Mediterranean Marine Science

Vol. 22, 2021

“New Alien Mediterranean Biodiversity Records” (March 2021)

ORFANIDIS SOTIRIS	Fisheries Research Institute (ELGO-DIMITRA), 64007, Nea Peramos, Kavala, Greece
ALVITO ANDREA	IMC - International Marine Centre, Loc. Sa Mardini, Torregrande - 09170 Oristano, Italy
AZZURRO ERNESTO	IRBIM, Institute of Biological Resources and Marine Biotechnologies – CNR, National Research Council, Ancona, Italy & Department of Integrative Marine Ecology, Stazione Zoologica Anton Dohrn, I-80121 Napoli, Italy
BADREDDINE ALI	Faculty of Sciences, Lebanese University, Hadath, Beirut, Lebanon
BEN SOUISSI JAMILA	Laboratory of Biodiversity, Biotechnology and Climate Change (LR11ES09), Tunis El Manar University, Tunisia & Institut National Agronomique de Tunisie, Université de Carthage, Tunisia
CHAMORRO CHAMORRO	C/Melchor Almagro 9 4c, Granada, Spain
CROCETTA FABIO	Department of Integrative Marine Ecology, Stazione Zoologica Anton Dohrn, I-80121 Napoli, Italy
DALYAN CEM	Istanbul University, Faculty of Science, Department of Biology, Division of Hydrobiology, Vezneciler, 34134 Istanbul, Turkey
FORTIČ ANA	Marine Biology Station, National Institute of Biology, Fornače 41, 6300 Piran, Slovenia
GALANTI LUCA	Capo Murro Diving Center,

	via Capo Ognina, 96100, Siracusa, Italy
GEYRAN KEMAL	Kırgülü Sk. 12, Orhantepe Mah. Kartal, 34865 Istanbul, Turkey
GHANEM RAOUIA	Laboratory of Biodiversity, Biotechnology and Climate Change (LR11ES09), Tunis El Manar University, Tunisia
GORUPPI ALENKA	National Institute of Oceanography and Applied Geophysics - OGS, Italy
GRECH DANIELE	IMC - International Marine Centre, Loc. Sa Mardini, Torregrande - 09170 Oristano, Italy
KATSANEVAKIS STELIOS	Department of Marine Sciences, University of the Aegean, University Hill, 81100 Mytilene, Greece
MADRENAS ENRIC	Grup d'Estudis VIMAR (Vida Marina), C/ Rocafort 246, 08029 Barcelona, Spain
MASTROTOTARO FRANCESCO	Department of Biology, University of Bari, Via E. & CoNISMa, Piazzale Flaminio 9, 00197, Roma, Italy
MONTESANTO FEDERICA	Department of Biology, University of Bari, Via E. & CoNISMa, Piazzale Flaminio 9, 00197, Roma, Italy
PAVIČIĆ MIŠO	Institute of Oceanography and Fisheries, Šetalište Ivana Meštrovića 63, 21000 Split, Croatia
PICA DANIELA	CoNISMa, Piazzale Flaminio 9, 00197, Roma, Italy & Department of Biological and Environmental Sciences and Technologies, University of Salento, Via Provinciale Lecce, 73100, Monteroni, Lecce, Italy
POLA LISA	Department of Life and Environmental Sciences (DiSVA), Polytechnic University of Marche, via Brecce Bianche, 60131, Ancona, Italy
PONTES MIQUEL	Grup d'Estudis VIMAR (Vida Marina), C/ Rocafort 246, 08029 Barcelona, Spain
RAGKOUSIS MICAIL	Department of Marine Sciences, University of the Aegean, University Hill, 81100 Mytilene, Greece
ROSSO ANTONIETTA	Department of Biological, Geological and Environmental Sciences, University of Catania, Via Androne 81, 95124 Catania, Italy

SÁNCHEZ-TOCINO LUIS	Department of Zoology, University of Granada, Campus Fuentenueva, 18071, Granada, Spain
TIERNO DE FIGUEROA JOSÉ MANUEL	Department of Zoology, University of Granada, Campus Fuentenueva, 18071, Granada, Spain
TIRALONGO FRANCESCO	Department of Biological, Geological and Environmental Sciences, University of Catania, Via Androne 81, 95124 Catania, Italy
TIRELLI VALENTINA	National Institute of Oceanography and Applied Geophysics - OGS, Italy
TSIOLI SOULTANA	Fisheries Research Institute (ELGO-DIMITRA), 64007, Nea Peramos, Kavala, Greece
TUNÇER SEZGINER	Faculty of Marine Sciences and Technology, Çanakkale Onsekiz Mart University, Barbaros, 17100 Çanakkale, Turkey
VRDOLJAK DARIO	Institute of Oceanography and Fisheries, Šetalište Ivana Meštrovića 63, 21000 Split, Croatia
VULETIN VEDRAN	Institute of Oceanography and Fisheries, Šetalište Ivana Meštrovića 63, 21000 Split, Croatia
ZAOUALI JEANNE	Institut National Agronomique de Tunisie, Université de Carthage, Tunisia
ZENETOS ARGYRO	Hellenic Centre for Marine Research, 19013, Anavyssos, Greece

https://doi.org/10.12681/mms.25294

To cite this article:

ORFANIDIS, S., ALVITO, A., AZZURRO, E., BADREDDINE, A., BEN SOUISSI, J., CHAMORRO, C., CROCETTA, F., DALYAN, C., FORTIČ, A., GALANTI, L., GEYRAN, K., GHANEM, R., GORUPPI, A., GRECH, D., KATSANEVAKIS, S., MADRENAS, E., MASTROTOTARO, F., MONTESANTO, F., PAVIČIĆ, M., PICA, D., POLA, L., PONTES, M., RAGKOUSIS, M., ROSSO, A., SÁNCHEZ-TOCINO, L., TIERNO DE FIGUEROA, J. M., TIRALONGO, F., TIRELLI, V., TSIOLI, S., TUNÇER, S., VRDOLJAK, D., VULETIN, V., ZAOUALI, J., & ZENETOS, A. (2021). "New Alien Mediterranean Biodiversity Records" (March 2021). *Mediterranean Marine Science, 22*(1), 180-198. doi:https://doi.org/10.12681/mms.25294

Collective Article A

Mediterranean Marine Science
Indexed in WoS (Web of Science, ISI Thomson) and SCOPUS
The journal is available on line at http://www.medit-mar-sc.net
DOI: https://doi.org/10.12681/mms.25294

New Alien Mediterranean Biodiversity Records (March 2021)

Sotiris ORFANIDIS[1], Andrea ALVITO[2], Ernesto AZZURRO[3,7], Ali BADREDDINE[4], Jamila BEN SOUISSI[5,23], Manuel CHAMORRO[6], Fabio CROCETTA[7], Cem DALYAN[8], Ana FORTIČ[9], Luca GALANTI[10], Kemal GEYRAN[11], Raouia GHANEM[5], Alenka GORUPPI[12], Daniele GRECH[2], Stelios KATSANEVAKIS[13], Enric MADRENAS[14], Fransesco MASTROTOTARO[15,16], Federica MONTESANTO[15,16], Mišo PAVIČIĆ[17], Daniela PICA[16,18], Lisa POLA[19], Miquel PONTES[14], Michail RAGKOUSIS[13], Antonietta ROSSO[20], Luis SÁNCHEZ-TOCINO[21], J. Manuel TIERNO DE FIGUEROA[21], Francesco TIRALONGO[20], Valentina TIRELLI[12], Soultana TSIOLI[1], Sezginer TUNÇER[22], Dario VRDOLJAK[17], Verdan VULETIN[17], Jeanne ZAOUALI[23] and Argyro ZENETOS[24]

[1] Fisheries Research Institute (ELGO-DIMITRA), 64007, Nea Peramos, Kavala, Greece
[2] IMC - International Marine Centre, Loc. Sa Mardini, Torregrande - 09170 Oristano, Italy
[3] IRBIM, Institute of Biological Resources and Marine Biotechnologies – CNR, National Research Council, Ancona, Italy
[4] Faculty of Sciences, Lebanese University, Hadath, Beirut, Lebanon
[5] Laboratory of Biodiversity, Biotechnology and Climate Change (LR11ES09), Tunis El Manar University, Tunisia
[6] C/Melchor Almagro 9 4c, Granada, Spain
[7] Department of Integrative Marine Ecology, Stazione Zoologica Anton Dohrn, I-80121 Napoli, Italy
[8] Istanbul University, Faculty of Science, Department of Biology, Division of Hydrobiology, Vezneciler, 34134 Istanbul, Turkey
[9] Marine Biology Station, National Institute of Biology, Fornače 41, 6300 Piran, Slovenia
[10] Capo Murro Diving Center, via Capo Ognina, 96100, Siracusa, Italy
[11] Kırgülü Sk. 12, Orhantepe Mah. Kartal, 34865 Istanbul, Turkey
[12] National Institute of Oceanography and Applied Geophysics - OGS, Italy
[13] Department of Marine Sciences, University of the Aegean, University Hill, 81100 Mytilene, Greece
[14] Grup d'Estudis VIMAR (Vida Marina), C/ Rocafort 246, 08029 Barcelona, Spain
[15] Department of Biology, University of Bari, Via E. Orabona, 4, 70125, Bari, Italy
[16] CoNISMa, Piazzale Flaminio 9, 00197, Roma, Italy
[17] Institute of Oceanography and Fisheries, Šetalište Ivana Meštrovića 63, 21000 Split, Croatia
[18] Department of Biological and Environmental Sciences and Technologies, University of Salento, Via Provinciale Lecce, 73100, Monteroni, Lecce, Italy
[19] Department of Life and Environmental Sciences (DiSVA), Polytechnic University of Marche, via Brecce Bianche, 60131, Ancona, Italy
[20] Department of Biological, Geological and Environmental Sciences, University of Catania, Via Androne 81, 95124 Catania, Italy
[21] Department of Zoology, University of Granada, Campus Fuentenueva, 18071, Granada, Spain
[22] Faculty of Marine Sciences and Technology, Çanakkale Onsekiz Mart University, Barbaros, 17100 Çanakkale, Turkey
[23] Institut National Agronomique de Tunisie, Université de Carthage, Tunisia
[24] Hellenic Centre for Marine Research, 19013, Anavyssos, Greece

Contributing Editor: Vasilis Gerovasileiou
Published online: 26 March 2021

Abstract

This article includes twenty (20) new records of alien and cryptogenic species in the Mediterranean Sea, belonging to six (6) Phyla (Rhodophyta, Tracheophyta, Mollusca, Arthropoda, Bryozoa, and Chordata) distributed from the Eastern Mediterranean to the Sea of Alboran. The records are reported from nine (9) countries and can be classified into two categories: new records for the Mediterranean Sea and new records of non-indigenous species expanding within the Mediterranean Sea. The first category includes the gastropod *Turbo radiatus* from Lebanon coasts, the portunid crab *Charybdis* (*Charybdis*) *natator* from Tunis southern lagoon, the mollusc *Thuridilla mazda* from South Spain, and the nudibranch *Okenia picoensis* from the Alboran coasts of Spain and from Malta. The second category includes the bivalve *Nudiscintilla* cf. *glabra* from the Aegean coast of Turkey, the rhodophyte *Colaconema codicola* from the North Aegean coasts of Greece, the naked band gaper *Champsodon nudivittis* from the Sea of Marmara, Turkey. Also, the brachyuran *Gonioinfradens giardi* from the Greek Ionian waters, the codlet *Bregmaceros nectabanus* from the Croatian coasts of the Adriatic Sea, and the bryozoan *Arbopercula tenella* and copepod *Parvocalanus crassirostris* both from the Gulf of Trieste, Slovenian and Italian coasts, respectively. New records were also reported for the ascidian *Distaplia bermudensis* from brackish the Gulf of Naples, Italy, the damselfish *Abudefduf* cf. *saxatilis* and the seagrass *Halophila stipulacea* from Sardinia, Tyrrhenian Sea, and for the fish *Paranthias furcifer* from the harbour of Almeria, Alboran Sea, Spain. Through these records, an understanding of the expanding mechanisms and processes and, if possible, the development of mitigation measures within the region will be further facilitated.

