

MARINE RECORD

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The southernmost range limit for the hidden angelshark *Squatina occulta*

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Abstract

Background: Angelsharks (Genus *Squatina*) are distributed in the southern Southwest Atlantic Ocean between southeastern Brazil and central Patagonia. The endangered hidden angelshark *Squatina occulta* is reported in the literature as ranging from Espírito Santo, Brazil to Southern Uruguay. Its presence in Argentine waters has been suspected but not verified so far. This study describes and analyzes a specimen of *S. occulta* found in Puerto Quequén 38° 40'S - 58° 50'W, Buenos Aires Province, Argentina.

Results: An immature male of 578 mm total length and 1,450 g was collected from commercial landings of the bottom trawl fishery of Puerto Quequén. The specimen exhibited the coloration pattern, dermal denticle distribution, and tooth formula characteristic of *S. occulta*.

Conclusions: *Squatina guggenheim* and *S. argentina* are already known to occur off Puerto Quequén. The present finding confirms the presence of a third species of angelshark in Argentina and constitutes the southernmost record of *S. occulta*.

Keywords: Chondrichthyes, Elasmobranchii, Squatinidae, Southwest Atlantic Ocean

Background

The genus *Squatina* Dumeril 1806 is composed of 20 species of angelsharks (Weigmann 2016). The species of this genus are unique among sharks due to their ray-like features. Their bodies are flattened dorso-ventrally with broad pectoral fins, a terminal mouth, and eyes and spiracles located dorsally. They also have a long and flattened tail without an anal fin. Unlike rays, however, their gill slits are located laterally on the head and forward of the pectoral-fin origins (Last & White 2008).

Angelsharks are distributed in the southern Southwest Atlantic Ocean between southeastern Brazil and central Patagonia (Cousseau & Figueroa 2001; Vooren & Klipper 2005). They are found from the inshore to the upper continental slopes (Vooren & Klipper 2005). The similarity of external morphology among species led to different

taxonomic hypothesis and misidentifications in previous literature (Cousseau & Figueroa 2001; Cousseau 1973; Vaz & de Carvalho 2013; Faria et al. 2014). Recently, the taxonomy of these species was revised and clarified and, *Squatina guggenheim* Marini 1936, *S. argentina* (Marini 1930) and *S. occulta* Vooren & da Silva 1991 are recognized as valid species in this area (Vaz & de Carvalho 2013). Genetic analysis supports the differentiation of these three species (Solé-Cava & Levy 1987; Solé-Cava et al. 1983; Furtado-Neto et al. 2002; Falcão et al. 2014).

Despite the recent clarifications of the taxonomy, problems concerning the distribution and occurrence of angelsharks in the region still persist, at least for *S. occulta*. The hidden angelshark *S. occulta* is reported in the literature as ranging from Espírito Santo State, Brazil to southern Uruguay in the Argentinean-Uruguayan Common Fishing Zone (Vaz & de Carvalho 2013; Milessi et al. 2001). Even though *S. occulta*'s presence was proposed along the Argentinean shelf (to 45° S), this could not be verified so far (Cousseau & Figueroa 2001; Vooren & Klipper 2005; Vaz & de Carvalho 2013). The present study reports and describes a specimen of this species found in

