

A NEW RECORD OF *DIODON HYSTRIX* (ACTINOPTERYGII: TETRAODONTIFORMES: DIODONTIDAE) IN THE MEDITERRANEAN SEA

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Abstract. The spot-fin porcupinefish, *Diodon hystrix* Linnaeus, 1758, was first recorded in the Mediterranean by Torchio (1963), from the Gulf of Taranto, Italy. There have been no subsequent records, from this sea, ever since. In this paper, we report a new record of *D. hystrix* from the Balearic Islands, western Mediterranean, fifty-five years after the first record. The fish individual was caught during a spearfishing competition. The social networks and the WhatsApp instantaneous messenger proved to be useful tools for the rapid contact with the scientists who are now reporting this record. In view of the fast growth and spreading of other populations of exotic species in the Mediterranean, fostering the communication between recreational fishers and scientists through these types of digital tools could help in monitoring of the natural environment.

Keywords: porcupinefish, Balearic Islands, recreational fishery, citizen science, social networks, WhatsApp

INTRODUCTION

The porcupinefish family Diodontidae contains seventeen species in seven genera (Fricke et al. 2018). The family is widely distributed in tropical and temperate marine areas of the Indo-Pacific and Atlantic Oceans (Leis 2006). Six species of Diodontidae, representing two genera, occur in the Atlantic Ocean (Leis 2016). However, only three of them have been recorded from the Mediterranean Sea: *Diodon hystrix* Linnaeus, 1758, *Chilomyxterus reticulatus* (Linnaeus, 1758), and *Chilomyxterus spinosus mauretanicus* (Le Danois, 1954) (see Torchio 1963, Follesa et al. 2009, Garrido et al. 2014, respectively). The fourth porcupinefish species, native of the Indo-Pacific area, *Cyclichthys spilostylus* (Leis et Randall, 1982), also occurs in the Mediterranean, due to the phenomenon of the Lessepsian migration through the Suez Canal (Golani 1993, Erguden et al. 2012). Mediterranean porcupinefish records are based on occasional observations, whilst no evidence

of established populations exists and the entire family is considered as vagrant (Relini 2010, Golani et al. 2017). The previous localities where *D. hystrix* have been recorded in the North-eastern Atlantic and the Mediterranean are: the Atlantic coast of southern Iberian Peninsula (and possibly Valencia on the Mediterranean coast of Spain), Atlantic coast of Morocco, the Atlantic archipelagos of Madeira and Azores, and the Gulf of Taranto in southern Italy, central Mediterranean (Gonçalves 1941, di Noronha and Sarmiento 1948, Lozano y Rey 1952, Dollfus 1955, Torchio 1963, Tortonese 1986, Santos et al. 1997) (Fig. 1); another specimen found in East Anglia, UK was based on an aquarium release (Ellis 2006).

Records of *D. hystrix* from Turkey (Akşiray 1954) are considered unreliable (Bilecenoglu et al. 2002). The observation of *D. hystrix* from the Canary Islands (Brito et al. 2002) was erroneous and based on *Diodon eydouxii* Brisout de Barneville, 1846 (see Azevedo et al. 2004).

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In this paper, we report a new capture of the spot-fin porcupinefish, *D. hystrix*, in the Mediterranean Sea. Although the spot-fin porcupinefish is a circumtropical species, widely distributed in the Atlantic, Indian, and Pacific oceans (Leis 2006), it is currently considered as ‘not established’ or ‘casual’ in the Mediterranean Sea (Zenetos et al. 2012) where, to the best of our knowledge, it has only been recorded once before, by Torchio (1963), from the Gulf of Taranto, the Ionian Sea.

MATERIAL AND METHODS

On 19 November 2016, an adult specimen of *Diodon hystrix* was captured during a spearfishing competition along the north-eastern coast of Menorca, Balearic Islands (39°54'37"N, 004°17'49"E) (Fig. 1). The meristic and morphometric characters were recorded on the fresh specimen. The taxonomic identification was based on Leis (2001, 2006, 2016). Unfortunately, the individual was lost due to an electricity failure that affected the freezer where it was stored. The only remains left of it is one two-rooted body spine.

RESULTS

The specimen was a large individual weighing 7800 g and measuring 640 mm in total length. Morphometric measurements are presented in Table 1. The individual was positively identified as *Diodon hystrix* due to the coincidence of its characters with those described in Leis (2006, 2016) for this species. The fish presented a wide and hard body covered with erectile long spines with two large roots under the skin; dorsal and anal fins with 14 and 16 rays, respectively; dorsal fin in posterior position opposing anal fin, both fins rounded; caudal fin rounded; no pelvic fins; pectoral fin with 23 rays; wide and blunt head; large mouth with a beak-like structure without a median suture dividing the jaws into left and right halves; one spine on the dorsal surface of the caudal peduncle and eighteen spines from lower jaw to anus; colour light to dark brown dorsally, with small black spots, and white ventrally; all fins heavily spotted (Fig. 2).

Table 1

Morphometric measurements of *Diodon hystrix* recorded in Menorca (Balearic Islands, western Mediterranean)

Morphometric character	Value	
	[mm]	[%TL]
Total length (TL)	640	
Standard length	554	86.6
Head length	173	27.0
Head width	218	34.1
Head depth	137	21.4
Eye diameter	28	4.4
Snout length	59	9.2
Gill opening length	55	8.6
Body depth	135	21.1
Interorbital length	140	21.9
Postorbital length	86	13.4
Pectoral fin height	92	14.4
Pre-pectoral length	195	30.5
Pectoral fin base length	85	13.3
Pre-dorsal length	390	60.9
Dorsal fin base length	45	7.0
Dorsal fin height	82	12.8
Pre-anal length	410	64.1
Anal fin base length	48	7.5
Anal fin height	80	12.5
Pre-caudal length	554	86.6
Caudal peduncle length	111	17.3
Caudal peduncle depth	37	5.8
Caudal fin length	87	13.6

DISCUSSION

In the last few years an increasing number of ‘newcomers’ (sensu Evans et al. 2015) has been documented in the Mediterranean Sea (Rilov and Galil 2009, Galil et al. 2015). The geographical expansion of thermophilic species is a global phenomenon, and one of the most direct consequences of climate change on marine species (Parmesan and Yohe 2003, Sunday et al. 2012).