Introduction

Non-indigenous species (NIS), also known as aliens, are invading the Mediterranean Sea coastal and transitional waters (Orlando-Bonaca *et al*., 2019) at an accelerated rate (Zenetos & Galanidi, 2020) due to an interplay of "chance and necessity". By chance, most tropical species did not return to the sub-tropical eastern part of the Mediterranean after its desiccation (Messinian crisis) due to palaeoclimatic changes, leaving empty niche and space (Lüning, 1990). By necessity, because of the Mediterranean Sea's contemporary diversity drivers, such as habitat modification, pollution, coastal urbanization, aquaculture, maritime transport, fisheries overexploitation (Korpinen *et al*., 2019; MedECC, 2020), and the Suez canal's opening and enlargement offer a niche for new species introduction and expansion. The establishment of thermophile tropical species at the expense of the natives is expected to be facilitated further by climate warming based on species origin (Bianchi *et al*., 2012) and ecophysiology (Orfanidis, 1991; Orfanidis *et al*., 1999; Raitsos *et al*., 2010). By performing Horizon scanning based on 267 taxa across European Seas, Tsiamis *et al*. (2020) concluded that the Mediterranean Sea appeared to be the most threatened regional sea, as it is likely to be affected by the arrival or further spread of the highest number of HS marine species considered (232 taxa) and their (potential) impact.

Among the 700 NIS species in the Mediterranean, most of them enter through the Suez Canal and occur in the Eastern sub-region, and more than 600 are invasive, establishing permanent populations in their new environment (Zenetos & Galanidi, 2020). Although their impact on local ecosystems started recently to be quantitatively assessed (Katsanevakis *et al*., 2016), their effects on marine biodiversity, ecosystem services, and the economy can be profound (Katsanevakis *et al*., 2014; Mannino *et al*., 2017). European Union has implemented several legislative actions, among them the Marine Strategy Framework Directive (EC, 2008) and EU Regulation on Invasive Alien Species (EU, 2014), under the Convention on Biological Diversity (CBD), that demand collection of distribution data and mapping of spatial patterns. Recording, quantifying the abundance and mapping the invasive alien species are the tools to understand the expanding mechanisms and process and, if possible, developing mitigation measures and prevent new invasions (Mačić *et al*., 2018).

Through its Collective Article, Series A, the *Mediterranean Marine Science* journal offers a platform to facilitate NIS data collection. In the current issue, records are grouped by country, from East to West. NIS records' locations are illustrated in Figure 1, and further information corresponding to each report can be found in Table 1.

In the current article, twenty (20) new alien species records are reported from nine (9) countries. They can be classified into two categories, new records for the Mediterranean Sea and new records of existing in the Mediterranean Sea species.

The first category includes the gastropod *Turbo radiatus* from Lebanon coasts, the portunid crab *Charybdis* (*Charybdis*) *natator* from Tunis southern lagoon, the mollusc *Thuridilla mazda* from the Almuñécar coasts (Spain), and the nudibranch *Okenia picoensis* from the Alboran coasts of Spain and Malta.

The second category includes the bivalve *Nudiscintilla* cf. *glabra* from the Aegean coasts of Turkey, the rhodophyte *Colaconema codicola* from Thessaloniki Gulf, North Aegean Sea, Greece, the naked band gaper *Champsodon nudivittis* from the northern Dardanelles, Sea of Marmara, Turkey. Also, the brachyuran *Gonioinfradens giardi* from the Ionian Sea, Greece, the codlet

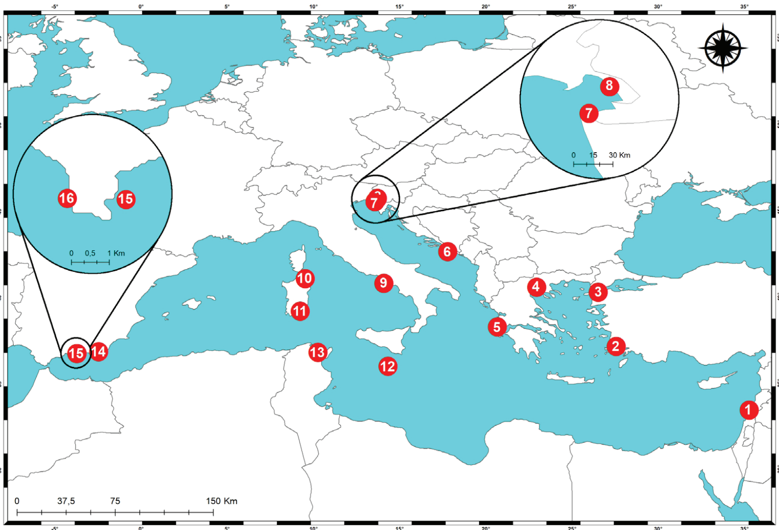

Fig. 1: Location of new non-indigenous species, as reported in this article. Location numbers correspond to Table 1.

Table 1. List of species reported in this paper, dedicated Sub-chapter (SC), latitude & longitude of locations, country of the report, location number corresponding to Figure 1 (LN). * first record in the Mediterranean Sea. + refers to more than one record of the species in the area.

Taxon	Phylum	SC	Latitude	Longitude	Sub-region	Country	LN
Colaconema codicola	Rhodophyta	1.1	40.569	22.953	Aegean Sea	Greece	4
Halophila stipulacea+	Tracheophyta	2.1	41.0526	9.5234	Tyrrhenian Sea	Italy	10
*Turbo radiatus**	Mollusca	3.1	33.4396	35.2741	Levantine	Lebanon	1
*Thuridilla mazda**	Mollusca	3.2	36.7228	-3.7236	Alboran Sea	Spain	15
Nudiscintilla cf. *glabra*	Mollusca	3.3	37.1293	27.5716	Aegean Sea	Turkey	2
*Okenia picoensis**+	Mollusca	3.4	35.9878	14.3286	Central Mediterranean	Malta	12
			36.7231	-3.7375	Alboran Sea	Spain	16
*Charybdis (Charybdis) natator**	Arthropoda	4.1	36.7946	10.2639	Tunis lagoon	Tunisia	13
Parvocalanus crassirostris	Arthropoda	4.2	45.70	13.71	Adriatic Sea	Italy	8
Gonioinfradens giardi	Arthropoda	4.3	38.2634	20.6733	Ionian Sea	Greece	5
Arbopercula tenella	Bryozoa	5.1	45.5187	13.5676	Adriatic Sea	Slovenia	7
Distaplia bermudensis	Chordata	6.1	40.793	14.077	Tyrrhenian Sea	Italy	9
Paranthias furcifer	Chordata	6.2	36.8266	-2.4662	Alboran Sea	Spain	14
Champsodon nudivittis	Chordata	6.3	40.2716	26.5178	Marmara Sea	Turkey	3
Bregmaceros nectabanus	Chordata	6.4	42.6247	17.7809	Adriatic Sea	Croatia	6
Abudefduf cf. *saxatilis*	Chordata	6.5	39.1756	9.2230	Tyrrhenian Sea	Italy	11

Bregmaceros nectabanus from the Croatian coasts of the Adriatic Sea, and the bryozoan *Arbopercula tenella* and copepod *Parvocalanus crassirostris* both from the Gulf of Trieste, Slovenian and Italian coasts, respectively. New records were also reported for the ascidian *Distaplia bermudensis* from brackish Miseno Lake, Gulf of Naples, Italy, for the damselfish *Abudefduf* cf. *saxatilis* and the seagrass *Halophila stipulacea* from Sardinia, Tyrrhenian Sea, and for the fish *Paranthias furcifer* from the harbour of Almeria, Alboran Sea, Spain. Through these records, an understanding of the expanding mechanisms and processes and, if possible, the development of mitigation measures within the region will be further facilitated.

1. RHODOPHYTA

1.1 First record of the rhodophyte *Colaconema codicola* in North Aegean Sea, Greece

Soultana TSIOLI and Sotiris ORFANIDIS

Colaconema codicola (Børgesen) Stegenga, J.J. Bolton & R.J. Anderson is a filamentous marine rhodophyte widely recorded in temperate regions under different synonyms. It is regarded as native to the Indo-Pacific Ocean and alien in the Mediterranean Sea (Verlaque *et al.*, 2015; Zenetos & Galanidi, 2020), usually found as an epiphyte on the alien in the Mediterranean Sea *Codium fragile* subsp. *fragile* (Cormaci *et al.*, 2017). In the Mediterranean Sea, it was first found on French coasts in 1952, probably introduced along with its host through vessels during the Second World War.

Concerning the Aegean Sea, Tsiamis & Panayotidis (2019) claimed that a specimen found at 1986 in the Saronikos Gulf, named as *Rhodothamniella codii*, was probably a misidentification of *C. codicola*. The only record from the Aegean Sea is attributed to Cirik *et al.* (1990), who found *C. codicola* (as *Acrochaetium codicola*) at Imbros Island between 1972-1987, lacking a description. Since its host is one of the most successful invasive species in the Mediterranean Sea, *C. codicola* should be monitored to evaluate establishment status and impact.

The present study confirms the presence of *C. codicola* as an epiphyte of *C. fragile* subsp. *fragile* (Suringar) Hariot (Fig. 2A) during the monitoring of Nea Krini coasts, Thessaloniki Gulf, North Aegean Sea (40.569° N, 22.953° E) in November 2019, and January and July 2020.

The seaweed is bushy, about 3-5 mm tall, with a multicellular filamentous endophytic base, and prostrate and erect uniseriate filaments. Erect axes 11-15 μm of diameter, usually more branched at the upper part of the axes (Fig. 2B); cells 34-99 μm long, containing at least

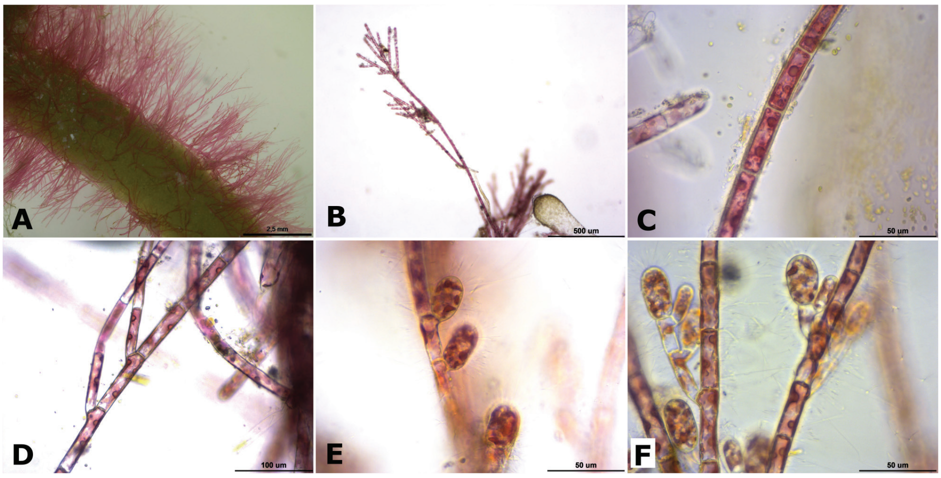

Fig. 2: *Colaconema codicola* in Northern Greece: A) Habit. B) Branching pattern. C, D) Detail of cells, showing parietal chloroplasts, each with a single pyrenoid. E) Sessile monosporangia. F) Stalked monosporangia.

two-lobed, parietal chloroplasts, each containing a single pyrenoid (Figs 2C, D). Sessile and stalked monosporangia found in July material, usually adaxially located on the proximal cells, cylindrical in shape, about 17-21 µm wide and 28-31 µm long (Figs 2E, F).

