Mar. Sci. Tech. Bull. (2022) 11(4): 454-466
e–ISSN: 2147–9666
info@masteb.com

dergipark.org.tr/en/pub/masteb
www.masteb.com
DOI: 10.33714/masteb.1185291

Marine Science and Technology Bulletin

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RESEARCH ARTICLE

Recent update on the distribution of alien and neonative fishes in the Aegean Sea

İlker Aydın[1] • Önder Yıldırım[2] • Kıvanç Topçuoğlu[3] • Sercan Yapıcı[4*]

[1] *Ege University, Faculty of Fisheries, Department of Fishing Technology, 35100, İzmir, Türkiye*
[2] *Muğla Sıtkı Koçman University, Faculty of Fisheries, Department of Aquaculture, 48000, Muğla, Türkiye*
[3] *Muğla Sıtkı Koçman University, Ula Ali Koçman Vocational School, 48000, Muğla, Türkiye*
[4] *Muğla Sıtkı Koçman University, Faculty of Fisheries, Department of Marine–Inland Waters Sciences and Technology, 48000, Muğla, Türkiye*

ARTICLE INFO

Article History:
Received: 06.10.2022
Received in revised form: 08.11.2022
Accepted: 08.11.2022
Available online: 22.12.2022

Keywords:
Gibraltar Strait
Suez Canal
Native species
Non-native species
Bioinvasion

ABSTRACT

The Mediterranean Sea is considered an aquatic biodiversity hotspot that hosts approximately 782 fish species and 72 of them are categorized as endemic. However, non-native species introductions that are of natural or human-mediated origin have posed a major threat to the biodiversity of the Mediterranean Sea which is showing high rates of endemism. Here, we represent historical and recent updated data alien (*Champsodon nudivittis, Nemipterus randalli, Pterois miles, Scarus ghobban, Scomberomorus commerson*), neonative (*Seriola fasciata, Sphoeroides pachygaster*) fishes spreading on the Aegean Sea.

Please cite this paper as follows:

Aydın, İ., Yıldırım, Ö., Topçuoğlu, K., & Yapıcı, S. (2022). Recent update on the distribution of alien and neonative fishes in the Aegean Sea. *Marine Science and Technology Bulletin*, *11*(4), 454-466. https://doi.org/10.33714/masteb.1185291

Introduction

In terms of marine bio-invasion, the Mediterranean Sea is considered a crossroads for non-native marine organisms that introduce via the Gibraltar Strait and the Suez Canal (Rilov & Galil, 2009; Edelist et al., 2012; Zenetos et al., 2012). The Mediterranean Sea hosts approximately 17000 species and more than a third of them are endemic species classified as endangered, threatened, or vulnerable on the IUCN Red List (Coll et al., 2010). Although non-native species diversity displays sharp differences throughout the west-east axis of the Mediterranean Sea, the endemic and endangered taxa of the Mediterranean Sea have faced the invasion of the non-native species (Coll et al., 2010). The rate of influx of non-native

* Corresponding author
E-mail address: sercanyapici@mu.edu.tr (S. Yapıcı)

species classified as alien and neonative into the Mediterranean is affected by several vectors that such as ballast waters, water mass circulations, and increasing sea temperature (Bianchi, 2007). The fact that negative effects of invasive species are not limited to ecosystem services they also affect negatively socio-economic activities forces scientists and public authorities to close monitoring of new introductions/range expansions of non-native species.

Until today, Mediterranean marine biodiversity has gone altered by many thousands of species that have spread beyond their natural ranges because of intentionally or unintentionally human drivers. As well known, the temperature is the primary factor that determines the boundaries of the natural habitats of species, hence changing sea temperature level is the keystone causing to shift in the geographical range of aquatic organisms. This functional factor also affects migration patterns, seasonal activities, species interactions, and abundances of species (Walther et al., 2002). This continuing warming trend has enabled the introduction and expansion of thermophilic non-native species and transformed some of them into invasive. These non-native freshwater and marine species that are introduced directly or indirectly by human activity are an ever-increasing problem in the Mediterranean, such that the number of non-native species in Europe has been reported as 42% (Stranga & Katsanevakis, 2021).

In the present study, we aimed to present the recent distribution data related to alien and neonative fish species that are two sides of the same coin in the Mediterranean marine bio-invasion. We also believe that the results of this study will provide recent data for scientists, stakeholders, and public authorities on several topics such as reacting against alien species, distribution modelling, risk assessment protocols, and update of marine conservation actions.

Material and Methods

Alien Species

Champsodon nudivittis

On 30 March 2022, a single specimen was collected by bottom trawl at a depth of 70 m on a sandy-mud bottom in the Edremit Bay (North Aegean Sea). The identification of the specimen was following the instruction provided by Nemeth (1994). The specimen was deposited in Muğla Sıtkı Koçman University Faculty of Fisheries Museum.

