Al-Massab)	34.968416	35.875922	October 2021	rocky shore	small marina	Ammar, (2023a)
			Latakia (HIMR – Ibn Hani)	35.5927	35.74191	2016	4	rocky	Ammar *et al.* (2023)
		Felimare picta (Philippi, 1836)	Al-Samraa (Shatt al-Armen)	35.927828	35.915995	2019	5	rocky beds	Ammar (2023c)
	Dendrodorididae	*Dendrodoris grandiflora* (Rapp, 1827)	Latakia (Ibn Hani)	35.592939	35.750071	2022	approx. 2	rocky beds	Ammar (2023a)

E. grandifolia (Kelaart, 1858) or *E. ornata* (Swainson, 1840) (Ammar *et al.*, 2022).

Due to current limitations in genetic classification within Syrian scientific institutions, experts from abroad were consulted. Their analyses of similar samples from the Lebanese coast confirmed that all individuals, despite their morphological variations, belong to a single species, *Elysia grandifolia* (personal communication). This suggests that *E. ornata* is currently absent from Syria. *E. grandifolia* has emerged as the dominant species in the shallow coastal areas of Syria, with its breeding season occurring in December. The number of observed individuals has been increasing over recent years, reaching approximately 20 individuals per square meter, particularly in sites such as Al Fawwar and the Ibn Hani reserve.

Additionally, three, possibly four, rare Mediterranean species from the Pleurobranchida order were observed and photographed in the northern sector of the Syrian coast (Tab. 1).

Berthella stellata (Risso, 1826), previously misidentified as *Doris verrucosa* Linnaeus, 1758 in a study by Ammar (2023c), belongs to the family of Pleurobranchidae. One individual of *B. stellata* was found under a rock in Ibn Hani (Fig. 3B), and another specimen was later collected from an artificial reef nearby (Fig. 3C). The observed specimens featured a pair of short rhinophores on the head; their yellowish-gray bodies appeared covered with numerous papillae (Fig. 3 B+C).

Establishing a specific and clear classification for the two specimens found in two close but different environments of northern Latakia (natural and artificial) was challenging. Genetic and morphological analyses have revealed *B. stellata* to be a complex species comprising eight different subspecies (Ghanimi *et al.*, 2020). The two Syrian specimens resembled what is known as the subspecies *Berthella stellata albocrossata* Heller & T. E. Thompson, 1983, however, their classification remains uncertain (WoRMS, 2024), due to an ongoing debate regarding the identification of subspecies based on genetic and morphological analyses (Ghanimi *et al.*, 2020).

A very small individual of the *Berthella* genus was discovered attached to stones on a shallow rocky shore near the port of Al-Bassit (35.852528, 35.821737) on September 22, 2023 (Fig. 3D). The sample looked very similar to *Berthella perforata* (Philippi, 1844) (Ghanimi *et al.*, 2020).

B. perforata, known as an Atlantic-Mediterranean species, has been documented along the Turkish coasts of the Mediterranean Sea (Öztürk *et al.*, 2014), in the Sea of Marmara, and in Greece within the Greek Exclusive Economic Zone (Manousis, 2021). Its habitat extends across the South and North Atlantic Oceans, from South Africa as far as Ireland, where it is referred to as *B. plumula* (WoRMS, 2024).

Pleurobranchus testidinarius Cantraine, 1835 (Fig. 3E), belonging to the order Pleurobranchida and the family Pleurobranchidae, is a Mediterranean species documented in various Mediterranean countries, including Turkey, Greece, Italy, France, and Spain, and in the North Atlantic Ocean. Regionally, records of *P. testidinarius* have been reported in Turkey and the Levantine Basin since 1971 (Gökoğlu *et al.*, 2018; Ergüden *et al.*, 2020). In Syria, this rare species was observed for the first time in 2019. Two specimens, each displaying different coloration—yellow and dark red—, were photographed during free diving at a depth of 2 meters over the rocky bottom of Ibn Hani [35.592939, 35.750071] to the north of Latakia, and at Al-Samra [35.927828, 35.915995]. The first official report of *P. testidinarius* in Syria was made in 2023 (Ammar, 2023b).

