

## Rapid Communication

## First confirmed record of the white-spotted puffer *Arothron hispidus* (Linnaeus, 1758) in the Mediterranean Sea

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Received: 11 July 2018 / Accepted: 18 September 2018 / Published online: 16 October 2018

Handling editor: Ernesto Azzuro

### Abstract

The tropical aquarium business is thriving worldwide and typical aquarium fishes are being recorded in several parts of the Mediterranean Sea. In this study, we report the occurrence of an individual *Arothron hispidus* in the Mediterranean, off the coast of Cyprus (Protaras, 34.969733°N; 33.963550°E). The puffer record was based on high resolution photos and a movie taken on 2 February 2018 and uploaded on social media. Among the possible introduction modes, an aquarium release event seems to be the most likely reason for the presence of the species in the Mediterranean Sea.

**Key words:** first record, Tetraodontidae, non-indigenous species, aquarium release, citizen science, Cyprus

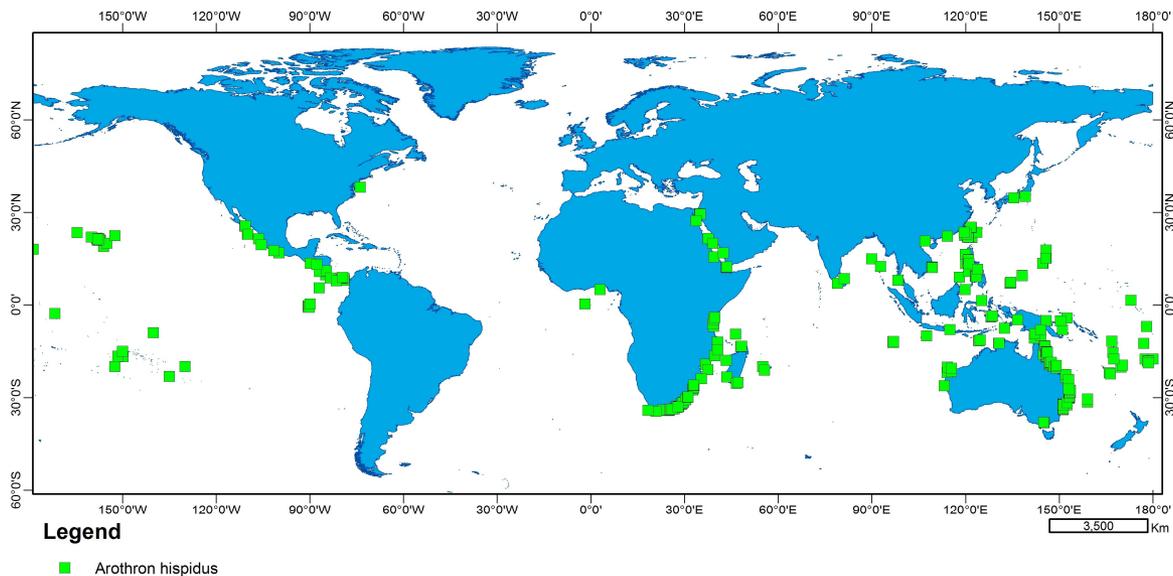
### Introduction

The Tetraodontidae constitutes a family commonly referred to as puffers. It is composed of about 191 species of marine tropical and subtropical fish species found in the Atlantic and Indo-Pacific oceans (Fricke et al. 2018; Froese and Pauly 2018). All members of this family are characterized by the presence of four fused teeth separated by a median suture in each jaw and the ability to inflate with water or air (Nelson 2006). The White-spotted Puffer *Arothron hispidus* (Linnaeus, 1758) is a highly widespread species, occurring in the vast Indo-Pacific realm, from the Red Sea and all the way to the Gulf of California and Panama (Allen and Robertson 1994; Bussing 1995; Randall et al. 2012). It can reach 50 cm in length and is known to live in a variety of habitats including coral reefs and rocky bottoms, while juveniles are also commonly found in estuaries (Randall et al. 2012; Froese and Pauly 2018). *Arothron hispidus* is mainly a solitary puffer, living down to 50 m depth, and primarily feeding on a wide range of invertebrates (Pinto and Punchihewa

1996; Cole et al. 2008; Allen and Erdmann 2012; Randall et al. 2012). As in many confamilial members, the flesh and viscera contain tetraodotoxin and the species is considered to be among the most virulently poisonous puffers (Allen and Erdmann 2012; Randall et al. 2012). It is also a common species in the marine aquarium trade (Geomans 2012; <http://www.saltwaterfish.com>). Here, we document the first confirmed record of *Arothron hispidus* in the Mediterranean Sea, along the coast of Cyprus.

### Material and methods

The White-spotted Puffer identification was based on high resolution photos and a video record taken by one of the authors (CC). The photos were uploaded on a social media group (Facebook: Mediterranean Marine Life, <https://www.facebook.com/groups/396314800533875/>) in which scientists, fishermen and various stakeholders and sea lovers share their photos, videos, provide identifications and discuss matters related to the Mediterranean Sea. Distinctive characters allowed the characterisation of the species (Fischer and Bianchi 1984; Randall et al. 2012).



**Figure 1.** Worldwide distribution of *Arothron hispidus*, including the current record (star) from the Mediterranean Sea. Data retrieved from Fishbase: List of Point Data (Froese and Pauly 2018).



**Figure 2.** Underwater photos of the White-spotted Puffer *Arothron hispidus* observed at 8 m depth, off Cape Greco nature park, Protaras, Cyprus (34.969733°N; 33.963550°E). Photograph by: C. Constantinou.