Nemipterus randalli

On 17 July 2020, a specimen was captured from the Edremit Bay (North Aegean Sea), at a depth of 96 m. The identification of the specimen was following the instruction provided by Russell (1990). The specimen was deposited in the fish collection of the Fisheries Faculty, Ege University (ESFM-PIS/2021-01)

Pterois miles

On 05 February 2022, a single specimen was caught by trammel net from Edremit Bay (North Aegean Sea) at a depth of 30 m on rocky bottom. The identification of the specimen was following the instruction provided by Golani & Sonin (1992). The specimen was deposited in Muğla Sıtkı Koçman University Faculty of Fisheries Museum.

Scarus ghobban

On 28 September 2021, a single specimen was caught by fishing pot at a depth of 2 m on a sandy-mud bottom in the Gökova Bay (SE Aegean Sea). The identification of the specimen was following the instruction provided by Goren & Aronov (2002). The specimen was deposited in Muğla Sıtkı Koçman University Faculty of Fisheries Museum.

Scomberomorus commerson

On 03 March 2022, a single specimen was collected by trammel net at the 25 m in the Edremit Bay (North Aegean Sea). The identification of the specimen was following the instruction provided by Collette (2001).

Neonative Species

Seriola fasciata

On 10 October 2021, a single specimen was caught by trammel net at a depth of 30 m on a sandy-mud bottom in the Edremit Bay (North Aegean Sea). The identification of the specimen was following the instruction provided by Smith-Vaniz & Berry (1981). The specimen was deposited in Muğla Sıtkı Koçman University Faculty of Fisheries Museum.

Sphoeroides pachygaster

On 29 July 2020, one specimen was caught by bottom trawl at a depth of 93 m on a sandy and muddy bottom from the Edremit Bay (North Aegean Sea). The identification of the specimen was following the instruction provided by Smith & Heemstra (1986). The specimen was deposited in the fish

collection of Ege University, Fisheries Faculty (ESFM-PIS/2021-02).

Results

Alien Species

Champsodon nudivittis

Systematics:

Class: Actinopteri

Family: Champsodontidae Jordan & Snyder, 1902

Genus: *Champsodon* Günther, 1867

Champsodon nudivittis (Ogilby, 1895) (Figure 1a)

Diagnostic characteristics: Compressed body dark brown dorsally. Caudal lobes pale. Scaleless chin covered with melanophore spots. The breast was scaled. The maxilla extended beyond the eye (Nemeth, 1994).

Measurements (mm): Total length 112, standard length 94, pre-anal length 50.2, pre-dorsal length 35.1, pre-pectoral length 29.6, body depth 16.7, caudal peduncle depth 6.4, head length 28.7, eye diameter 4.8.

Distribution: The first Mediterranean record of *C. nudivittis* was given by Çiçek & Bilecenoğlu (2009) from eastern Mediterranean. The following records are in the Levantine-Aegean axis: Greece (Kalogirou & Corsini-Foka, 2012; Kousteni & Christidis, 2019) Israel (Goren et al., 2011), Lebanon (Bariche, 2010, 2011), Syria (Ali et al., 2017), Türkiye (Ergüden & Turan, 2011; Gökoğlu et al., 2011; Dalyan et al., 2012; Gökoğlu & Özvarol, 2013; Filiz et al., 2014; Akyol & Ünal, 2015; Aydın & Akyol, 2015; Kebapçıoğlu & Dereli, 2016; Yapıcı et al., 2016; Dalyan et al., 2021). The present study provides additional record for northernmost distribution of *C. nudivittis* in the Aegean Sea (Figure 2).

Nemipterus randalli

Systematics:

Class: Actinopteri

Family: Nemipteridae Regan, 1913

Genus: *Nemipterus* Swainson, 1839

Nemipterus randalli Russell, 1986 (Figure 1b)

Diagnostic characteristics: Mouth terminal; five pairs of small recurved canine teeth on the premaxilla. Body covered with big ctenoid scales. Long and pointed pectoral fins, reaching beyond the level of anal fin origin. Caudal fin with a filamentous extension on the upper lobe. Upper part of the body is pinkish while ventral surface is silvery. Three or four pale yellow stripes on the lateral side. Three or four pale yellow stripes exist on the lateral side. The pectoral base includes a golden blotch. The dorsal fin pales bluish, upper margin edged with red, with yellow striped. The anal fin colour is pale bluish and includes a narrow yellow medial band (Russell, 1990).

Measurements (mm): Total length 187, standard length 153, fork length 167, pre-anal length 91.8, pre-dorsal length 42.8, pre-pectoral length 44.1, body depth 47.8, caudal peduncle depth 14.9, head length 44.3, eye diameter 12.6.

