

Additional records of Norwegian skate *Dipturus nidarosiensis* (Storm, 1881) (Pisces: Rajidae) in the Adriatic Sea

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*Additional records of the Norwegian skate *Dipturus nidarosiensis* (Storm, 1881) from the Adriatic Sea are reported. Two specimens were collected in the southern Adriatic Pit in 2008 and 2010, respectively. The records reported herein improve our knowledge on the distribution of a rarely encountered, deep water species *D. nidarosiensis*, whose presence has only recently been confirmed in the Mediterranean Sea.*

Key words: *Dipturus nidarosiensis*, records findings, Mediterranean Sea, Adriatic Sea

INTRODUCTION

The Mediterranean Sea is considered a global marine biodiversity hotspot and it is inhabited by at least 89 chondrichthyan species, which corresponds to about 7% of the global species diversity of this group of fishes (SERENA, 2005; BRADAI *et al.*, 2012). Several non-native and range expanding elasmobranch species have recently been recorded in the Mediterranean Sea, for example, *Galeocerdo cuvieri*, *Rhizoprionodon acutus*, *Himantura uarnak*, etc. (BRADAI *et al.*, 2012; ZENETOS *et al.*, 2011, 2012; GOLANI *et al.*, 2019). The Norwegian Skate, *Dipturus nidarosiensis* is known to be distributed in the Northeast Atlantic from Iceland and Norway in the north to the Bay of Biscay in the south where it is considered uncommon (STEHMANN *et al.*, 2015). In recent

studies, the presence of this species has also been ascertained in the Mediterranean (CANNAS *et al.*, 2010; FOLLESA *et al.*, 2012; RAMIREZ-AMARO *et al.*, 2017; CARBONARA *et al.*, 2019). According to the IUCN classification, this species' status is evaluated as "Near Threatened (NT)" (STEHMANN *et al.*, 2015). Misidentifications of species of the genus *Dipturus* are well documented and long-term taxonomic confusion can hamper the effectiveness of conservation efforts (IGLESIAS *et al.*, 2010). In the Southern Adriatic and Western Ionian Sea, the presence of *Dipturus nidarosiensis* has been recently confirmed by CARBONARA *et al.* (2019). It represents the third species of genus *Dipturus* so far recorded in the Adriatic Sea, the two other species being *Dipturus batis* (Linnaeus, 1758) and *Dipturus oxyrinchus* (Linnaeus, 1758) (LIPEJ & DULČIĆ, 2010).

In the present study, we report additional records of *D. nidarosiensis* in the Adriatic Sea.

MATERIALS AND METHODS

Two female specimens of the Norwegian skate *Dipturus nidarosiensis* were caught during FAO AdriaMed Deep Sea Expedition in 2008 and 2010 on two locations in the south Adriatic Pit (42°02,920 N; 18°22,66 E and 41°49,22 N; 17°38,94 E, respectively, Fig 1.) with the deep water bottom otter trawl and longline, respectively. Both specimens were photographed (Fig. 2), identified and the tissue samples from both specimens were stored in the Ravenna Laboratory, Department of Biological, Geological and Environmental Sciences, University of Bologna, Italy. Both specimens were measured, weighed and dissected for determination of sex and maturity stage according to MEDITS survey protocol (BERTRAND *et al.*, 2002). During the 2008 survey, an additional specimen, identified on the basis of morphological characters (i.e. pointed snout, dark underside) was caught on the bottom set longline, but it got unhooked and managed to escape before landing on board.

Identification was carried out following the identification key provided by EBERT & STEHMANN (2013). In reporting the occurrence of *D. nidarosiensis* in the Adriatic Sea, we followed the protocol suggested by BELLO *et al.* (2014).

RESULTS AND DISCUSSION

Basic biological data of the two specimens as well as additional data regarding their capture are presented in Table 1.

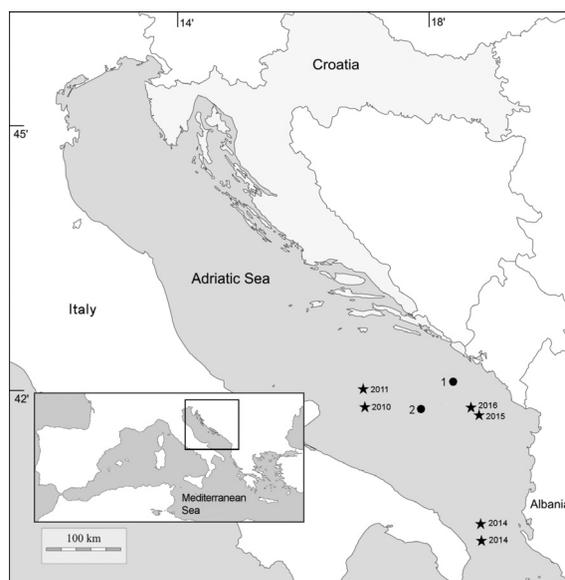


Fig 1. Locations of the captures of *D. nidarosiensis* in the Adriatic Sea. Black dots indicate locations of the specimens presented in this study. Numbers correspond to the specimens presented in Table 1. Black stars indicate locations of the specimens collected in the study by CARBONARA *et al.* (2019) with indication of the year of collection

