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ORIGINAL ARTICLE

Checklist of marine elasmobranchs of Colombia

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Abstract

A review and update to the shark and ray species recorded for the marine waters of Colombia was carried out. A total of 206 species had been recorded in the literature, of which 138 species (76 sharks and 62 rays) could be confirmed from museum records, catches, photographs, and videos. No evidence was found for 25 species, but their distribution included neighboring countries, and they were therefore classified as possible based on distribution. Thirty-six species were classified as improbable based on distribution and seven more were considered as misidentifications. The inventory of confirmed species includes 57 genera (30 shark and 27 batoid genera) and 34 families (18 shark and 16 batoid families). There was notably an addition of 26 confirmed species since 2007 as well as numerous modifications to group systematics and taxonomy, especially for batoids. The total number of confirmed elasmobranchs represented 12.1% of species known worldwide, and could even reach 14.5%, indicating that Colombia has one of the richest cartilaginous fish faunas in Latin America, behind Mexico and Brazil. This demonstrates that although Colombia cannot be considered an elasmobranch biodiversity hotspot or site of elasmobranch endemism globally, it does have good representativity of these species´ biodiversity at the regional level, especially regarding amphi-American species.

Keywords: Biodiversity; sharks and batoids; species list; richness.

Introduction

Recent studies on shark and ray zoogeography in Colombia considered that the number of recorded species was high compared with the extension of the Colombian coasts, representing almost 15 % of worldwide richness (Navia *et al*., 2016). Despite this high representativity, since the first mention

of sharks in fish checklists of Colombia (Posada, 1909), few detailed studies have been carried out on the richness and distribution of these species in Colombia (García, 2017).

Numerous studies reporting first records of species or expansions of geographic range have been published in recent decades (e.g. Acero P & Franke, 1995; Caldas *et al*., 2004; Acero *et al*., 2007; Grijalba-Bendeck & Acevedo, 2009; Mejía-Falla & Navia, 2009; Anguila *et al*., 2016 a,b; Acero *et al*., 2018), however, detailed listings of this group are rather scarce. The first specific checklists of elasmobranchs in Colombia were carried out by Mercado (1990), who included 61 species, and Mantilla (1998), who included 127 species. The latter author also included freshwater stingrays. Mejía-Falla *et al*. (2007), based on these checklists, on bibliographic references, and on physical and visual evidence, found that of 176 recorded species, only 121 could be considered confirmed for marine and freshwater environments of Colombia. The last chondrichthyan identification guide of Colombia included a total of 124 marine and freshwater elasmobranch species (Mejía-Falla *et al*., 2011).

A subsequent listing (Álvarez-León *et al*., 2013) based only on bibliographic compilation, and therefore lacking the evidence supports of the occurrence of the species, reported a total of 204 species of sharks and batoids for Colombia. This value greatly overestimates the elasmobranch richness of the country and contributes to perpetuating errors in the Colombian chondrichthyan biodiversity by including species as the great white shark (*Carcharodon carcharias*), the common thresher shark (*Alopias vulpinus*), electric rays as *Discopyge tschudii* and *Narcine brasiliensis*, and even sawfishes such as *Pristis microdon*, among others.

Since the publications by Mejía-Falla *et al*. (2007, 2011), there have been significant additions, and taxonomic and systematic modifications to this group internationally (Naylor *et al*., 2012; Last *et al*., 2016a; Weigmann, 2016). In particular, there have been changes to the classification of batoids and of some amphi-American sharks into different families and genera, and even the "resurrection" of families and species (Castro, 2011; Carvalho *et al*., 2016 a,b; Last *et al*., 2016 b,c; White & Naylor, 2016; White & Last, 2016 a,b,c). There have also been increases to the richness (Acero-P *et al*., 2016) and to the distribution of sharks and rays in Colombia (Navia *et al*., 2016; García, 2017), leading to current listings being out of date in terms of their composition locally (Mejía-Falla *et al*., 2007, 2011) and globally (Last *et al*., 2016 a; Weigmann, 2016), even more so regarding their taxonomic classification and systematics.

The objective of the present study was to contribute to the update and consolidation of the marine cartilaginous fish checklist of Colombia, based on supporting evidence that would allow to confirm, question, or reject the presence of each analyzed species. Along with the updated checklist, annotations to modify the original lists were included as well as comments for species that present taxonomic or systematics problems.

Materials and methods

Construction and homogenization of cartilaginous fish databases

Based on checklists by Mejía-Falla *et al*. (2007, 2011) a baseline list of marine elasmobranch species of Colombia was created, to which newly available records were added (e.g. Gámez-Barrera *et al*., 2012; Acero-P *et al*., 2016, 2018; Anguila *et al*., 2016 a,b; García, 2017). Considering that the sole mention of a species in a document did not guarantee the presence of that species in the study area, a confirmation process for the presence of each species recorded in the initial list was performed. For this verification, the following activities were carried out:

1) A search of records of species in national and international ichthyological collections. Web pages were consulted, with an emphasis on spatial location data where each species was collected in order to validate its presence within the marine limits established for Colombian Pacific and Caribbean waters. For this study, it was assumed that a correct identification process had been undertaken for each of the recorded specimens in the ichthyological collections. However, when a species presented a record for Colombia but its natural distribution does not correspond to or close to Colombian waters, that record was considered a potential identification error.