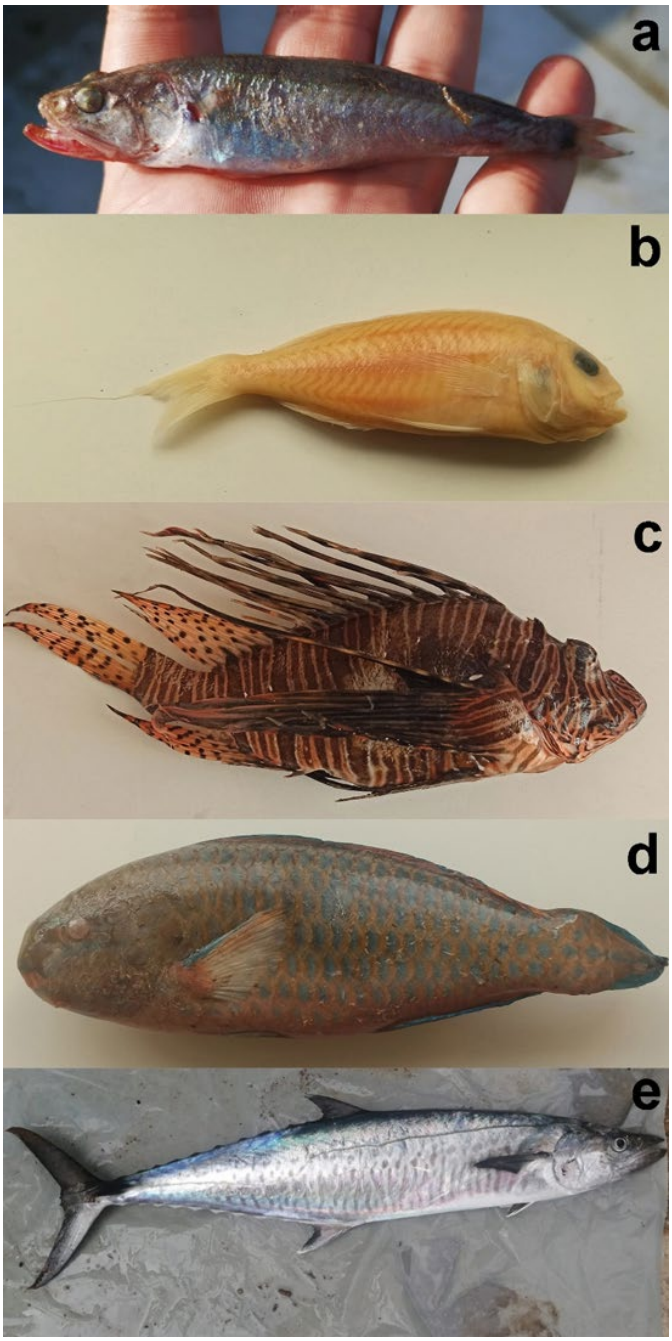

Figure 1. Alien species in the Aegean Sea. A) *Champsodon nudivittis*, B) *Nemipterus randalli*, C) *Pterois miles*, D) *Scarus ghobban*, E) *Scomberomorus commerson*

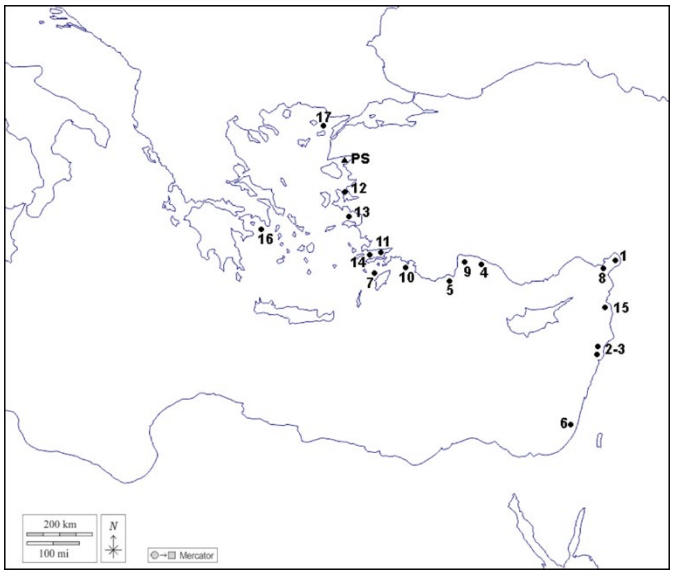

Figure 2. *Champsodon nudivittis* recordings from the Aegean-Levantine Sea up to date: [1]Çiçek & Bilecenoğlu (2009), [2]Bariche (2010), [3]Bariche (2011), [4]Gökoğlu et al. (2011), [5]Erguden & Turan (2011), [6]Goren et al. (2011), [7]Kalogirou & Corsini-Foka (2012), [8]Dalyan et al. (2012), [9]Gökoğlu & Özvarol (2013), [10]Filiz et al. (2014), [11]Akyol & Ünal (2015), [12]Aydın & Akyol (2015), [13]Kebapçıoğlu & Dereli (2016), [14]Yapıcı et al. (2016), [15]Ali et al. (2017), [16]Kousteni & Christidis (2019), [17]Dalyan et al. (2021), [PS]Present study

