MARINE RECORD

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First report of the whitesaddled catshark Scyliorhinus hesperius (Springer 1966) in Guatemala's Caribbean Sea

Ana Hacohen-Domené^{1*}, Francisco Polanco-Vásquez¹ and Rachel T. Graham²

Abstract

Background: The present study represents the first record of *Scyliorhinus hesperius* in Guatemala's Caribbean Sea. **Methods:** Five male whitesaddled catsharks, *S. hesperius*, were captured in 200 m deep waters of Guatemala's Caribbean coast.

Results and Conclusion: All specimens were male with total lengths ranging from 420 mm to 510 mm. These fish represent the first record of mature male *S. hesperius*, the first record for this species in Guatemalan territorial waters, and a range extension in the Western Central Atlantic.

Keywords: Deep-water chondrichthyans, First record, Range extension, Caribbean,

Background

Scyliorhinidae (catsharks) constitute the largest shark family with at least 160 species distributed across 17 genera (Ebert et al. 1996). These species are broadly distributed throughout temperate and tropical waters, inhabiting the bottom of shallow and deep waters over 100 m (Nakaya 1975). Catsharks are small, demersal species, and relatively poor swimmers (Compagno et al. 2005).

The genus *Scyliorhinus* Blainville 1816, is comprised of 16 species distributed in cold, subtemperate to tropical waters (Ebert et al., 2015; Soares et al., 2016) including the eastern and western Atlantic and the Mediterranean (Rodríguez-Cabello et al. 2007; Ebert et al. 2015). In the western Atlantic, *Scyliorhinus* is most diverse and at least six species of *Scyliorhinus* are distributed in the Caribbean (Compagno, 1984) with three species occurring throughout the Central America Caribbean: *Scyliorhinus boa* Goode and Bean 1896, *S. retifer* Garman 1881, and *S. hesperius* Springer 1966 (Compagno, 1984).

S. hesperius was described by Springer (1966) based on an immature female holotype of 415 mm total length

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¹Fundación Mundo Azul, Blvd. Rafael Landivar 10-05 Paseo Cayala Zona 16, Edificio D1 Oficina 212, Guatemala City, Guatemala Full list of author information is available at the end of the article Maximum size for this species is based on a singular female *S. hesperius* (470 mm), with no information on its biology (Leandro 2004). Compagno (1988) reports two immature specimens from Nicaragua, one female and one male, 159 mm and 356 mm respectively. Size range of specimens reported in this study was 420–510 mm TL, all adult male sharks. This study represents the first report of adult male *S. hesperius* and also the largest *S. hesperius* specimen collected to date, based on morphometric data of specimen Rf. 252.

The whitesaddled catshark *S. hesperius* is currently listed by the International Union for the Conservation of Nature's Red List as Data Deficient due to insufficient information available to assess the species population status (Leandro 2004). No current information exists for



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⁽TL). Additionally Springer (1966) examined 12 specimens, sex not specified, ranging in total length from 177–460 mm. All specimens were captured between 274 m and 530 m depth in the Western Caribbean near Jamaica and Honduras and southward towards Panama and Columbia (Springer 1966). Later, Ross and Quattrini (2009) reported sightings of three individual sharks *S. hesperius* resting on thick coral rubble between 580–604 m depth, off of Jacksonville, Florida, while conducting deep water dives on deep reefs along the southeastern US continental shelf slope.

this species' biology, and distributional limits are poorly known. This paper reports the first record of *S. hesperius* in Guatemalan waters, representing a range extension in Central America and the Caribbean.

Methods

On March 20th 2016, five whitesaddled catsharks were captured by artisanal fishermen of El Quetzalito, Izabal Department, in Guatemala (Fig. 1). These specimens were captured with a 1000 m wide bottom trammel net, consisting of one panel with 3.5 in. mesh size, set at 200 m depth.

All specimens were initially kept on ice prior to preservation in formaldehyde (10%) for 3 weeks and transferred to ethyl alcohol (70%) for final preservation. The specimens were donated to the Laboratory of Biological Science and Oceanography, Centro de Estudios del Mar y Acuicultura (CEMA) of the Universidad San Carlos de Guatemala (USAC). The specimens are part of the collection registered to the Consejo Nacional de Áreas Protegidas (CONAP) under the reference numbers (Rf) 252, 253, 254, 255 and 256.

The five specimens were sexed and measured after being preserved. A total of 91 morphometric measurements were taken (Table 1) as proposed by Compagno (2001). Measurements are expressed as percentages of total length (%TL). All specimens were examined and identified using identification guides developed by Compagno (1984, 2001). Maturity for males was determined by the full calcification of claspers.

