

The presence of the invasive Lionfish *Pterois miles* in the Mediterranean Sea

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Abstract

Here we report the occurrence of *Pterois miles* in the Mediterranean Sea, based on the capture of two specimens along the coast of Lebanon. Previously, only one record of the species from the Mediterranean Sea had been documented. The new records highlight the arrival of new propagules of *P. miles*, more than two decades later, hinting to a future potential invasion of the Mediterranean Sea.

Keywords: Invasive species, Lessepsian migration, Suez Canal, Eastern Mediterranean, Lebanon.

Introduction

The two Lionfishes, *Pterois volitans* (Linnaeus, 1758) and *Pterois miles* (Bennett, 1828), are currently considered amongst the most successful marine invaders in the history of aquatic invasions (Albins & Hixon, 2008). They are both native to the Indo-Pacific realm, with *P. miles* present from the Red Sea to Sumatra, and *P. volitans* mainly in the western Pacific (Froese & Pauly, 2013). They are thought to have been introduced to the western Atlantic in the mid 1990's by aquarists (Hare & Whitfield, 2003). This resulted in a progressive and spectacular invasion of the eastern coasts of the United States and the Caribbean (reviewed by Schofield, 2009). Detrimental effects of this invasion on the diversity and function of native communities have been documented (Albins & Hixon, 2008; Morris & Whitfield, 2009; Green *et al.*, 2012) and there is growing concern regarding the presence of these highly predatory species in the invaded environment and their spread to other ecosystems (Claydon *et al.*, 2012; Valdez-Moreno *et al.*, 2012). Lionfishes were found abundant in some invaded areas as well as dominating reef fish communities (Green & Côté, 2009; Morris & Whitfield, 2009; Kulbicki *et al.*, 2012). The unparalleled speed and magnitude of Lionfish invasions has prompted a rapid response from scientists devoted to the investigation of the biology and ecology of the two species (reviewed by Morris & Whitfield, 2009). While Lionfishes are conspicuous and easy to spot in nature, *P. miles* and *P. volitans* are almost indistinguishable morphologically. They have been considered two separate species only recently (Schultz, 1986; Hamner *et al.*, 2007).

In the Mediterranean Sea, a single specimen of *P. miles* has been recorded from the Levantine coast in 1991 (Golani & Sonin, 1992). The current work reports the capture of new Lionfish from the same region.

Materials and Methods

Most diagnostic features were observed under a dissecting microscope and all measurements were made with a digital calliper. For genetic confirmation, a fin clip stored in 96% ethanol, was digested with Proteinase K in a lysis buffer (10 mM Tris, 400 mM NaCl, 2 mM EDTA, 1% SDS) at 55°C and total DNA was extracted according to Sambrook *et al.* (1989). PCR amplification of the mitochondrial cytochrome oxidase I (COI) gene was performed followed by sequencing (Ward *et al.*, 2005). The sequence was then compared to deposited sequences in GenBank. The specimen and the remaining part of the fin clip was stored at the marine collection of the American University of Beirut, with access code AUBM OS3893.

Results

On October 2nd and December 12th 2012, two Lionfish were captured separately off the village of Al Minie (34°29'26.15"N; 35°54'47.73"E) in the northern part of Lebanon. The first specimen was caught using a wire trap, photographed by a fisherman and then discarded (Fig. 1A). The second specimen, with a total length of 209 mm and a standard length (SL) of 148 mm (Fig. 1B), was captured in the same area by means of a trammel net

placed over a coralligenous bottom at a depth of 30 m.

Specific morphometric measurements and meristic counts of the second specimen (Fig. 1B) are described as follows: Body moderately compressed; depth, 2.7 in SL. Head length (HL), 3.3 in SL; snout length, 2.7 in HL, eye diameter, 4.0 in HL and the interorbital width, 4.4 in HL. Dorsal fin XIII + 10; anal fin III + 6; pectoral fin 14; pelvic fin I, 5; gill rakers, 14. Pelvic longest fin ray, 1.9 in SL and pectoral longest ray, 1.2 in SL, reaching the middle of the caudal fin. Supraorbital tentacles, 1.4 in HL. Fresh specimen colour: Body with alternating wide dark brown and narrow white and reddish bands. Dorsal, pectoral and pelvic fins banded with black, red and white. Soft rays of dorsal, anal and caudal fins with dark spots. Several prominent white spots on pelvic fins. Tentacles banded.

The specimen was identified as *P. miles* based on the dorsal and anal fin ray meristics (D XIII + 10; A III + 6) as opposed to *P. volitans* (D XIII + 11; A III + 7) following Schultz (1986). Furthermore, a total of 611 base pairs of the COI sequence resulted in 99% identity to *P. miles* (gb|FJ584026.1|), while 95% identity to *P. volitans* (gb|FJ581044.1|), confirming the identification of the species (Fig. 1B).