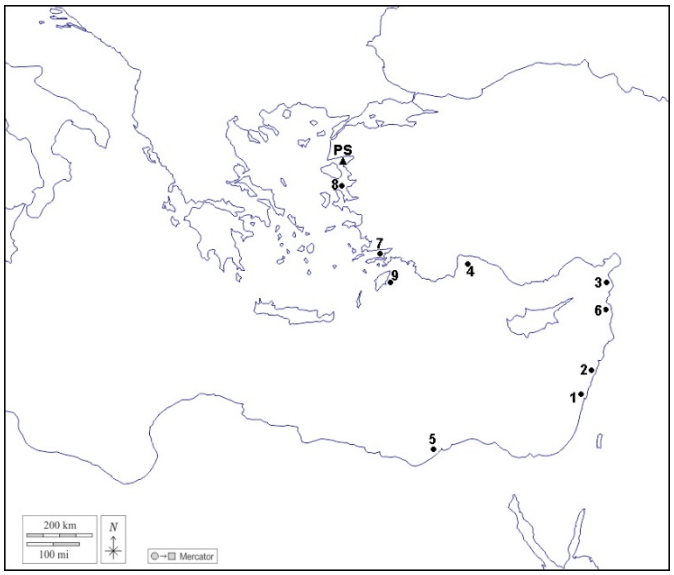

Figure 3. *Nemipterus randalli* recordings from the Aegean-Levantine Sea up to date: [1]Golani & Sonin (2006), [2]Lelli et al. (2008), [3]Bilecenoğlu & Russell (2008), [4]Gökoğlu et al. (2009), [5]Halim & Rizkalla (2011), [6]Ali et al. (2013), [7]Gülşahin & Kara (2013), [8]Aydın & Akyol (2017), [9]Kampouris et al. (2019), [PS]Present study.

Distribution: *N. randalli* was first reported from Israeli coasts by Golani & Sonin (2006) in the Mediterranean. The following records are in the Levantine-Aegean axis: Egypt (Halim & Rizkalla, 2011), Greece (Kampouris et al., 2019), Lebanon (Lelli et al., 2008), Syria (Ali et al., 2013), Türkiye (Bilecenoğlu & Russell, 2008; Gökoğlu et al., 2009; Gülşahin & Kara, 2013; Aydın & Akyol, 2017). The present study provides the northernmost occurrence of *N. randalli* in the Aegean Sea (Figure 3).

Pterois miles

Systematics:

Class: Actinopteri

Family: Scorpaenidae Risso, 1827

Genus: *Pterois* Oken, 1817

Pterois miles (Bennett, 1828) (Fig. 1c)

Diagnostic characteristics: Moderately compressed body is reddish to tan and numerous thin dark bars on body and head vertically; median fins covered with visible small spots. Long and venomous dorsal spines longer than body (Golani & Sonin, 1992).

Measurements (mm): Total length 244, standard length 181, pre-anal length 124, pre-dorsal length 53.1, pre-pectoral length 57.3, body depth 64.1, caudal peduncle depth 20.0, head length 60.4, eye diameter 12.0, snout length 18.0

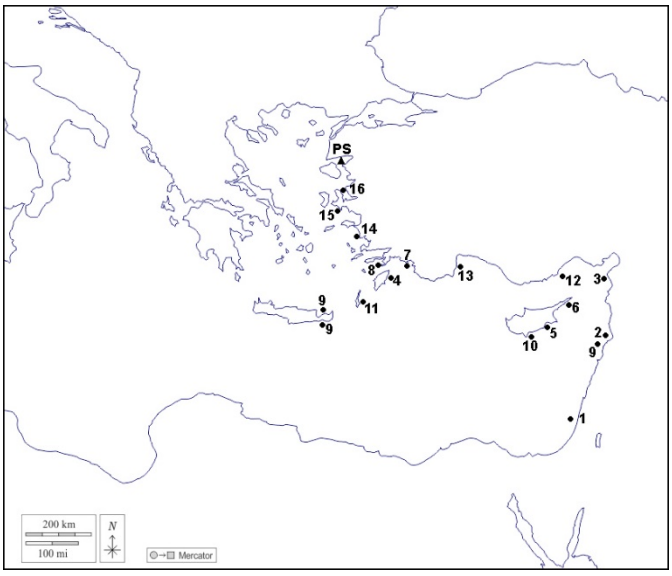

Figure 4. *Pterois miles* recordings from the Aegean-Levantine Sea up to date: [1]Golani & Sonin (1992), [2]Bariche et al. (2013), [3]Turan et al. (2014a), [4]Crocetta et al. (2015), [5]Iglésias & Frotté (2015), [6]Oray et al. (2015), [7]Turan & Öztürk (2015), [8]Bilge et al. (2016), [9]Dailianis et al. (2016), [10]Jimenez et al. (2016), [11]Mytilineou et al. (2016), [12]Yağlıoğlu & Ayaş (2016), [13]Özgür Özbek et al. (2017), [14]Yapıcı (2018), [15]Özgül (2020), [16]Oruç et al. (2022), [PS]Present study

Distribution: *P. miles* was first reported by Golani & Sonin (1992) in the Mediterranean. The following records are: Cyprus

(Iglesias & Frotte, 2015; Oray et al., 2015; Jimenez et al., 2016), Greece (Crocetta et al., 2015; Dailianis et al., 2016; Mytilineou et al., 2016), Lebanon (Bariche et al., 2013), Türkiye (Turan et al., 2014a; Turan & Öztürk, 2015; Bilge et al., 2016; Yağlıoğlu & Ayas 2016; Özgür Özbek et al., 2017; Yapıcı, 2018; Özgül, 2020; Oruç et al., 2022). The present study indicates the northernmost occurrence of *P. miles* in the Aegean Sea (Figure 4).

