

REVIEW OF THE RECORDS OF THE SMALLTOOTH SAND TIGER SHARK, *ODONTASPIS FEROX* (ELASMOBRANCHII: LAMNIFORMES: ODONTASPIDIDAE), IN THE AZORES

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Abstract. In recent years Azorean fishermen reported the presence of the smalltooth sand tiger shark, *Odontaspis ferox* (Risso, 1810), a very rare demersal shark species, associated with insular shelves and slopes, with occasional incursions into shallow waters and of poorly known biology and ecology. There are fourteen new records of this species, between 1996 and 2014, captured by spearfishing, harpoons, hand lines, or entangled in fishing gear in the Azores. These records were analysed and complemented with fishermen interviews, providing new locations and new biological data for this species. Also, specimens photographs were studied and post-mortem analysis were carefully carried out in one individual.

This species is rare and captured only as bycatch in shallow waters. More detailed information on this species is critically needed in order to assess its conservation status and implement management guidelines. Bycatch statistics are crucial in this respect.

Keywords: new records, smalltooth sand tiger shark, *Odontaspis ferox*, Azores, North-eastern Atlantic

INTRODUCTION

The lamniform *Odontaspis ferox* (Risso, 1810) is a large shark, with a short-pointed snout, small eyes, protruding spike-like, characteristic multicuspid teeth (Fig. 1), a tearing-type dentition, and small dorsal and anal fins which are similar in size; the two dorsal fins being sub-equal, constitute also an important diagnose feature of odontaspid sharks (Compagno et al. 1989). This species inhabits warm-temperate and tropical seas, on or near the bottom on continental and insular shelves and upper slopes at depths ranging from 13 to 420 m while it is also possibly epipelagic from 140 to 180 m over the ocean floor (Compagno 2002, Barreiros and Gadig 2011), with a maximal depth range of 880 m (Graham et al. 2016). This species was first described from the Mediterranean Sea by Risso (1810), its last confirmed record from the North African Mediterranean area (Tunisia) dates back to the mid 1770s. (Capapé 1975). Fergusson et al. (2008) summarized the vast geographic and depth distribution

of this species with more than 160 records. Albeit this wide range, the species seems to be naturally rare with fragmented populations (Graham et al. 2016).

Analogous to the current distribution of *Odontaspis ferox*, reports of fossil shark teeth of this species are rare and poorly documented in the scientific literature (Cappetta 2012). Since 2000 only six publications described new records of *O. ferox*: Atlantic Miocene, North Carolina, Purdy et al. (2001); Venezuela, Aguilera and Rodrigues de Aguilera (2001); Italy, Pliocene, Marsili (2006), Fulgosi et al. (2009); Pacific Miocene, Chile, Suarez et al. (2006), Staig et al. (2015). On the other hand, there are no fossil records of *Odontaspis noronhai* (Maul, 1955). By contrast, fossil teeth of *Carcharias taurus* Rafinesque, 1810 are common and widespread (Cappetta 2012).

It is notable that the fossil records of *O. ferox* are limited to sediments close to the mainland (Purdy et al. 2001, Aguilera and Rodrigues de Aguilera 2001) and no fossil records from the Atlantic islands are known so far

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Fig. 1. Details of the characteristic multicuspoid teeth of the *Odontaspis ferox*, a specimen from Terceira Island (captured on the 28 June 2013)

[Azores: Ávila et al. (2012); Canary Islands: Meco et al. (2015), Betancort et al. (2016); Cape Verde Islands: Serralheiro (1976); Antilles - Carriacou Island: Portell et al. (2008); Cuba: Iturralde-Vinent et al. (1996)]. Despite this fact, Neogene marine sediments are known from the Azores (Ávila et al. 2012).

In addition, fishes of the genus *Odontaspis* are completely absent in the Tethys/Paratethys/Mediterranean Sea during the Miocene (Cappetta 2012) and the oldest fossil record from the Mediterranean is from the Lower Pliocene (Zanclean, 5.333 MY) (Marsili 2006, Fulgosi et al. 2009). These sediments settled after the Messinian salinity crisis (Marsili 2008), indicating that *O. ferox* probably migrated to the Mediterranean Sea during Zanclean for the very first time.

This species was first reported to occur in the Azores based on the results of the historic oceanographic campaigns lead by King Carlos I of Portugal and Prince Albert I of Monaco during the last decade of the 19th century (de Monaco 1889, Bragança 1902). After a gap of about 100 years, the species was again recorded by Santos et al. (1997) and Anonymous (2017), based on four specimens captured in 1991 and 1994 (see Santos et al. 1997 for detailed information).

