

Rapid Communication

Range expansion of the common lionfish *Pterois miles* (Bennett, 1828) in the Mediterranean Sea: an unwanted new guest for Italian waters

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Abstract

Lionfishes are conspicuous and disruptive predators once introduced outside of their native range. Here we provide a revision of the occurrences of the common lionfish *Pterois miles* (Bennett, 1828) in the Mediterranean Sea, showing its rapid geographical expansion since 2012. A single lionfish was photographed in September 2016 during a scientific survey off the Vendicari coast, Southern Sicily, Italy. This is the first record of this notorious invasive species from Italian waters. Given its large size, conspicuous appearance, and venomous spines, it is critical to involve informed citizen scientists in tracking the spread of this species and to develop means to manage or adapt to its presence in the Mediterranean Basin.

Key words: biological invasions, devil firefish, Sicily, Mediterranean, protected areas

Introduction

The Indo-Pacific lionfishes *Pterois volitans* (Linnaeus, 1758) and *P. miles* (Bennett, 1828) represent a well-documented example of highly damaging invasive species spreading rapidly worldwide. In the last two decades, they rapidly spread through the Western Atlantic and Caribbean Sea (Schofield 2009), becoming a major problem for coastal environments and represent one of the world's top conservation issues (Sutherland et al. 2010). The invasive lionfish can reach very high population densities and can greatly alter ecosystem structure and function, mainly through predation on small fishes (Muñoz et al. 2011). In the Mediterranean Sea, a lionfish was first detected in July 1991 by Golani and Sonin (1992), who identified it as *Pterois miles*. Despite the conspicuous appearance of this fish, no further observations were made until 2012, when two new *Pterois miles* specimens, confirmed by molecular



Figure 1. The common lionfish *Pterois miles* photographed off the coast of Vendicari (Southern Sicily) on September 23th 2016 at a depth of 3.5 meters. Photo: B. Stancanelli.



Figure 2. Cumulative occurrences of *Pterois miles* in the Mediterranean Sea from July 1991 to October 2016. Data consisted of 230 geo-referenced observations pooled by bibliographic sources (see Supplementary material Table S1). Sightings reported in the scientific literature are reported with circles, whilst the Venticari specimen is marked with a star.

analyses, were recorded (Bariche et al. 2013). Soon after, new specimens were detected in the easternmost sectors of the Levant Basin. Recently, clear signs of numerical increase emerged, raising concerns for an incipient lionfish invasion (e.g. Dailianis et al. 2016; Kletou et al. 2016; Azzurro and Bariche 2017). Here, we report the first observation of this species in Italian waters. We also summarize the chronology of its spread and the information associated with lionfish sightings by reviewing available literature.

Methods

The individual reported in this study was photographed with an underwater Pentax WG-10 camera during a routine SCUBA survey. The identification was based on the unique and conspicuous characteristics that distinguish lionfishes from all the other marine species. Literature analysis was based on 79 geo-referenced observations extracted from published scientific works. An additional 151 presence records were gathered from the work of Azzurro and

Bariche (2017) based on the Local Ecological Knowledge of Lebanese fishermen. However, these latter were not included in the analysis because no associated information was provided.

Results

On September 23th 2016, a single lionfish was observed and photographed (Figure 1), within the protected area “Riserva Naturale Orientata Oasi Faunistica di Venticari”, off of the Venticari coast (Southern Sicily, 36°49'10.36"N; 15°06'28.99"E) at 3.5 metres depth. The sighting was made by two of the authors (BS and VDM) whilst performing a scientific dive aimed at monitoring the spread of invasive algae (Project: “Spread of *Caulerpa taxifolia* var. *distichophylla* in the Western and Northern Mediterranean basin” CNR/ISAFoM UOS of Catania). The specimen was encountered on a coarse sandy bottom intermingled with sparse calcareous rocks where patches of algae dominated by *Caulerpa taxifolia* (Vahl) C. Agardh var. *distichophylla* (Sonder) Verlaque,