Scarus ghobban

Systematics:

Class: Actinopteri

Family: Scaridae Rafinesque, 1810

Genus: *Scarus* Forsskål, 1775

Scarus ghobban Forsskål, 1775 (Figure 1d)

Diagnostic characteristics: The body was dorsally brightly salmon pink with green-blue marks and stripes and ventrally was brownish. Scales were turquoise-blue with brown margins. The head was covered by irregular bands of turquoise-blue to brownish colour. The coloration of the lower and upper margins of the pectoral and pelvic fins was turquoise-blue while the middle part included a longitudinal band of reddish-brown (Goren & Aronov, 2002).

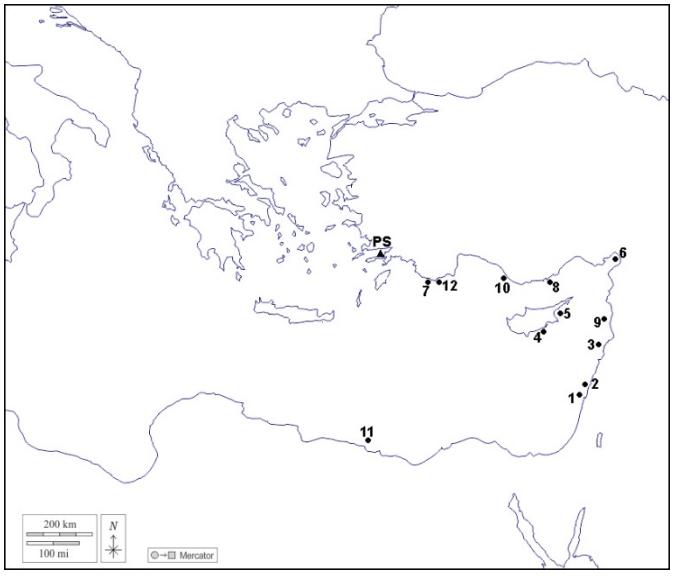

Figure 5. *Scarus ghobban* recordings from the Aegean-Levantine Sea up to date: [1]Goren & Aronov (2002), [2]Golani & Levy (2005), [3]Bariche & Saad (2008), [4]Ioannou et al. (2010), [5]Filiz & Sevingel (2014), [6]Turan et al. (2014b), [7]Karachle et al. (2016), [8]Yağlıoğlu & Ayaş (2016), [9]Soliman et al. (2018), [10]Ergüden et al. (2018), [11]Al Mabruk et al. (2020), [12]Tüney-Kızılkaya & Akyol (2020), [PS]Present study

Measurements (mm): Total length 279, standard length 230, fork length 273, pre-anal length 138.8, pre-dorsal length 75.1, pre-pectoral length 68.1, body depth 83.2, caudal peduncle depth 33.0, head length 70.8, eye diameter 8.3, snout length 24.5.

Distribution: Its first Mediterranean record was given from Israeli coasts by Goren & Aronov (2002). The following records are in the Levantine-Aegean axis: Cyprus (Ioannou et al., 2010; Filiz & Sevingel, 2014), Greece (Karachle et al., 2016), Israel (Golani & Levy, 2005) Lebanon (Bariche & Saad, 2005), Egypt (Al Mabruk et al., 2020), Syria (Soliman et al., 2018), Türkiye (Turan et al., 2014b; Yağlıoğlu & Ayaş, 2016; Ergüden et al., 2018; Tüney-Kızılkaya & Akyol, 2020). The present study provides the northernmost record of *S. ghobban* in the Aegean Sea (Figure 5).

Scomberomorus commerson

Systematics:

Class: Actinopteri

Family: Scombridae Rafinesque, 1815

Genus: *Scomberomorus* Lacepède, 1801

Scomberomorus commerson (Lacepède, 1800) (Figure 1e)

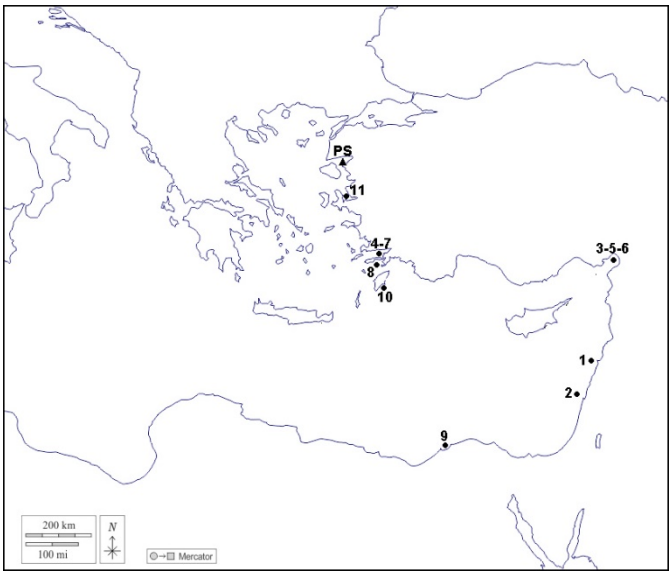

Figure 6. *Scomberomorus commerson* recordings from the Aegean-Levantine Sea up to date: [1]George & Athanassiou (1965), [2]Ben-Tuvia (1971), [3]Gücü et al. (1994), [4]Buhan et al. (1997), [5]Başusta & Erdem (2000), [6]Torcu & Mater (2000), [7]Öğretmen et al. (2005), [8]Öz et al. (2007), [9]Bakhoum (2007), [10]Corsini-Foka & Kalogirou (2008), [11]Akyol & Tosunoğlu (2019), [PS]Present study. (*The first Mediterranean record (Hornell, 1935) could not be shown on the map because the coordinate information could not be reached)