Discussion

Prior to our records, only one individual of *P. miles* had been recorded in the Mediterranean in 1991 (Golani & Sonin, 1992). It has been suggested that this specimen entered through the Suez Canal, like other hundreds of marine organisms (Zenetos *et al.*, 2012), or released from captivity (Golani *et al.*, 2002). Since then, no other Lionfish has ever been reported, suggesting that the species had not established itself in the Mediterranean Sea.

The recent records from Lebanon, which occurred more than two decades later, provide evidence of the arrival of new propagules of this species in the Mediterranean Sea. It is noteworthy to mention that two unconfirmed records of unidentified Lionfish may have been collected in Cyprus in February 2013, soon after our sighting (Evripidou, 2013). Considering that *P. miles* is a common fish in the Red Sea and the proximity of the Suez Canal to the recent sightings, the Suez Canal seems to be the most likely pathway for the introduction of the species into the Mediterranean Sea.

Lionfishes can potentially spread and survive in a large part of the Mediterranean Sea because they have shown extensive dispersal capabilities and can survive to a minimum temperature of 10°C (Kimball *et al.*, 2004). In addition, their highly venomous needle-sharp dorsal, anal and pectoral fin spines offer protection and significantly reduce predation. Nevertheless, one potential natural predator of *P. miles* already exists in the Mediterranean. In the northern Red Sea, a juvenile Lionfish

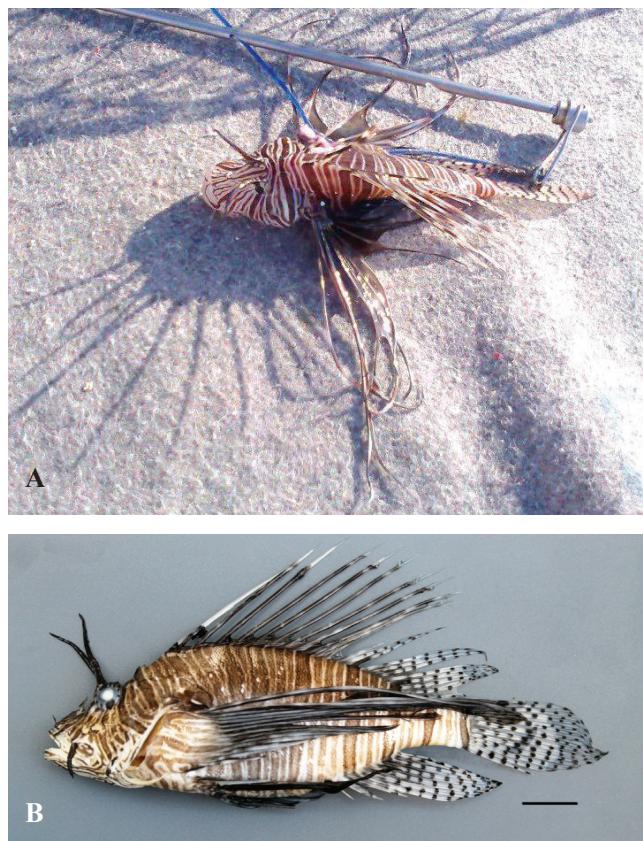


Fig. 1: Lionfish *Pterois miles* captured in the eastern Mediterranean (Lebanon). (A) Disgarded specimen (2 October 2012), (B) AUBM OS3893 (12 December 2012, picture taken 20 days after fixation in formalin). Scale bar indicates 2 cm.

(10 cm SL) was discovered in the stomach of *Fistularia commersonii* Rüppell, 1838, the blue spotted cornetfish (Bernadsky & Goulet, 1991). Notably, *F. commersonii* has invaded the Mediterranean Sea within the last decade and established large populations in the eastern part (reviewed by Azzurro *et al.*, 2012) and may act as a biological control of a future possible invasion. Other possible predators could be native Mediterranean groupers, as found in the Caribbean (Mumby *et al.*, 2011).

The recent findings of Lionfish may be an indication of a new wave of arrivals of *P. miles* in the Levant, raising justifiable concerns of a possible onset of a new invasion in the Mediterranean Sea. Many Caribbean countries have instituted Lionfish eradication programs. These actions include initiatives that involve the general public in removal efforts, such as engaging recreational divers to capture Lionfish and using commercial divers and fishers to target this species as a source of food (e.g. Morris & Whitfield, 2009). Nevertheless, when the Lionfish has established a permanent population, its complete eradication seems to be unrealistic (Barbour *et al.*, 2011). Therefore, in the Mediterranean Sea, it will be extremely important to raise awareness and to implement monitoring efforts during the early stages of colonization, when control measures could still be effective.

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