Occurrence of lionfish, *Pterois miles* (Bennett, 1828) in the coast of Aegean Sea (Turkey): The northernmost dispersal record

Ege Denizi kıyılarında aslan balığının *Pterois miles* (Bennett, 1828) bulunusu: En kuzey kaydı

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Abstract: *Pterois miles* (Bennett, 1828) is one of the worst aquatic invaders in history and its rapid dispersal in the Mediterranean Sea raise serious concerns for local communities. On August 2019, one specimen was caught by spear-fisher at depths of 15 m in Kokar Bay of Aegean Sea, Turkey. This occurrence represents the northernmost record of the species in the Aegean Sea.

Keywords: *Pterois miles*, devil firefish, alien species, Aegean Sea

Oz: *Pterois miles* (Bennett, 1828), tarihin en kötü istilacı türlerinden biridir ve Akdeniz'deki hızlı dağılımı yerel topluluklar için ciddi kaynaklar oluştururdu. Ağustos 2019 tanesiyle bir balık Ege Denizi'nin Kızılırmak Kıyı'nda 15 m derinlikte yakalanmıştır. Bu kayıt, günümüzde kadar türün Ege Denizi'ndeki en kuzey kaydedilmiş tarihi temsil etmektedir.

Anahtar kelimeler: *Pterois miles*, aslan balığı, yabancı türler, Ege Denizi

INTRODUCTION

The number of alien species becoming major invasive threat has been increasing in the Aegean Sea remarkably. A potentially destructive Indo-Pacific species, *Pterois miles* (Bennett, 1828), have recently been introduced to the Mediterranean, which may unfavorably affect not only the structure and function of local ecosystems but also the socioeconomic, fishery, biodiversity and also even human health (Bilecenoglu, 2018). *P. miles* is a species commonly found in the Indian Ocean and Red Sea (Froese and Pauly, 2019). They are usually found in reef fish communities (Green and Côté, 2009) and commonly found in water depths from 25 to 85 m on hard bottom, coral reefs and artificial substrate, sometimes found under ledges and hiding in crevices (Hare and Whitfield, 2003). They invade the Mediterranean from the Red Sea via the Suez Canal (Golani and Sonin, 1992).

Lionfish *P. miles* was recorded for the first time from the Mediterranean Sea at Haifa Bay in 1991 (Golani and Sonin, 1992), and later lionfish *P. miles* were reported from Lebanon coast (Bariche et al. 2013) and Cyprus coast (Evripidou, 2013) and then sighted in Turkey (Turan et al., 2014), Rhodes in Greece (Crocutta et al., 2015). Recently, several records were reported from the southern coast of Turkey indicating a westerly migration of the species towards the Aegean Sea (Bilge et al., 2016; Yaglicoglu and Ayas, 2016; Turan et al., 2017). First observation of *P. miles* from the Aegean Sea was reported from Fethiye Bay in July 2015 and Dalyan coast in August 2015 (Turan and Öztürk, 2015). Nowadays it also reported in Lebanon (Azzurro et al., 2017), Cyprus (Jimenez et al., 2016), Greece (Crocutta et al., 2015; Daillianis et al., 2016), Tunisia (Azzurro et al., 2017; Karachle et al., 2017), Libya (Mabruk and Rizgala, 2019) and also Italy (Azzurro et al., 2017). And over the last years, the species has expanded towards the northeast Aegean Sea. Up to the present, a northernmost occurrence of the species from the Didim coast off Turkey (Yapıcı, 2018). This ichthyologic note presents the northernmost record, updating our present knowledge on the distribution of Lessepsian *P. miles* for the Aegean Sea.

MATERIAL AND METHODS

On 26 August 2019, a specimen of *P. miles* was captured by a spearfisher from Kokar Bay-Izmir at depth of 15 m on rocky bottoms. The specimen was having a total length (TL) of 144 mm captured at 38.1°N and 26.60980 E (Figure 1). The water temperature was 20.5°C. The specimen was identified based on the description provided by Golani et al. (2006). Fish were preserved in 10% buffered formalin and...
deposited in the Ichthyological Collection of Ege University, Fisheries Faculty, under catalog numbers ESFM-PIS/2019-003.

Figure 1. The distribution of *P. miles* occurrences in the Mediterranean Sea and, towards on the Aegean Sea (Red points indicated that underwater observation from spearfisher (Gökay Gülhep personal comm.).