2) The following national collections were consulted: INV-PEC: Marine Natural History Museum of Colombia (INVEMAR, Santa Marta), ICN-MHN: Natural Science Institute, Natural History Museum (Bogotá), IAvH: Ichthyological Collection of the Alexander von Humboldt Institute (Tunja), CIUA: Fish collection of the Universidad de Antioquia (Medellín), CICH-CHbCH: Hydrobiological Collection of Chocó, Universidad Tecnológica del Chocó (Quibdó), PNNG: Reference Marine Biological Collection of the Biological Station "Henry von Prahl" of the Gorgona Natural National Park (Gorgona Island), UNSSA: Universidad Nacional de Colombia in San Andrés (San Andrés). All the collections consulted, except UNSSA, are included in the National Registry of Biological Collections. Although the reference

collection of the Universidad del Valle (CIRUV) was taken into account for a previous checklist (Mejía-Falla *et al*. 2007), it could not be included in the present study by the curator's request, as a revision of all specimens was underway. However, this did not affect the results of the present study, as all species previously confirmed in that collection were also reported by other museums, or there were records of capture or sightings.

The International collections reviewed were: AMNH: American Museum of Natural History (Washington), CAS: California Academy of Sciences (San Francisco), GCRL: Gulf Center Research Laboratory (Ocean Springs), FLMNH: Florida Museum of Natural History (Gainesville), NRM: Swedish Museum of Natural History (Sweden), USNM: Smithsonian National Museum of Natural History (Washington), SIO: Scripps Institution of Oceanography (San Diego, California), MNHN: Muséum National D'Histoire Naturelle (Paris), MCZ: Museum of Comparative Zoology, Harvard University (Cambridge), TCWC: Texas A&M University, Cooperative Wildlife Collection (Texas), CMNFI: Canadian Museum of Nature Fish Collection, FMNH: Field Museum of Natural History (Zoology) Fish Collection (Chicago), SAIAB: The South African Institute for Aquatic Biodiversity (South Africa), AfroBIS: Iziko South African Museum, Shark Collection (South Africa).

Identification catalogues that included geolocation information in the species records (Robertson & Allen 2015, Robertson *et al*., 2015) were also consulted, as well as the Global Biodiversity Information Facility (GBIF) and the Information System on Marine Biodiversity of Colombia (SIBM).

A search of capture records and *in situ* observations of individuals for different locations in Colombian Pacific and Caribbean waters. For these records several different information sources were consulted:

a) Documents related to checklists, updates or new records of fish species for Colombian Pacific and Caribbean waters or for particular areas within them, based on captures and/or visual observations, and for which there were descriptions and photographs that could validate the identification of the mentioned species.

b) Documents related to biological, ecological, and genetic studies of fish species within Colombian Pacific and Caribbean waters that included the diagnostic characteristics of the studied species and would therefore validate the presence of the species in the area.

c) Photographic catalog of the Squalus Foundation, created from different projects carried out in Colombian Pacific and Caribbean waters, which allowed to validate the identity of the species and to record locations of capture or observation.

Reports of catches and visual observations were obtained from institutions such as the Squalus Foundation (SF), Malpelo Foundation (MF), EAT-Fishing consulting (EAT), Universidad del Valle (UV), and Marine and Coastal Research Institute, INVEMAR (INV). Geolocated records that appeared in "Shorefishes of the Tropical Eastern Pacific: online information system" (Record TEP) and "Shorefishes of the Greater Caribbean: online information system" (Record SGC) were also included, as well as records in published documents that included photographs of the specimens and allowed to validate their identity. Based on evidence found (museums, catches, visual observations, or literature records), the species cited in the present study were grouped into three large categories: 1. Confirmed species: species that appeared in A) national and/or international museum records, or B) records of fisheries catches (catch) or *in situ* observations (visual record). 2. Unconfirmed species, possible based on distribution: Species that had been mentioned in different scientific documents, for which there was no physical evidence in any collection or geolocated visual confirmation. However, the known species distribution included the marine waters of neighboring countries, and therefore its presence in Colombian Pacific or Caribbean waters could not be rejected. 3. Unconfirmed species, improbable based on distribution: Species that, despite being included in marine fish checklists of Colombia or in regional identification guides, had distribution areas that did not encompass the study area, or even belonged to distant areas (e.g. Atlantic Ocean, Indo-Pacific, Indian Ocean, Mediterranean), to antitropical areas, or waters colder than those of the Eastern Pacific and Western Atlantic, which meant that their presence in Colombian Pacific or Caribbean waters would be improbable. The appearance of these species could have resulted from incorrect identifications or from being inadequately included based on previous checklists that did not verify sources. For unconfirmed species, two types of evidence were considered: C: regional or worldwide identification guides, and D: national references.

Since the taxonomy and systematics of this group has changed significantly over the past five years, it was necessary to update several orders, families, genera, and species. To do this were used as reference documents by Naylor *et al*. (2012), Carvalho *et al*. (2016 a,b), Last *et al*. (2016 a,b,c); White & Naylor (2016), White & Last (2016 a,b,c), and Weigmann (2016). This process allowed to present an updated checklist in terms of species nomenclature, and to avoid the duplication of species that could correspond to synonymies.

Results

A total of 138 marine elasmobranchs were confirmed in this study, 76 sharks and 62 rays (**Table 1**), adding 26 species to the checklist by Mejía-Falla *et al*. (2007). This number of confirmed species for Colombia represents 12.1 % of the world's total, as well as 30.5 % of genera, 58.6 % of families, and 80.0 % of orders (**Fig. 1**). A total of 90 species (57 sharks and 33 rays) were confirmed for the Colombian Caribbean and 67 species (36 sharks and 31 rays; Table 1) were confirmed for the Colombian Pacific. Consequently, the representation percentage of genera and families was greater for the Caribbean than for the Pacific, whereas there were 11 orders found in each region (Fig. 1).