2. TRACHEOPHYTA

2.1 First records of the seagrass *Halophila stipulacea* in Sardinia (Tyrrhenian Sea, Italy)

Daniela PICA, Luca GALANTI and Lisa POLA

The seagrass *Halophila stipulacea* (Forsskål) Ascherson (Order Alismatales, Family Hydrocharitaceae) is a small tropical dioecious species, with a native distribution in the Red Sea and Indian Ocean. This species is one of the first successful Lessepsian migrants to enter the Mediterranean after the opening of the Suez Canal (Fritsch, 1895). This Non Indigenous Species (NIS; alien) was first observed in the Levantine basin and slowly spread westward through the southern Mediterranean Sea (Winters *et al.*, 2020). For a long time, it was hypothesised that the winter 14° C sea surface isotherm acted as a boundary that many Lessepsian migrants, including *H. stipulacea*, were not able to overcome, and therefore limiting the expansion of these species to the western Mediterranean. However, it was demonstrated that *H. stipulacea* can survive, photosynthesise, and grow within a broad range of temperatures (Georgiou *et al.*, 2016), and it has been predicted that the species will colonise the entire basin within the next 100 years, enabled by the increased seawater temperature associated with climate change (Nguyen *et al.*, 2020). To date, the northernmost area colonised by *H. stipulacea* in the western Mediterranean is Palinuro harbour (Salerno, Italy) (Winters *et al.*, 2020).

In this study, we report the presence of *Halophila stipulacea* in two localities of north-east Sardinia (Italy): Razza di Juncu (41.0526° N, 9.5234° E) and Gulf Aranci (40.9937° N, 9.6266° E). In October 2018 and August 2019, two patches of about 30 m^2 each were recorded in Razza di Juncu at 2-3 m depth (Fig. 3). The seafloor is coarse/detritic without dead matte of *Posidonia oceanica*. In May 2020, four patches (about 221, 188, 75.6 and 69 m^2) of *H. stipulacea* were observed in Gulf Aranci at 5.9-8 m depth. The seafloor is also colonized by the seagrasses *Cymodocea nodosa*, and both species grow on a dead *Posidonia* matte. Measurement of 100 random leaves at Razza di Juncu showed higher values in October 2018 (leaf length mean value = 43.1 ± 7.4 Standard Deviation mm; leaf width mean value = 6.4 ± 0.9 mm) compared with those collected in August 2019 (27.5 ± 5.5 mm and 5.0 ± 0.9 mm) and none showed any sign of grazing activities. Male flowers were only recorded in Razza di Juncu in August 2019 at different development phases.

This study reports several established and flowering patches of *H. stipulacea* in north-east Sardinia, representing the north-westernmost point of its distribution in the Mediterranean Sea. These new records suggesting that the expansion of this NIS is going much faster than hypothesized. Non-Indigenous Species, such as *H. stipulacea*, represent a distinct threat to the environment and an important global change element. Therefore, data on its expansion are fundamental for implementing policies concerning the spread of alien species in the Mediterranean Sea.

Fig. 3: A) *Halophila stipulacea* meadow at Razza di Juncu. B) Plant with a closed male flower (arrow). C) Sample of *H. stipulacea* showing a closed male flower (arrow). D) Sample with an opened male flower.

3. MOLLUSCA

3.1 *Turbo radiatus* Gmelin, 1791 (Mollusca: Gastropoda) entered the Mediterranean Sea: a first record from Lebanon

Ali BADREDDINE and Fabio CROCETTA

The rayed dwarf-turban *Turbo radiatus* Gmelin, 1791 is a mollusc of the family Turbinidae Rafinesque, 1815 characterized by a medium-sized (up to about 75 mm, approximately equal in height and width), heavy, and solid shell, with a relatively tall spire and a large inflated body whorl. Strong spiral cords encircle all whorls, although those on the shoulder and the periphery of the body whorl may have sharper lamellate folds, and the outer lip is imbricate. The suture is deep, and the umbilicus is closed. The aperture is round. The shell colour ranges from grey/ivory/beige to brown with a mottled pattern, and the aperture is whitish/yellowish. The operculum is thick and usually white/grey, but mostly is smooth, a character that allow its easy distinction from the very similar congeneric species *Turbo argyrostomus* Linnaeus, 1758 (Bosch & Bosch, 1989; Alf & Kreipl, 2003). *Turbo radiatus* is widespread in the Indo-Pacific region, including the Red Sea and the Persian Gulf, where it lives on reefs in shallow waters (Alf & Kreipl, 2003; Heiman *et al.*, 2012).

During fieldwork carried out on the 31th December 2020, an unknown turbinid species was first observed in the tide pools of the vermetid reef of Saksakiyeh (33.4396° N, 35.2741° E), southern Lebanon (Fig. 4A). After a careful inspection of the area, more than 20 individuals were observed, three of which were sampled for further identification (total height ~4.1-5.3 cm) (Fig. 4B). They were subsequently ascribed to *T. radiatus* based on the morphological characters listed above, and preserved

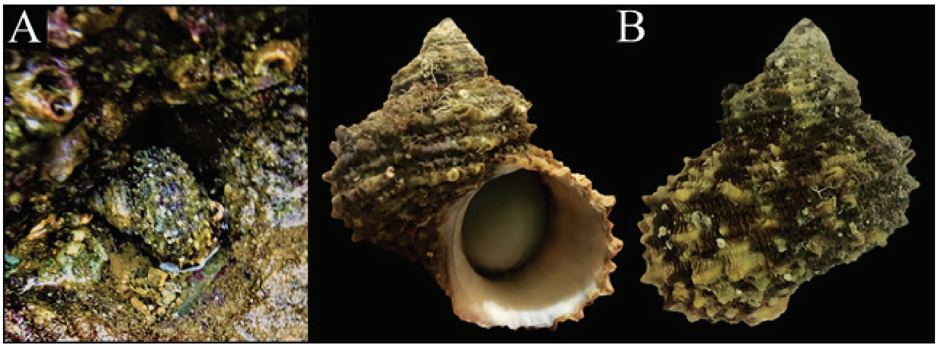

Fig. 4: *Turbo radiatus* from Saksakiyeh (Lebanon). A) Live specimen in the tide pools of the vermetid reef. B) Ventral and dorsal view of one of the specimens sampled (total height ~4.1 cm).

in the private collection of the first author (AB). To the best of our knowledge, such a finding constitutes the first record of this species not only in Lebanon, but in the Mediterranean Sea as a whole (Zenetos & Galanidi, 2020; Crocetta *et al.*, 2020).

No certainties occur regarding the pathway of arrival of *T. radiatus* in Lebanon and in the Mediterranean Sea. However, taking into account that the species is widespread in the Red Sea and that Lebanon lies along the natural pathway of Indo-Pacific taxa spreading in the Mediterranean Sea via the prevailing currents, it may easily have spread in the area via the Suez Canal. Alternatively, its presence in Lebanon may be related to ship-mediated transport. Whatever is true, further fieldwork is necessary to evaluate the current status of this alien species in Lebanese waters and the Mediterranean Sea and its impacts on the local benthic communities.

3.2 First record of the Caribbean Sea slug *Thuridilla mazda* Ortea & Espinosa, 2000 (Mollusca, Sacoglossa) in the Mediterranean Sea

Luis SÁNCHEZ-TOCINO, Manuel CHAMORRO and J. Manuel TIERNO DE FIGUEROA

The genus *Thuridilla* Bergh, 1872 (family Plakobranchidae) currently includes 23 species, four of them with an Atlantic distribution: *T. hopei* (Vérany, 1853), *T. picta* (A.E. Verrill, 1901), *T. mazda* Ortea & Espinosa, 2000, and *T. malaquita* Ortea & Buske, 2014 (Ortea & Buske, 2014).

Thuridilla mazda was described from the Caribbean Sea, particularly from Cuba and Costa Rica coasts (Ortea & Espinosa, 2000b). Its known distribution area in western Atlantic waters was afterward expanded, particularly to other areas from the Caribbean Sea as well as to the Gulf of Mexico (Ortea & Buske, 2014). In eastern Atlantic waters, it has been reported from the Azores Archipelago (Malaquias *et al*., 2012) and the Canary Islands (Ortea *et al*., 2015).

A specimen of *Thuridilla mazda* was observed and photographed (Fig. 5) the 18th of February of 2021 at Punta del Vapor (Almuñécar, Granada, Spain) at 12 m depth (36.7228° N, 3.7236° W). The specimen size was approximately 10 mm. Its body color pattern, and the length, conical shape and color of the rhinophores coincide with the original description of this species (Ortea & Espinosa, 2000b) and with the description reported for the specimen of *T. mazda* in the Azores Archipelago (Malaquias *et al*., 2012), as well as the photograph of the specimen from the Canary Islands (Ortea *et al*., 2015). This allowed its specific determination and its distinction from the other described Atlantic species of the genus.

In the Mediterranean Sea, only another species of the genus *Thuridilla*, *T. hopei*, is known (e.g. Ortea & Espinosa, 2000b). Thus, in this work the presence of *T. mazda* in the Mediterranean waters is reported for the first time.

The amphi-Atlantic distribution of *T. mazda* is not unusual in other opisthobranch species (Malaquias *et al.*, 2012), but integrative taxonomic studies including phylogeographic and morphological approaches are needed to understand better the status of many of these species (Carmona *et al*., 2011), to clarify if they are naturally range expanding species or their presence is due to human activities. Zenetos *et al*. (2020a) have coined the term crypto-expanding for such cases as it specifies the cause of the cryptogenic uncertainty.

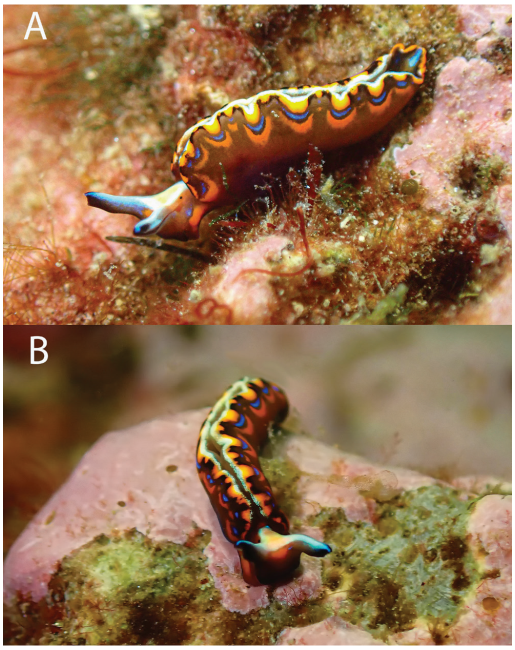

Fig. 5: Specimen of *Thuridilla mazda* from the Almuñécar coast (Granada, Spain). A) lateral view and B) dorso-frontal view. Photo credit: Miguel Vila (A), Manuel Chamorro (B).

3.3 First records of the NE Atlantic nudibranch *Okenia picoensis* Paz-Sedano, Ortigosa & Pola, 2017 (Gastropoda, Goniodorididae) in the Mediterranean Sea

Miquel PONTES and Enric MADRENAS

The genus *Okenia* Menke, 1830 (Gastropoda: Nudibranchia: Goniodorididae) includes about 50 valid species (Pola *et al.,* 2019) and is formed by relatively small sea slugs that live in all oceans, from the tropics to colder waters, but also in temperate seas like the Mediterranean.

Pola *et al*. (2019) confirm the presence of *O. elegans* (Leuckart, 1828), *O. hispanica* Valdés & Ortea, 1995, *O. mediterranea* (Ihering, 1886) and *O. aspersa* (Alder & Hancock, 1845) in the Mediterranean Sea. They replaced former Mediterranean observations of *O. cupella* and *O.impexa* by the new species *O. problematica* Pola, Paz-Sedano, Macali, Minchin, Marchini, Vitale, Licchelli & Crocetta, 2019 and the former Mediterranean reports of *O. zoobotryon* by the new species *O. longiductis* Pola, Paz-Sedano, Macali, Minchin, Marchini, Vitale, Licchelli & Crocetta, 2019. Mediterranean reports of *O. leachii* (Alder & Hancock, 1854) are rejected. Finally, they state the need of further examination of Mediterranean specimens due to confusing morphology (Pola, 2015).

Okenia picoensis Paz-Sedano, Ortigosa & Pola (2017) was recently described in the Azores archipelago on specimens showing two different colour morphs: white with the tips of the body processes yellow, or bright yellow with the tips of the body processes orange. The morpho-

Fig. 6: *Okenia picoensis* in the Mediterranean Sea: a) November 18th, 2020 at Um El Faroud wreck, Wied iż-Żurrieq (Malta). b) November 24th, 2020 at Ċirkewwa arch (Malta). c) March 1st, 2021 at La Piedra del Hombre, La Herradura, Granada (Spain). Photo credit: Kristaps Dzonsons (a, b) and David Ballesteros (c).