Results

Systematic account Family Scyliorhinidae Gill, 1862 Scyliorhinus Blainville, 1816 *Scyliorhinus hesperius* Springer, 1966 Common name: Whitesaddled catshark.

Material examined

Rf 252 specimen: male, mature, 510 mm TL (Fig. 2a); Rf 253 specimen: male, mature, 455 mm TL (Fig. 2b); Rf 254 specimen: male, mature, 429 mm TL (Fig. 2c); Rf 255 specimen: male, mature, 435 mm TL (Fig. 2d); Rf 256 specimen: male, mature, 420 mm TL (Fig. 2e).

All specimens were caught approximately 15 Km north of El Quetzalito, Izabal, Guatemala (15° 49.776 N,–88° 12.340 W), at approximately 200 m, based on known length of net deployed.

Description

Color pattern variable, of seven to eight dark saddles with large light spots concentrated in the saddle marks. Background coloration is light brown on the dorsal surface and paler on the ventral surface. First dorsal fin originates behind pelvic fins, and larger than second dorsal fin (Fig. 2). Lower labial furrows present (Fig. 3).

Discussion

This study provides multiple first records for *S. hesperius* with the largest of the species described based on Reference 252 and also the first mature males. This study further supports the extension of the known range

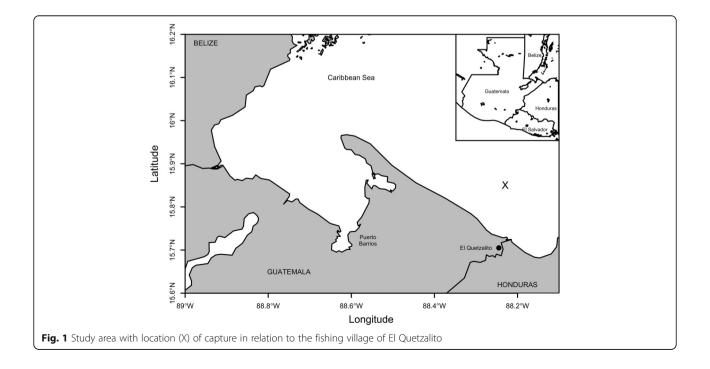
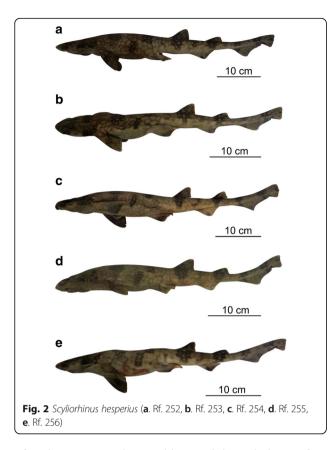


Table 1 Morphometric measurements (mm) of individuals of five male specimens of Scyliorhinus hesperius