Twenty-five species (13 sharks and 12 batoids) could not be confirmed but were considered possible according to available records and the known distribution of the species (**Table 2**), whereas 36 species (15 sharks and 21 batoids) were catalogued as improbable due to their known distribution (**Table 3**). Although seven species presented collection records in locations within Colombia's Economic Exclusive Zone, there was only one record for each, or they were far from the known distribution of those species; they were therefore assumed to be incorrect identifications (**Table 4**).

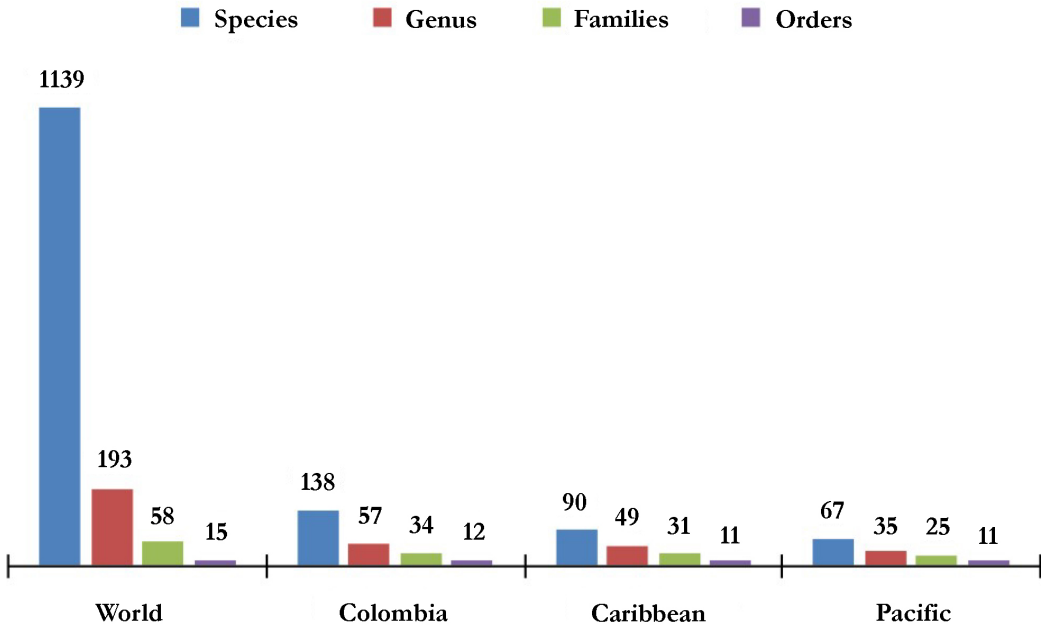

Figure 1. Numerical representation of the richness of orders, families, genera and species of elasmobranchs from Colombian Caribbean and Pacific, compared to the worldwide richness according to Weigmann (2016).

Table 1. Species of confirmed elasmobranchs for the Colombian Pacific (P) and Caribbean (C), with their corresponding category (A: recorded in national and/or international museums; B: recorded in fisheries [catch] or *in situ* observations [visual record]) and type of support (see methods for details). Species added with respect to Mejía-Falla *et al*. (2007, 2011) are shaded in light blue, and species that presented modification in their systematics or taxonomy are shaded in light green. (*) specimens are presented in the indicated collection but have not yet been assigned a catalog number. (**) specimens correspond to holotypes.

No	Species	Category	Support	Area
	Superorder Squalomorphii			
	Order Heterodontiformes			
	Family Heterodontidae			
1	*Heterodontus francisci* (Girard, 1855)	B	Catch SF	P
2	*Heterodontus mexicanus* Taylor & Castro-Aguirre, 1972	A, B	PNNG 1250; SIO 80-202, 80-203; AfrOBIS, Record TEP; Catch SF	P
	Order Orectolobiformes			
	Family Ginglymostomatidae			
3	*Ginglymostoma cirratum* (Bonnaterre, 1788)	A, B	IAvH-P 71; Record SGC; Visual record SF	C
4	*Ginglymostoma unami* del Moral-Flores *et al*., 2015	A, B	CICH-CHbCH 00216; Record TEP; Visual record FS; Visual record MF	P
	Family Rhincodontidae			
5	*Rhincodon typus* Smith, 1828	A, B	PNNG 1061; INV-PEC 88117; Record TEP; Record SGC; Visual record SF; Visual record INV	P-C
	Order Lamniformes			
	Family Alopiidae			
6	*Alopias pelagicus* Nakamura, 1935	B	Record TEP; Catch and visual record SF	P
7	*Alopias superciliosus* (Lowe, 1839)	B	Catch in Ospina (2001); Visual record in Nieto *et al.* (2003); Catch SF	P-C
	Family Lamnidae			
8	*Isurus oxyrinchus* Rafinesque, 1810	B	Visual record in Ballesteros & Castro (2006); Visual record SF	P-C
9	*Isurus paucus* Guitart Manday, 1966	B	Visual record in Gámez-Barrera *et al.* (2012)	C