Table 2. New records of *Okenia picoensis* in the Mediterranean Sea.

Date	Location	Depth	Temperature
6 November 2020	Rozi wreck, Ċirkewwa, Malta (35.9878° N, 14.3286° E)	29 m	21º C
18 November 2020	Um El Faroud wreck, Wied iż-Żurrieq, Malta (35.8191° N, 14.4498° E)	23 m	21º C
24 November 2020	Ċirkewwa arch, Malta (35.9878° N, 14.3286° E)	17 m	21º C
17 January 2021	Um El Faroud wreck, Wied iż-Żurrieq, Malta (35.8191° N, 14.4498° E)	27 m	16º C
1 March 2021	"La Piedra del Hombre", Almuñécar, Granada, Spain (36.7231º N, 3.7375º W)	16 m	15º C

logically similar western Atlantic species *O. miramarae* (Ortea & Espinosa, 2000a), described from Cuba but also reported from Taliarte, Gran Canaria, Canary Islands (Moro *et al*., 2016) is likely the same species (Paz Sedano *et al*., 2017) but further anatomical and molecular studies are needed to clarify this point, so we keep them separated.

Numerous specimens of *O. picoensis* (Fig. 6a-b) were reported by Kristaps Dzonsons at three different locations in Malta (Table 2). Sizes were not reported. Another small specimen (<10mm.) of *O. picoensis* (Fig. 6c) was observed and photographed by David Ballesteros at SE Spain.

Body colour pattern and morphology of these specimens from Malta and Almuñécar match the white morph original description of *O. picoensis* (Paz-Sedano *et al*., 2017), they do not have the purplish pink stain behind the gill nor the distally tuberculate rhinophores reported by Ortea & Espinosa (2000a) for *O. miramarae*, and do not fit any of the other Mediterranean *Okenia* species.

So here we present the first report of the presence of *Okenia picoensis* for the Mediterranean Sea. Unfortunately, the observers did not collect the specimens so we could not dissect nor sequence them to fully confirm their identification, so there is the possibility that these findings belong to a cryptic species group.

Multiple sightings in several locations at Malta suggest the species is well established there, while the status in the coast of Granada (Spain), with the first and only report of a single specimen for the Spanish coast, is still uncertain.

Distribution range extensions are not unusual for newly described species, but integrative taxonomic studies are needed to clarify if this expansion is natural or related to human activities. Curiously, despite the Mediterranean has the best known malacofauna of the world, in the recent years there is a steady flow of newcomer species that never ceases to surprise us.

3.4 *Nudiscintilla* cf. *glabra* Lützen & Nielsen, 2005 reaches the Aegean coasts of Turkey

Kemal GEYRAN and Argyro ZENETOS

The bivalve *Nudiscintilla* cf. *glabra* Lützen & Nielsen, 2005 was first recorded from the Mediterranean Sea by Mifsud & Ovalis (2012), based on five living specimens collected at Adana, Yumurtalik, on the Mediterranean coast of Turkey. Since its first detection year (2010: P. Ovalis pers. commun.), the species has been reported from Israel (Albano *et al*., 2021a, b). Here we report the finding of a single living specimen from Bodrum, on the Aegean coast of Turkey (37.129356° N, 27.571639° E) in August 2019.

Our material (Fig. 7) was collected at a depth around 2-3 m under a rock, attached to it. The sea bed was mainly covered with detritus and pebbles. Its habitat agrees with that of Mifsud & Ovalis, 2012 (living under stones in shallow water in 1.5-2 m) and Albano *et al*. (2021a,b) (rocky substrata).

We provisionally identified the specimen as *Nudiscintilla* cf. *glabra* based on the shell morphology that matches well with that of the specimen figured by Mifsud & Ovalis (2012). Dentition details as described by Lützen & Nielsen (2005) were not examined as the hinge of the single collected specimen was not opened to avoid damage. The specimen is kept in the private collection of one of us (KG).

Shipping (Transport-Stowaway) appears to be the likely mode of introduction of *N. glabra* in the Mediterranean. Most locations it has been detected to date are from or in the vicinity of harbours: Adana (Mifsud & Ovalis, 2012), Nahariya (rocky platform 200 m north of the entrance to the marina, Albano *et al*., 2021b), Bodrum (this work). Alternatively, the species may have expanded its distribution unaided from a locally established population in Yumurtalik Bay. The present record, along with those of Albano *et al*. (2021a, b) confirm the establishment of *N.* cf. *glabra* and its expansion from the Levantine to the Aegean Sea. The number of established alien species in the Mediterranean (Zenetos & Galanidi, 2020) keeps increasing.

Fig. 7: *Nudiscintilla* cf. *glabra* from Bodrum (length = 12.3, height = 7.3 mm). Photo credit: Kemal Geyran.

4. ARTHROPODA

4.1 First record of the portunid crab *Charybdis (Charybdis) natator* (Herbst, 1789) in the Mediterranean Sea

Raouia GHANEM, Jeanne ZAOUALI and Jamila BEN SOUISSI

The ridged swimming crab *Charybdis (Charybdis) natator* (Herbst, 1789) is a widespread Indo- West Pacific species found in East Africa, Madagascar, Red Sea, India, China, Japan, Philippines, Thailand, Malaysia, Singapore, Indonesia, and Australia (Wee & Ng, 1995). It is mainly found under rocks, among pebbles, or in the sand at depths ranging from 3 to 55 m (Sakai, 1976; Apel & Spiridonov, 1998).

On 18 February 2020, two large specimens of crabs (male and female) were caught alive with gillnets in Tunis southern lagoon (36.7946° N, 10.2639° E) western Mediterranean Sea after a scuba diving tracking during a periodic assessment of climate change impacts on marine biodiversity. The individuals were found at 5 m depth on sandy-muddy substrate not far from the artificial rocky shores of the lagoon, associated to the macrophytes *Caulerpa prolifera* (Forsskål) J.V.Lamouroux and *Chaetomorpha linum* (O.F.Müller) Kützing. Species have been identified as *Charybdis (Charybdis) natator*, following Sakai (1976), Wee & Ng (1995), and Apel & Spiridonov (1998). The two specimens were preserved in 95% alcohol and deposited at the Institut National Agronomique de Tunisie under the catalogue numbers: INAT- POR-Ch-nat01/ INAT- POR-Ch-nat02.

The collected specimens (Fig. 8) exhibited the typical morphological characters of *C. natator* according to the description of colours, carapace dentations, chelipeds, and pereiopods shapes by Sakai (1976), Wee & Ng (1995), and Apel & Spiridonov (1998). Morphometric measurements of the two specimens were summarized in Table 3.

With this new record, the number of alien brachyuran spe-

Table 3. Morphometric measurements and weight of the two specimens of *Charybdis (Charybdis) natator* caught in Tunis southern lagoon.

Morphometric characters (mm)	Female	Male
Carapace Width	95.04	86.18
Carapace Length	71.46	62.15
Anterolateral Border Length	53.44	49.32
Posterolateral Border Length	57.71	52.99
Chela Length	54.96	68.87
Chela Width	8.51	10.98
Chela Height	15.44	19.79
Body Height	35.36	32.76
Abdomen Length	40.69	32.05
Abdomen Width	43.31	14.44
Frontal Length	33.51	31.56
Orbital Length	9.95	10.27
Total Weight (g)	108.56	121.01

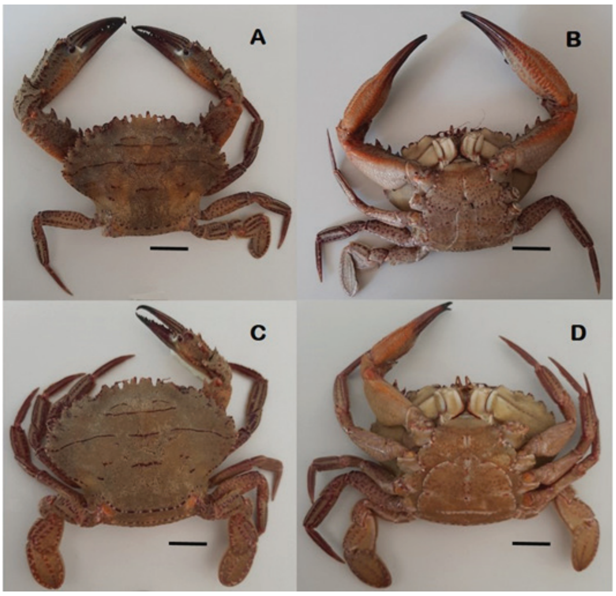

Fig. 8: Specimens of *Charybdis (Charybdis) natator* from Tunis southern lagoon. A) Dorsal male view. B) Ventral male view. C) Dorsal female view. D) Ventral female view. Scale bars: 10 mm.

cies present in the Mediterranean Sea increases to 52 (B. Galil, personal communication 2020). Among the most successful families colonizing its coasts, are Portunidae with a total of 16 reported species (Corsini-Forka *et al.*, 2010; Froglia, 2012; present study). Two non-indigenous portunid crabs are already present on Tunisian coasts and are considered invasive alien species; *Portunus segnis* (Forskål, 1775) and *Callinectes sapidus* Rathbun, 1896. As suggested for the precedent blue crabs, the potential pathway of introduction of *C. natator* could be shipping, as it was recorded in the vicinity of two commercial ports, "La Goulette" and Radès.

The species establishment and possible proliferation could affect the high-value food of blue crabs' production in Tunisia as noted by Sumpton *et al.* (1990). The recent Tunisian blue crab industry currently provides more than 3500 tons for export and constitutes about 3% of total annual seafood catches.

Regular monitoring of non-indigenous decapods is needed to prevent threats due to their high level of invasiveness to predict, mitigate and adapt to biodiversity loss and modification.

4.2 First record of *Parvocalanus crassirostris* (Copepoda, Calanoida, Paracalanidae) in the northernmost area of the Mediterranean Sea

Alenka GORUPPI and Valentina TIRELLI

The calanoid *Parvocalanus crassirostris* (Dahl F., 1894) is a free living copepod widely distributed in all tropical and subtropical waters (Razouls *et al*., 2005-2020). *P. crassirostris* is one of the most important species of copepods extensively used in hatcheries throughout the world for commercial cultivation. This species is classified as an alien species for European waters in EASIN (European Alien Species Information Network), and it was reported in the Black Sea, Levantine Basin, NE Aegean Sea, Ionian Sea, NE-NW Mediterranean and Adriatic Sea (Razouls *et al*., 2005-2020). In particular, *P. crassirostris* was recently found in the eastern Adriatic Sea (December 2014), firstly in the Croatian port of Šibenik (Vidjak *et al*., 2016) and some weeks later (February 2015), northwards in the port of Rijeka (Vidjak *et al*., 2019). Here we report on 3 females of *P. crassirostris* which were collected in the Italian waters of the Gulf of Trieste at the LTER_EU_IT_056 station (45.70° N, 13.71° E; depth 18 m), on 9th November 2016. Zooplankton sampling was performed by the WP2 net (200 µm mesh size), vertically towed from near bottom to surface. Throughout the water column, the temperature was 16.1°C, and salinity varied between 36.99 and 37.11, probably due to the strong wind that was blowing the day before the sampling. Half of the sample was used for dry mass analysis, and the other half was fixed (4% formaldehyde solution) for later determination of composition and abundance. The individuals of *P. crassirostris* (with total body length of 0.55-0.56 mm) (Fig. 9) were sorted out from the entire sample and sent to Dr. Olja Vidjak, who confirmed the identification. *P. crassirostris* abundance was 1.71 ind. m^{-3}, accounting for only 0.4% of the copepod community which was dominated by *Acartia (Acartiura) clausi* Giesbrecht, 1889 (41%), another non-indigenous species *Pseudodiaptomus marinus* Sato, 1913 (15%) and *Oncaea curta* Sars G.O., 1916 (12%).

Fig. 9: *Parvocalanus crassirostris* (Dahl F., 1894), female habitus and detail of fifth leg (P5) and genital segment.