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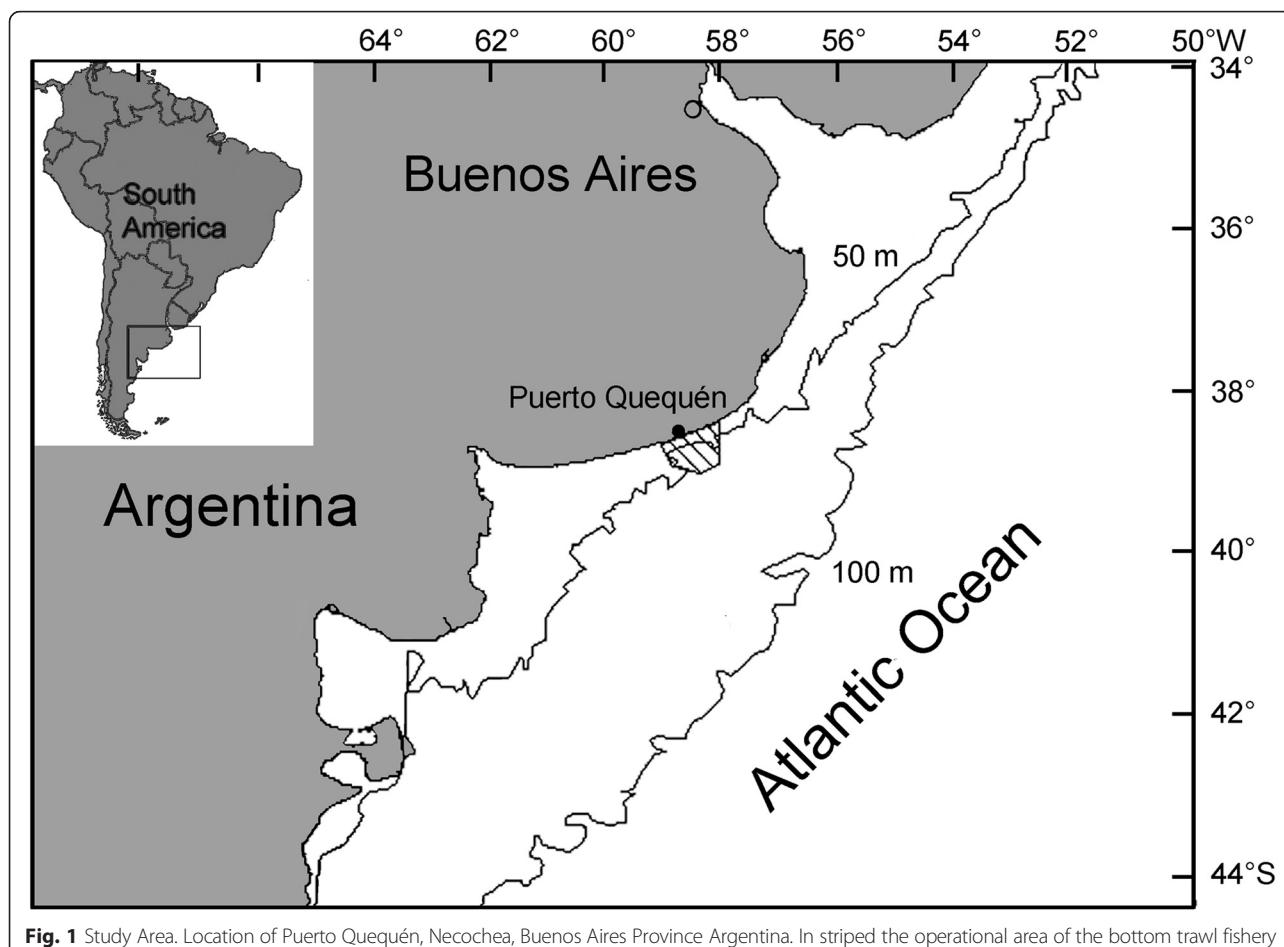


Fig. 1 Study Area. Location of Puerto Quequén, Necochea, Buenos Aires Province Argentina. In striped the operational area of the bottom trawl fishery

the area of Puerto Quequén, Necochea, Buenos Aires Province, Argentina.

Methods

Sampling site

Puerto Quequén ($38^{\circ} 40' S$ - $58^{\circ} 50' W$; Fig. 1) is a grain export port located in Necochea, Buenos Aires Province, northern Argentina which also harbors a small fishery. Its fleet is composed of 14 vessels which operate in an arc of 30 nautical miles from the coastline with the port as its focal point. The primary fishing gear employed is the bottom trawl. Landings are approximately 3,000 metric tons annually. Puerto Quequén is the second largest fishing port in Argentina with respect to commercial landings of angelsharks and contributes, on average, 10 % of the country's total catch (period 2006 to 2012) (Sánchez et al. 2012; Navarro et al. 2014). As in other fisheries of Argentina, angelsharks are recorded in a common category without discrimination between species.