Both individuals shared the same general body description. The body has the shape of a broad rhomboidal disc, with moderately double concave anterior margins and acute outer corners; snout long and pointed; tail relatively short and gradually tapering to a tip; two small dorsal fins, similar in size and clearly separated; dorsal surface of the disc mostly smooth except for the median row of small thorns along the tail to first dorsal fin; prickly areas on the head and anterior disc margins and small thornlets on orbital rims; ventral part almost entirely covered with coarse dermal denticles. Color dorsally plain dark greyish-brown, somewhat darker on the disc

Table 1. Total length, weight, disc width, sex, maturity of two specimens of *D. nidarosiensis* from the Adriatic Sea

Specimen	Total Weight (g)	Total length (mm)	Disc width (mm)	Sex	Maturity Stage (MEDITS scale)	Depth	Date	Gear
1.	3210	930	670	F	1	1080	21.8.2008	Trawl
2.	3500	940	680	F	1	1144	12.5.2010	Longline

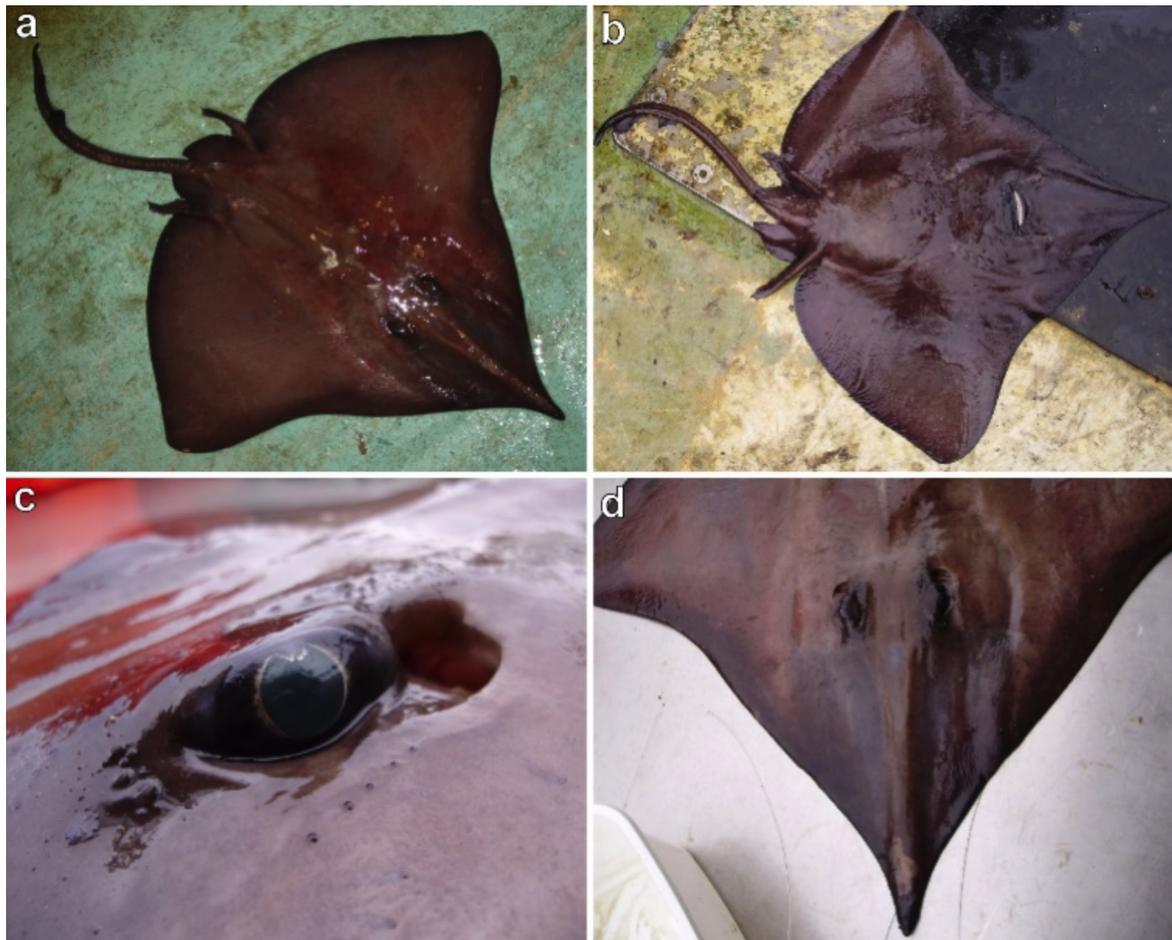


Fig 2. Photos of the two specimens of *Dipturus nidarosiensis* collected in the southern Adriatic Sea. Photos description as follows: a) dorsal view of specimen 1; b) ventral view of specimen 2; c) closeup of the left eye and spiracle of specimen 2; d) closeup of anterior part with rostrum of specimen 2. See Table 1 for additional details

margins; underside darker brown and covered by a thick black mucus layer. This description is in agreement with that given by EBERT & STEHMANN (2013).