Measurements	Rf. 252	Rf. 253	Rf. 254	Rf. 255	Rf. 256
Total length (mm)	510.0	455.0	429.0	435.0	420.0
Fork length	440.0	401.0	381.0	390.4	370.0
Precaudal fin length	400.0	358.0	335.0	345.5	330.0
Pre-second dorsal-fin length	350.0	315.0	293.3	303.1	272.2
Pre-first dorsal-fin length	247.6	235.2	220.3	234.9	204.7
Head length	98.1	93.8	91.8	97.2	90.0
Prebranchial length	69.4	67.2	66.3	68.8	58.2
Prespiracular length	52.1	50.4	52.2	53.5	49.4
Preorbital length	28.8	26.9	26.4	27.3	26.4
Prepectoral-fin length	91.3	86.8	83.8	82.1	75.3
Prepelvic-fin length	205.2	186.1	178.8	189.7	175.2
Snout-vent length	221.2	200.3	190.9	204.8	197.9
Preanal-fin length	304.3	277.9	268.2	278.2	253.2
Interdorsal space	55.1	53.8	45.0	47.9	40.1
Dorsal caudal-fin space	30.4	23.6	23.0	22.0	20.0
Pectoral-fin pelvic-fin space	96.4	86.2	79.4	82.0	76.6
Pelvic-fin anal-fin space	70.6	64.2	58.0	62.1	52.7
Anal-fin caudal-fin space	48.3	39.5	45.5	39.3	43.0
Pelvic-fin caudal-fin space	155.5	139.1	130.4	132.0	127.0
Vent caudal-fin length	184.9	167.8	168.6	159.8	164.0
Prenarial length	14.5	12.4	13.4	12.5	12.3
Preoral length	22.2	20.9	18.9	20.7	18.2
Eye length	20.3	18.2	18.4	20.0	19.9
Eye height	6.7	5.1	5.1	5.2	4.2
Intergill length	30.3	27.7	23.4	28.4	23.8
First gill slit height	7.5	6.5	5.2	5.8	4.6
Second gill slit height	6.5	5.3	4.5	4.8	3.8
Third gill slit height	8.7	7.9	5.1	5.9	5.2
Fourth gill slit height	6.3	5.7	3.8	5.3	4.5
Fifth gill slit height	4.9	4.5	3.7	5.1	4.5
First dorsal-fin length	45.7	39.8	39.9	38.4	34.3
First dorsal-fin anterior margin	46.8	42.5	44.1	41.8	36.4
First dorsal-fin base	31.3	27.4	29.2	28.2	25.4
First dorsal-fin height	34.4	24.2	21.2	23.7	23.5
First dorsal-fin inner margin	14.7	14.2	14.2	12.3	9.8
First dorsal-fin posterior margin	29.2	22.7	22.1	22.2	9.8 19.8
Second dorsal-fin length Second dorsal-fin anterior margin	41.2	31.8	35.4	32.2	30.6
	31.5	29.6	32.3	31.2	28.4
Second dorsal-fin base	25.5	20.7	23.1	21.0	21.3
Second dorsal-fin height	21.6	15.5	13.0	14.9	14.8
Second dorsal-fin inner margin	14.1	12.2	10.6	10.6	10.1
Second dorsal-fin posterior margin	16.3	16.0	14.5	14.3	11.0
Pectoral-fin anterior margin	67.3	61.2	60.1	59.1	54.0
Pectoral-fin base	57.0	52.0	51.3	49.7	46.7
Pectoral-fin inner margin	29.0	26.6	24.8	26.1	23.5
Pectoral-fin posterior margin	48.2	45.7	41.5	42.9	38.5