Specimen

Squatina occulta was sampled on 15 March 2015 during fishery landings at Puerto Quequén. The specimen was

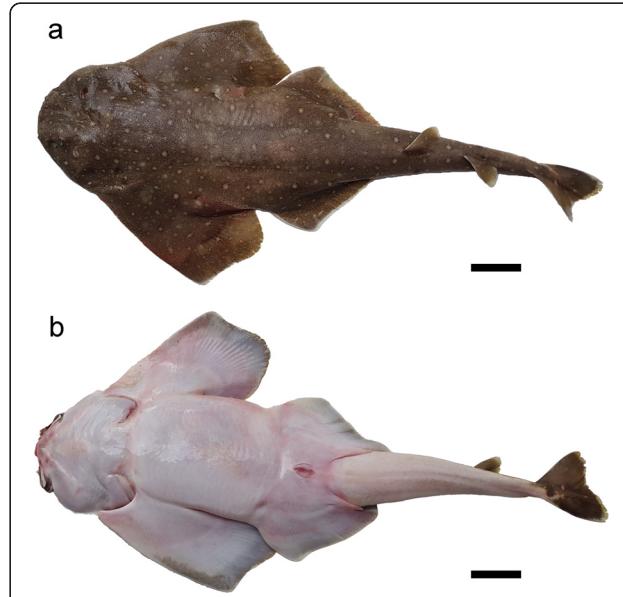


Fig. 2 *Squatina occulta* MACN-Ict 10942. Immature male of 578 mm of total length collected at Puerto Quequén. **a** dorsal color view. **b** ventral color view. Scale bar= 50 mm

Table 1 Morphological measurements of *Squatina occulta* MACN-Ict 10942 collected at Puerto Quequén

Morphometric character	mm	% TL	Morphometric character	mm	% TL
Total length (TL)	578		Clasper inner length	65.2	11.3
Pre-caudal length	493	85.3	Clasper outer length	9.8	1.7
Pre-dorsal length	371	64.2	Clasper base width	5.0	0.9
Pre-pectoral length	122	21.1	Snout-cloaca length	287	49.7
Pre-pelvic length	239	41.3	Cloaca-caudal length	289	50
Pre-brachial length	88.4	15.3			
Pre-spiracular length	52.4	9.1			
Pre-ocular length	31.5	5.4			
Pre-orbital length	23.7	4.1			
Head width	119.8	20.7			
Orbital head width	74.7	12.9			
Spiracular head width	116.2	20.1			
Mouth width	76.5	13.2			
Head height	38.6	6.7			
Interorbital distance	48.2	8.3			
Eye length	11.1	1.9			
Eye width	7.7	1.3			
Eye-spiracle distance	15	2.6			
Internarial distance	36.5	6.3			
Interspiracular distance	45.5	7.9			
Spiracle length	13.1	2.3			
Intergill width	14.8	9.8			
Intergill length	56.6	2.6			
Interdorsal distance	36.9	6.4			
Dorsal-caudal distance	38.8	6.7			
Pectoral-pelvic distance	49.1	8.5			
Pelvic (origin)-caudal distance	253	43.8			
Pelvic-caudal distance	190	32.9			
Width at pectoral origins	85.5	14.8			
Trunk width	102.2	17.7			
Tail width	61.5	10.6			
Tail height	27	4.7			
Pectoral-fin length	177	30.6			
Pectoral-fin anterior margin	152	26.3			
Pectoral-fin base length	55.9	9.7			
Pectoral-fin width	98.6	17.1			
Pectoral-fin inner margin	91.4	15.8			
Pelvic-fin length	128.3	22.2			

Table 1 Morphological measurements of *Squatina occulta* MACN-Ict 10942 collected at Puerto Quequén (Continued)

Pelvic-fin width	81.7	14.1
Pelvic-fin inner margin	69.2	12.0
First dorsal-fin base length	22.9	4.0
First dorsal-fin anterior margin	45.9	7.9
First dorsal-fin height	29.5	5.1
First dorsal-fin inner margin	16.8	2.9
Second dorsal-fin base length	21.1	3.7
Second dorsal-fin anterior margin	42.5	7.4
Second dorsal-fin height	26.5	4.6
Second dorsal-fin inner margin	17.5	3
Dorsal caudal-fin margin	64.3	11.1
Preventral caudal -fin margin	79.4	13.7
Caudal-fin height	76.3	13.2

preserved at -20 °C for 24 h and identified after defrosting. Identification and morphological measurements followed (Last & White 2008; Vaz & de Carvalho 2013). The specimen was deposited in the fish collection of the División Ictiología of the Museo Argentino de Ciencias Naturales “Bernardino Rivadavia” and catalogued as MACN-Ict 10942.

