

Short Communication

First record of the kitefin shark, *Dalatias licha* (Bonnaterre, 1788) from the Guatemalan Caribbean Sea

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ABSTRACT. Deepwater fishing operations occur close to the shore of the Guatemalan Caribbean. In a study to characterize the deepwater species present in the fishing area, the incidental catch of a kitefin shark, *Dalatias licha*, was recorded at a depth of ~284-334 m, ca. 11 km northeast of El Quetzalito fishing village. The adult female with a total length of 1420 mm had morphological characteristics consistent with *D. licha*, which was confirmed by molecular methods. First record of *D. licha* in the western Caribbean region, a species cataloged at risk by the IUCN red list. With this record, the number of shark species known in the Guatemalan Caribbean increases to 25.

Keywords: Chondrichthyes; Dalatiidae; *Dalatias licha*; by-catch; deep-water; Cayman Trench; Guatemala

The kitefin shark (*Dalatias licha*) (Bonnaterre, 1788) is a medium-sized (1820 mm maximum Total length, TL) deepwater, mesopelagic to benthic species encountered in warm, temperate, and tropical waters of the outer continental and insular shelves and slopes from 37 to 1800 m depth (Compagno 1984). However, it is most commonly recorded at depths between 300 to 1000 m (Castro 2011). The species occurs circumglobally with patchy distributions in the Atlantic and Indo-West Central Pacific oceans (Finucci et al. 2018), reportedly forming distinct regional subpopulations (Compagno & Cook 2005).

D. licha is a target and incidental catch across its range for the flesh, squalene-rich liver oil, fishmeal, and leather (Compagno 2016). However, life history characteristics of *D. licha*, such as slow growth and relatively large size at maturity of 1000-1200 mm TL

(Walls & Guallart 2015, Ebert et al. 2021), render it particularly vulnerable to exploitation and rapid depletion, as evidenced by declines in targeted fisheries in Australia and the northeast Atlantic (Walls & Guallart 2015, Finucci et al. 2018). Due to significant population declines documented in regional subpopulations, the species was globally assessed as Vulnerable by the International Union for the Conservation of Nature Red List with an inferred global population decline of at least 30% (Finucci et al. 2018).

The recorded specimen of *D. licha* measured 1420 mm TL and weighed 13.6 kg. The shark was caught by an artisanal fishing vessel (7.62 m long and outboard motor) on January 10, 2023, using a longline (100 circle hooks #18, baited with tarpon and mullet) in a fishing area called "El Hoyo" at ~284-334 m depth. The area is located 11 km northeast of El Quetzalito, Guatemala, on the margin of the Cayman Trench.

The taxonomic identification of the specimen was done following Ebert et al. (2021). Eighty two morphometric measurements were taken (Table 1) following Compagno (1984) for its description. The caught individual had dark brown coloration, short nose, thick lips, large spiracles, no anal fin, and triangular lower teeth with serrations (Fig. 1). The specimen was deposited at the Centro de Estudios del Mar y Acuicultura (CEMA) collection of the Universidad de San Carlos de Guatemala (USAC) under reference number 166.

Molecular analysis was conducted to confirm species identification. Tissue samples were collected and preserved in 95% ethanol. Genomic DNA was extracted for the samples using the manufacturer's tissue protocol for the Qiagen DNAeasy kit (Qiagen, Valencia, California). DNA barcoding to amplify the highly conserved mitochondrial Cytochrome oxidase I gene (COI) was used following the protocol outlined by Cardenosa et al. (2014). Partial COI sequences (~450-600 bp) were amplified using the universal primers FishCoxI F (5' TCWACCAACCACAAGAYATYGG CAC 3') and FishCoxI R (5' TARACTTCWGGGTG RCCRAAGAATCA 3') modified from Ward et al. (2005). The Polymerase chain reaction (PCR) profile was as follows: 94°C for 2 min followed by 35 cycles of 94°C for 30 s, 55°C for 45 s, and 72°C for 40 s, with a final extension of 72°C for 10 min. A no-template negative control was included to monitor for reagent contamination. PCR products were visualized on 2% agarose gel, purified using Exo-SAP, and sequenced on an ABI3730 DNA Analyzer (Thermo Fisher Scientific).

The sequences were cleaned and edited using Geneious 2023.2.1 (<http://www.geneious.com>). Trimmed sequences were used as query searches for BLAST of National Center for Biotechnology (NCBI) GenBank (<https://blast.ncbi.nlm.nih.gov/Blast.cgi>) and Barcode of Life Data Systems (<http://www.boldsystems.org>), assigning species identity with a >99% sequence similarity to *D. licha*. A fragment of 567 bp of the COI gene was obtained for the sample (E-value = 0.0). The sequence was submitted to GenBank under accession number OQ591896.