Table 1 Morphometric measurements	(mm) of individuals of five male sr	pecimens of Scyliorhinus hesperius (Continued)
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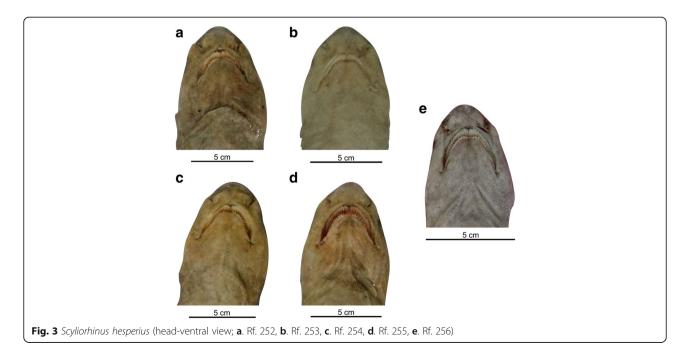
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Pelvic-fin nor margin (length) 27.9 23.4 22.7 0.8 Pelvic-fin posterior margin (length) 39.4 35.9 34.5 35.2 Anal-fin length 33.5 49.9 45.8 47.5 Anal-fin netrior margin 34.4 34.7 36.0 36.0 Anal-fin base 41.7 37.5 35.6 34.9 Anal-fin beight 19.6 16.4 16.8 14.5 Anal-fin beight 19.6 16.4 16.8 14.5 Anal-fin beight 19.6 16.4 16.8 14.5 Anal-fin beight 19.6 25.7 23.1 24.5 Head height 35.5 33.7 34.0 25.8 Tunk height 14.7 25.8 28.9 26.4 Tail height 15.5 16.8 14.3 13.4 Mouth length 16.9 15.2 14.7 3.0 23 Caudal-fin poduncle height 20 5.4 3.8 2.9 2.4 2.4	Pelvic-fin base	31.1	30.7	28.8	26.8	25.8
Pelvic-fin posterior margin (ength)9495945952Anal-fin length535499458475Anal-fin length344347360360Anal-fin base417375356349Anal-fin beight196164168145Anal-fin height125133125120Anal-fin posterior margin280257231245Head height335337340298Trunk height411300413430Abdomen height314258289264Tail height35730031.5273Caudal-fin peduncle height15516814.3134Mouth width20254282263Upper labil-furrow length60505161Nostril width999890103Internarial space80797879Internarial space40414409Ipper labil-furrow length3528429Spiracle space40414241Head width406434414409Intervoltal space6052144438Adomen width456434414409Adomen width456434414409Intervoltal space63152144138Adomen width456434414409Adomen width	Pelvic-fin height	29.0	19.8	28.2	18.7	18.1
Anal-fin anterior margin 53.5 49.9 45.8 47.5 Anal-fin anterior margin 34.4 34.7 36.0 36.0 Anal-fin base 41.7 37.5 35.6 34.9 Anal-fin breight 19.6 16.4 16.8 14.5 Anal-fin inner margin 12.5 14.3 12.5 12.0 Anal-fin posterior margin 28.0 25.7 23.1 245 Head height 33.5 33.7 34.0 29.8 Trunk height 47.1 39.0 41.3 43.0 Abdomen height 31.4 25.8 28.9 26.4 Tail height 35.7 30.0 31.5 27.3 Caudal-fin peduncle height 15.5 16.8 14.3 13.4 Mouth width 20.0 25.4 28.2 26.8 Upper labial-furrow length 6.0 5.0 5.1 6.1 Nostril width 9.9 9.8 9.0 10.3 Interroital space <td< td=""><td>Pelvic-fin inner margin (length)</td><td>27.9</td><td>23.4</td><td>22.7</td><td>20.8</td><td>20.8</td></td<>	Pelvic-fin inner margin (length)	27.9	23.4	22.7	20.8	20.8
Anal-fin anterior margin344347360360Anal-fin base41.737.535.634.9Anal-fin height19.616.416.814.5Anal-fin inner margin12.514.312.520.0Anal-fin posterior margin28.025.723.129.8Head height33.533.740.029.8Trunk height31.429.041.320.0Abdome height5.75.828.926.4Cadal-fin peduncle height5.516.814.313.4Cadal-fin peduncle height16.915.615.214.7Motth Height20.025.428.226.8Notth Width20.025.420.023.1Lower labial-furrow length60505.16.1Nostril width9.99.89.00.3Internal space807.92.22.3Spiracle length3.54.44.42.9Lead width404.14.14.1Head width4.64.44.14.1Lead width4.64.44.14.1Lead width4.64.14.14.1Link width6.54.44.14.1Link width4.64.14.14.1Link width4.64.14.14.1Link width4.64.14.14.1Link width6.54.14.1 <td< td=""><td>Pelvic-fin posterior margin (length)</td><td>39.4</td><td>35.9</td><td>34.5</td><td>35.2</td><td>35.5</td></td<>	Pelvic-fin posterior margin (length)	39.4	35.9	34.5	35.2	35.5
Anal-fin anterior margin344347360360Anal-fin base41.737.535.634.9Anal-fin height19.616.416.814.5Anal-fin inner margin12.514.312.520.0Anal-fin posterior margin28.025.723.129.8Head height33.533.740.029.8Trunk height31.429.041.320.0Abdome height5.75.828.926.4Cadal-fin peduncle height5.516.814.313.4Cadal-fin peduncle height16.915.615.214.7Motth Height20.025.428.226.8Notth Width20.025.420.023.1Lower labial-furrow length60505.16.1Nostril width9.99.89.00.3Internal space807.92.22.3Spiracle length3.54.44.42.9Lead width404.14.14.1Head width4.64.44.14.1Lead width4.64.44.14.1Lead width4.64.14.14.1Link width6.54.44.14.1Link width4.64.14.14.1Link width4.64.14.14.1Link width4.64.14.14.1Link width6.54.14.1 <td< td=""><td>Anal-fin length</td><td>53.5</td><td>49.9</td><td>45.8</td><td>47.5</td><td>42.0</td></td<>	Anal-fin length	53.5	49.9	45.8	47.5	42.0
Ahal-fin height196164168145Anal-fin inner margin125143125120Anal-fin posterior margin28025.723.1245Head height33.537.740.029.8Trunk height47.130.041.343.0Abdomen height15.425.828.926.4Tail height5.730.031.527.3Caudal-fin peduncle height15.916.814.313.4Mouth length15.915.615.214.7Mouth width20.025.428.226.8Upper labial-furrow length20.050.05.16.1Nostril width9.98.49.010.3Internaria space8.02.82.92.2Spiracle length5.52.82.92.2Experience space4.04.12.22.6Muthvidth9.92.62.92.2Spiracle space4.04.14.14.1Head width4.54.44.44.1Head width4.54.44.44.1Head width1.61.51.44.3Interwidth6.51.61.44.3Interwidth6.51.61.41.3Interwidth6.51.61.41.3Interwidth1.61.51.41.3Interwidth6.51.61.41.3I		34.4	34.7	36.0	36.0	28.8
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Anal-fin inner margin125143125120Anal-fin posterior margin280257231245Head height335337440298Trunk height47.139041.3430Abdomen height14.425.8289264Tail height55.730.031.527.3Caudal-fin peduncle height15.516.814.313.4Mouth hength6.915.615.214.7Mouth width2025.428.226.8Upper labial-furrow length2.2303.02.3Internarial space807.97.87.9Interorbital space2.926.628.82.9Spiracle length4.04.14.14.1Head width4.964.44.14.1Head width1.9615.21.41.3Turk width2.92.62.82.92.2Spiracle length6.05.16.11.51.1Head width4.04.14.14.14.1Head width4.04.14.14.14.1Turk width1.61.51.41.81.3Tail width2.62.02.02.12.12.1Abdomen width2.62.02.02.12.12.1Turk width2.62.02.02.12.12.1 <trr>Turk width2.62</trr>	Anal-fin height	19.6	16.4	16.8	14.5	15.3
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Caudal-fin peduncle width 8.0 7.7 9.0 6.1						21.4
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Clasper inner length 37.5 33.7 35.0 31.4 Clasper base width 4.9 4.8 4.0 4.3						34.1 3.7