	Family Mitsukurinidae			
10	*Mitsukurina owstoni* Jordan, 1898	B	Visual record in Grijalba-Bendeck & Acevedo (2009)	C
	Family Odontaspididae			
11	*Odontaspis ferox* (Risso, 1810)	B	Catch in Anguila *et al.* (2016b); Visual record SF	P-C
	Order Carcharhiniformes			
	Family Carcharhinidae			
12	*Carcharhinus acronotus* (Poey, 1860)	A	ICN-MHN 307	C
13	*Carcharhinus albimarginatus* (Rüppell, 1837)	A, B	INV-PEC 92093, 88200; PNNG 1016, 1261; Record TEP; Visual record SF	P
14	*Carcharhinus altimus* (Springer, 1950)	A, B	SIO 62-205; Record TEP	P-C
15	*Carcharhinus brachyurus* (Günther, 1870)	A	USNM 232768	P
16	*Carcharhinus cerdale* Gilbert, 1898	A, B	FMNH 59346; CAS 56615; USNM 206825, 221211, 221214, 221227, 221211; Record TEP; Catch SF	P
17	*Carcharhinus falciformis* (Müller & Henle, 1839)	A, B	INV-PEC 7147, 8202; Record TEP; Visual record SF	P-C
18	*Carcharhinus galapagensis* (Snodgrass & Heller, 1905)	B	Record TEP; Visual record SF	P
19	*Carcharhinus leucas* (Valenciennes, 1839)	A, B	USNM 206995; CMNFI 1974-0095.1; Record TEP; Catch and visual record SF	P-C
20	*Carcharhinus limbatus* (Valenciennes, 1839)	A, B	INV-PEC 88108, 91102, 88130, 92048, 91099, 89037, 91109; PNNG 1264; Record TEP; Record SGC; Catch and visual record SF	P-C
21	*Carcharhinus longimanus* (Poey, 1861)	A, B	USNM 221232; CAS 66823, SAIAB 39375; MCZ 165837; Record TEP; Record SGC; Visual record SF	P-C
22	*Carcharhinus perezii* (Poey, 1876)	A, B	FLMNH 24416; Record SGC; Visual record SF	C
23	*Carcharhinus porosus* (Ranzani, 1839)	A, B	INV-PEC 1732; CIUA 7, 3350; Record SGC	C
24	*Galeocerdo cuvier* (Péron & Lesueur, 1822)	A, B	INV-PEC 91008; PNNG 1257; Record TEP; Record SGC; Catch and visual record SF	P-C

25	*Nasolamia velox* (Gilbert, 1898)	A, B	USNM 206824; INV-PEC 93001, 90075, 87071, 90109; PNNG 1266, 1269; Record TEP	P
26	*Negaprion brevirostris* (Poey, 1868)	B	Record TEP; Record SGC; Visual record SF	P-C
27	*Prionace glauca* (Linnaeus, 1758)	A, B	ICN-MHN-477; Catch and visual record SF	P-C
28	*Rhizoprionodon lalandii* (Valenciennes, 1839)	A, B	INV-PEC 5211; FLMNH 224380, 28004, USNM 221373; Record SGC	C
29	*Rhizoprionodon longurio* (Jordan & Gilbert, 1882)	A, B	INV-PEC 88005, 90071, 90147, 90149, 91010, 91032; PNNG 1265, 91032; USNM 206823; Record TEP; Catch SF	P
30	*Rhizoprionodon porosus* (Poey, 1861)	A, B	CIUA 9; FLMNH 28002, USNM 221208, 221242; Record SGC	C
31	*Triaenodon obesus* (Rüppell, 1837)	A, B	INV-PEC 87047, 87078; PNNG 1018; Record TEP; Visual record SF	P
	Family Scyliorhinidae			
32	*Apristurus canutus* Springer & Heemstra, 1979	A	USNM 221254	C
33	*Apristurus parvipinnis* Springer & Heemstra, 1979	A	USNM 201906, 221499, 268106; TCWC 33351.18	C
34	*Apristurus riveri* Bigelow & Schroeder, 1944	A	USNM 221534	C
35	*Cephalurus cephalus** (Gilbert, 1892)	A	INVPEC	C
36	*Galeus arae* (Nichols, 1927)	A	USNM 402345	C
37	*Galeus cadenati* Springer, 1966	A	USNM 221368	C
38	*Schroederichthys maculatus* Springer, 1966	A	USNM 221650	C
39	*Scyliorhinus boa* Goode & Bean, 1896	A	INV-PEC 4556, 2430; FLMNH 222965, 224213, 27979; USNM 221563, 221532	C
40	*Scyliorhinus haeckelii* (Miranda-Ribeiro, 1907)	B	Record SGC	C
41	*Scyliorhinus hesperius* Springer, 1966	A	FLMNH 27980, 223244; USNM 221654, 402344	C
42	*Scyliorhinus retifer* (Garman, 1881)	B	Record SGC	C