Diagnostic characteristics: Body shape elongated and moderately strongly compressed. The posterior margin of the eye intersects with the upper jaw. Two dorsal fins, the first of which is longer than the second. Finlets originating after the

second dorsal fin reach out to the back end of the body. Lateral line abruptly bent downward below end of second dorsal fin. The dorsal side of the body is iridescent blue-grey and covered with distinctive thin-wavy vertical bands (Collette, 2001).

Measurements (mm): Detailed measurements could not be realized since the fisherman despatched a specimen to sell. However, he stated that the specimen was 80 cm in total length and weighed ~ 3 kg.

Distribution: Its first Mediterranean record was given from Palestine by Hornell (1935). The following records are in the Levantine-Aegean axis: Egypt (Bakhoum, 2007), Greece (Corsini-Foka & Kalogirou, 2008), Israel (Ben-Tuvia, 1971), Lebanon (George & Athanassiou, 1965), Türkiye (Gücü et al., 1994; Buhan et al., 1997; Başusta & Erdem, 2000; Torcu & Mater, 2000; Öğretmen et al., 2005; Öz et al., 2007; Akyol & Tosunoğlu, 2019). The present study provides the northernmost record of *S. commerson* in the Aegean Sea (Figure 6).

Neonative species

Seriola fasciata

Systematics:

Class: Actinopteri

Family: Carangidae Rafinesque, 1815

Genus: *Seriola* Cuvier, 1816

Seriola fasciata (Bloch, 1793) (Figure 7a)

Diagnostic characteristics: Body shape is elongated, moderately deep, somewhat compressed, and also covered with small cycloid scales. The body is dark olive dorsally, sides lighter, and belly silvery. Two dorsal fins, first lower than second. A dark band exists between the eye and the anterior of the dorsal fin. Seven dark irregular and broken bands throughout the body; 8th band is small and dark, at the end of the caudal peduncle (Smith-Vaniz & Berry, 1981).

Measurements (mm): Total length 210, standard length 161, fork length 182, pre-anal length 94.5, pre-dorsal length 54.8, pre-pectoral length 49.8, body depth 64.3, caudal peduncle depth 9.5, head length 36.7, eye diameter 10.0, snout length 17.3

Distribution: Its first record in the Mediterranean was reported by Massutí & Stefanescu (1993) from Balearic Island. The following records are in the Levantine-Aegean axis: Greece (Corsini et al., 2006), Israel (Sonin et al., 2009), Syria (Jawad et al., 2015), Türkiye (Kapiris et al., 2014; Doğdu et al., 2019; Yapici & Filiz, 2020; Akyol & Ünal, 2021), Egypt (Stamouli et al., 2017). The present paper provides the northernmost record and of *S. fasciata* for the Aegean Sea (Figure 8).