The literature has limited information about this species' regional distribution, fisheries, ecology, and biology from the western Atlantic. In the western Atlantic, the species was first reported in the Gulf of Maine, north Atlantic Ocean (Bigelow & Schroeder 1948), followed by Oregon in the northern Gulf of Mexico (Bigelow et al. 1955). Subsequently, there were photographic records in Bermuda and Grand Cayman

Table 1. Morphometric measurements of *Dalatias licha* from the Caribbean Sea of Guatemala.

Measurement	Measurements (mm)	% of total length
Total length	1420	
Precaudal length	1140	80.28
Pre-second dorsal length	975	68.66
Pre-first dorsal length	505	35.56
Head length	280	19.71
Prebranchial length	215	15.14
Prespiracular length	120	8.45
Preorbital length	90	6.33
Prepectoral length	280	19.71
Prepelvic length	835	58.80
Snout-vent length	920	64.78
Interdorsal space	340	23.94
Dorsal-caudal space	135	9.50
Pectoral-pelvic space	405	28.52
Pelvic-caudal space	170	11.97
Vent-caudal length	500	35.21
Prenarial length	35	2.46
Preoral length	62	4.36
Eye length	55	3.87
Eye height	25	1.76
Intergill length	70	4.92
First-gill slit height	30	2.11
Second-gill slit height	30	2.11
Third-gill slit height	32	2.25
Fourth-gill slit height	32	2.25
Fifth-gill slit height	37	2.60
Pectoral anterior margin	135	9.50
Pectoral radial length	155	10.91
Pectoral base	80	5.63
Pectoral inner margin	70	4.92
Pectoral posterior margin	90	6.33
Pectoral height	150	10.56
Pectoral length	125	8.80
Dorsal caudal margin	281	19.78
Preventral caudal margin	130	9.15
Upper postventral caudal margin	230	16.19
Subterminal caudal margin	40	2.81
Subterminal caudal width	60	4.22
Terminal caudal margin	62	4.36
Terminal caudal lobe	65	4.57
First dorsal length	140	9.85
First dorsal anterior margin	130	9.15
First dorsal base	68	4.78
First dorsal height	52	3.66
First dorsal inner margin	70	4.92
First dorsal posterior margin	60	4.22
Second dorsal length	150	10.56
Second dorsal anterior margin	125	8.80
Second dorsal base	90	6.33
Second dorsal height	80	5.63
Second dorsal inner margin	70	4.92
Second dorsal posterior margin	78	5.49
Pelvic length	190	13.38

Continuation

Measurement	Measurements (mm)	% of total length
Pelvic anterior margin	140	9.85
Pelvic base	130	9.15
Pelvic height	100	7.04
Pelvic inner margin length	82	5.77
Pelvic posterior margin length	135	9.50
Head height	130	9.15
Trunk height	170	11.97
Abdomen height	195	13.73
Tail height	80	5.63
Caudal peduncle height	45	3.16
First dorsal midpoint-pelvic origin	280	19.71
Pelvic midpoint-first dorsal insertion	350	24.64
Pelvic midpoint-second dorsal origin	20	1.40
Mouth length	60	4.22
Mouth width	105	7.39
Upper labial furrow length	20	1.40
Lower labial furrow length	25	1.76
Nostril width	15	1.05
Internarial space	40	2.81
Anterior nasal flap length	15	1.05
Interorbital space	70	4.92
Spiracle length	20	1.40
Eye spiracle space	25	1.76
Head width	180	12.67
Trunk width	200	14.08
Abdomen width	200	14.08
Tail width	65	4.57
Caudal peduncle width	30	2.11
Girth	470	33.09

(Clark & Kristof 1990), and more recently, this species has been reported from the south Atlantic in Brazil (Soto & Mincarone 2001) and the southern Caribbean Sea in Venezuela (Tagliafico et al. 2007) (Table S1).

Before the present study, the specimen from Venezuela was the only documented record from the Caribbean Sea and the most recent record in the western Atlantic. The specimens recorded from the Caribbean were both mature females of the same size (1420 mm TL) over the length at maturity (1170-1200 mm TL) (Castro 2011, Ebert et al. 2021). Additionally, 14 specimens from the western Atlantic, mainly from the northern Gulf of Mexico and the Gulf of Maine, have been found in ichthyological collections (Table S2).