Although the LTER_EU_IT_056 station has been sampled monthly since 1986, *P. crassirostris* had never been sighted before November 2016. Moreover, this species was not even found in the harbour of Trieste during the survey of the zooplanktonic communities of the Adriatic ports (2014-2015), carried out in the framework of BALMAS project, which allowed the discovery of *P. crassirostris* in the ports of Šibenik and Rijeka (Vidjak *et al*., 2019). Therefore, we can speculate that *P. crassirostris* arrived in the Gulf of Trieste later than in Croatian waters, probably due to inter-Adriatic translocation via ballast waters.

After November 2016, *P. crassirostris* was no longer found in the Gulf of Trieste, but the nets with smaller meshes should be used to sample this small alien calanoid species more efficiently.

4.3 First record of the Indo-Pacific brachyuran *Gonioinfradens giardi* (Nobili, 1905) from the Ionian Sea

Michail RAGKOUSIS and Stelios KATSANEVAKIS

Gonioinfradens giardi is one of the eight portunid crabs that have been introduced into the Mediterranean Sea (Galil *et al.*, 2018) and is a species that exhibits invasive properties (Kondylatos *et al.*, 2017). Native to the Red and the Arabian Sea, it was first reported from the Mediterranean as *Gonioinfradens paucidentatus* from Rhodes Island, Greece (Corsini-Foka *et al.*, 2010), to which *G. giardi* had been previously considered a junior synonym until Galil *et al.* (2018) resurrected the species. Through molecular analysis, they separated *G. giardi* from *G. paucidentatus*, and suggested that the specimens collected in the Mediterranean should be referred to *G. giardi*. Consequently, molecular analysis has confirmed the Aegean finding to belong to *G. giardi* (Zenetos *et al*., 2020b). So far, *G. giardi* had been reported only from the Aegean and Levantine Seas (Corsini-Foka *et al.*, 2010; Galil *et al.*, 2018; Kondylatos *et al.*, 2020).

On July 15th 2020, while surveying Antisamos bay, Kefallonia, Greece (38.2634° N, 20.6733° E) via SCUBA diving, we photographed an unfamiliar brachyuran at 14 m depth (Fig. 10). Although the photographic samples did not allow for detailed examination, sufficient diagnostic characters were visible to identify the taxon. Particularly, the four large anterolateral teeth that were clearly visible are an important diagnostic trait of the *Gonioinfradens* genus. No other alien portunid crab in the Mediterranean Sea, namely *Callinectes sapidus* (Rathbun, 1896), *Carupa tenuipes* (Dana, 1852), *Charybdis helleri* (Milne-Edwards, 1867), *Goniohellenus longicollis* (Leene, 1938), *Portunus segnis* (Forskål, 1775), *Thalamita poissonii* (Audouin, 1826), and *Thalamita indistincta* (Apel & Spiridonov, 1998), has fewer than five anterolateral teeth (Apel & Spiridonov, 1998). Furthermore, the specimen is similar in color patterns to the specimens in Israel, described by Galil *et al*. (2018): chelipeds deep reddish with dark tips, legs reddish with lighter-colored bands close to the joints, anterolateral spines light-banded and dark-tipped. Based on the known portunid species of the Mediterranean Sea, the recorded specimen is most likely *G. giardi*. The current report constitutes the first record of *G. giardi* in the Ionian Sea and the Central Mediterranean region.

Fig. 10: *Gonioinfradens giardi* from Kefallonia island. Photo credit: Michail Ragkousis.

5. BRYOZOA

5.1 First record of *Arbopercula tenella* (Hincks, 1880) in the Adriatic Sea: the alien bryozoan spreads to the colder regions of the Mediterranean Sea

Ana FORTIČ and Antonietta ROSSO

Arbopercula tenella (Hincks, 1880) is an encrusting cheilostomatid bryozoan that forms delicate, translucent to white unilaminar colonies. It has been described in Florida and is widely distributed in the subtropical and tropical West Atlantic Ocean. *A. tenella* is now also present in New Zealand, Japan and India (Rosso, 1994 and references therein; Thessalou-Legaki *et al*., 2012 and references therein). First found in 1990 in the Mediterranean Sea in the Gulfs of Noto and Catania (Sicily, Ionian Sea) (Rosso, 1994), this bryozoan was later reported from further localities in Italy (Sicily and Livorno) and Israel (Ferrario *et al*., 2018).

The habitats where this bryozoan has been found can be very illustrative in deciphering its introduction and diffusion vectors, and status. Firstly, the findings of *A. tenella* in Mediterranean harbours (Ferrario *et al.,* 2018) link the species to shipping, where both hull fouling and ballast waters are plausible vectors due to the planktotrophic larvae of this species. Secondly, colonies are often found on floating objects of human origin, which are also a possible diffusion vector (Thiel & Gutow, 2005 and references therein). Finally, the recent discovery of a specimen on a natural substrate and the observation rate in eastern Sicily, Ionian Sea (Ferrario *et al*., 2018) indicate that the species has established itself in this region.

Here we report on the first findings of *A. tenella* in the Adriatic Sea. Two colonies were discovered on experimental panels, which were set up in the Piran Bay, Gulf of Trieste, Slovenia (45.518708° N, 13.567613° E). They were found at a depth of 8-10 m, one in summer (17.6.2019; Fig. 11A) and the second in winter (18.2.2019; Fig. 11B). The zooids of this species are rectangular to ovoid, with arcuate, marginally chitinized opercula. Gymnocyst bears one to two hollow spinous processes proximally; cryptocyst is beaded, larger proximally and narrowing distally. The Slovenian colonies confirm a high plasticity of the species, both between and within the colonies, in the development of opesial spines, the size and shape of zooids, and cryptocyst extension (Fig. 11). The discovery of this species in northern Adriatic Sea, characterized by average winter temperatures of 10° C (Grilli *et al.*, 2020), suggests that the newcomer is capable of colonising even the colder regions of Mediterranean Sea. Due to the inconspicuous appearance of colonies of this species, this could go largely unnoticed.

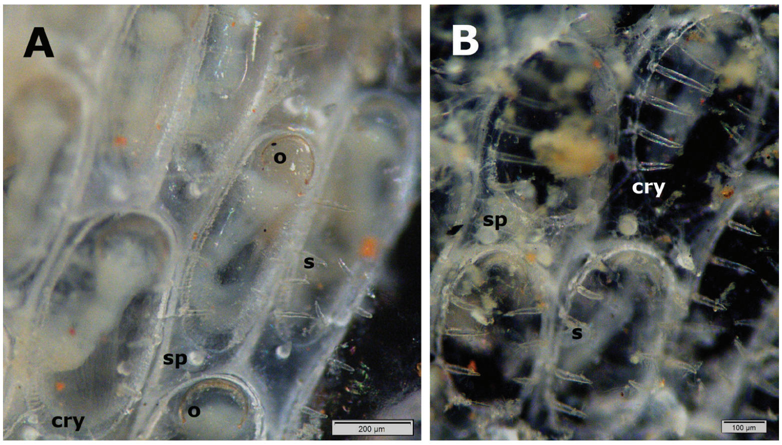

Fig. 11: Two colonies of *Arbopercula tenella* from Bay of Piran (Slovenia) found in summer (A) and winter (B) 2019. o - operculum, s - spine, sp - spinous process, cry - cryptocyst.

6. CHORDATA

6.1 New record of the non-indigenous species *Distaplia bermudensis* Van Name, 1902 (Tunicata, Ascidiacea) along Italian coasts

Federica MONTESANTO and Francesco MASTROTOTARO

Distaplia bermudensis is a colonial ascidian originally described from Bermuda (Van Name, 1902) and widespread in the Western Atlantic Ocean, from the Caribbean to Brazil (Mastrototaro & Brunetti, 2006 and references therein). This species was first reported in the Mediterranean Sea within the Gulf of Taranto in 2000 on natural and artificial substrata (Mastrototaro & Brunetti, 2006). Here we report a new finding of this species in the Tyrrhenian Sea.

Colonies of *D. bermudensis* were photographed (Fig. 12A) and collected from rocky substrata within the brackish Miseno Lake (Gulf of Naples, Tyrrhenian Sea, Italy) (40.793° N, 14.077° E), in September 2020. Colonies were preserved in 4% formalin solution after being relaxed with menthol crystals for morphological analysis.

The colonies appear dark purplish-blue or brown in colour, with zooids arranged in radiating systems showing white rings encircling the siphons (Fig. 12A). The zooids are about five mm in length, with smooth oral siphon and atrial aperture surmounted by a simple languet (Fig. 12B). The pharynx has four rows of stigmata with a parastigmatic vessel in each row and 20-22 stigmata per half-row (at the level of the 1st stigmatal row) (Fig. 12C). The stomach is smooth, and the gonads are placed in the gut loop that ends in a bilobed anus placed between 3rd and 4th stigmatal row (Fig. 12B). The zooids are hermaphroditic, with the ovary surrounded by the testis (Fig. 12B). Embryos are incubated in a broodpouch, which consists of a continuation of the oviduct and it is placed in the dorsal part of the zooid, between thorax and abdomen. It is usually found detached from the zooid and it can contain up to three larvae (Fig. 12D). Larvae are about one mm in trunk length, showing an ocellus, three triangle-arranged adhesive organs, and four enlarged ampullae (Fig. 12E).

Distaplia bermudensis is distinguished from the other seven co-generic species of the Mediterranean and North Atlantic including Azores. In detail, *D. clavata* (Sars, 1851), *D. lucillae* Brunetti, 2006, *D. livida* (Sars, 1851), *D. lubrica* von Drasche, 1883 and *D. rosea* Della Valle, 1881 are characterized by a plicated stomach. *D. magnilarva* Della Valle, 1881 shows only monosexual gonads, while *D. corolla* Monniot F., 1974 shows a particular arrangement of the zooids and it lacks the broodpouch (Brunetti & Mastrototaro, 2017).

This is the second record of *D. bermudensis* within the Mediterranean basin; both areas (Taranto and Miseno Lake) are interested in mussel farming (Cecere *et al.*, 2016; Mastrototaro *et al.*, 2019), suggesting aquaculture facilities as the most likely pathway of the introduction of *D. bermudensis* along Italian coasts.

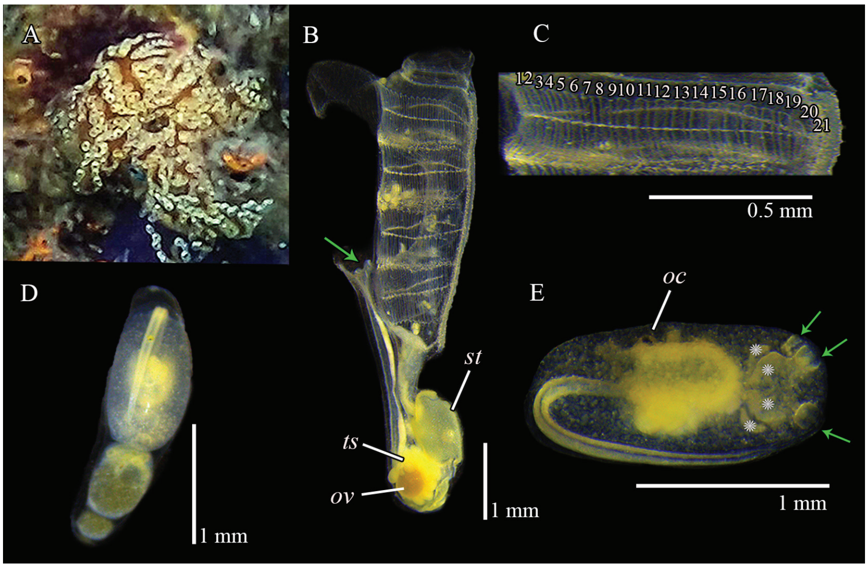

Fig. 12: *Distaplia bermudensis*. A) Colony of *D. bermudensis* photographed within the Miseno Lake (Gulf of Naples, Italy), white rings encircling the siphons of the zooids are visible. B) Zooid extracted from the tunic showing four rows of stigmata, smooth stomach (*st*), gut loop ending in a bilobed anus (arrow) and hermaphroditic gonads placed in the gut loop, with ovary (*ov*) surrounded by the testis (*ts*). C) Magnification of the first stigmatal row with 21 stigmata. D) Broodpouch containing three larvae. E) Larva with ocellus (*oc*), three adhesive organs (arrows) and four median ampullae (asterisks).