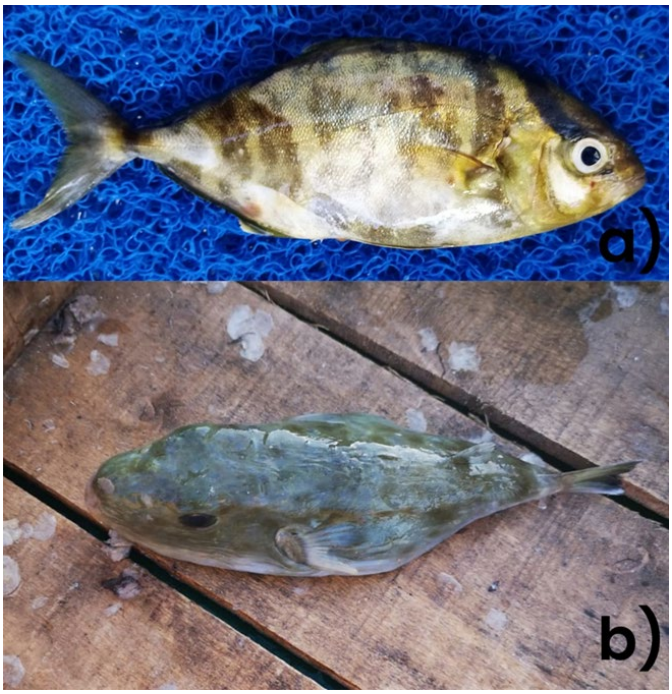

Figure 7. A) *Seriola fasciata* B) *Sphoeroides pachygaster*

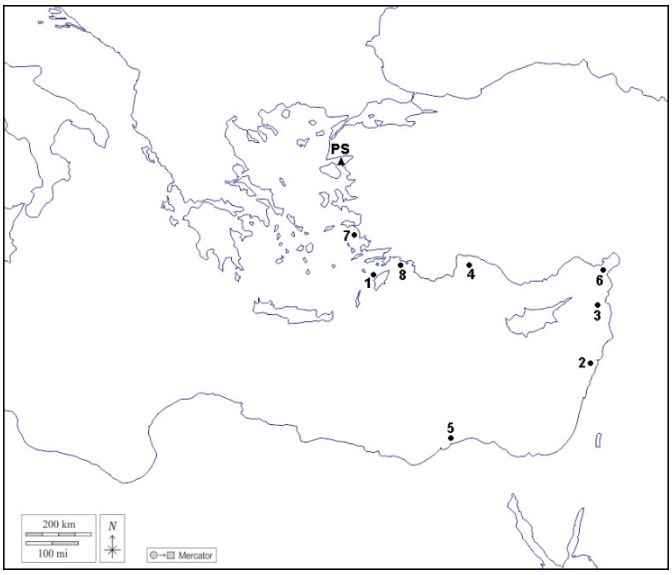

Figure 8. *Seriola fasciata* recordings from the Aegean-Levantine Sea up to date: [1]Corsini et al. (2006), [2]Sonin et al. (2009), [3]Jawad et al. (2015), [4]Kapiris et al. (2014), [5]Stamouli et al. (2017), [6]Doğdu et al. (2019), [7]Yapıcı & Filiz (2020), [8]Akyol & Ünal (2021), [PS]Present study

Sphoeroides pachygaster

Systematics:

Class: Actinopteri

Family: Tetraodontidae Bonaparte, 1831

Genus: *Sphoeroides* Anonymous [Lacepède], 1798

Sphoeroides pachygaster (Müller & Troschel, 1848) (Figure 7b)

Diagnostic characteristics: Body compressed and inflatable. Scaled absent. One lateral line. Skin covered by small spines often present on back and belly. Caudal fin truncated or

rounded. Two nostrils on each side of snout. Body of the dorsal surface and the flanks is greyish to olive green with many pale dots and ventral side is whitish (Smith & Heemstra, 1986).

Measurements (mm): Total length 162, standard length 139, pre-anal length 114, pre-dorsal length 106, pre-pectoral length 57.9, body depth 48.2, caudal peduncle depth 20.0, head length 51.3, eye diameter 11.0.

Distribution: The first Mediterranean record of *S. pachygaster* was given by Oliver (1981) from Balearic Island. The following records are in the Levantine-Aegean axis: Cyprus (Katsanevakis et al., 2009; Akbora et al., 2021), Egypt (Farrag et al., 2016), Greece (Zachariou-Mamalinga & Corsini, 1994; Peristeraki et al., 2006; Dailianis et al., 2016), Israel (Golani, 1996), Lebanon (Gerovasileiou et al., 2017), Syria (Abdul Rahman et al., 2014) and Türkiye (Eryılmaz et al., 2003; Eleftheriou et al., 2011; Akyol & Aydın, 2017; Akbora et al., 2021). The present study provides additional record for northern distribution of *S. pachygaster* in the Aegean Sea (Figure 9).

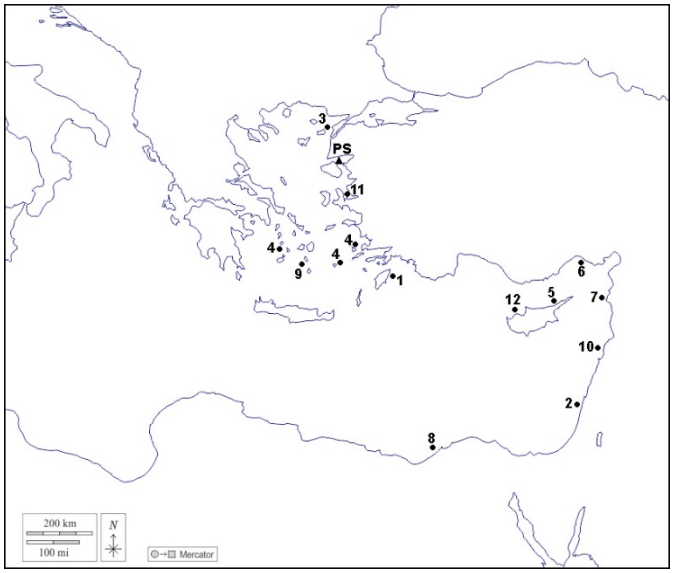

Figure 9. *Sphoeroides pachygaster* recordings from the Aegean-Levantine Sea up to date: [1]Zachariou-Mamalinga & Corsini (1994), [2]Golani (1996), [3]Eryılmaz et al. (2003), [4]Peristeraki et al. (2006), [5]Katsanevakis et al. (2009), [6]Eleftheriou et al. (2011), [7]Abdul Rahman et al. (2014), [8]Farrag et al. (2016), [9]Dailianis et al. (2016), [10]Gerovasileiou et al. (2017), [11]Aydın & Akyol (2017), [12]Akbora et al. (2021), [PS]Present study