The order Nudibranchia is represented by nine species belonging to five families (Table 1). In summer 2019, two individuals from the family Aeolidiidae were collected for the first time in Al-Massab, where they were discovered under rocks at a depth of approximately 0.5 meters. They were small, not exceeding 4 cm in length (Fig. 4A). In 2020, another individual was collected from the same site. The morphological characteristics of all three individuals suggest they could be classified as either *Spurilla neapolitana* (Delle Chiaje, 1823) or, possibly, as part of the genus *Aeolidiella* Bergh, 1867. However, precise classification is pending genetic analysis, particularly given the challenges in accurately classifying species within this family based solely on morphology (Carmona *et al.*, 2013). The present constitutes an additional record of this species in the eastern Mediterranean following previous ones from Turkey and Greece (Öztürk *et al.*, 2014; Manousis, 2021).

Fiona pinnata (Eschscholtz, 1831) from the family Fionidae was documented for the first time in Syria during this study. Several individuals were found north of Tartus in 2021, attached to an old piece of driftwood alongside a group of goose barnacles (Lepas) and ascidians (Fig. 4B). While *F. pinnata* is known to have a global distribution, this marks its first documented occurrence in the Levantine Basin and Syria.

Plocamopherus ocellatus Rüppell and Leuckart, 1828 (Fig. 4C+D), and *Thecacera pennigera* (Montagu, 1813) (Fig. 4E) are members of the family Polyceridae. *P. ocellatus*, a Lessepsian migrant originating from the western Indian Ocean, was discovered as a single small individual at the Ibn Hani site in 2022. *T. pennigera*, a cryptogenic species, was collected in deeper waters off Latakia in 2013 and noted as a rare occurrence in the Syrian sea.

