

MARINE RECORD

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# First record of the ragged-tooth shark, *Odontaspis ferox* (Risso, 1810), in the Venezuelan Caribbean

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## Abstract

One specimen of the ragged-tooth shark, *Odontaspis ferox*, was caught by a commercial shark fishery to the north of Cape Codera (10° 56' N, 66° 02' W), northeastern Venezuela. The specimen (sex unidentified, ~ 180 cm TL, ~ 30 kg) was identified on the basis of its dry jaw and characteristic dentition: which comprise teeth moderately large, with prominent narrow cusps and two or three pairs of lateral cusplets. This is the first record of *O. ferox* in the Venezuelan Caribbean, and this finding complements the knowledge of geographic distribution of this rare species in the Western Central Atlantic.

**Keywords:** Distribution, Elasmobranch, Species, Taxonomy

## Introduction

The dramatic decline in the abundance of sharks, together with a greater understanding of their ecological importance and the high vulnerability of some of these species to extinction have attracted increasing scientific concern in recent years (Baum and Myers 2004; Ferretti et al. 2010; Dulvy et al. 2014; Heupel et al. 2014). Sharks and rays are among the marine organisms under direct threat from overfishing either as bycatch or in direct fisheries (Jackson et al. 2001; Baum and Myers 2004; Clarke et al. 2007). Knowledge about biodiversity and species distribution is crucial for the development of management and conservation plans, in order to contribute to the recovery and sustainability of shark populations. In the case of rare species, their occurrence may be under-reported, which can have management implications since many shark species are conservation-dependent (Santander-Neto et al. 2011).

The ragged-tooth shark, *Odontaspis ferox*, is an uncommon and poorly known species, widely distributed in warm-temperate and tropical seas of continental and insular shelves and upper slopes (Compagno 2001; Fergusson et al. 2008). It is a bulky shark with a long and

conical snout and mouth very long and angular; five medium to large gill slits, all anterior to the pectoral fin; two dorsal fins, the first dorsal large and situated closer to the pectoral fins, and the second dorsal fin slightly smaller than the first dorsal fin. The dentition of this species is very characteristic, with teeth moderately large, prominent narrow cusps and two or three pairs of lateral cusplets; and body colour is typically brownish-grey dorsally and lighter below with darker dusky spots along the sides (Compagno 2001). *Odontaspis ferox* is a large shark with a maximum total length around 400 cm TL in both sexes, and a size at birth of about 100 cm TL (Fergusson et al. 2008).

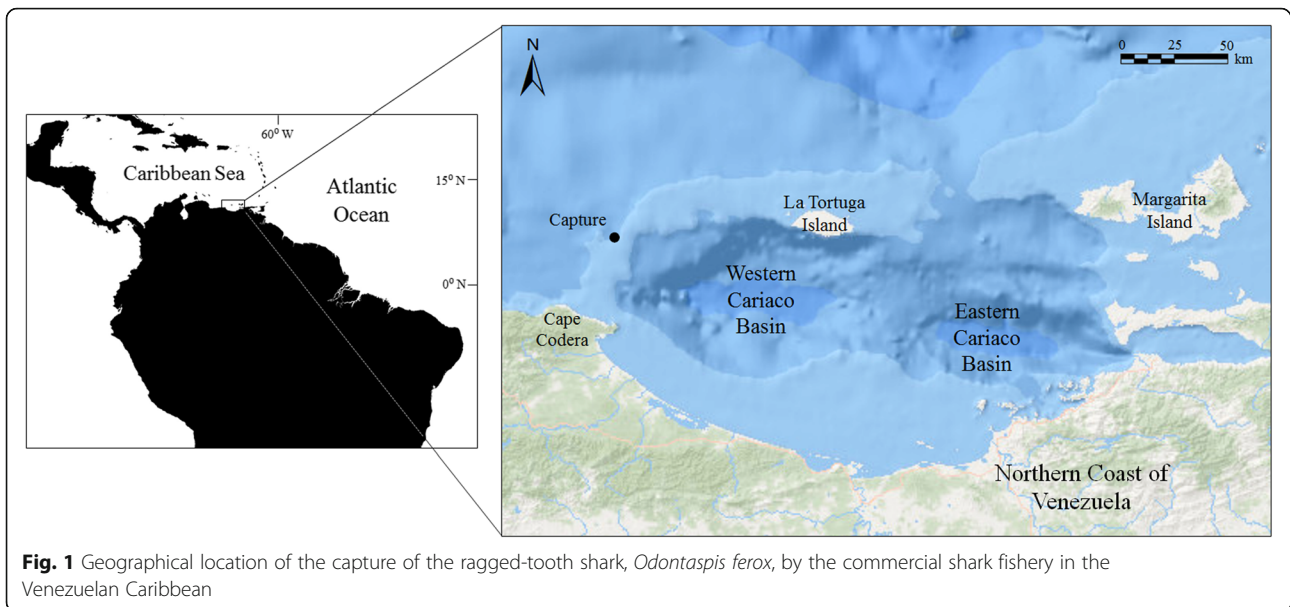
In the Western Atlantic, its distribution was unknown until the 1990s. The first reports of *O. ferox* for the Western Atlantic were from Yucatán, Gulf of Mexico (Bonfil 1995), Natal, northeastern Brazil (Menni et al. 1995), and North Carolina, US Atlantic (Sheehan 1998). More recently, this species has been recorded from off South Carolina and Florida, US Atlantic (Ross and Quattrini 2007), Fernando de Noronha Archipelago and Ceará, northeastern Brazil (Garla and Garcia 2008; Santander-Neto et al. 2011), and Barranquilla, Colombian Caribbean (Anguila et al. 2016). Despite the recent increase in reports of *O. ferox* in the region has not hitherto been reported for the Venezuelan Caribbean (between Colombia and Brazil). Currently, this species is