43	*Scyliorhinus torrei* Howell Rivero, 1936	A	USNM 221560	C
	Family Sphyrnidae			
44	*Sphyrna corona* Springer, 1940	A, B	USNM 206819, 206987, 222044, 222055; Record TEP; Catch SF	P
45	*Sphyrna lewini* (Griffith & Smith, 1834)	A, B	CICH-CHbCH 217; NRM 13052, Record TEP; Catch and visual record SF	P-C
46	*Sphyrna media* Springer, 1940	B	Record TEP; Catch and visual record SF;	P-C
47	*Sphyrna mokarran* (Rüppell, 1837)	B	Record TEP; Visual record SF	P-C
48	*Sphyrna tiburo* (Linnaeus, 1758)	A, B	INV-PEC 3668, 6151; IAvH-P 64; USNM 222050, 222051, 222035, 94754; Catch and visual record SF	P-C
49	*Sphyrna tudes* (Valenciennes, 1822)	A, B	INV-PEC 7058; Record SGC	C
50	*Sphyrna zygaena* (Linnaeus, 1758)	B	Record TEP	P
	Family Triakidae			
51	*Mustelus canis* (Mitchill, 1815)	A	UNSSA*	C
52	*Mustelus dorsalis* Gill, 1864	B	Record TEP	P
53	*Mustelus henlei* (Gill, 1863)	A, B	INV-PEC 90121, 90129, 91067, 90113, 92200, 91070, 90138, 92040, 91128, 91078, 91071, 91022, 92042; PNNG 681, 682, 704, 713, 988, 1005, 1034, 1040, 1071, 1080, 1249, 1253, 1383; Record TEP; Catch SF	P
54	*Mustelus higmani* Springer & Lowe, 1963	A	FLMNH 28000	C
55	*Mustelus lunulatus* Jordan & Gilbert, 1882	A, B	INV-PEC 92029, 90123, 91096, 92047; PNNG 963, 1259, 1270, 1275; USNM 206820, 206821, 206822; Record TEP; Catch SF	P
56	*Mustelus minicanis* Heemstra, 1997	A	USNM 207962, 208016	C
57	*Mustelus norrisi* Springer, 1939	A	FLMNH 101345; USNM 201920	C
	Order Hexanchiformes			
	Family Hexanchidae			
58	*Heptranchias perlo* (Bonnaterre, 1788)	A, B	UNSSA*, Catch in Anguila *et al.* (2016a)	C

59	*Hexanchus griseus* (Bonnaterre, 1788)	B	Catch in Anguila *et al.* (2016b)	P-C
60	*Hexanchus nakamurai* Teng, 1962	A	UNSSA*	C
61	*Notorynchus cepedianus* (Péron, 1807)	A, B	INV-PEC 90151, 88075; PNNG 1262, 1263; AfrOBIS; Record TEP	P
	Order Echinorhiniformes			
	Family Echinorhinidae			
62	*Echinorhinus brucus* (Bonnaterre, 1788)	B	Catch Anguila *et al.* (2016b)	C
	Order Squaliformes			
	Family Centrophoridae			
63	*Centrophorus granulosus* (Bloch & Schneider, 1801)	A	INV-PEC 2281; USNM 205781	C
	Family Etmopteridae			
64	*Centroscyllium nigrum* Garman, 1899	B	Visual record in Rubio *et al.* (2005)	P
65	*Etmopterus bullisi* Bigelow & Schroeder, 1957	A	USNM 220229; AfrOBIS-SAMS-SHARKS-003686	C
66	*Etmopterus carteri* Springer & Burgess, 1985	A	USNM 206090**, 206091, 206092; FLMNH 40691	C
67	*Etmopterus gracilispinis* Krefft, 1968	A	FLMNH 27977	C
68	*Etmopterus hillianus* (Poey, 1861)	A	TCWC 7360.06	C
69	*Etmopterus perryi* Springer & Burgess, 1985	A	INV-PEC 2435-37, USNM 206093**, 206094, 206095, 202620, 206221; FLMNH 27973, 40692, 40693	C
70	*Etmopterus robinsi* Schofield & Burgess, 1997	A	FLMNH 27960	C
71	*Etmopterus schultzi* Bigelow, Schroeder & Springer, 1953	A	INV-PEC 2438-43, 8266, 8267; FLMNH 27975, 27978; USNM 220394, 220425, 220443, 268110, 268113; TCWC 6511.02, 3789.14	C
72	*Etmopterus virens* Bigelow, Schroeder & Springer, 1953	A	FLMNH 27974, 27976; USNM 220450, 220448, 220454, 220474, 220484	C
	Family Somniosidae			
73	*Somniosus* sp. Lesueur, 1818	A	Visual record in Acero-P *et al.*, 2018	C

	Family Squalidae			
74	*Squalus cubensis* Howell Rivero, 1936	A	INV-PEC 717, 2356; USNM 220584, 220603	C
	Order Squatiniformes			
	Family Squatinidae			
75	*Squatina armata* (Philippi, 1887)	A, B	PNNG 1256; Catch SF	P
76	*Squatina david* Acero P., Tavera, Anguila & Hernández, 2016	A	INV-PEC 8250, 8252, 2186, 3988, 4117	C
	Superorder Batoidei			
	Order Torpediniformes			
	Family Narcinidae			
1	*Diplobatis colombiensis* Fechhelm & McEachran, 1984	A	USNM 232494**, 232929, 226773	C
2	*Diplobatis guamachensis* Martin-Salazar, 1957	A	INV-PEC 1934, 4435, 4434, 3928, 3929, 4106, 6233, 6234, 6235; FLMNH 29870, 29871, 29872, 29876, 29880, 29888, 29889, 29890, 29891, 110043	C
3	*Diplobatis ommata* (Jordan & Gilbert, 1890)	B	Record TEP	P
4	*Diplobatis picta* Palmer, 1950	A	USNM 222449; FLMNH 29869, 29871, 29878, 29877, 29879, 29891, 176815, 222289, 222337, 226509	C
5	*Narcine bancroftii* (Griffith & Smith, 1834)	A, B	INV-PEC 2124, 2224, 5201-03; ICN-MHN 1372; FLMNH 228854; USNM 00222463, 00222496; Visual record SF	C
6	*Narcine entemedor* Jordan & Starks, 1895	A, B	INV-PEC 6778; CAS 58354; USNM 206986, 206997, 222466; Record TEP; Catch and visual record SF	P
7	*Narcine leoparda* Carvalho, 2001	A, B	INV-PEC 6731; USNM 222198, 222199, 222200, 222498, 222500, 235919; Record TEP; Catch and visual record SF	P
8	*Narcine vermiculata* Breder, 1928	A	GCRL 5145	P
	Family Torpedinidae			
9	*Tetronarce nobiliana* (Bonaparte, 1835)	A	INV-PEC 2445; USNM 222488	C