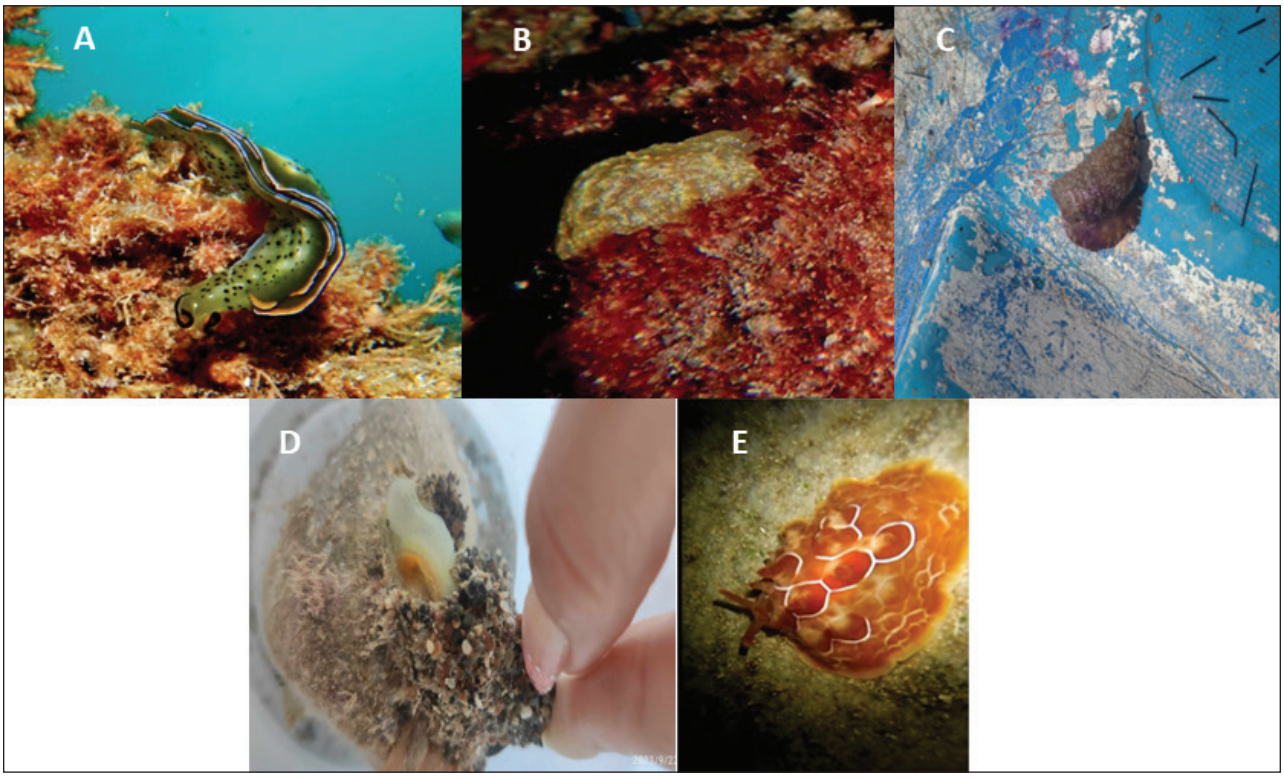

Fig. 3/Sl.3: (A) *Elysia grandifolia****, (B, C)*** *Berthella stellata albocrossata****, (D)*** *Berthella* ***sp., (E)*** *Pleurobranchus testidinarius****.***

The Chromodorididae family is represented in Syria by four species, three of which – *Goniobranchus annulatus* (Eliot, 1904), *G. obsoletus* (Rüppell & Leuckart, 1830), and *Hypselodoris infucata* (Rüppell & Leuckart, 1830) – are non-native. These species have been observed frequently, expanding their distribution range across all studied sites. *G. annulatus* and *G. obsoletus* were first documented in the rocky shore of Latakia (HIMR) in 2016 at a depth of 2–5 meters, with subsequent sightings in the Alsokhneh beach pool north of Jableh in June 2019 and Al-Massab in April 2021 (Fig. 4F, 4G, 4H). Currently, *G. obsoletus* is widespread in all the mentioned sites.

H. infucata, endemic to the Red Sea, occurs in the Mediterranean as a non-indigenous and, in some regions, even invasive species. It was first recorded in 2016 near the Ibn Hani MPA by amateur divers (Fig. 4I), with subsequent sightings in Al-Massab in 2020 and 2021, and in Al Bassit in 2022. Although the species still occurs only in small numbers along the shallow coastal areas of Tartus and Jableh, its invasive potential warrants attention (Ammar *et al.*, 2022).

The Mediterranean slug *Felimare picta* (Philippi, 1836), the only native species of this family found in Syria, was observed once, during a free dive in the far north sector, at Shatt al-Armen, in June 2019 at a depth of 5 meters. The specimen, measuring a notable 18 cm in size, featured continuous parallel yellow lines running along its dark dorsum and extending all the way to the rhinophoral sheaths, complete yellow circles around the edge of the rhinophoral sheath, and several yellow rings on the edges (Fig. 4J).

A single individual of *Dendrodoris grandiflora* (Rapp, 1827) of the family Dendrodorididae, which is typically distributed in the Mediterranean and northeastern Atlantic, was sighted at the Ibn Hani site in September 2022 at a depth of approximately 2 meters. This specimen was 30–40 millimeters long, pale gray with dark brown spots on the dorsum and small brown spots and dark striations on the mantle margin (Fig. 4K). In previous publications (Ammar, 2023c), the species was misclassified as *Tayuva lilacina* (Gould, 1852).

The nocturnality of these species, combined with the challenges of free diving, limited the availability of photographs and specimens necessary for accurate classification, underscoring the rarity and difficulty associated with studying these organisms.

No specific scale is provided for photographs, as the size of the object in the image may vary depending on its proximity or distance, as well as zoom level.

The current study represents the first documented record of *Fiona pinnata* (Eschscholtz, 1831) and *Berthella perforata* (Philippi, 1844) in Syria,