Little is known about the reproduction of *O. ferox*. To this point, no pregnant females have been reported on the scientific literature (Ferguson et al. 2008, Graham et al. 2016). Only one adult female has been described with

hundreds of small eggs (diameter about 3 mm) in its right ovary (Villavicencio-Garayzar 1996). Compagno (2002) suspected that *O. ferox* practices uterine cannibalism in the form of oophagy. This form of oophagy has been hitherto documented only for *Carcharias taurus* (see Musick and Ellis 2005) while Saïdi et al. (2005) commented general oophagy in sharks on their analysis of a pregnant *Carcharodon carcharias* (Linnaeus, 1758).

The very low reproductive capacity associated with the natural rareness makes the species highly susceptible to exploitation, mainly in the form of fisheries by-catch. For this reason, it is considered Vulnerable by the IUCN Red List (Graham et al. 2016).

In this paper we report 14 recently captured specimens and the circumstances involving their capture, providing data that will lead to a better understanding of the occurrence and status of this species.

MATERIAL AND METHODS

Between 23 March 1996 and 2 July 2014 fourteen specimens of *Odontaspis ferox* were captured off the Azorean islands of Flores, Pico, Graciosa, Terceira, São Miguel, and Santa Maria (Fig. 2), entangled in fishing gear or captured otherwise by spearfishing, harpoons, or hand lines. The available data and photographs (because of low resolution cannot be published) were collected (Table 1) and studied, although only the 28 June 2013 specimen from Terceira reached one of us (JPB) and could be fully analysed, including the preservation of the head now deposited frozen in the Anatomy Laboratory of the Faculty of Agrarian and Environmental Sciences, Azores University. Species determination followed Hennemann (2001) and Barreiros and Gadig (2011). We also looked extensively for any additional possible records of this species in the Azores.

Additionally, 35 fishermen from the São Mateus fishing port (south coast of Terceira Island) were interviewed and shown photos and drawings of *O. ferox* in order to verify if they were familiarized or even knew this species of shark.

RESULTS

Judging by the size at maturity (estimated by Fergusson et al. 2008), the six captured males of *Odontaspis ferox* were adults, with one of them exceeding the maximum size reported by the above-mentioned researchers (see their table I). Five of the females (including the two that were captured in the same fishing gear) were sub-adults. All specimens were captured in shallow waters from 0 m (stranded) to 50 m of depth.

Azorean fishermen commonly report catching a “different Albafar” or an “...abnormal Albafar” occasionally caught by deep longline trawls, (several pers. comm. to JPB since 1994 mainly from the fishing port of São Mateus) with two dorsal fins and always point out that it is *O. ferox* when shown a photo of this shark. “Albafar” is the common name used locally for *Hexanchus griseus* (Bonnaterre, 1788), a species familiar to and feared by local fishermen.

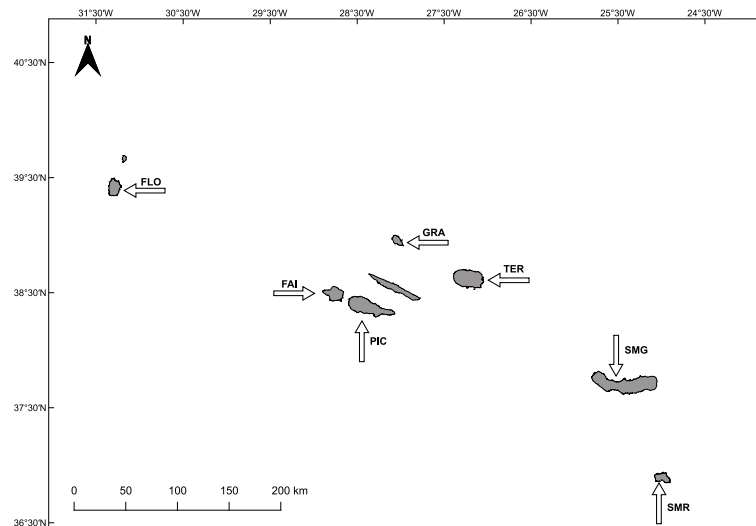


Fig. 2. Location of Azores archipelago, with indication of the islands where the specimens were caught: FAI = Faial Island, PIC = Pico Island, GRA = Graciosa Island, TER = Terceira Island, SMG = São Miguel Island, SMR = Santa Maria Island