10	*Tetronarce tremens* (de Buen, 1959)	A	INV-PEC sin número	P
11	*Torpedo andersoni* Bullis, 1962	B	Visual record SF	C
	Order Rhinopristiformes			
	Family Pristidae			
12	*Pristis pristis* (Linnaeus, 1758)	B	Saw records in Gómez-Rodríguez *et al.* (2014); Record TEP; Catch and visual record SF	P-C
13	*Pristis pectinata* Latham, 1794	B	Saw records in Gómez-Rodríguez *et al.* (2014)	C
	Family Rhinobatidae			
14	*Pseudobatos glaucostigma* (Jordan & Gilbert, 1883)	B	Record TEP	P
15	*Pseudobatos leucorhynchus* (Günther, 1866)	A, B	INV-PEC 4972; USNM 206816, 206817, 206818; Record TEP; Catch and visual record SF	P
16	*Pseudobatos percellens* (Walbaum, 1792)	A	ICN-MHN 3769; INV-PEC 3963; IAvH-P 131; FLMNH 37005; USNM 222085, 222078	C
17	*Pseudobatos planiceps* (Garman, 1880)	A, B	TCWC 12113.02; Record TEP	P
18	*Pseudobatos prahli* (Acero P. & Franke, 1995)	A, B	ICN-MHN 4049; Record TEP; Catch and visual record SF	P
	Family Trygonorrhinidae			
19	*Zapteryx xyster* Jordan & Evermann, 1896	A, B	PNNG 1258, 1260; USNM 206992, 222091, 222100; Record TEP; Catch and visual record SF	P
	Order Rajiformes			
	Family Rajidae			
20	*Breviraja nigriventralis* McEachran & Matheson, 1985	A	INV-PEC 2451-53, 8274; FLMNH 29854; MCZ 164855, 51809, 51019; TCWC 6511.26	C
21	*Breviraja spinosa* Bigelow & Schroeder, 1950	A	TCWC 2807.01; MCZ 59234	C
22	*Dactylobatus clarkii* (Bigelow & Schroeder, 1958)	A	INV-PEC 2454-55, USNM 222213; MCZ 51069, 51810, 48999	C
23	*Dipturus bullisi* (Bigelow & Schroeder, 1962)	A	INV-PEC 2456, 3277-78; FLMNH 29860; MCZ 59236	C

24	*Dipturus garricki* (Bigelow & Schroeder, 1958)	A	INV-PEC 2457, FLMNH 123764	C
25	*Dipturus teevani* (Bigelow & Schroeder, 1951)	A	FLMNH 29856	C
26	*Rostroraja cervigoni* (Bigelow & Schroeder, 1964)	A	INV-PEC 2184; MCZ 51037, 51053	C
27	*Rostroraja equatorialis* (Jordan & Bollman, 1890)	A	INV-PEC 4971, USNM 222220, 222215; TCWC 6531.01, 15483.01	P
28	*Rostroraja velezi* (Chirichigno, 1973)	A, B	INV-PEC 88033, 92094; PNNG 1268; Record TEP; Catch and visual record SF	P
29	*Rajella fuliginea* (Bigelow & Schroeder, 1954)	A	FLMNH 29858	C
30	*Rajella nigerrima* (de Buen, 1960)	A	TCWC 3885.01	P
	Family Gurgesiellidae			
31	*Fenestraja plutonia* (Garman, 1881)	A	TCWC 2572.01	C
32	*Fenestraja sinusmexicanus* (Bigelow & Schroeder, 1950)	A, B	TCWC 7360.23; MCZ 51068; Record SGC	C
33	*Gurgesiella atlantica* (Bigelow & Schroeder, 1962)	A	INV-PEC 1351, 2458-60, 8275, 8276; FLMNH 29859, 222933, 117467; USNM 222261, 222258; TWCW 7360.22, 2735.01; MCZ 51798, 51805, 164871	C
	Family Anacanthobatidae			
34	*Schroederobatis americana* (Bigelow & Schroeder, 1962)	A	INV-PEC 1350, 2447, 2446, 2448, 2449, 2450, 8273, 8268, 8269, 8270, 8271, 8272, 7913; FLMNH 29855, 29857, 117468; USNM 222143, 222146; MCZ 164854, 51815, 51807, 49003, 48995, 48993; TCWC 6511.27, 3353.05, 5682.01	C
35	*Springeria longirostris* (Bigelow & Schroeder, 1962)	A	TCWC 7360.20, 7374.04, 7374.03, 3789.18, 3789.25	C
	Family Cruriraji dae			
36	*Cruriraja poeyi* Bigelow & Schroeder, 1948	A	FLMNH 123765	C
37	*Cruriraja rugosa* Bigelow & Schroeder, 1958	A	FLMNH 29851, 222752; MCZ 164867	C
	Order Myliobatiformes			
	Family Dasyatidae			
38	*Hypanus americanus* (Hildebrand & Schroeder, 1928)	A	PEC1483; ICN-MHN 4003; FLMNH 10861, Visual record SF	C