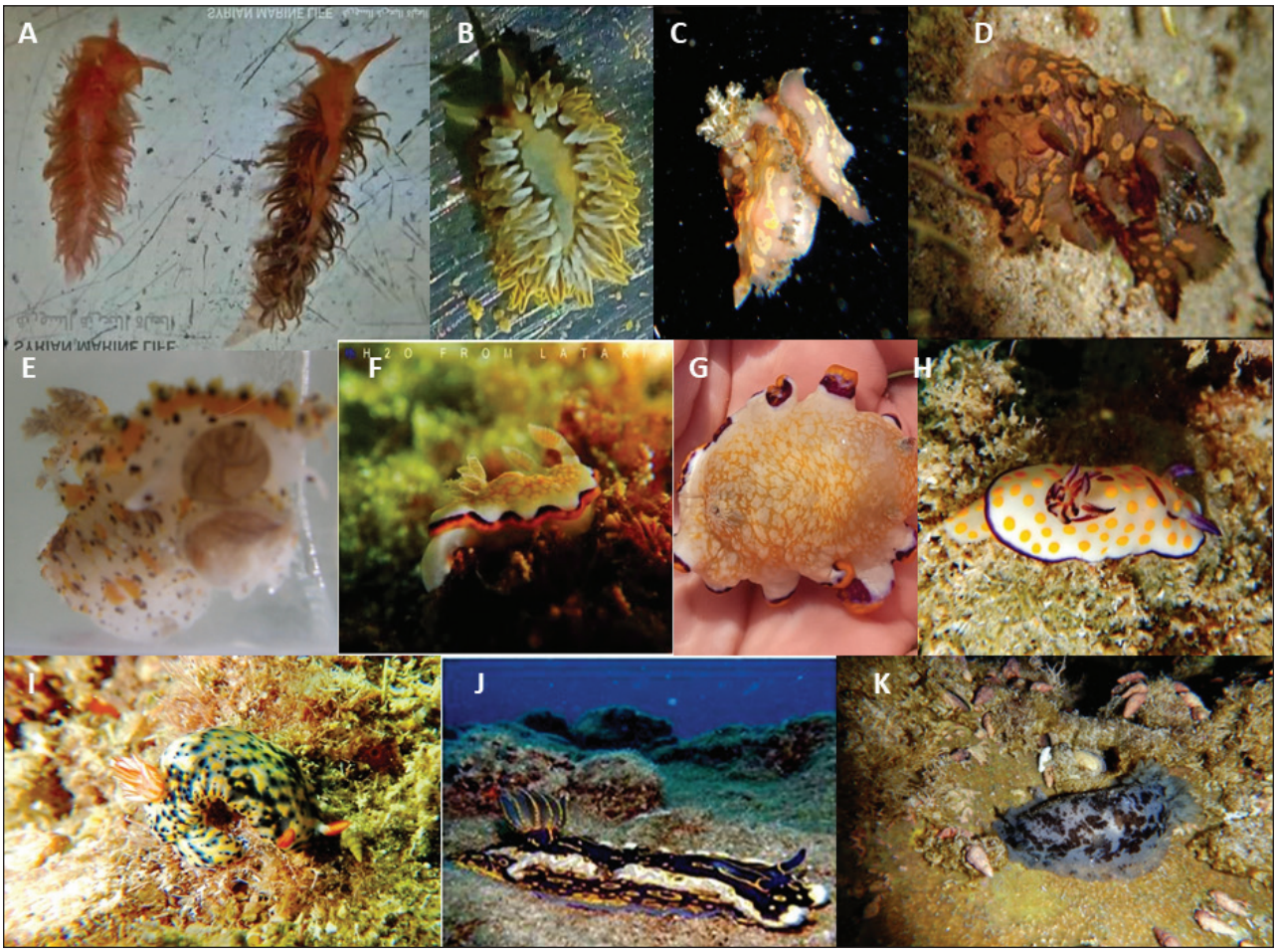

Fig. 4: Underwater photographs of nudibranchs from the Syrian coast: ***(A)*** *Spurilla neapolitana*, ***(B)*** *Fiona pinnata*, ***(C & D)*** *Plocamopherus ocellatus*, ***(E)*** *Thecacera pennigera*, ***(F & G)*** *Goniobranchus obsoletus*, ***(H)*** *Goniobranchus annulatus*, ***(I)*** *Hypselodoris infucata*, ***(J)*** *Felimare picta*, ***(K)*** *Dendrodoris grandiflora*.
Sl. 4: Podvodne fotografije gološkrgarjev iz sirske obale: ***(A)*** *Spurilla neapolitana*, ***(B)*** *Fiona pinnata*, ***(C & D)*** *Plocamopherus ocellatus*, ***(E)*** *Thecacera pennigera*, ***(F & G)*** *Goniobranchus obsoletus*, ***(H)*** *Goniobranchus annulatus*, ***(I)*** *Hypselodoris infucata*, ***(J)*** *Felimare picta*, ***(K)*** *Dendrodoris grandiflora*.

and rectifies previous identifications of *Dendrodoris grandiflora* (Rapp, 1827) and *Berthella stellata albocrossata* Heller & T. E. Thompson, 1983.