## Results

On 2 February 2018, an individual of *Arothron hispidus* was observed underwater in the coastal waters of Cape Greco nature park (Protaras, 34.969733°N; 33.963550°E), southeastern coast of the island of Cyprus (Figure 1). The individual was swimming at a depth of 8 m, over a rocky bottom (<https://youtu.be/TvRIZ6iKT08>). The fish seems to have been previously attacked as it was clearly injured on its front left side (Figure 2). We estimated its size to 25–30 cm in total length (Figure 2).

Diagnostic characters were as follows: olivaceous body coloration with small white spots, white ventrally, with six dark bars extending ventrally into the white

ventral part of head and abdomen. The base of the pectoral fin presents a vertically oval black spot containing few white and yellow small spots and a single white line encircling the fin base. Almost complete white circles are found around the eyes. The dorsal fin has white spots but not the anal fin. The caudal fin also presents few white spots on its base.

## Discussion

The White-spotted Puffer *Arothron hispidus* is recorded here from the Mediterranean Sea. The closest morphologically similar species is the Reticulated pufferfish *Arothron reticularis* (Bloch and Schneider, 1801). They can be distinguished by

the small dermal spinules covering most of the body except around the mouth and the base of the fins in *A. reticularis*, while these spinules are absent on the snout and the posterior half of the caudal peduncle in *A. hispidus* (Matsuura 1999; Randall et al. 2012). *Arothron reticularis* has also a wider interorbital space than *A. hispidus* (Matsuura 1999). Since the individual has not been collected, these differences cannot be observed and thus used for its identification. However, the two species can also be distinguished by their color patterns (Randall et al. 2012). The high resolution photos and video (Figure 3, <https://youtu.be/TvRIZ6iKT08>) show the color pattern of an *A. hispidus* individual as opposed to *A. reticularis* which usually displays continuous dark brown bands on the body. Despite the clear description made by Randall et al. (2012), we remain cautious on the identification based exclusively on photos since *Arothron* spp. are known to be highly polychromatic, with variable patterns and coloration occurring both at the intraspecific level and within different size ages (Su and Tyler 1986; Randall et al. 2012). Furthermore, different populations of *A. hispidus* display variation in color patterns between the Red Sea, Indian and the Pacific Oceans (reviewed in Randall et al. 2012). Finally, the individual from Cyprus seems to be a subadult since it shows incomplete white ring-forming circles around the eyes, while adults have usually several complete white rings (Lieske and Myers 2004; Randall et al. 2012).

It is important to note that several *Arothron hispidus* individuals have been recorded earlier from the Mediterranean Sea. In fact, old citations exist from Italy (around Sicily) but without clear description provided or preserved materials (Psomadakis et al. 2012). Torchio (1961) also recorded the species from Italian waters, based on a badly preserved specimen. Despite that the few meristic characters provided did match those of *A. hispidus*, the dried specimen was considered impossible to identify (Tortonese 1979; Psomadakis et al. 2012). Another specimen of the same species was recorded a few years later from Greek waters but was also considered a misidentification (Ondrias 1971; Papaconstantinou 1988). Among the several known pathways of introduction (Katsanevakis et al. 2013, 2014), the specimen of *A. hispidus* could theoretically cross the Suez Canal as a Lessepsian migrant. This is because it naturally occurs in the Red Sea and the coloration of the observed individual is consistent with Red Sea individuals (Randall et al. 2012). In total, five other tetraodontids are considered to have entered the Mediterranean following the Suez Canal route (Golani et al. 2002). The hypothesis of larval transport via water ballast is also theoretically possible and cannot

be excluded. However, the sudden appearance of a single individual in Cyprus and not on the Levant coast as it is for most Lessepsian migrants (e.g. Katsanevakis et al. 2014), is intriguing. An aquarium release event seems to be a plausible reason for the occurrence of a large individual of *A. hispidus* in Cyprus. This is because many puffers are common in the tropical aquarium trade and this species is usually well known among aquarists.

The recorded puffer also seems to have been recently attacked by another animal, as shown by patterns that look like teeth marks (Figure 2). This could be a predator or an attack driven by territoriality. This observation goes in line with the hypothesis of a recently released fish as it is not supposed to be familiar with its environment and thus prone to predation or aggression. Its escape from the attack can be directly linked to defense mechanisms of most puffers, such as inflating to increase in size and also the presence of tetrodotoxin on their skin which should make them foul tasting to predators.

From an aquarist point of view, the species can reach relatively large sizes (45 cm), and is considered semi-aggressive and should be kept in large fish tanks with selected fish species only. This is because it is known to harass or nip the fins of other fishes present within the same tank. It is also not considered “reef safe” since it eats coral polyps and predate on ornamental invertebrates (e.g. Geomans 2012). All these could be credible reasons, along with ignorance about the dangers of introduced species, for why a beginner hobbyist could be tempted to discard it in the marine environment. This may explain the sporadic observations of some other tropical fishes, also common in the aquarium trade (e.g. Zenetos et al. 2016; Giovos et al. 2018). The thriving home aquarium market may become an additional pathway of arrival of non-indigenous invaders from the tropical world or elsewhere.

## Acknowledgements

This work has been funded by the University Research Board of the American University of Beirut (DDF 103367/23927). Special thanks are expressed to Facebook “Mediterranean Marine Life” users for sharing their photos and observations.

The publication of this article is supported by the Open Access Publishing Fund of the International Association for Open Knowledge on Invasive Alien Species (INVASIVESNET).

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