Discussion

Invasion processes are controlled by the interaction between the characteristics of the invasive species and the conditions of the receiving environment and so are species-specific. Biodiversity of the Mediterranean that includes high endemism has been remodelled by non-native species introduced from the Gibraltar Strait and Suez Canal (Coll et al., 2010). Even though all non-native Atlantic and Lessepsian species are termed alien species, the invasion processes actually differ from each other. Therefore, range-expanding non-native species were classified into two groups as alien and neonative species (Essl et al., 2019). According to this definition, alien species directly exploit human agency (human-made canals, tunnels) in their range expansions, while neonative species may use human-induced changes of the biophysical environment to expand their ranges, however, do not use a directly human agency, intentional or unintentional. This classification clarifies that alien species (Lessepsian species) are often reported in unexpected areas distant from their native range and neonative (Atlantic species) are usually observed in new areas close to their native range.

There is a marked difference in the diversity of non-native species between the western and the eastern basin in the Mediterranean, however, this difference tends to decrease due to changes in the physicochemical conditions in the Mediterranean Sea. Because remodelling of the sea currents in the Mediterranean has given the opportunity to reduce or eliminate the adaptation phase of non-native species. Considering the historical spread of invasive species in the Mediterranean, the 38th parallel had considered a breaking point for the invasion because non-native species (especially Lessepsian migrants) could not appear, due primarily to the cold-water temperature (Papaconstantinou, 1990). Additionally, most scientists have suggested that even though a taxonomic richness of the alien biota, there is not essentially an expansion of the Lessepsian province above the 38th parallel (Bilecenoğlu, 2016). Sea surface temperature (SST) of the Aegean Sea that involves the 38th parallel mainly depends on the exchange between cold/fresh Black Sea and warm/saline Levantine basin (Poulain et al., 2012).

However, the effects of global warming have altered the borders of existent sea currents in the Mediterranean. In particular, water-mass modifications in the Mediterranean Transient (EMT)) have caused to penetration of a warm-water masses (Levantine Surface Water and Levantine Intermediate Water) into northern colder sectors of the Aegean Sea. Similar changes are also observed in the Atlantic Ocean, which connects with the Mediterranean Sea via the Strait of Gibraltar. Biton (2020) declared that water mass that flows from the Mediterranean Sea into the Atlantic (Mediterranean Overflow Water - MOW) has been caused the eastern Atlantic including the Strait of Gibraltar to be as saltier (~0.36 psu), warmer

(1.8°C), and so changed the characteristics of the Atlantic Meridional Overturning Circulation (AMOC). Effects of transport of warm water mass that Levantine origin to the northern sectors and the equalization trend of temperature and salinity between the eastern Atlantic and the Mediterranean on the introduction and dispersal of subtropical and tropical alien and neonative species are already observed throughout the Mediterranean (Katsanevakis et al., 2020; Dalyan et al., 2021). On the other hand, studies on the effect of environmental factors on the distribution of demersal Lessepsian species have not detected a correlation between temperature and dispersal mechanism. According to the results, only *N. randalli* had a positive correlation with water temperature. However, based on the results of the present study, it could be asserted that *N. randalli* is experiencing the temperature-dependent integration phase of the invasion. Similarly, Poursanidis et al. (2022) simulated the distribution of *P. miles* in the Mediterranean via the Bayesian framework and outputs showed this species would invade and settle whole the Aegean coasts for the 2040-2050 period. The northernmost observation of *P. miles* presented in this study proves the accuracy of the simulation outputs.

The process and success of the invasion in the Mediterranean cannot be completely attributed to the increase in SST, but it is also obvious that the increase in SST shortens the invasion processes and increases the success of the invasion. Because considering the distribution of non-native species in the Mediterranean (except *Fistularia commersonii*), veteran species took longer to settle and spread than newly introduced species. For example, invasion momentum in the Levant-Aegean axis is ~290 km/y^{-1} for *N. randalli* and 15 km/y^{-1} for *Siganus luridus*. In recent years, many thermophilic non-native and native taxa reported on northern Aegean coasts clearly reflect remodelling biodiversity in the Mediterranean (Katsanevakis et al., 2020; Dalyan et al., 2021; Esposito et al., 2021).

Conclusion

Non-native species that are directed by climate change and other human-induced vectors and native species are an integral part of biodiversity. Consequently, monitoring these species will enable scientists and public authorities to understand current/possible changes and their long-term effects on biodiversity.

Acknowledgements

The authors would like to thank captains Hasan BİRAN and Uğur Ali BİRAN of the F/V "DÜLGER" for supporting the survey. We also thank Mr. Yüksel TÜRK for providing some specimens as part of citizen science. Some data in this study were obtained in the project funded by Ege University Scientific Research Projects Coordination (2017/SÜF/005).

Compliance With Ethical Standards

Authors' Contributions

İA: Designed the study, provided the data.
ÖY: Provided the data.
KT: Provided the data.
SY: Designed the study, wrote the first version of manuscript.
All authors read and approved the final manuscript.

Conflict of Interest

The authors declare that there is no conflict of interest.

Ethical Approval

For this type of study, formal consent is not required.

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