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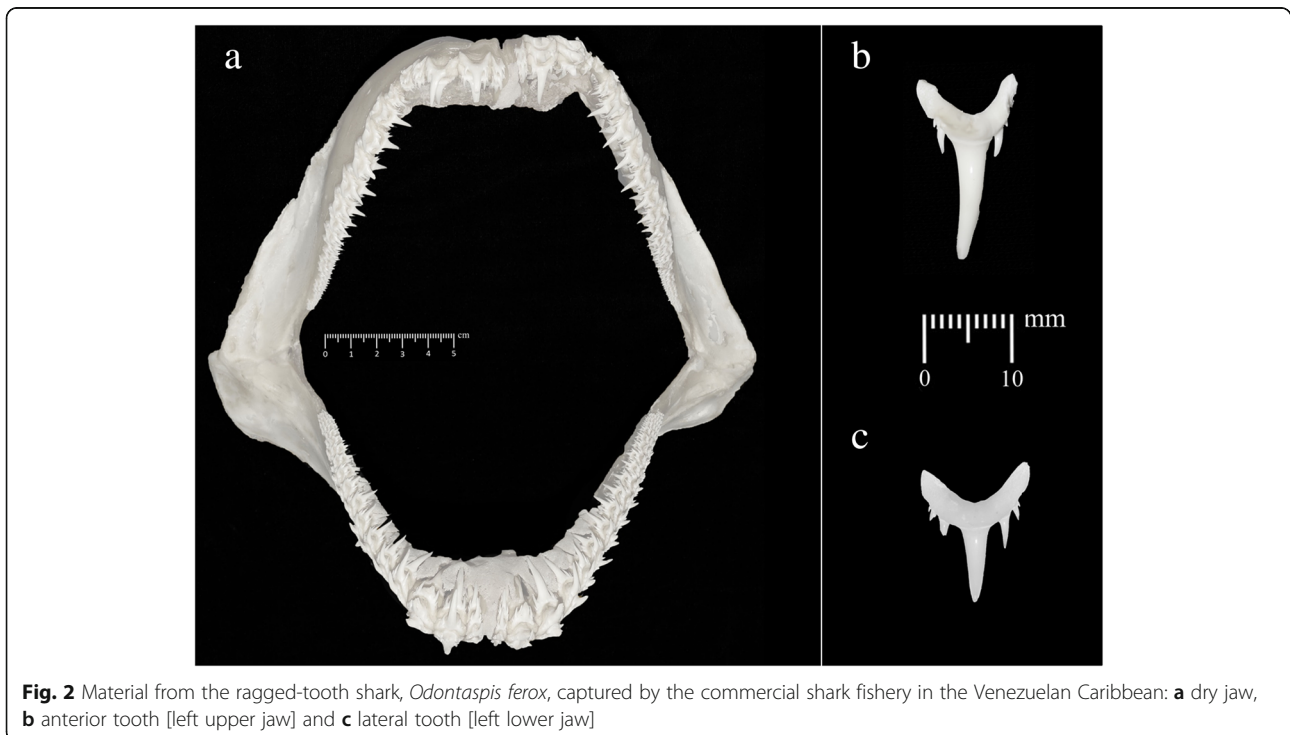


listed as vulnerable in the IUCN Red List of Threatened Species due to its rarity, very low fecundity and high vulnerability to exploitation (Graham et al. 2016).