6.2 First record of *Paranthias furcifer* (Valenciennes, 1828) (Pisces, Serranidae) from Spain

Francesco TIRALONGO and Ernesto AZZURRO

The Creole-fish *Paranthias furcifer* (Valenciennes, 1828) is a small subtropical serranid, naturally distributed throughout the eastern and western Atlantic Ocean on rocky and reef bottoms up to 100 m of depth. So far, this species has been reported three times from the Mediterranean, firstly in the Adriatic Sea (Croatia), then in the eastern Levant (Lebanon), and recently in the Aegean Sea (Turkey) (see Ragkousis *et al.*, 2020).

On July 24th 2016, a single individual of *P. furcifer* (Fig. 13) was captured by line fishing within the commer-

Fig. 13: The specimen of *Paranthias furcifer* collected on July 24th 2016 within the commercial harbour of Almeria (Spain). Picture posted to the web platform sea watchers.net. Photo credit: Luis Marquez Torres.

cial harbour of Almeria, Alboran Sea, Spain (36.8266° N, 2.4662° W). The picture was posted by a recreational fisher to the sea watchers.net. (https://www.seawatchers.net/Observations/9/5844) platform designed to collect citizen generated data. The record was kept on stand-by until its validation by the sea watchers.net. editorial team.

The individual is described as follows: Body relatively elongated, laterally compressed and ovaliform; caudal fin forked and well developed; pectoral and pelvic fins moderately developed; dorsal fin quite elongated, begins just behind the base of the pectoral fin; anal fin short, in the posterior part of the body. The body was almost uniformly reddish, with a darker caudal and dorsal fin and a dark spot on the upper base of the pectoral fin. Furthermore, as described by the sea watchers.net. observer, little whitish spots were present on the dorsal surface of the live specimen.

Although Smith (1971) synonymized *Paranthias colonus* (Valenciennes, 1846) with *P. furcifer*, Heemstra & Randall (1993) demonstrated marked and constant meristic differences between the two species. Following the description provided by Heemstra & Randall (1993), *P. furcifer* can be clearly distinguished from *P. colonus* based on the following colouration: a darker tail; a dark spot on the upper base of the pectoral fin; and white spots on the dorsal surface (spots are bright blue or violet in *P. colonus*). Based on these traits and in agreement with the taxonomical analyses by Ragkousis *et al*. (2020), we identify the Almeria specimen as *P. furcifer* and here we report its first observation from Spain.

6.3 The occurrence of the naked band gaper, *Champsodon nudivittis* (Ogilby, 1895) in the Sea of Marmara

Sezginer TUNÇER and Cem DALYAN

Champsodontids are known as gapers, and among them, *Champsodon nudivittis* (Ogilby, 1895) is the only Red Sea immigrant found in the Mediterranean Sea (Stern *et al*., 2020). It is distributed along the Indo-West Pacific (Madagascar, Indonesia, Philippines, and Australia), Red Sea and eastern Mediterranean coasts from Israel to Greece (Dalyan *et al*., 2021). It is a bathypelagic species inhabiting sandy-muddy bottom. The depths preferred by the species are up to 716 m in the Mediterranean Sea (Dalyan *et al*., 2021).

A single specimen was caught by purse seine on 22 November 2020 at a depth of 30 m. It was found in the northern Dardanelles (40.2716° N, 26.5178° E, Fig. 14), and preserved in 75% ethanol, and stored at Canakkale Onsekiz Mart University, Piri Reis Museum Canakkale PRM-PIS 2020-067.

The total and standard length of the specimen were measured as 121 and 103 mm, respectively. Its weight was 15 g. The meristic formula of the specimen was D1, V; D2, 18; A, 19; P, 12; V, 6. The metric characteristics of the specimen are as follows: Head length 3.7 times, body depth 6.4 times, predorsal length 3.7 times and preanal length 1.8 times in standard length; eye diameter 9.3 times in head length. The body slightly compressed laterally. The breast is fully scaled, while a triangular patch of the scales is not found in the area of extending from the pectoral to the pelvic fin bases.

The species was reported for the first time by Çiçek & Bilecenoğlu (2009) in the Levantine Sea and by Kalogirou & Corsini-Foka (2012) in the Aegean Sea. This report represents the first record of *C. nudivittis* from the Sea of Marmara.

Yaglioglu *et al*. (2014) emphasized that the maximum age of *C. nudivittis* is two years. Also, the fish almost totally feeds on juvenile fishes (53%) and shrimps (45%) in the Iskenderun Bay (unpublished data). These studies exposed some clues (such as its relatively small body size, short life span, and high trophic level) that the species has a high invasive character. Hence its bioecology should be well studied in the recent expansion areas.

Fig. 14: The sampled specimen of *C. nudivittis* (TL = 121 mm) from the northern Dardanelles, Sea of Marmara.

6.4 Additional records of the smallscale codlet, *Bregmaceros nectabanus* (Pisces: Bregmacerotidae) in the Adriatic Sea

Dario VRDOLJAK, Mišo PAVIČIĆ and Vedran VULETIN

Family Bregmacerotidae, commonly known as codlets, comprises 14 valid species (Fricke *et al*., 2020). Smallscale codlet *Bregmaceros nectabanus* Whitley, 1941 is the only member of this family known to occur in the Mediterranean Sea. It is native to the Indo-West Pacific and western Indian Ocean, including the Red Sea (Harold & Golani, 2016). Its historical occurrences and exact distribution in the Mediterranean are poorly known, and in the past, it has been misidentified and reported under the name *B. atlanticus* Goode & Been, 1886 (Harold & Golani, 2016). The main distinguishing characters which separate *B. nectabanus* from *B. atlanticus* are the presence of a distally fimbriate opercular spine, a thin dorsolateral longitudinal stripe below the second dorsal fin and a nearly unpigmented abdomen in the former species (Harold & Golani, 2016). The first record of smallscale codlet in the Adriatic Sea was based on two specimens caught in December, 2019 by bottom trawl off Mola di Bari (Italy) at 100 m depth (Dulčić *et al*., 2020).

One individual of smallscale codlet was collected by bottom trawl offshore of island Mljet on July 20, 2020 at 138 m depth (42.6247° N, 17.7809° E), while two individuals were collected on November 3, 2020 by gillnets in Neretva Channel at a depth of 45 m (43.0298°N, 17.3245° E) representing the northernmost occurrence of this species (Fig. 15A). Identification was based on Harold & Golani (2016) and Dulčić *et al*. (2020). Determination and measurements of all individuals were performed at the Institute of Oceanography and Fisheries in Split. The total length of specimens ranged from 58 to 74 mm while weight ranged from 1.6 to 2.38 g. The identification of *B. nectabanus* was indicated by the typical coloration and presence of a distally fimbriate opercular spine (Fig. 15B). The entry of these species into the Adriatic Sea can be associated with the active spread of adults or the passive transport of eggs and larvae from other areas (i.e., the Ionian Sea) (Ketsilis-Rinis & Dimitrou in Chartosia *et al*., 2018). Harold & Golani (2016) reported that *B. nectabanus* entered the Mediterranean through the Suez Canal (Lessepsian migrant), while Özgul & Akyol (2017) considered the species introduction via ballast water, due to the detection of the species near the commercial ports. Dulčić *et al*. (2020) also mentions the possibility of shipping-related introduction. At present, both hypotheses have support as the two of our specimens have been found in the vicinity of cargo port Ploče.

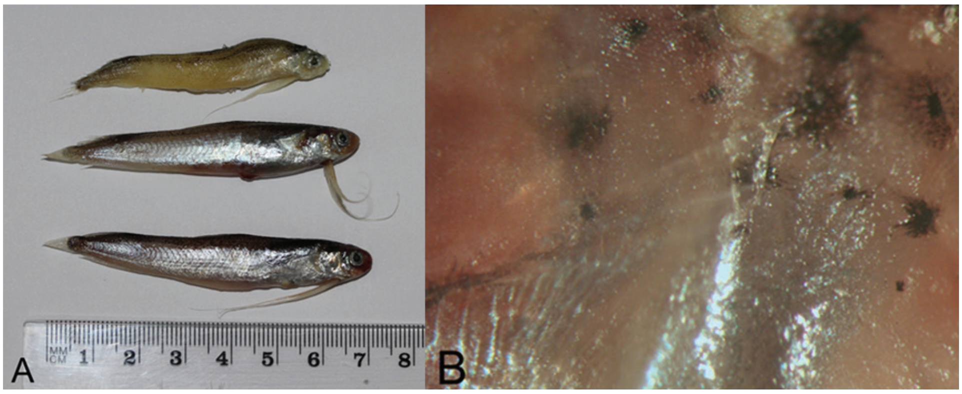

Fig. 15: A) Three specimens of *B. nectabanus* caught in the Adriatic Sea. B) Fimbriate opercular spine of *B. nectabanus* from the Adriatic Sea. Photo credit: Mišo Pavičić.

6.5 Sergeant in motion: A new record of *Abudefduf* cf. *saxatilis* along Tyrrhenian Sea (Western Mediterranean Sea)

Andrea ALVITO and Daniele GRECH

Abudefduf saxatilis is an Atlantic representative of the Pomacentridae genus, present from Canada to Rhode Island, USA, and abundant in Caribbean reefs, as well as around mid-Atlantic islands, Cape Verde, and along the tropical coast of western Africa south to Angola (Froese & Pauly, 2020). In the Western Mediterranean Basin, the species was spotted twice in the last 60 years: the first (uncertainly, classified as *A. saxatilis vaigiensis*) in the Gulf of Naples (Tardent, 1959) and the second in recent times close to Spanish coast (Azzurro *et al*., 2013). Its latest distribution in the Mediterranean as *Abudefduf* sp. is summarized by Dragičević *et al*. (2021), supplemented by Zenetos & Miliou (2020).

On September 16th a single individual of the non-native damselfish has been observed by the authors at a depth of 18 m, just above a low complex algal vegetation cover (turf) covering big blocks of sandstone in the Gulf of Cagliari (39.1756° N, 9.2230° E, water temperature 25° C), Sardinia, Italy. Pictures of the fish (Fig. 16) were collected and showed to local marine guides in order to evaluate and follow the eventual re-occurrence and settlement of the specimen in the dive area, but in spite a weekly dive in the same spot until November 1th, it was no longer observed.

The species was identified using current available literature and provisionally identified as *Abudefduf* cf. *saxatilis* (Dragičević *et al*., 2021). The specimen found in Sardinia represents the first record of an individual of the genus *Abudefduf* in the Tyrrhenian Sea since the record of 1959, about 500 km southwest far. This fish is reported to be a probable fast spreader (Azzurro *et al.*, 2013) and it has been probably introduced by the Atlantic current that influences Sardinian coastlines (Ribotti *et al*., 2004). Other possible origin explanations are ship transport (Cagliari harbour is an important focal point in the international trade network) and less likely aquarium release.

The present record of *A.* cf. *saxatilis* in the Tyrrhenian Sea certainly is of valuable importance as the first documented evidence of a new species for Sardinia, meanwhile highlighting the importance of an increase in public dissemination and engagement on the topic of alien species. This is especially true considering that it is the main crossroad towards the Western Mediterranean Basin: a warning outpost for the detection of introduced species in a relatively sparsely inhabited large island with a complex and long fragmented coastline where the citizen science approach is still in its infancy. These actions may also trigger important synergies, generating public awareness and enhancing the exchange of information within the broad public, something that is of primary importance in the field of invasion biology.