of *S. hesperius* in the Caribbean while including a first record for the species in Guatemala. Although the whitesaddled catshark has been recorded in the Western Central Atlantic in Honduras, Panamá and Colombia (Kyne et al. 2012), Ross and Quattrini's regional study

(2009) and this study suggest that the species' range may be more extensive than originally thought.

Knowledge of S. hesperius basic biology is limited. By comparison, considerable literature exists on S. canicula, a relatively abundant catshark species distributed throughout the Eastern North Atlantic and Mediterranean (Sims et al. 2001; Rodríguez-Cabello et al. 2007; Ebert et al. 2015). In south-west Ireland, an acoustic tagging study of four S. canicula revealed that two tagged females exhibited alternative behavioural strategies compared to the tagged two males, a difference resulting in spatial segregation of the sexes by habitat (Sims et al. 2001). Sims (2003) further reports that sexual segregation in this species occurs primarily as a consequence of male avoidance by females. In the western Mediterranean, segregation between juveniles and adults occurs for S. canicula where juveniles are found in depths greater than 100 m while adults almost exclusively occupy shallower depths Massutí and Moranta (2003). By comparison, in the Northern Aegean Sea, the pattern of vertical distribution of S. canicula showed that individuals did not exhibit any sexual segregation and juveniles and adults were found together in the bathyal zone, often located swimming near the benthos D'Onghia et al. (1995). Considering the range of behavioral strategies demonstrated by members of the genus Scyliorhinus, it is currently unclear if S. hesperius exhibits sexual and size segregation in the Caribbean. This study's record of male-only specimens raises the question if S. hesperius segregate by sex in waters 200 m deep in Guatemala's Caribbean waters. According to artisanal fishers interviewed, this species is rarely captured in



the fishery and never utilized due to the species' small size. These results suggests a further need for fisheries-independent studies to elucidate habitat preferences and distribution by sex and size of *S. hesperius*.

Conclusions

This paper provides noteworthy multiple firsts records of *S. hesperius* in Guatemalan waters, that represents a range extension in Central America and the Caribbean, the largest *S. hesperius* and the first mature males collected to date. Future studies are needed to identify the behavior and ecology of *S. hesperius* in the Caribbean in light of increasing fisheries effort.

Abbreviations

Km: Kilometer; M: Meter; Mm: Millimeter; TL: Total length

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Availability of data and materials

The specimens are available at the Laboratory of Biological Science and Oceanography, Centro de Estudios del Mar y Acuicultura (CEMA) of the Universidad San Carlos de Guatemala (USAC). The specimens are part of the collection registered to the Consejo Nacional de Áreas Protegidas (CONAP) under the reference numbers (Rf) 252–255. Additionally, photographs and dataset supporting the conclusions of this article are included.

Authors' contributions

AH and FP participated in the identification of the species, recorded the morphometric data of all specimens, and contributed to draft the manuscript. RTG contributed to draft the manuscript. All authors read and approved the final manuscript.

Competing interest

The authors declare that they have no competing interests.

Consent for publication

Not applicable

Ethics approval

The work was carried out under permit N°00,263-B, issued by the Consejo Nacional de Áreas Protegidas (CONAP), Guatemala.

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