During the same fishing trip, two other deepwater species were incidentally caught along with *D. licha*, the dwarf sicklefin chimera *Neoharriotta carri* Bullis & Carpenter, 1966 (663-1090 mm TL) and the whitesaddled catshark *Scyliorhinus hesperius* Springer, 1966 (440-480 mm TL). Both species have been previously reported in the study area (Hacohen-Domené et al. 2016, Polanco-Vásquez et al. 2017) in



Figure 1. Adult female 1420 mm total length of *Dalatias licha*. a) lateral view, b) dorsal view, c) upper jaw teeth, d) lower jaw teeth.

addition to the sharpnose sevengill shark *Heptranchias perlo* (Bonnaterre, 1788), which was recently documented from the same fishing village (El Quetzalito) in the Guatemalan Caribbean (Hacohen-Domené et al. 2017).

The presence of the Cayman Trench near the Guatemalan Caribbean coast could explain the record of these deepwater shark species. The Cayman Trench is a narrow, deep linear basin immediately north of the Nicaraguan Rise, notable for being the site of contemporary sea-floor spreading. It extends from the Gulf of Honduras to southeastern Cuba. It has the deepest zones of the entire Caribbean (with regions deeper than 6000 m) and is bounded on the north and south sides by steep walls (Donnelly 1994).

With the record of *D. licha*, the number of shark species known in the Guatemalan Caribbean increased to 25. The few reports of this species in the Caribbean Sea reflect that current encounter rates in the fishery are low; however, the expansion of coastal fisheries to deeper waters presents an emerging threat to vulnerable deepwater assemblages of elasmobranchs as targeted and incidental catch (Baremore et al. 2021, Talwar et al. 2022).

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Conflict of interest statement: The authors declare no conflict of interest.

Ethics approval: All research activities were conducted under permit Bno.1048, issued by Consejo Nacional de Areas Protegidas (CONAP).

Data and materials availability: The specimen is available at the Centro de Estudios del Mar y Acuicultura (CEMA) collection of the Universidad de San Carlos de Guatemala (USAC) under reference N°166. Additional photographic material is available on request.

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SUPPLEMENTARY MATERIAL

Table S1. Records of *Dalatias licha* in the western Atlantic and the Caribbean Sea. TL: total length.

Sex (maturity stage)	Capture site	Ichthyological collection	TL (mm)	Depth of capture	Year of capture	Reference
Female (adult)	Georges Bank, Gulf of Maine, USA	Am. Mus. Nat. Hist., No. 14056	1470	83.5 m	1937	Bigelow & Schroeder (1948)
Female (juvenile)	Oregon, USA, northern Gulf of Mexico	U.S. Nat. Mus., N°157834	845	376 m	?	Bigelow et al. (1955)
Male (neonate)	Off State Rio Grande, southern Brazil	Museu Oceanográfico do Vale do Itajaí (MOVI 16034)	344	Surface waters, drift net	2000	Soto & Mincarone (2001)
Female (adult)	Northwest Isla Margarita, Venezuelan Caribbean	CI-ECAM 0135	1420	240 m	2006	Tagliafico et al. (2007)
Female (adult)	Guatemalan Caribbean	CEMA 166	1420	284-334	2023	Present study

Table S2. Records of *Dalatias licha* in the western Atlantic from ichthyological collections (<http://www.fishnet2.net/search.aspx>). GOM: Gulf of Mexico. MCZ: Museum of Comparative Zoology, Harvard; USNM: Smithsonian National Museum of Natural History; CNPE: Colección Nacional de Peces, Biology Institute of the National Autonomous University of Mexico.

Ichthyological collection	Catalog number	Country	Site of collection	Depth (m)	Year
MCZ	Ich S-1293	USA	Gulf of Maine		Mid-1800s
USNM	157834	USA	Pensacola, FL (GOM)	411	1955
USNM	157844	USA	Alabama (GOM)	366	1955
USNM	RAD100095	USA	Alabama (GOM)	366	1955
USNM	187625 (n = 2)	USA	Florida (Atlantic)		1958
USNM	220861	USA	Louisiana (GOM)	402	1962
USNM	206066	USA	Mississippi (GOM)	393-411	1962
USNM	188501	USA	Mississippi (GOM)	366-375	1962
CNPE	14609	Mexico	Southern GOM	698	2004
MCZ	Ich S-1310	USA	Gulf of Maine		
MCZ	Ich S-1306	USA	Gulf of Maine		
MCZ	Ich S-1305	USA	Gulf of Maine		
USNM	220739	USA	Florida (FL)		