#### Capture location

In April 2018, an uncommon shark was captured by a commercial shark fishery, at a depth of 80 m, approximately 38 km north of Cape Codera ( $0^{\circ} 56' N$ ,  $66^{\circ} 02' W$ ) in the Venezuelan Caribbean (Fig. 1). The northeastern region of Venezuela (from Cape Codera to the boundary

with Trinidad and Tobago) is under the strong influence of oceanographic and environmental factors, such as a seasonal upwelling system (Rueda-Roa and Muller-Karger 2013) and regional river runoff, including the discharges of the Orinoco River into the Caribbean Sea (Muller-Karger and Varela 1990; McConnell et al. 2009). These events contribute to the high marine productivity by increasing primary production and abundance of fishing resources. In the northeastern region, the salinity fluctuates around 36.6‰, and the water temperature oscillates between 20.5



and 29.7 °C during the principal and relaxation upwelling periods, respectively (Castellanos et al. 2002; McConnell et al. 2009).

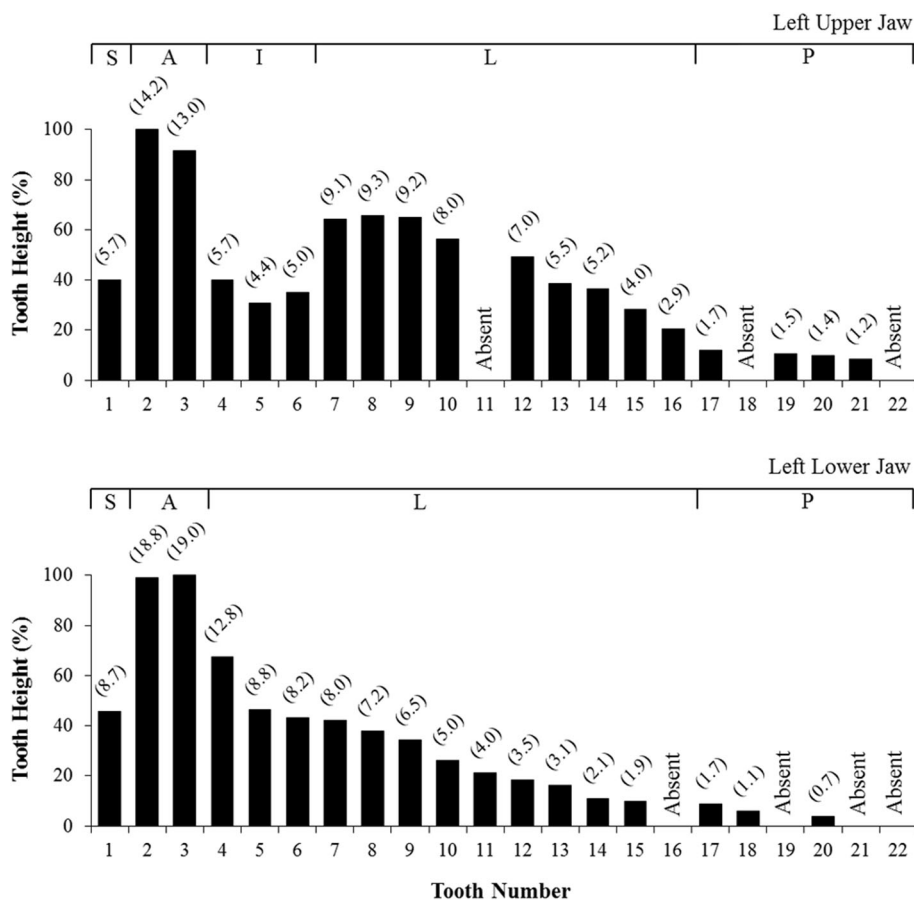
The fishing boat involved in the capture of the shark comes from the medium-scale artisanal fishing fleet based on Margarita Island, and this particular boat (13 m in length, equipped with a central motor of 120 hp) operates with bottom gillnets (300–600 m long, 3.0 m deep, 21.0 cm square mesh) in an extensive area of the northeastern region of Venezuela, from around Margarita Island to Cape Codera and La Tortuga Island. According to the information provided by fishermen, the captured specimen (sex unidentified) measured ~180 cm total length and weighed ~30 kg. The body colour reported for the specimen was uniformly grey without the apparent presence of dark spots on the back or sides.