39	*Hypanus dipterurus* (Jordan & Gilbert, 1880)	A, B	TCWC 13217.01; Record TEP; Catch and visual record SF	P
40	*Hypanus guttatus* (Bloch & Schneider, 1801)	A	INV-PEC 1733, 2334, 5443; IAVH-P 138; NRM 24275, 15806	C
41	*Hypanus longus* (Garman, 1880)	A, B	INV-PEC 91068, 91095, 91110; PNNG 1252, 1271; USNM 206990; Record TEP; Catch and visual record SF	P
42	*Pteroplatytrygon violacea* (Bonaparte, 1832)	B	Catch and visual record SF	P
	Family Gymnuridae			
43	*Gymnura crebripunctata* (Peters, 1869)	A	USNM 222595, 206993	P
44	*Gymnura marmorata* (Cooper, 1864)	B	Record TEP; Catch and visual record SF	P
	Family Mobulidae			
45	*Mobula birostris* (Walbaum, 1792)	B	Record TEP; Visual record SF	P-C
46	*Mobula munkiana* Notarbatolo-di Sciara, 1987	A, B	INV-PEC 89004; PNNG 1271; Record TEP	P
47	*Mobula thurstoni* (Lloyd, 1908)	A, B	PNNG 1267; Record TEP	P
	Family Aetobatidae			
48	*Aetobatus laticeps* (Gill, 1865)	B	Record TEP; Catch and visual record SF	P
49	*Aetobatus narinari* (Euphrasen, 1790)	A, B	ICN-MHN 1339, 3779; IAvH-P 132, 3067; Record SGC; Visual record SF	C
	Family Rhinopteridae			
50	*Rhinoptera bonasus* (Mitchill, 1815)	A	INV-PEC 1531; IAvH-P 125	C
51	*Rhinoptera brasiliensis* Müller, 1836	A	INV-PEC 615	C
52	*Rhinoptera steindachneri* Evermann & Jenkins, 1891	A, B	PNNG 1274; Record TEP; Catch and visual record SF	P
	Family Potamotrygonidae			
53	*Styracura pacifica* (Beebe & Tee-Van, 1941)	B	Visual record in Ross & Schäfer (2000)	P
54	*Styracura schmardae* (Werner, 1904)	A, B	INV-PEC 1734, IAvH-P 135; Visual record SF	C
	Family Urotrygonidae			
55	*Urobatis tumbesensis* (Chirichigno & McEachran, 1979)	B	Visual record in Mejía-Falla & Navia (2009)	P

56	*Urobatis halleri* (Cooper, 1863)	B	Record TEP; Visual record SF	P
57	*Urobatis jamaicensis* (Cuvier, 1816)	A	INV-PEC 1482, 4037, 4124, 3792; IAvH-P 101; GCRL15263	C
58	*Urotrygon aspidura* (Jordan & Gilbert, 1882)	A, B	USNM 222705; CIUA 4749, 4752, 4754; Record TEP; Catch SF	P
59	*Urotrygon chilensis* (Günther, 1872)	A, B	USNM 222628, 222638; Record TEP	P
60	*Urotrygon munda* Gill, 1863	A, B	USNM 206994; Record TEP	P
61	*Urotrygon rogersi* (Jordan & Starks, 1895)	A, B	INV-PEC 6715; CIUA 4748, 4750; Record TEP; Catch SF	P
62	*Urotrygon venezuelae* Schultz, 1949	A	ICN-MHN 11099; AMNH 55623, NRM 16282, GCRL 15264; TCWC 7057.01, 7058.02	C

Table 2. List of elasmobranch species not confirmed, but possible by distribution for the Colombian Pacific (P) or Caribbean (C). The type (C, D) and reference of support are indicated (see methods for details). Species with modifications in their systematics or taxonomy are shaded in light green.

No	Category	Support type	Reference	Area
	Superorder Squalomorphi			
	Order Lamniformes			
	Family Alopiidae			
1	*Alopias vulpinus* (Bonnaterre, 1788)	D	Álvarez-León *et al.*, 2013	P
	Familia Cetorhinidae			
2	*Cetorhinus maximus* (Gunnerus, 1765)	C	Skomal *et al.*, 2009	C
	Family Pseudocarchariidae			
3	*Pseudocarcharias kamoharai* (Matsubara, 1936)	C	Compagno *et al.*, 1995	P
	Order Carcharhiniformes			
	Family Carcharhinidae			
4	*Carcharhinus brevipinna* (Valenciennes, 1839)	C	Cervigón & Alcalá, 1999	C

