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ORIGINAL ARTICLE

New record of *Squalus cubensis* Howell Rivero, 1936 (Chondrichthyes, Squalidae) in Colombia

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Abstract

Two Cuban dogfish *Squalus cubensis* (Squalidae) are recorded for the first time in the area of influence of *Isla Fuerte*, an island located at the limit of the southern continental shelf of the Colombian Caribbean. Additionally, it is the first capture report of this species in Colombia by artisanal fishery and at shallower catch depths than those reported in previous records. Due to the little existing knowledge about the biology of this species in the country, information on the reproductive biology of the captured individuals is provided.

Keywords: *Squalus cubensis*; Shark; Squalidae; Cuban dogfish; *Isla Fuerte*.

Introduction

The Cuban dogfish *Squalus cubensis* (Howell Rivero, 1936) inhabits the subtropical Atlantic Ocean from North Carolina to southern Brazil and Argentina, including the greater Caribbean and the Gulf of Mexico (Compagno, 1984, 2002; Monzini, 2006; Jones *et al.*, 2013; Brooks *et al.*, 2015). Schools are probably present below 100 m in the Portobelo area (Panama, Caribbean Coast, Colon Province) and in the San Andres archipelago area (Monzini, 2006).

The Cuban dogfish is a bottom-dwelling species that inhabits deep warm temperate and tropical waters of the outer continental shelf and uppermost slopes, and is found on or near the bottom in large dense schools. Reported capture depths vary between 60 and 730.6 m (Compagno, 1984; Castro, 2011; Jones *et al.*, 2013, Brooks *et al.*, 2015). This species may form large schools of same-sex and size individuals (Castro, 2011) and is never found in surface waters. Juvenile Cuban dogfishes reside in shallow waters along the continental shelf and mature specimens are found in deep waters (Compagno 1984, 2002).

Little information is known about this species and separate catch statistics are not reported for any population. Information available refers to *S. cubensis* as by-catch of artisanal and commercial fisheries in the Caribbean, mainly caught in the northern Gulf of Mexico, although details are lacking and this species cannot be assessed beyond Data Deficient (IUCN Red List) at present (Monzini, 2006).

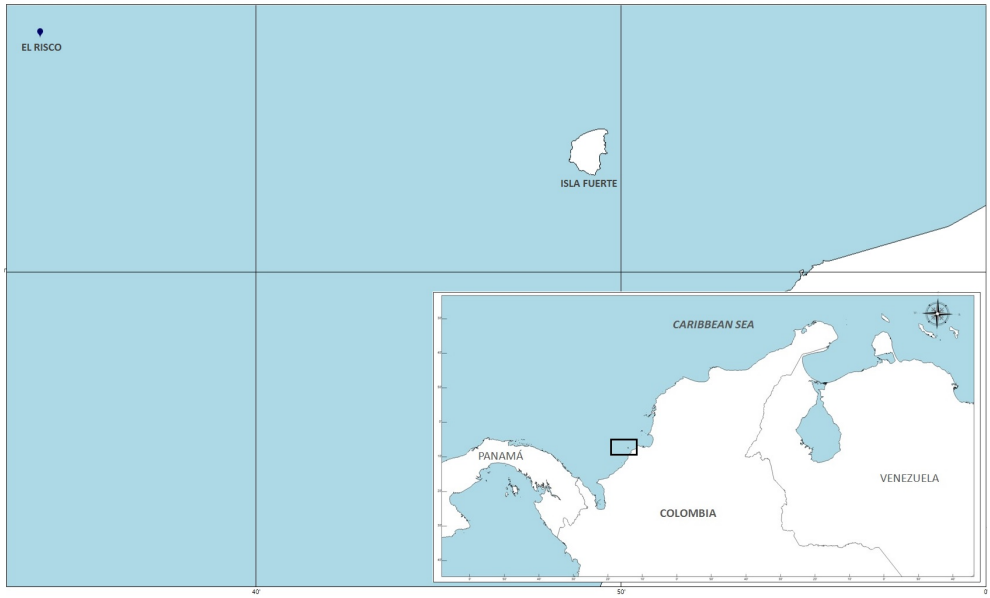

Fig. 1. Geographic location of the site of capture of *Squalus cubensis* off Isla Fuerte, Colombia.