Among the species listed, six are non-indigenous species (NIS) originating from the Indian Ocean and the Red Sea: *Goniobranchus annulatus*, *Goniobranchus obsoletus*, *Elysia grandifolia*, *Hypselodoris infucata*, *Plocamopherus ocellatus*, and *Dendrodoris grandiflora*. Two species, *Aplysia dactylomela* and *Thecacera pennigera*, are classified as cryptogenic, *Berthella stellata albocrossata* is yet to be confirmed as a distinct species, while *Spurilla neapolitana* and *Berthella perforata* are identified as native Atlantic-Mediterranean species.

The study has revealed an expanding presence of alien heterobranchs in Syria and a tendency for them to dominate in new environments. Their expansion therefore calls for continued monitoring and management efforts to mitigate the impacts of these invasive species on native ecosystems.

The rise in seawater temperature in the eastern Mediterranean due to global warming has been linked to an increase in the number of alien species of sea slugs, particularly those of tropical origin, in the region. Studies by Rothman *et al*. (2017) and Mioni & Furfaro (2022) have highlighted the impact of climate change on the colonization of these species in the Mediterranean Sea. Prior to 2013, the Mediterranean was home to 30 species of alien Nudibranchia, equaling 6% of the total number of sea slugs in the region (Crocetta *et al*., 2013).

The discovery of rare species in the Mediterranean has been made easier through various methods, including observations and photography by divers passionate about marine life, as well as contributions from field experts. Online platforms such as the Mediterranean

Slug Site and Sea Slug Forum have proven to be valuable resources for sharing information and images of these rare species (Follett & Strezov, 2015; Yonow, 2015).

The observed increase in the occurrence and distribution of non-native sea slugs along the Syrian coast, in both southern and northern regions, underscores the impact of climate change on marine biodiversity. This trend is supported by the heightened interest and field efforts aimed at documenting and understanding the presence of these species in the region.

CONCLUSIONS

The relatively low number of recorded heterobranchs in Syria up to 2023 can be attributed to several factors, including limited targeted research efforts and reliance on observations by amateur divers. Furthermore, certain species may have been overlooked or not specifically targeted in previous studies, giving the impression that marine gastropods along the Syrian coast are underrepresented.

The emergence and dominance of alien sea slug species, particularly in coralligenous habitats such as the Ibn Hani marine protected area (MPA), bring attention to the possible effects of climate change and global warming on marine biodiversity in Syria and the Eastern Mediterranean. The increasing presence of Atlantic tropical species suggests rapid colonization and adaptation to the Levantine Sea that may alter the local ecosystem dynamics.

The participation of citizen scientists in documenting the presence of rare Mediterranean species is crucial for supplementing local biodiversity records. Their contributions enhance our understanding of marine ecosystems and serve as valuable additions to scientific research efforts. As climate change continues to affect marine environments, collaboration between scientists and citizen scientists in monitoring and conserving coastal biodiversity becomes ever more important.

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PRELIMINARNI SEZNAM MORSKIH POLŽEV ZAŠKRGARJEV (MOLLUSCA: GASTROPODA: HETEROBRANCHIA) SIRIJE

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POVZETEK

Porast raziskav morske biodiverzitete v Siriji s posebnim poudarkom na tujerodne vrste in vključevanje amaterskih ljubiteljskih potapljačev sta omogočila tudi zbiranje podatkov o drugih vrstah, med drugim tudi o polžih zaškrgarjih (Mollusca: Gastropoda). Med letoma 2016 in 2023 so potapljači opazili številne vrste polžev zaškrgarjev v globinskem pasu med 2 in 12 m ob sirski obali. Dodatne primerke so ročno nabrali na skalnati obali med letoma 2020 in 2023. Skupno je bilo v sirskih morskih vodah ugotovljeno 16 vrst polžev zaškrgarjev. Med njimi je 6 vrst tujerodnih, dve sta kriptogeni, nekatere od njih tudi invazivne. Avtor je obelodanil tudi prvo pojavljanje redkih vrst kot sta Fiona pinnata *in* Berthella stellata albocrossata*, v Siriji. Zanimivo je, da sta kriptogena vrsta* Aplysia dactylomela *in invazivna vrsta* Elysia grandifolia *prevladovali na večini lokalitet.*

Ključne besede: Nudibranchia, Mollusca, novi zapis o pojavljanju, redke vrste, vzhodno Sredozemsko morje

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