**Identification**

After the capture, the specimen was immediately eviscerated, stored and later sold by fishermen on Margarita

Island; this precluded taxonomic identification, sex determination and data collection (i.e. morphometric and biological characteristics). However, the specimen was identified to species level on the basis of its dry jaw and dentition characteristics (Fig. 2a). The jaw was donated by the fishermen and deposited in the collection of shark jaws (under the code number CIT 1–037) of the Centro para la Investigación de Tiburones (CIT), Caracas, Venezuela.

The species *O. ferox* can be easily identified by its particular dentition which comprises generally three rows of small intermediate teeth between the upper anterior and lateral tooth rows, and teeth mostly with two or three cusplets on each side of the cusp, characteristics unique to this species (Fig. 2b, c). In order to facilitate comparisons, dentition configuration and teeth measurements of the left upper and lower jaw were graphically represented by using frequency histograms (Fig. 3) according to Garrick (1974). The height of the external teeth (crown height) was taken at the middle of each tooth from the crown-base junction to the apical edge of



**Fig. 3** Height of external teeth of the left upper and lower jaw (expressed as a percentage of height of largest tooth) for ragged-tooth shark, *Odontaspis ferox*, captured by the commercial shark fishery in the Venezuelan Caribbean. In parenthesis heights of tooth (mm). S, symphyseal; A, anterior; I, intermediate; L, lateral; P, posterior

the crown. The morphological and meristic characteristics of the dentition of the dry jaw agree with previous descriptions for this species (Compagno 2001; Bonfil 1995; Menni et al. 1995; Sheehan 1998).

## Discussion

This capture of *O. ferox* near Cape Codera is the first report of the occurrence of this species in the Venezuelan Caribbean and complements knowledge of its range in the Western Central Atlantic. Although this species appears to have a cosmopolitan distribution in the Atlantic, records of its occurrence have been very limited in the tropical region. The paucity of capture records of *O. ferox* may be attributable to the low relative abundance of this species (Graham et al. 2016) but also to its deep-water habitat out of the depth range of most commercial and traditional fishing operations (Sheehan 1998). Available data indicated that the overall depth range for *O. ferox* is 10–883 m; however, most specimens have been registered at depths between 200 and 600 m (Fergusson et al. 2008), reflecting the preference of this species for zones of deep waters generally close to the seabed around islands and outer continental shelves.

According to the maturity size reported for *O. ferox* (males: 200–250 cm TL; females: 300–350 cm TL; Fergusson et al. 2008), the specimen captured (180 cm TL) in the Venezuelan Caribbean corresponds to an immature individual. The absence of captures of pregnant females with advanced stages of gestation and newborn individuals has prevented the identification of the nursery grounds of this species through its range of distribution. Fergusson et al. (2008) suggested that nurseries of *O. ferox* are commonly associated with deep offshore habitats on upper continental and insular slopes. The Caribbean Sea comprises a combination of environments (including chain islands, reef systems, submarine basins, and underwater seamounts) that provide a wide variety of habitats for sharks. The capture of a large number of pregnant females and juveniles of oceanic sharks in the Venezuelan Caribbean showed that this tropical region is crucial in the life cycle of this group of fishes (Tavares and Arocha, 2008).

The monitoring of fishing activities is essential to obtain biological information and to increase knowledge of the exploited species. The Venezuelan governmental organizations with responsibility in fishery administration and data collection must make an effort to improve and expand the programs that monitor fishing. These actions, together with the support of researchers, will ensure more accurate information on the fishing operations and the species captured. Additionally, the use of novel techniques (BRUVs, baited remote underwater video systems) helps

to improve our understanding of distributions, ecology and behaviour of marine fauna (Wellington et al. 2016), for example in cases of poorly known and vulnerable species such as the ragged-tooth shark.

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## Authors' contributions

RT organized the co-authors, wrote the manuscript, and prepared the final maps and images. LS measured the teeth, analyzed data, and gave technical assistance in photographic sessions. JMB received the shark jaw from fishermen and interviewed the captain of the fishing boat. All authors read and approved the final manuscript.

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## Availability of data and materials

All data generated during this study are included in this published article. The dry jaw of the examined specimen (*Odontaspis ferox*) was deposited (under the code number CIT 1–037) in the jaw collection of the Centro para la Investigación de Tiburones (CIT), Caracas Venezuela.

## Ethics approval

Not applicable.

## Consent for publication

All authors consent to publication.

## Competing interests

The authors declare that they have no competing interests.

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