Previous records have reported the presence of the Cuban dogfish in Colombia only through industrial fishery studies and experimental trawl surveys (Rey-Carrasco & Acero (1988) in the continental slope of the northeastern coast; Puentes *et al.* (2009) in the San Andrés archipelago; and Paramo *et al.* (2012, 2015) across the Colombian Caribbean.

The present article describes two females captured in the southern continental shelf of the Colombian Caribbean (**Figure 1**), becoming the first record of this species in the area. Furthermore, some characteristics of its reproduction are described in order to provide additional information to the basic knowledge of the species.

The recording of morphometric measures was made point-to-point on the fresh specimens, using a measuring tape and a caliper, following Compagno (1984, 2001, and 2002). For pregnant females, number of embryos *in utero* and their sex, location (left or right uterus), and total length of each embryo (L_{TE}) were recorded (Braccini *et al.*, 2006).

The specimens were preserved in 5% formaldehyde, transferred to 70% alcohol and deposited under the catalog number MPUJ 7875 in the Museum of Natural History of the Pontificia Universidad Javeriana, in Bogotá-Colombia.

Results and discussion

Squaliformes Compagno, 1973

Squalidae Blainville, 1816

Squalus Linnaeus, 1758

Squalus cubensis Howell Rivero, 1936. Proc.Boston Soc.Nat.Hist., 41(4): 45, pls.10 and 11 (**Figure 2**).

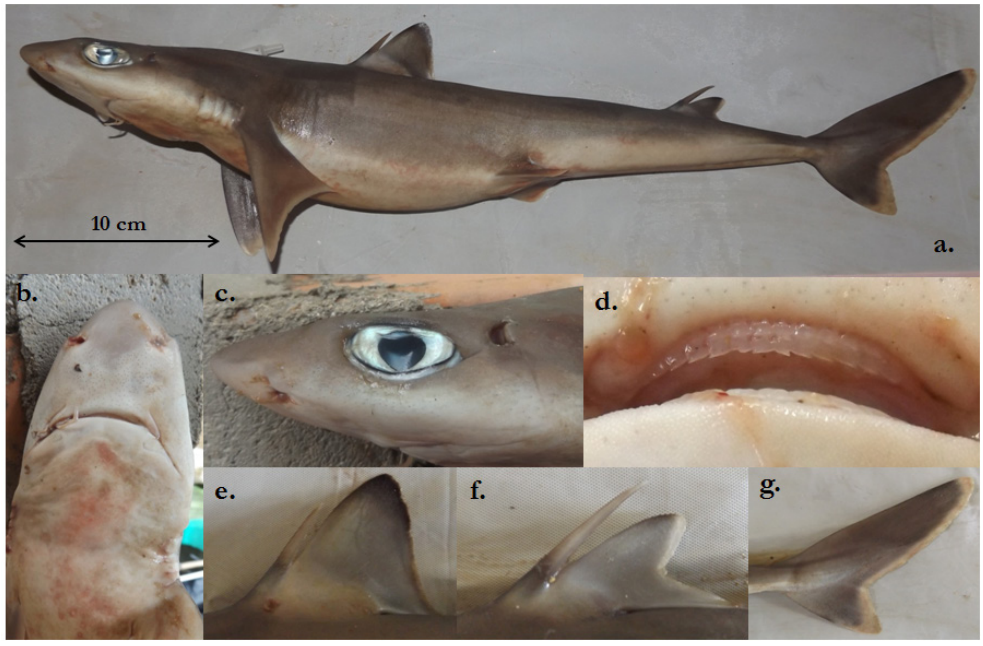

Fig. 2. Female of *Squalus cubensis* 51.7 cm LT. **a**. Side view. **b**. Ventral view of the head. **c**. Detail of the eye and spiracle. **d**. Detail of the upper teeth. **e**. First dorsal fin. **f**. Second dorsal fin. **g**. Caudal fin.