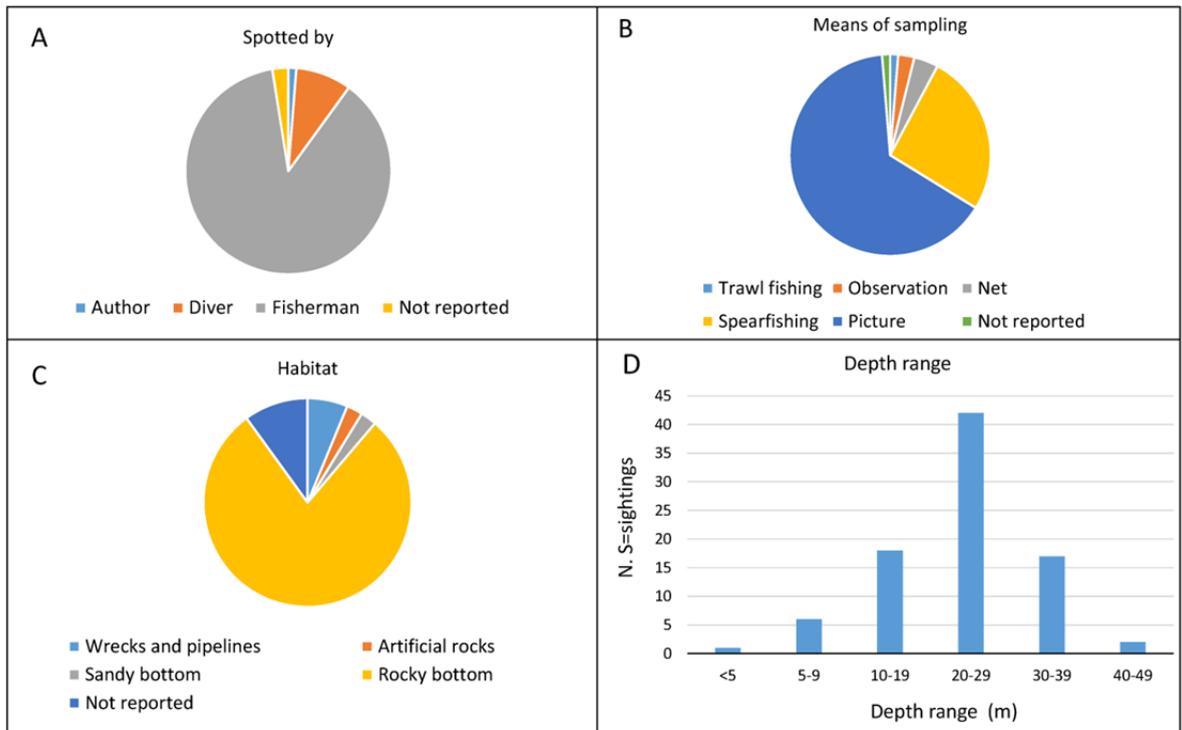


Figure 3. Pie charts showing the percent distribution of categories of stakeholders which detected the lionfish (A); Means of sampling (B); Habitat where the lionfish was detected (C). The depth distribution of these sightings is plotted by histogram (D). Data was extracted from 79 geo-referenced observations published in scientific literature (see Supplementary material Table S1).

Huisman and Procaccini, together with *Padina pavonica* (Linnaeus) Thivy, *Dasycladus vermicularis* (Scopoli) Krasser, *Flabellia petiolata* (Turra) Nizamuddin, *Dictyota dichotoma* (Hudson) J. V. Lamouroux, *Stypocaulon scoparium* (Linnaeus) Kützing and *Lophocladia lallemandii* (Montagne) F. Schmitz, were present. The specimen was estimated to be 12 cm total length.

The chronological order of the lionfish sightings, which accounts for the period July 1991 to October 2016, showed a progressive expansion of the lionfish westward from the coast of the Levant (Figure 2). To our best knowledge, no published records of the lionfish are available for the Mediterranean coasts of Egypt and Libya, nor for Italy and the western Mediterranean countries. Based on the reviewed literature, lionfish have been spotted 230 times in the Mediterranean (geo-referenced observations are given as supplementary material) and the analysis of 79 of these sightings highlighted the vital role of informed fishermen (including spearfishers) and divers for detection of this conspicuous species (Figure 3A). Underwater photographs are the most-used evidence to support the lionfish observations (Figure 3B) and the species has been mostly

encountered in the vicinity of rocks, but also on sandy bottoms and artificial structures (Figure 3C). Most sightings occurred in waters 4 to 42 m deep, with a peak between 20 and 29 m (Figure 3D).

Discussion

The lionfish observed at Vendicari represented the first known occurrence of this species in Italian waters, and its observation confirms a trend of rapid expansion through the Mediterranean Sea. The 21-year interval between the first and the second record of this species in Mediterranean seems lengthy. Considering the conspicuous appearance of *P. miles*, and its relatively ease in recognition, the lack of observations until 2012 is unlikely “a detection lag” (*sensu* Azzurro et al. 2016) and the 1991 record (Golani and Sonin 1992) can be considered as evidence of a failed introduction. Immediately after its record from Lebanon (Bariche et al. 2013), the species increased rapidly in abundance and quickly made its way to other Mediterranean countries, crossing the eastern basin in only two years. In the Sicily Strait, *P. miles* was first recorded in 2015 along the northern Tunisian coast (Dailianis et al. 2016).

The present observation of *P. miles* in Sicily was expected by Italian scientists of the Institute for Environmental Protection and Research, ISPRA, which in October 2016, launched a national alert to warn the general public about the imminent arrival of this venomous pest in Italian waters (ISPRA 2016). In the Mediterranean Sea, the lionfish is one of the targets of citizen science initiatives, such as Seawatchers (<http://www.seawatchers.org>) and its observations are shared and debated through social networks (e.g. Facebook groups: Lionfish in Cyprus, Mediterranean Marine Life, Oddfish). Considering that informed citizens (mostly divers and fishermen) were instrumental in helping scientists to both track and manage the lionfish invasion in the USA and Caribbean (Scyphers et al. 2014), participatory actions are expected to have a positive role in the Mediterranean as well.

In conclusion, even if the current abundances of *P. miles* are still below the threshold of a “true invasion” (Azzurro and Bariche 2017) there is an urgent need to take action and to promote control measures. In this respect, the drastic consequences of the lionfish introduction in the western Atlantic Ocean (Morris 2012) should be taken as a severe lesson of the possible consequences of a population explosion of *P. miles* in the Mediterranean Sea. This reinforces the need of implementing public awareness programs to engage local communities and capitalize on previous experiences on control and management of this infamous invader.

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Supplementary material

The following supplementary material is available for this article:

Table S1. Georeferenced observations of the common lionfish *Pterois miles* in the Mediterranean Sea.

This material is available as part of online article from:

http://www.reabic.net/journals/bir/2017/Supplements/BIR_2017_Azzurro_etal_TableS1.xls

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