Figure 2. *Pterois miles* captured off the Kokar Bay in the Aegean Sea

**RESULTS**

The captured specimen was 144 mm in total length, its total body weight was 38.8 g (Table 1). It was identified as a *P. miles* based on a combination of morphological characters, morphometric measurements, meristic counts and colour, which were in total agreement with previous descriptions of the species by Golani and Sonin (1992). It was measured to the nearest millimeter, and some morphometric measurements were indicated in Table 1.

**DISCUSSION**

The presence of *P. miles* in the Aegean Sea was first reported in 2015 in Rhodes (Crocetta et al., 2015), Fethiye and Dalyan (Turan and Öztürk, 2015). It has been emphasized by many authors that the temperature of seawaters will rise northward in the following years (Poursanidis, 2015; Giovos et al., 2018). This study supports the accuracy of these ideas. *P. miles* is expected to be detected further north in the coming years. It is reported by the spearfisher that lionfish are sighted and caught further north from the area where the fish in this study was caught (Gökay Gülhep, pers.comm.). According to spearfisher *P. miles* also has been sighted in Kokay Bay (18 m; September 2019), Sığacık Bay (17 m, September 2019) and also Foça (15 m, October 2018). These observations also indicate that *P. miles* are successfully and rapidly expanding from the Mediterranean coasts northward to the Aegean Sea. Its extension may be determined by sea temperature (Turan et al., 2016). In recent years, the increase in the distribution towards the northern Aegean Sea, and the records of smallest individuals indicate that it has strengthened the spread and started to be one of the established species. *P. miles* get high scores in risk analysis studies on lespeian species on southwestern coasts of Turkey (Filiz et al., 2017; Bilge et al., 2019).
These studies drawn attention to the speed and seriousness of the invasion.

**Table 1.** Morphometric measurements in mm and as percentages of total length (%TL), standard length (%SL) meristic counts and weight in grams recorded in the specimen of *Pterois miles* from the Aegean Sea

| Morphometric measurements | mm  | TL% |
|---------------------------|-----|-----|
| Total length              | 144 | 100.0 |
| Standard length           | 106 | 73.6 |
| Barbel length             | 17  | 11.8 |
| Head length               | 36  | 25.0 |
| Body depth                | 38  | 26.4 |
| Dorsal fin rays           | 10 + XIII |
| Pelvic fin rays           | 5 + I |
| Anal fin rays             | 6 + III |
| Pectoral fin rays         | 14  |
| Caudal fin rays           | 15 + II |
| Total weight (grams)      | 38.8 |

Mediterranean seawater temperatures are steadily increasing, and alien species are spreading, causing community shifts and tropicalization (Lejeune et al., 2010; Montefalcone et al., 2015). There are now >1000 alien species in the Mediterranean and the majority are thermophilic species that have entered the eastern basin through the Suez Canal (Katsanevakis et al., 2014). Recent enlargement of this canal coupled with sea surface warming is raising concerns that this problem will get worse. *P. miles* has been considered highly temperature-dependent (Dabruzzi et al., 2017), according to Kimball et al. (2004) *P. miles* unable to survive below 10°C. However, Özgür-Özbek et al. (2017) reported that the *P. miles* continued feeding in low winter temperature (14.9°C) in the Mediterranean Sea. Although most recordings were obtained in the summer, seawater temperatures ranged from 14.3°C to 29.0°C (Yapıcı, 2018). In this study, the individual was observed in the period when the water temperature was high. Nonetheless, the more widespread colonization of the Mediterranean and Aegean region by *P. miles* seems no temperature-dependent. Further studies should focus on the interaction between lionfishes and seasonal water temperature variation in order to better understand whether temperature.

Lionfish are usually distributed in tropical marine waters, and have been found on hard bottoms, mangroves, sea grass, coral, and artificial reef communities (Gomez et al., 2013). In their original habitats, they occur along coral reefs and rocky shores down to depth of 50 m (Froese and Pauly, 2019). All records from various parts of the Mediterranean Sea report this species generally from depths of 2-110 m (Bariche et al., 2013; Oray et al., 2015; Kletou et al., 2016; Bilge et al., 2017; Yapıcı, 2018). Characteristics such as location, date, total length, observation method, habitat type and depth were obtained from peer-viewed publications to examine the journey of the species in the Mediterranean Sea (Figure 2; Table 2).