On 25 September 2014, two adult females (MPUJ 7875) were captured by artisanal fishermen through longline fishing in the limit of the southern continental shelf of the Colombian Caribbean, 27 km off Isla Fuerte and 40 km off the continental coastline at 100 meters depth, at the fishing locality named *El Risco* (9° 26' 25. 72" N, 76° 25' 55. 82" W). The record of these two females constitutes the first report of this species in the southern continental shelf, extending its distribution range to the southern Caribbean Sea. **Table 1** shows the morphological measurements taken on both specimens.

The total length (51.7 and 50 cm L_T) is larger than previous records in Colombian waters: 29.5 cm L_T northeastern coast of Colombia (Rey-Carrasco & Acero 1988). Currently, there is no additional information about the size of *S. cubensis* in Colombia. For other locations in the Caribbean (Jamaica, Bahamas, Gulf of Mexico and Venezuela) the size ranges vary between 21.2 and 80 cm L_T (McLaughlin & Morrissey, 2004; Jones *et al.*, 2013; Tagliafico *et al.*, 2014; Brooks *et al.*, 2015).

In Colombia, the Cuban dogfish has been reported in depth ranges of 270-630 m (Rey-Carrasco & Acero, 1988) and 246-388 m (Paramo *et al.* 2012, 2015). Other records in the Caribbean show depth ranges between 198.11 and 913 m (McLaughlin & Morrissey, 2004; Jones *et al.*, 2013; Brooks *et al.*, 2015). Our report constitutes the shallowest depth record for this species in the area: 100 m depth. According to Brooks *et al.* (2015), the variation in depth is attributable to geographical variation in thermal profiles of the water column; they suggest that *S. cubensis* select vertical habitats based on thermal rather than barometric or photic preferences leading to the disparate depth ranges in different latitudes.

Table 1. Morphometric characters of the two females (MPUJ 7875) and other references of Squalus cubensis in the area.

MEASURAMENT		PRESENT STUDY	
		Female 1	Female 2
TL	**Total length**	**51.7 cm**	**50 cm**
FL	Fork length	89.4 %	88.4 %
PCL	Precaudal length	80.3 %	80.4 %
PD2	Pre-second dorsal fin length	63.8 %	66.0 %
PD1	Pre-first dorsal fin length	30.0 %	31.0 %
HDL	Head length	21.7 %	21.0 %
PG1	Prebranchial length	18.0 %	17.0 %
POB	Preorbital length	7.0 %	6.8 %
PP1	Prepectoral fin length	21.9 %	21.0 %
PP2	Prepelvic fin length	48.4 %	48.0 %
IDS	Interdorsal space	25.9 %	29.0 %
DCS	Dorsal-caudal fin space	8.5 %	11.0 %
PPS	Pectoral fin-pelvic fin space	22.8 %	23.2 %
PAS	Pelvic fin-caudal fin space	27.5 %	27.8 %
PRN	Prenarial length	3.1 %	3.4 %
POR	Preoral length	8.7 %	9.0 %
EYL	Eye length	4.4 %	4.6 %
EYH	Eye height	2.3 %	2.4 %
ING	Intergrill length	5.8 %	4.0 %
P1A	Pectoral fin anterior margin	13.2 %	11.4 %
P1P	Pectoral fin posterior margin	10.6 %	11.6 %
P1H	Pectoral fin height	12.4 %	11.4 %
D1L	First dorsal fin length	13.5 %	14.0 %
D1A	First dorsal fin anterior margin	10.1 %	9.0 %
D1B	First dorsal fin base	7.2 %	8.0 %
D1H	First dorsal fin height	7.2 %	7.0 %
D1I	First dorsal fin inner margin	6.4 %	6.0 %
D1P	First dorsal fin posterior margin	9.7 %	9.8 %
D2L	Second dorsal fin anterior margin	6.2 %	6.0 %
D2P	Second dorsal fin posterior margin	2.7 %	2.8 %
D2B	Second dorsal fin base	4.6 %	4.4 %
D2I	Second dorsal inner margin	3.1 %	4.0 %
D2L	Second dorsal fin length	7.7 %	8.4 %
CPV	Preventral caudal fin margin	11.8 %	11.0 %
CFL	Caudal fin fork length	9.1 %	8.4 %
CDM	Dorsal caudal fin margin	20.7 %	21.0 %
CPL	Lower postventral caudal margin	6.2 %	5.0 %
CPU	Upper postventral caudal margin	15.9 %	16.0 %