Results

The specimen was determined to be an immature male of 578 mm TL and 1,450 g. Anterior margin of the pectoral fin slightly convex with its posterior tip not reaching the external angle of the pelvic fin (Fig. 2a). Brown dorsal color pattern, with numerous white to yellowish rounded spots over the entire surface and larger white spots surrounded by many blackish dots located at the mid-dorsal region of the body (Fig. 2a). The larger white

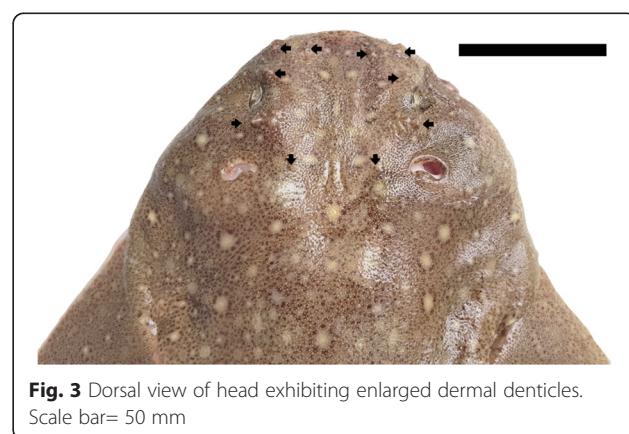


Fig. 3 Dorsal view of head exhibiting enlarged dermal denticles.
Scale bar= 50 mm

spots ranged from 7.0 ± 0.7 mm wide over the head and trunk to 8.2 ± 0.8 mm wide over the trunk. Posterior margin of the pectoral fin mottled, and the tail displayed a creamy coloration pattern. The rest of the ventral surface was white (Fig. 2b). Morphological measurements are provided in Table 1.

Dermal denticles on dorsal midline and pectoral fins similar in size to those from the remaining regions of the body with the exception of slightly enlarged dermal denticles near the origin of the first dorsal fin. Above the head enlarged dermal denticles were found symmetrically organized (Fig. 3). A pair of enlarged denticles between the spiracles, one on each side of the dorsal midline of the body. A cluster of four or five enlarged denticles posterior to each eye, two of them noticeably larger than the others. Three enlarged denticles anterior to each eye, one on the anterior edge of the eye, one between the eyes and the nostrils, and the most anterior one nearly reaching the snout (Fig. 3).

Teeth smaller in the upper jaw than in lower jaw and arranged in 18 longitudinal upper rows and in 20 lower rows. Tooth formula: 9–9/10–10, respectively.

Discussion

The specimen collected at Puerto Quequén confirms the presence of *S. occulta* in Argentina. The most distinctive characteristics of the individual found were its coloration pattern, the relative size of the spots, and the distribution pattern of enlarged dermal denticles. The morphological measurements were in the range of the values reported for *S. occulta* even though they were not useful for discriminating among Southwestern Atlantic species, as pointed out by the authors (Vaz & de Carvalho 2013).

This individual was distinguished from *S. guggenheim* and *S. argentina* by its brown background color with several rounded yellowish spots on the dorsal surface (spot size ranging from 0.54 to 0.81 eye-length), the larger spots surrounded by many small blackish dots; the slightly convex anterior margin of the pectoral fin; absence of enlarged dermal denticles and enlarged dermal denticles symmetrically distributed on the head with a pair of them located between spiracles.

Conclusion

Squatina guggenheim and *S. argentina* are already known to occur off Puerto Quequén, Necochea (Marini 1930; Marini 1936). The present finding confirms the presence of a third species of angelshark in Argentina and constitutes the southernmost record of *S. occulta*.

Abbreviations

TL, total length; g, grams; mm, millimeters; MACN, Museo Argentino de Ciencias Naturales "Bernardino Rivadavia"

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Availability of data and materials

The specimen analyzed in the present study is available in the fish collection of the División Ictiología of the Museo Argentino de Ciencias Naturales "Bernardino Rivadavia", catalogued as MACN-Ict 10942.

Authors' contributions

MLE and DCL collected the specimen, identified the specimen and performed the measurements, took the photograph and prepared the figures. MLE analyzed the data. MLE, VVF, GEC, JMDA prepared the manuscript. All the authors corrected the draft, read and approved the final manuscript.

Competing interests

The authors declare that they have no competing interests.

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