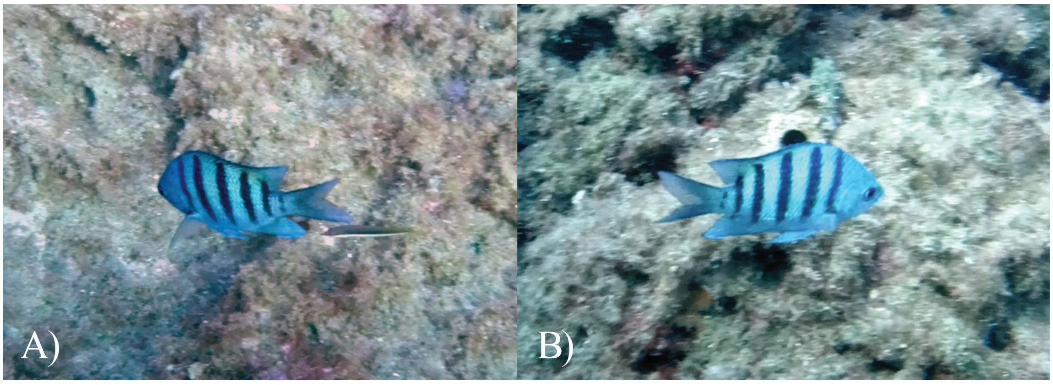

Fig. 16: A) The left side of the damselfish *Abudefduf* cf. *saxatilis* observed in Sardinian waters swimming alongside a juvenile specimen of *Coris julis* just above a brown algae turf. The same individual is showed in its right side (B) showing morphological characteristic of the species: fifth vertical dark bar extends without gap on the posterior margin of the dorsal fin and two black spots on the caudal peduncle.

Aknowledgements

Soultana Tsioli and Sotiris Orfanidis were supported by the Greek Ministry of Environment and Energy within the framework of the Marine Strategy monitoring Project (2018-2023; OPS 5010856). Daniela Pica, Luca Galanti and Lisa Pola would like to thank the skippers of the Oxygen sail, Federica Tommaso and Nina, for their help during the survey (https://www.oxygenesail.org/) and Egidio Trainito for useful information about *Halophila* occurrence at Golfo Aranci. Luis Sánchez-Tocino, Manuel Chamorro and J. Manuel Tierno De Figueroa want to thank Dr. Juan Lucas Cervera for his help. Miquel Pontes and Enric Madrenas thank Kristaps Dzonsons, Sarah Shaw and David Ballesteros for sharing their observations and pictures. They also thank Dr. Manuel Ballesteros for his suggestions and support. Alenka Goruppi and Valentina Tirelli thank Dr. Olja Vidjak (Institute of Oceanography and Fisheries Split, Croatia), who personally observed the *Parvocalanus crassirostris* specimens and validated their identification. Moreover, they are grateful to Alessandra de Olazabal for the support in morphological analysis and the OGS staff for their help in zooplankton sampling. Antonietta Rosso was granted by PIACERI 2020-2022. Michail Ragkousis and Stelios Katsanevakis were supported by the Hellenic Foundation for Research and Innovation (HFRI) under the "First Call for HFRI Research Projects to support Faculty members and Researchers and the procurement of high-cost research equipment grant" (Project ALAS – 'ALiens in the Aegean – a Sea under siege'; Project Number: HFRI-FM17-1597); Carlo Froglia is acknowledged for confirming the identification of *Gonioinfradens giardi*. Francesco Tiralongo and Ernesto Azzurro are indebted to Mr. Luis Marquez Torre, the registered observer who posted the observation of *Paranthias furcifer* to the citizen science platform http://www.seawatchers.net. Francesco Tiralongo and Ernesto Azzurro warmly also thank all the sea watchers.net. team, especially Macarena Marambio, Joaquim Garrabou and Paula Lopez Sendino for the technical and scientific assistance. Dario Vrdoljak, Mišo Pavičić and Vedran Vuletin are grateful to Željko Peko, the fisher who caught two specimens in Neretva Chanel and the crew of scientific vessel Bios Dva who collected one specimen during MEDITS scientific survey; their work has been supported by Croatian Science Foundation (HRZZ) partially under the project LEKFishResCRO (IP-2016-06-5251).

References

Albano, P.G., Steger, J., Bošnjak, M., Dunne, B., Guifarro, Z. *et al*., 2021a. Native biodiversity collapse in the eastern Mediterranean. *Proceedings of the Royal Society B*, 288 (1942), 20202469.

Albano P.G., Steger J., Bakker P.A.J., Bogi C., Bošnjak M. *et al*., 2021b. Numerous new records of tropical non-indigenous species in the Eastern Mediterranean highlight the challenges of their recognition and identification. *Zookeys*, 1010, 1-95.

Alf, A., Kreipl , K., 2003. *A Conchological Iconography. Family Turbinidae. Subfamily Turbininae, Genus Turbo*. ConchBooks, Hackenheim, Germany, 78 pp., 95 pl.

Apel, M., Spiridonov, V.A., 1998. Taxonomy and zoogeography of the portunid crabs (Crustacea: Decapoda: Brachyura: Portunidae) of the Arabian Gulf and the adjacent waters. *Fauna of Arabia*, 17, 159-331.

Azzurro, E., Broglio, E., Maynou, F., Bariche, M., 2013. Citizen science detects the undetected: The case of *Abudefduf saxatilis* from the Mediterranean Sea. *Management of Biological Invasions*, 4, 167-170.

Bianchi, C.N., Morri, C., Chiantore, M., Montefalcone, M., Parravicini, V. *et al.,* 2012. Mediterranean Sea biodiversity between the legacy from the past and a future of change. In: *Life in the Mediterranean Sea: A Look at Habitat Changes*. Stambler, N. (Ed.), Nova Science Publishers, New York, pp. 1-55.

Bosch, D., Bosch, E., 1989. *Seashells of southern Arabia*. Motivate Publishing, United Arab Emirates, 123 pp.

Brunetti, R., Mastrototaro, F., 2017. *Ascidiacea of the European waters*. Milan, Edagricole New Business Media II, 447 pp.

Carmona, L., Malaquias, M.A.E., Gosliner, T.M., Pola, M., Cervera, J.L., 2011. Amphi-Atlantic distributions and cryptic species in sacoglossan sea slugs. *Journal of Molluscan Studies*, 77 (4), 401-412.

Cecere, E., Portacci, G., Petrocelli, A., 2016. Alien seaweeds as indicators of environmental impact: the case of the Phlegrean Lakes Fusaro and Miseno (Gulf of Naples, Tyrhenian Sea). *Biologia Marina Mediterranea*, 23 (1), 106.

Chartosia, N., Anastasiadis, D., Bazairi, H., Crocetta, F., Deidun, A. *et al*., 2018. New Mediterranean Biodiversity Records (July 2018). *Mediterranean Marine Science*, *19* (2), 398-415.

Çiçek, E., Bilecenoglu, M., 2009. A new alien fish in the Mediterranean Sea: *Champsodon nudivittis* (Actinopterygii: Perciformes: Champsodontidae). *Acta Ichthyologica et Piscatoria*, 39, 67-69.

Cirik, S., Zeybek, N., Aysel, V., 1990. Note preliminaire sur le vegetation marine de l'ile de Gokceada (mer Egee Nord, Turquie). *Thalassographica*, 13, 33-37.

Cormaci, M., Furnari, G., Alongi, G., 2017. Flora marina bentonica del Mediterraneo: Rhodophyta (*Rhodymeniophycidae* escluse). *Bullettin of the Gioenia Academy of Natural Sciences of Catania*, 50 (380), FP1-FP391.

Corsini-Foka, M., Pancucci-Papadopoulou, M.A., Kondylatos, G., Kalogirou, S., 2010. *Gonioinfradens paucidentatus* (A. Milne Edwards, 1861) (Crustacea, Decapoda, Portunidae): a new alien crab in the Mediterranean Sea. *Mediterranean Marine Science*, 11 (2), 331-340.

Crocetta, F., Bitar, G., Zibrowius, H., Oliverio, M., 2020. Increase in knowledge of the marine gastropod fauna of Lebanon since the 19th century. *Bulletin of Marine Science*, 96 (1), 1-22.

Dalyan, C., Gonulal, O., Kesici, N.B., Yapici, S., 2021. The northernmost record of *Champsodon nudivittis* (Ogilby, 1895) in the Mediterranean Sea. *Aquatic Sciences and Engineering*, 36, 85-88.

Dragičević, B., Fricke, R., Ben Soussi, J., Ugarković, P., Dulčić, J. *et al.,* 2021. On the occurrence of *Abudefduf* spp. (Pisces: Pomacentridae) in the Mediterranean Sea: a critical review with new records. *BioInvasions Records*, 10, (1), 188-199.

Dulčić, J., Bello, G., Dragičević, B., 2020. *Bregmaceros nectabanus* Whitley, 1941 (Teleostei: Bregmacerotidae), a new Lessepsian migrant in the Adriatic Sea. *BioInvasions Records*, 9 (4), 808-813.

EC, 2008. Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive). Official Journal of the European Union, L164, 19–40.

EU, 2014. Regulation (EU) No 1143/2014 of the European Parliament and of the Council on the prevention and management of the introduction and spread of invasive alien species. Official Journal of the European Union, L315, 35-55.

Ferrario, J., Rosso, A., Marchini, A., Occhipinti-Ambrogi, A., 2018. Mediterranean non-indigenous bryozoans: an update and knowledge gaps. *Biodiversity and Conservation*, 27, 2783-2794.

Fricke, R., Eschmeyer, W., Fong, J., 2020. *CAS - Eschmeyer's Catalog of Fishes - Genera/Species by Family/Subfamily*. Available at: http://researcharchive.calacademy.org/research/ichthyology/catalog/SpeciesByFamily.asp (Accessed 1 December 2020).

Fritsch, C., 1895. Über die Auffindung einer marinen Hydrocharidee im Mittelmeer. *Verhandllungen der kaiserlichkongiglichen zoologish-botanishen Gesellschaft in Wien*, 45, 104-106.

Froese, F., Pauly, D., 2020. *Fish Base*. http://www.fishbase.org (Accessed 29 December 2020).