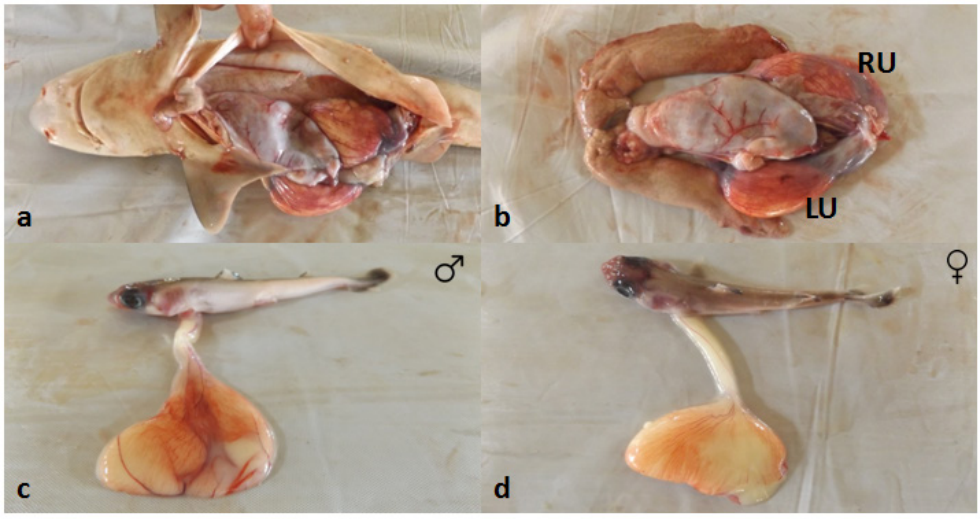

Fig. 3. *Female 1*. **a.** View of internal organs. **b.** RU-Right uterus and LU-Left uterus with candle inside. **c.** Male mid-term embryo with large external yolk sac. **d.** Female mid-term embryo with large external yolk sac.

Female 1 **(Figure 3):** Mature specimen with embryos macroscopically visible in utero. Right uterus with candle contained one mid-term embryo (male 10.2 cm L_{TE}), with a large external yolk sac, small follicles, and enlarged oviducal gland. Left uterus with candle contained one mid-term embryo (female 10.6 cm L_T) and a large external yolk sac, small follicles, and enlarged oviducal gland (**Table 2**).

Table 2. Size and sex of the offspring of the two females of *Squalus cubensis* (MPUJ 7875).

	Total Length Female L_T (cm)	Uterus	# Embryos	Embryo Sex	Total Length Embryos L_{TE} (cm)
Female 1	51.7	Right	1	Male	10.2
		Left	1	Female	10.6
Female 2	50	Right	1	Unknown	2.2
		Left	0		

Female 2 **(Figure 4):** Mature specimen with embryos macroscopically visible *in utero*. Right uterus with candle contained one embryo at an early stage of development (2.2 cm L_{TE}) and a large external yolk sac, small follicles, and enlarged oviducal gland. Left uterus empty and expanded, developing follicles, and enlarged oviducal gland (Table 2).

The females of the Cuban dogfish, as other dogfish sharks, are asynchronous breeders in which ovulation, parturition, and mating do not occur at any particular time of the year (Braccini *et al.*, 2006). According to Castro (2011), females mature at 49 – 50 cm and the pups are born at 25 – 27 cm. Jones *et al.* (2013), estimated that during the maturation process of females, the oviducal glands width begins at approximately 42 cm L_T, followed by development of the uterus at approximately 46 cm L_T, estimating the size-at-maternity at 47.8 cm L_T, and suggested that the size-at-birth is approximately 20 cm L_T.