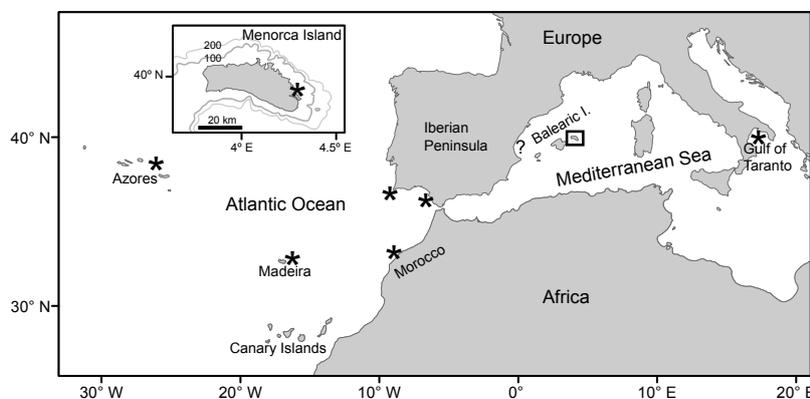


Fig. 1. Map showing the previous records of *Diodon hystrix* in the northeast Atlantic and Mediterranean (see references in the main text); the inset shows the location of the presently reported new record in Menorca, Balearic Islands; star-like symbols indicate the location of confirmed records; question mark near the Mediterranean coast of the Iberian Peninsula indicates the record with uncertain origin mentioned in Lozano y Rey (1952)



Fig. 2. Dorsal, anterior, and lateral views of the *Diodon hystrix* individual described in the presently reported new record of the species from Menorca (Balearic Islands, western Mediterranean); a detailed photograph of a two-rooted erectile body spine is also shown

According to the available literature, the presently reported finding is the second confirmed record of *Diodon hystrix* in the Mediterranean Sea. There has been a time lag of 55 years between the first and second record suggesting either that the species only reaches the Mediterranean Sea occasionally or that the species is commonly present but not detected due to its low abundance. The presently described record is coincident with an increase in the frequency of recent new records of Diodontidae in the north-eastern Atlantic and Mediterranean such as those of *Diodon holocanthus* Linnaeus, 1758 (see Porteiro et al. 2010) and *Diodon eydouxi* (see Azevedo et al. 2004, Barreiros and Fricke 2015) from the Azores Archipelago and *Chilomycterus reticulatus* (see Follesa et al. 2009) and the Lessepsian migrant *C. spilostylus* (see Erguden et al. 2012) from Sardinia and southern Turkey, respectively, in the Mediterranean. The recently observed global warming may be allowing Diodontidae species, mainly adapted to live in warm temperate and tropical waters (Leis 2006), to extend their distribution range. Particularly, the increase of water temperature in the Mediterranean (Vargas-Yáñez et al. 2005) may be favouring the adaptation and extension not only of Diodontidae but also other Tetraodontiformes such as the tetraodontid fish *Lagocephalus sceleratus* (Gmelin, 1789). The latter pufferfish entered in the Mediterranean through the Suez Canal and was recorded for the first time by Filiz and Er (2004) from the southern Aegean Sea, subsequently undergoing a population explosion in the Mediterranean Levant basin and a rapid expansion to the west (Kara et al. 2015). At the moment the scarce information on *D. hystrix* does not allow to assess whether a well-established population is present in the Mediterranean and if it has the potential

to become more abundant as reported for the Lessepsian migrant *L. sceleratus*. *Diodon hystrix* is a large fish, reaching 90 cm in standard length (Tortonese 1986) and it is considered one of the most powerful shell-crushing predators of molluscs and some crustaceans including hermit crabs on tropical coasts of the world (Vermeij and Zipser 2015). Therefore its establishment in the Mediterranean Sea could have important consequences not only for its main preys but also for the indigenous competitors that feed on the same trophic resources. The size of the individual reported in the present paper is far above the size at which *D. hystrix* starts to feed on benthic species (23 cm; Leis 1978, Vermeij and Zipser 2015), so it can be expected that the individual was able to feed actively off the coasts of Menorca. Hence, monitoring its potential population growth in the Mediterranean Sea is of particular importance.

Regarding the monitoring of *Diodon hystrix* and, in general, other non indigenous species in the Mediterranean, besides the information from the commercial fleets, it may be of high importance the information on catches from recreational fishermen, which can provide an early detection of the arrival of these species (Azzurro et al. 2013, 2018, Banha et al. 2015). This may be particularly important when the species have low catchability with commercial gears and/or in areas where the recreational fishery has turned to be as important in catches as the commercial fleet, as it is the case of the Balearic Islands (Morales-Nin et al. 2015).

Finally, we would like to emphasize the dynamics of the record reported here. The specimen described in this paper was caught during a spearfishing competition. A spearfisher that was following the competition results

through social networks immediately contacted the authors of this publication by sending a picture via WhatsApp instantaneous messenger along with the information of the place of the competition, which allowed us to rapidly find and collect it. Future collaborations between researchers and recreational fishermen should be fostered, in particular in the context of social networks, as it could help in the early detection of the arrival of new non-indigenous species to the Mediterranean.

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