**Table 2.** The journey of *P. miles* from the Mediterranean Sea to the Aegean Sea (The number in front of each locality was shown in Figure 2)

| No | Location          | Coordinates | Length Range (TL mm) | Habitat          | Depth (m) | Observation Method | Reference                  |
|----|-------------------|-------------|----------------------|------------------|-----------|--------------------|---------------------------|
| 1  | Herzliya, Israel  | -           | 328                  | -                | 35        | Trawl              | Golani & Sonin, 1992     |
| 2  | Al Minie, Lebanon | 34.29N 35.54E | 209                 | Coralligenous    | 30        | Gill net           | Bariche et al., 2013     |
| 3  | Iksenderen, Turkey| 36.17N 35.46E | 276                 | Rocky bottom     | 25        | -                  | Turan et al., 2014       |
| 4  | Rhodes, Greece    | 36.38N 28.24E | -                   | Rocky bottom     | 7         | Diving             | Crocetta et al., 2015    |
| 5  | Rhodes, Greece    | 35.91N 27.85E | -                   | Shipwreck        | -         | Diving             | Crocetta et al., 2015    |
| 6  | Rhodes, Greece    | 36.45N 28.21E | -                   | Rocky bottom     | 2         | Diving             | Crocetta et al., 2015    |
| 7  | Ormidia, Cyprus   | -           | 170                  | -                | 10        | Gill net           | Iglesias & Frotte, 2015  |
| 8  | Karpas, Cyprus    | -           | 373                  | Rocky bottom     | 40        | Gill net           | Oray et al., 2015        |
| 9  | Dalyan, Turkey    | -           | -                    | Sandy bottom     | 11        | Diving             | Turan & Öztürk, 2015     |
| 10 | NE Crete, Greece  | 35.20N 26.30E | 250                 | Rocky bottom     | 33        | Gill net           | Daillianis et al., 2016  |
| 11 | SE Crete, Greece  | 35.01N 25.96E | 100                  | Rocky bottom     | 12-37     | -                  | Daillianis et al., 2016  |
| 12 | Karpathos Island, Greece | 35.55N 27.20E | 100              | Rocky bottom     | 17        | Diving             | Mytilineou et al., 2016  |
| 13 | Karpathos Island, Greece | 35.50N 27.22E | 200              | Rocky bottom     | 16        | Diving             | Mytilineou et al., 2016  |
| 14 | Mersin, Turkey    | 36.08N-33.40E | 250                  | -                | 100-110   | Trawl              | Yağışoğlu & Ayas, 2016   |
| 15 | Kemer, Turkey     | -           | 85-293               | Rocky bottom     | 10-15     | Spearfishing       | Özgür-Özbek et al., 2017 |
| 16 | Didim-Aydın, Turkey| 37.20N 27.14E | -                   | Rocky bottom     | 18        | Diving             | Yapıcı, 2016             |
| 17 | Kokar Bay, Turkey | 38.13N 26.61E | 144                 | Rocky bottom     | 15        | Spearfishing       | Present study             |
Top predators are very important to decrease lionfish populations that indicate conservation of top predators to struggle lionfishes. Lionfish have very few documented natural predators due to their venomous spines. Grouper species such as dusky grouper Epinephelus marginatus, goldblotch grouper Epinephelus costae and blue-spotted cornetfish Fistularia commersonii are the main predators of the lionfishes (Bernadsky and Goulet, 1991; Maljković et al., 2008; Turan et al., 2017). Especially groupers of these species, as these may, may help control the spread of invasive fish (Mumby et al., 2011; Kletou et al., 2016). However, illegal fishing pressure on these species should be controlled in the Mediterranean and the Aegean Sea. Since fishing activities such as trawling and purse seine and also trammel nets do not solve the problem to struggle lionfish, which usually inhabit under big rocks and caves. Therefore, predators of lionfish need to be supported in this struggle. Countries in the Mediterranean Sea organize campaigns and spearfishing competitions to eradicate lionfish and also encourage the human consumption (Bilecenoglu, 2018). However, some researchers point out that complete eradication of lionfish is impossible; these organizations only may help to keep their population under control and protect the native marine ecosystems.

In conclusion, the status of P. miles in the Mediterranean and adjacent seas should be monitored closely via formal and citizen sciences. The recent and rapid expansion of the P. miles in the Mediterranean is therefore alarming and requires the immediate action of all concerned stakeholders in the area (Bariche et al., 2017). Finally, it is vital that the ecology and distribution of the invasive species are fully understood to design the most effective form of control.

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