Froglia, C., 2012. First record of *Charybdis japonica* (Crusta-

cea: Decapoda: Portunidae) in the Mediterranean Sea. *Marine Biodiversity Records*, 5, e33.
Galil, B.S., Douek, J., Gevili, R., Goren, M., Yudkovsky, Y. *et al.*, 2018. The resurrection of *Charybdis (Gonioinfradens) giardi* (Nobili, 1905), newly recorded from the SE Mediterranean Sea. *Zootaxa*, 4370, 580-590.
Georgiou, D., Alexandre, A., Luis, J., Santos, R., 2016. Temperature is not a limiting factor for the expansion of *Halophila stipulacea* throughout the Mediterranean Sea. *Marine Ecology Progress Series*, 544, 159-167.
Grilli, F., Accoroni, S., Acri, F., Aubry, F.B., Bergami, C. *et al*., 2020. Seasonal and Interannual Trends of Oceanographic Parameters over 40 Years in the Northern Adriatic Sea in Relation to Nutrient Loadings Using the EMODnet Chemistry Data Portal. *Water*, 12, 2280.
Harold, A.S., Golani, D., 2016. Occurrence of the Smallscale Codlet, *Bregmaceros nectabanus* in the Mediterranean Sea, previously misidentified as *B. atlanticus* in this region. *Marine Biodiversity Records*, 9 (1), 1-7.
Heemstra, P., Randall, J.E., 1993. *Groupers of the World*. FAO Species Catalogue, Rome, 382 pp.
Heiman, E.L., Holtzer, E., Mienis, H.K., Singer, B.S., 2012. Shells of East Sinai, an illustrated list. Turbinidae. *Triton*, 25, 6-7.
Kalogirou, S., Corsini-Foka, M., 2012. First record of the Indo-Pacific *Champsodon nudivittis* (Ogilby, 1895) (Perciformes, Champsodontidae) in the Aegean waters (eastern Mediterranean Sea). *BioInvasions Records*, 1, 229-233.
Katsanevakis, S., Wallentinus, I., Zenetos, A., Leppäkoski, E., Çinar, M.E. *et al*., 2014. Impacts of invasive alien marine species on ecosystem services and biodiversity: a pan-European review. *Aquatic Invasions*, 9 (4), 391-423.
Katsanevakis, S., Tempera, F., Teixeira, H., 2016. Mapping the impact of alien species on marine ecosystems: the Mediterranean Sea case study. *Diversity and Distributions*, 22, 694-707.
Korpinen, S., Klančnik, K., Peterlin, M., Nurmi, M., Laamanen, L. *et al*., 2019, *Multiple pressures and their combined effects in Europe's seas*. ETC/ICM Technical Report 4/2019: European Topic Centre on Inland, Coastal and Marine waters, 164 pp.
Kondylatos, G., Kampouris, T., Kouloumperis, V., Corsini-Foka, M., 2017. The Indo-Pacific brachyuran *Charybdis (Gonioinfradens) paucidentatus* (A. Milne-Edwards, 1861) (Brachyura, Portunidae) in the Cyclades, Aegean Sea. *Turkish Journal of Zoology*, 41, 1118-1120.
Kondylatos, G., Crocetta, F., Corsini-Foka, M., Froglia, C., 2020. Crustacea Decapoda from the Rhodes Island Area (Eastern Mediterranean): New Records and an Updated Checklist. *Diversity*, 12 (6), 246.
Lüning, K., 1990. *Seaweeds: their environment, biogeography, and ecophysiology*. John Wiley & Sons, Canada.
Lützen, J., Nielsen, C., 2005. Galeommatid bivalves from Phuket, Thailand. *Zoological Journal of the Linnean Society*, 144 (3), 261-308.
Mačić, V., Albano, P.G., Almpanidou, V., Claudet, J., Corrales, X. *et al.,* 2018. Biological invasions in conservation planning: a global systematic review. *Frontiers in Marine Science*, 5 (178), 1-13.
Malaquias, M., Calado, G., Cruz, J., Jensen, K., 2012. On the occurrence of the Caribbean sea slug *Thuridilla mazda* in the eastern Atlantic Ocean. *Marine Biodiversity Records*, 5, e50.
Mannino, A.M., Balistreri, P., Deidun, A., 2017. The marine biodiversity of the Mediterranean Sea in a changing climate: the impact of biological invasions, in Mediterranean Identities. In: *Environment, Society, Culture*. Fuerst-Bjelis, B. (Ed.). London, Intech, 101-112.
Mastrototaro, F., Brunetti, R., 2006. The non-indigenous ascidian *Distaplia bermudensis* in the Mediterranean: comparison with the native species *Distaplia magnilarva* and *Distaplia lucillae* sp. nov. *Journal of the Marine Biological Association of the United Kingdom*, 86 (1), 181.
Mastrototaro, F., Montesanto, F., Salonna, M., Grieco, F., Trainito, E. *et al.*, 2019. Hitch-hikers of the sea: concurrent morphological and molecular identification of *Symplegma brakenhielmi* (Tunicata: Ascidiacea) in the western Mediterranean Sea. *Mediterranean Marine Science*, 20 (1), 197-207.
MedECC, 2020. Climate and Environmental Change in the Mediterranean Basin – Current Situation and Risks for the Future. First Mediterranean Assessment Report. [Cramer, W., Guiot, J., Marini, K. (Eds.)], Union for the Mediterranean, Plan Bleu, UNEP/MAP, Marseille, France, 600 pp.
Mifsud, C., Ovalis P., 2012. A galeommatid bivalve new to the Mediterranean Sea. *Triton*, 26, 6-8.
Moro, L., Ortea, J., Bacallado, J.J., 2016. Nuevas citas y nuevos datos anatómicos de las babosas marinas (Mollusca: Heterobranchia) de las islas Canarias y su entorno. *Revista de la Academia Canaria de Ciencias*, 28, 9-52.
Nguyen, H.M., Yadav, N.S, Barak, S., Lima, F.P, Sapir, Y. *et al.*, 2020. Responses of invasive and native populations of the seagrass *Halophila stipulacea* to simulated climate change. *Frontiers in Marine Science*, 6, 812.
Orfanidis, S., 1991. Temperature responses and distribution of macroalgae belonging to the warm-temperate Mediterranean-Atlantic distribution group. *Botanica Marina*, 34, 541-552.
Orfanidis, S., Venekamp, L.A.H., Breeman, A.M., 1999. Ecophysiological adaptations of two Mediterranean red algae in relation to distribution. *European Journal of Phycology*, 34, 469-476.
Orlando-Bonaca, M., Lipej, L., Bonanno, G., 2019. Non-indigenous macrophytes in Adriatic ports and transitional waters: Trends, taxonomy, introduction vectors, pathways and management. *Marine Pollution Bulletin*, 145, 656-672.
Ortea, J., Buske, Y., 2014. Una nueva especie de *Thuridilla* Bergh, 1872 (Mollusca: Sacoglossa) de la isla de Martinica, Antillas Menores. *Revista de la Real Academia Canaria de Ciencias*, 26, 189-194.
Ortea, J., Espinosa, J., 2000a. New species of the genus *Okenia* Menke, 1830 (Mollusca Nudibranchia) from Cuba. *Avicennia*, 12 (13), 84-86.
Ortea, J., Espinosa, J., 2000b. New species of the genus *Thuridilla* Bergh, 1872 (Mollusca: Sacoglossa) from Cuba and Costa Rica. *Avicennia*, 12 (13), 87-90.
Ortea, J., Moro, L., Bacallado, J.J., 2015. *Babosas marinas canarias*. Turquesa Ediciones, Santa Cruz de Tenerife, 138 pp.
Özgul, A., Akyol, O., 2017. On the occurrence of the smallscale codlet, *Bregmaceros nectabanus* (Bregmacerotidae), off the Urla Coast in Izmir Bay (Aegean Sea, Eastern Mediterranean), *Annales, Series Historia Naturalis*, 27 (1), 69-74.

Paz-Sedano, S., Ortigosa, D., Pola, M., 2017. A new *Okenia* Menke, 1830 from the Azores Islands, Portugal. *Spixiana*, 40 (1), 13-22.

Pola, M., 2015. The Identity of *Okenia zoobotryon* (Smallwood, 1910) (Nudibranchia: Goniodorididae): Redescription and Proposed Designation of a Neotype. *American Malacological Bulletin*, 33 (1), 1-6.

Pola, M., Paz-Sedano, S., Macali, A., Minchin, D., Marchini, A. *et al.,* 2019. What is really out there? Review of the genus *Okenia* Menke, 1830 (Nudibranchia: Goniodorididae) in the Mediterranean Sea with description of two new species. *PLoS ONE*, 14 (5), e0215037.

Ragkousis, M., Abdelali., M., Azzurro, E., Badreddine, A., Bariche, M. *et al*., 2020. New Alien Mediterranean Biodiversity Records (October 2020). *Mediterranean Marine Science*, 21 (3), 631-652.

Raitsos, D. E., Beaugrand, G., Georgopoulos, D., Zenetos, A., Pancucci-Papadopoulou, A. M. *et al*., 2010. Global climate change amplifies the entry of tropical species into the Eastern Mediterranean Sea. *Limnology and Oceanography*, 55 (4), 1478-1484.

Razouls, C., Desreumaux, N., Kouwenberg, J., de Bovée, F., 2005-2020. *Biodiversity of Marine Planktonic Copepods (morphology, geographical distribution and biological data)*. Sorbonne University, CNRS. Available at http://copepodes.obs-banyuls.fr/en [Accessed November 02, 2020].

Ribotti, A., Puillat, I., Sorgente, R., Natale, S., 2004. Mesoscale circulation in the surface layer off the southern and western Sardinia island in 2000-2002. *Chemical Ecology*, 20 (5), 345-363.

Rosso, A., 1994. Segnalazione di *Electra tenella* (Hincks) (Bryozoa) lungo le coste sud-orientali della Sicilia. *Bollettino dell'Accademia Gioenia di Scienze Naturali*, 27 (346), 241-251.

Sakai, T., 1976. *Crabs of Japan and the Adjacent Seas*. Kodansha Ltd, Tokyo, 773 pp.

Smith C.L., 1971. A revision of the American Groupers: *Epinephelus* and allied genera. *Bulletin of the American Museum of Natural History*, 146, 241 pp.

Stern, N., Gouws, G., Golani, D., Goren, M., Gon, O., 2020. Champsodontidae (Pisces: Trachinoidei) in the Eastern Mediterranean: how many species are there? *Journal of Natural History*, 53, (47-48), 2869-2881.

Sumpton, W.D., 1990. Morphometric growth and fisheries biology of the crab, *Charybdis natator* (Herbst) in Moreton Bay, Australia (Decapoda, Brachyura). *Crustaceana,* 59, 113-120.

Tardent, P., 1959. Capture d'un *Abudefduf saxatilis vaigiensis* Q. und G. (Pisces, Pomacentridae) dans le Golfe de Naples. *Revue Suisse de Zoologie*, 66, 347-351.

Thessalou-Legaki, M., Aydogan, Ö., Bekas, P., Bilge, G., Boyaci, Y.O. *et al*., 2012. New Mediterranean Biodiversity Records (December 2012), *Mediterranean Marine Science*, 13 (2), 312-327.

Thiel, M., Gutow, L., 2005. The ecology of rafting in the marine environment. II. The rafting organisms and community. *Oceanography and Marine Biology: An Annual Review*, 43, 279-418.

Tsiamis, K. Panayotidis, P., 2019. Seaweeds of the Greek coasts: Rhodophyta excluding Ceramiales. *Acta Adriatica: international journal of Marine Sciences*, 60 (1), 3-23.

Tsiamis, K., Azzurro, E., Bariche, M., Çinar, M.E., Crocetta, F. *et al*., 2020. Prioritizing marine invasive alien species in the European Union through horizon scanning. *Aquatic Conservation: Marine and Freshwater Ecosystems*, 30 (4), 794-845.

Verlaque, M., Ruitton, S., Mineur, F., Boudouresque, C.F., 2015. *CIESM Atlas of exotic species. 4. Macrophytes*. CIESM Publisher, Monaco, 362 pp.

Vidjak, O., Bojanić, N., Ninčević Gladan, Ž., Skejić, S., Grbec, B., 2016. First record of small tropical calanoid copepod *Parvocalanus crassirostris* (Copepoda, Calanoida, Paracalanidae) in the Adriatic Sea. *Mediterranean Marine Science*, 17 (3), 627-633.

Vidjak, O., Bojanić, N., de Olazabal, A., Benzi, M., Brautović, I. *et al.,* 2019. Zooplankton in Adriatic port environments: Indigenous communities and non-indigenous species. *Marine Pollution Bulletin*, 147, 133-149.

Wee, D.P.C., Ng, P.K.L., 1995. Swimming crabs of the genera *Charybdis* de Haan, 1833, and Thalamita Latreille, 1829 (Crustacea: Decapoda: Brachyura: Portunidae) from Peninsular Malaysia and Singapore. *Raffles Bulletin of Zoology*, Supplement 1, 1-128.

Winters, G., Beer, S, Willette, D.A., Viana, I.G., Chiquillo, K.L. *et al.*, 2020. The tropical seagrass *Halophila stipulacea*: reviewing what we know from its native and invasive habitats, alongside identifying knowledge gaps. *Frontiers in Marine Science*, 7, 300.

Yaglıoglu, D., Deniz, T., Erguden, E., Gurlek, M., Turan, C., 2014. Age and growth of the nakedband gaper, *Champsodon nudivittis* (Ogilby, 1895), from the Iskenderun Bay, Northeastern Mediterranean. *Cahiers de Biologie Marine*, 55, 347-351.

Zenetos, A., Galanidi, M., 2020. Mediterranean non indigenous species at the start of the 2020s: recent changes. *Marine Biodiversity Records*, 13, 10.

Zenetos, A., Miliou, A., 2020. *Abudefduf* cf. *saxatilis* in the Saronikos Gulf. Unaided introduction or human aided transfer? *Annales, Series Historia Naturalis*, 30 (2), 227-230.

Zenetos, A., Ovalis, P., Giakoumi, S., Kontadakis, C., Lefkaditou, E. *et al*., 2020a. Saronikos Gulf: a hotspot area for alien species in the Mediterranean Sea. *BioInvasions Records*, 9 (4), 873-889.

Zenetos, A., Karachle, P.K., Corsini-Foka, M., Gerovasileiou, V., Simboura, N. *et al*., 2020b. Is the trend in new introductions of marine non-indigenous species a reliable criterion for assessing good environmental status? The case study of Greece. *Mediterranean Marine Science*, 21 (3), 775-793.