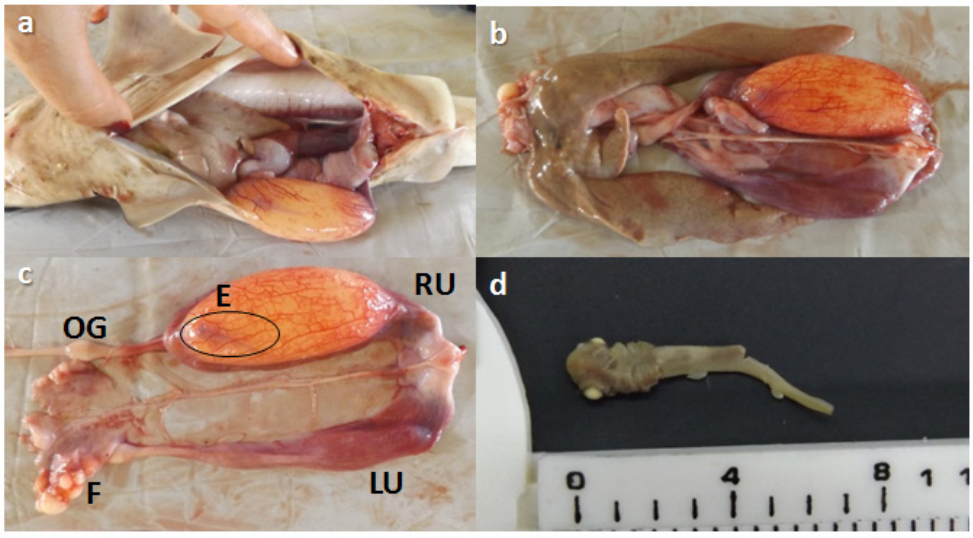

Fig. 3. *Female 2.* **a - b** View of internal organs. **c.** RU-Right uterus with candle inside, LU-Left uterus empty and enlarged, OG-Oviducal gland, F-Follicles, E-Embryo with a very large external yolk sac. **d.** Early stage embryo.

The two females reported here have similar lengths and showed different stages in the development of their embryos (mid-term and early stage of development) which is consistent with the long gestation period observed in the family Squalidae (Conrath & Musick, 2012).

In the Caribbean Sea and adjacent waters, information related to the biology and fisheries of sharks is scarce or non-existent. Tagliafico *et al.* (2014) estimated the length-mass relationship of 21 species of elasmobranchs in Venezuela, and *S. cubensis* showed an isometric growth. There is no information about biological parameter regarding the Cuban dogfish in Colombia and the little existing information is limited to specific capture records (Puentes *et al.* 2009).

Overfishing in shallow waters surrounding Isla Fuerte and the consequent reduction of fish populations has forced fishermen to expand their fishing areas and increase the deep sea artisanal fishery. This pressure in deep-waters may have a negative effect in sharks, particularly S. *cubensis*. It is important to obtain more biological data on this species by monitoring its catches to determine the population status in the area for its conservation and fishery management.

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Conflict of interest

Authors declare that there are no conflicts of interest related to the results obtained in this investigation.

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Nuevo registro de *Squalus cubensis* Howell Rivero, 1936 (Chondrichthyes, Squalidae) en Colombia

Resumen. Dos especímenes de tiburón galludo cubano, *Squalus cubensis* (Squalidae), se registraron por primera vez en el área de influencia de Isla Fuerte, localizada en el límite de la plataforma continental sur del Caribe Colombiano. Se trata, además, del primer reporte de captura de la especie en Colombia por medio de pesca artesanal a profundidades menores de las reportadas anteriormente. Para contribuir al conocimiento, hasta ahora escaso, acerca de la biología de esta especie en el país, se proporciona información sobre la biología reproductiva de los individuos capturados.

Palabras clave: *Squalus cubensis*; tiburón; Squalidae; tiburón galludo cubano; *Isla Fuerte*.

Novo registro de *Squalus cubensis* Howell Rivero, 1936 (Chondrichthyes, Squalidae) em Colômbia

Resumo. Reporta-se por primeira vez a presença de dois indivíduos de Cação-Bagre Squalus cubensis (Squalidae) na área de influência da Isla Fuerte, uma ilha localizada no limite da plataforma continental sul do Caribe Colombiano. Adicionalmente, este é o primeiro relato de captura dessa espécie em Colômbia por meio de pesca artesanal e a uma profundidade de captura menor do que as reportadas anteriormente. Devido ao pouco conhecimento existente sobre a biologia desta espécie no país, se aporta informação sobre a biologia reprodutiva dos indivíduos capturados.

Palavras-chave: *Squalus cubensis*; Tubarão; Squalidae; Cação-Bagre; *Isla Fuerte*.

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