Table 1

Recent records of *Odontaspis ferox* for the Azores with reference to date, locations, sex, sizes, capture methods, photos and other observations

Date	Island	Location	n	Sex	TL [cm]	Capture method	Depth [m]	Photos	Reference or comment
12 Dec 1991	FAI		1	M	280				Santos et al. 1997
20 Mar 1994	GRA		3	M	152–304	Gillnets			Santos et al. 1997
23 Mar 1996	SMG	São Roque beach	1	F	398	Stranded	0	+	Stranded, unknown cause of death
25 Apr 1996	SMG	Lagoa harbour	1	M	300	Stranded	0	+	Collected dead in the harbour; some bleeding from the claspers
01 Jan 2004	PIC		1	M	>250			+	
08 Jun 2005	PIC		1	M	ca. 200			+	
2006	SMG	Vila Franca do Campo	1					+	
22 Mar 2007	SMR		1	F	ca. 300			+	
17 Jun 2009	SMR		1	F	ca. 200			+	
23 Jul 2011	FLO	Off the Maria Vaz Islet	1	M	368	Spearfishing	<20	+	
19 Jul 2012	SMG	Rabo de Peixe	1	M	ca. 200	Spears and hooks	<10		Captured in the harbour
05 Jun 2013	SMG	Povoação Harbour	1	M	ca. 200	Spears and hooks	<5	+	Captured in the harbour
28 Jun 2013	TER		1	F	357			+	
13 May 2014	PIC		1	F	ca. 300			+	
02 Jul 2014	GRA	Folga harbour	2	F	250–300	Inshore gillnets	<30	+	Caught on the same line

n = number of specimens studied, TL = total length; FAI = Faial Island, GRA = Graciosa Island, PIC = Pico Island, TER = Terceira Island, SMG = São Miguel Island, SMR = Santa Maria Island.

DISCUSSION

The number of documented records of *Odontaspis ferox* at the Azores since 1991 reached a total of eighteen, including the 14 new records reported herewith. In no other area of the North-eastern Atlantic has such a number of individuals been detected, especially in a geographically restricted zone like the Azores where Porteiro et al. (2010) referred to this species as a vagrant. These findings suggest that this species predominantly

occurs along the Mid-Atlantic Ridge associated with warm temperate and tropical seas of insular shelves and upper slopes.

The presently reported observations confirm the assessment of Graham et al. (2016) that this species is rare and captured only as a bycatch. In the Azores, bottom trawls (the main sources of bycatch and responsible for generating large amounts of discards) are not used, but instead, there is a heavy deep-water

fishing, using demersal longlines. It must also be noted that both specimens of *O. ferox*, which were available for examination by Naylor et al. (2012a, 2012b), were collected from the Azores.

The demersal habits of *O. ferox* are reflected in the absence of any records of bycatch on pelagic fisheries. In fact, an extensive review of bycatch in drift nets in the NE Atlantic (Rogan and Mackey 2007) does not record this species. The same was also noted for the pelagic longline fishery (Coelho et al. 2012).

Odontaspis ferox has also been captured in shallow waters. Gillnets used in the Azores represent a shallow water gear deployed at depths no greater than 30 m. Two males have been captured with this method in the 1990s. More recently, a large female was captured inside a fishing harbour. Divers in the Canary Islands have also registered and documented on video the recurring presence of females (said to be pregnant) in summer and autumn on shallow waters around El Hierro Island, on the Canary Islands (A. Pinilla, personal communication). After the records published by Fergusson et al. (2008), several others have come to light (Table 2) that confirm the species' global distribution as well as its local rareness.

As the EU member states prepare to implement the discard ban imposed by the Common Fisheries Policy, it is expected that more information on this and other similarly poorly known species will accumulate. This can be an opportunity to implement conservation actions directed at poorly known deep-water sharks such as *Odontaspis ferox*.

Table 2

Records of *Odontaspis ferox* after 2008 (supplementing records listed by Fergusson et al. 2008)

Locality	Reference
Fortaleza, Brazil	Santander-Neto et al. 2011
Costa Rica	Cortés et al. 2012
Galapagos Island	Acuña-Marrero et al. 2013, Ritter and Compagno 2013
Taiwan	Hsu et al. 2013
Cape-Verde	Wirtz et al. 2013
Chile	Long et al. 2014
Equador	Estupiñán-Montaña et al. 2016
Australia	Wellington et al. 2017

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