The first record of *D. nidarosiensis* in the Adriatic Sea was reported by CARBONARA *et al.* (2019) on the basis of six specimens collected in the area around the pit of Bari at depths ranging from 320-720 meters in the period from 2011 to 2016 (Fig 1.). Total lengths of specimens ranged from 305 to 1422 mm. The authors also reported the occurrence of two specimens from the north-west part of the Ionian Sea. The identification of the specimens from that study was established both on the basis of molecular and morphological evidence. It should be noted that, according to CARBONARA *et al.* (2019), two Adriatic speci-

mens from the mentioned study were already previously analyzed by CARIANI *et al.* (2017), but the latter authors did not specify that those specimens had been collected in the Adriatic basin. The first Mediterranean record of the species, confirmed by molecular and morphological evidence, was reported by CANNAS *et al.* (2010). That record considered 14 specimens caught off Sardinia in the western central Mediterranean Sea at depths from 600–1420 m, which were collected in the period from 2005 to 2008. It should be noted that EBERT & STEHMANN (2013) considered individuals collected off Sardinia as morphologically distinct from North Atlantic *D. nidarosiensis* specimens and even considered it as members of a yet undescribed species (presented as *Dipturus* sp.). Additionally, FOLLESA *et*

al. (2012) reported some reproductive parameters as well as stomach contents of 23 specimens collected off Sardinia from 2005 to 2011. Eight specimens of *D. nidarosiensis*, whose identification was supported both by molecular and morphological evidence, were collected in the Alboran Sea in 2012, 2013 and 2016, between 620 and 819 m depth (RAMIREZ-AMARO *et al.*, 2017). In 2017, a juvenile specimen of *D. nidarosiensis*, collected from the Strait of Sicily, was reported by GERACI *et al.* (2019), thus confirming the presence of this species in that area. It should be noted that a previous finding of an egg case, attributed to *D. nidarosiensis* on the basis of the egg case morphology, already indicated its presence in the area (MASSI *et al.*, 2017).

Both female specimens from our study were immature (MEDITS scale 1). According to FOLLESA *et al.* (2012) length range at which females reach maturity is 1270-1420 mm (TL). CARBONARA *et al.*, (2019) reported a smaller mature female specimen (1194 mm TL) collected in the Adriatic Sea. Males of this species reach maturity at smaller lengths than females (1180 mm TL) (FOLLESA *et al.*, 2012).

Both of our specimens were found at greater depths than those previously reported in the Adriatic Sea. CARBONARA *et al.* (2019) noted that sub-adults and adults occur at lower depths, while segregation of juveniles occurred only in the upper part of the slope. FOLLESA *et al.* (2012) noted that immature and maturing female speci-

mens were found in a wide bathymetric range in the waters around Sardinia, while mature females were found at lower depths (550-600 m).

We point out that the capture of our specimens in 2008 and 2010, respectively, occurred earlier than those reported and discussed by CARBONARA *et al.* (2019). Furthermore, the specimen from 2008 represents one of the earliest Mediterranean records, preceded only by those reported by CANNAS *et al.* (2010). As already suggested by CANNAS *et al.* (2010) and CARBONARA *et al.* (2019), presence of this species in the Mediterranean has probably gone unnoticed due to two main reasons. One may be the misidentification with other species in the genus *Dipturus* and the other one its high depth and specific habitat preference which only partially overlap with fishery grounds, so that the possibility of being caught by the fishing fleets is reduced. Future studies of the deep Adriatic should shed more light on the biology and ecology as well as on other aspects of this poorly known species.

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Novi nalazi crne voline *Dipturus nidarosiensis* (Storm, 1881) (Pisces: Rajidae) iz Jadranskoga mora

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SAŽETAK

U radu su opisani novi nalazi crne voline *Dipturus nidarosiensis* (Storm, 1881) iz Jadranskoga mora. Dva primjerka ulovljena su na području Južnojadranske kotline 2008. odnosno 2010. godine.

Ovi nalazi proširuju saznanja o distribuciji ove rijetke dubokomorske vrste čija je prisutnost u Sredozemnom moru tek nedavno utvrđena.

Ključne riječi: *Dipturus nidarosiensis*, novi nalazi, Sredozemno more, Jadransko more