5	*Carcharhinus obscurus* (Lesueur, 1818)	D	Martínez, 1978	C
6	*Carcharhinus plumbeus* (Nardo, 1827)	D	Dahl, 1964	C
	Family Scyliorhinidae			
7	*Apristurus nasutus* de Buen, 1959	D	Rubio, 1987	P
	Family Triakidae			
8	*Mustelus mento* Cope, 1877	D	Rubio, 1987	P
9	*Mustelus whitneyi* Chirichigno F, 1973	D	Rubio, 1987	P
10	*Triakis acutipinna* Kato, 1968	D	Rubio, 1987	P
	Order Echinorhiniformes			
	Family Echinorhinidae			
11	*Echinorhinus cookei* Pietschmann, 1928	D	Fernández, 1975	P
	Order Squaliformes			
	Family Dalatidae			
12	*Isistius brasiliensis* (Quoy & Gaimard, 1824)	D	García, 2017	C
	Family Oxynotidae			
13	*Oxynotus caribbaeus* Cervigón, 1961	D	Álvarez-León *et al.*, 2013	C
	Superorder Batoidei			
	Order Rajiformes			
	Family Arhynchobatidae			
1	*Bathyraja spinosissima* (Beebe & Tee-Van, 1941)	D	Rubio, 1987	P
	Family Rajidae			
2	*Dactylobatus armatus* Bean & Weed, 1909	C	McEachran & Carvalho, 2002	C
3	*Rajella purpuriventralis* (Bigelow & Schroeder, 1962)	D	Mejía-Falla *et al.*, 2007	C
	Order Myliobatiformes			
	Family Gymnuridae			
4	*Gymnura altavela* (Linnaeus, 1758)	D	Álvarez & Barreto, 1975	C

5	*Gymnura micrura* (Bloch & Schneider, 1801)	D	Mejía-Falla *et al.*, 2007	C
	Family Mobulidae			
6	*Mobula hypostoma* (Bancroft, 1831)	D	Dahl, 1958	C
7	*Mobula mobular* (Bonnaterre, 1788)	C	McEachran & Notarbatolo-di Sciara, 1995	P
8	*Mobula tarapacana* (Philippi, 1892)	C	McEachran & Notarbatolo-di Sciara, 1995	P
	Family Myliobatidae			
9	*Myliobatis goodei* Garman, 1885	D	Mantilla, 1998	P
10	*Myliobatis longirostris* (Applegate & Fitch, 1964)	D	Chirichigno, 2001	P
11	*Aetomylaeus asperrimus* (Gilbert, 1898)	D	Mantilla, 1998	P
	Family Urotrygonidae			
12	*Urotrygon reticulata* Miyake & McEachran, 1988	C	McEachran & Notarbatolo-di Sciara, 1995	P

Table 3. List of elasmobranch species cited in scientific documents but without physical or visual support, and considered unlikely for the Colombian Pacific (P) or Caribbean (C), given its known distribution. The type (C, D) and the reference of support are indicated. Species that presented modification in their systematics or taxonomy are shaded in light green.

No	Category	Support type	Reference	Known distribution
	Superorder Squalomorphi			
	Order Lamniformes			
	Family Odontaspididae			
1	*Carcharias taurus* Rafinesque, 1810	D	Dahl, 1964	Circumglobal in tropical through warm temperate seas (including Mediterranean Sea and Red Sea), but not eastern and central Pacific
	Family Lamnidae			
2	*Carcharodon carcharias* (Linnaeus, 1758)	D	Posada, 1909	Nearly circumglobal, mostly in cool to warm temperate seas (including Mediterranean Sea)

	Order Carcharhiniformes			
	Family Carcharhinidae			
3	*Isogomphodon oxyrhynchus* (Müller & Henle, 1839)	D	Álvarez-León *et al.*, 2013	Central Western Atlantic: southern Caribbean Sea to Brazil.
	Family Scyliorhinidae			
4	*Apristurus brunneus* (Gilbert, 1892)	D	Rubio, 1987	British Columbia to Mexico, possibly to Peru
5	*Cephaloscyllium ventriosum* (Garman, 1880)	D	Álvarez-León *et al.*, 2013	Eastern Pacific: Monterey Bay, California to southern Mexico; also Chile
6	*Galeus antillensis* Springer, 1979	D	Álvarez-León *et al.*, 2013	Western Atlantic
	Family Triakidae			
7	*Galeorhinus galeus* (Linnaeus, 1758)	D	Álvarez-León *et al.*, 2013	Temperate waters of Southern Hemisphere; North Atlantic (including Mediterranean Sea, western Baltic Sea, North Sea); North Pacific
8	*Mustelus californicus* Gill, 1864	D	Álvarez-León *et al.*, 2013	Northern California (U.S.A.) to Gulf of California and Mexico
9	*Triakis maculata* Kner & Steindachner, 1867	D	Álvarez-León *et al.*, 2013	Southeastern Pacific
	Order Squaliformes			
	Family Centrophoridae			
10	*Centrophorus tessellatus* Garman, 1906	C	Compagno, 2002	Indo-West Pacific: Maldives, southern Japan, Hawaiian Islands, possibly off North America.
11	*Centrophorus uyato* (Rafinesque, 1810)	D	Álvarez-León *et al.*, 2013	Atlantic, Indo-West Pacific
	Family Etmopteridae			
12	*Etmopterus granulosus* (Günther, 1880)	D	Rubio, 1987	Southeastern Pacific, southwestern Atlantic, New Zealand area; Indian Ocean doubtful
13	*Etmopterus pusillus* (Lowe, 1839)	D	García, 2017	Cosmopolitan, mostly in temperate seas (including Hawaiian Islands Chain)

	Family Squalidae			
14	*Squalus blainville* (Risso, 1827)	D	Álvarez-León *et al.*, 2013	Mediterranean Sea, Black Sea, North Atlantic; doubtful from other areas (e.g. Madagascar, Mascarenes, New Caledonia, Japan)
15	*Squalus mitsukurii* Jordan & Snyder, 1903	E	Compagno, 2002	Japan and in tropical through temperate seas
	Superorder Batoidei			
	Order Torpediniformes			
	Family Narcinidae			
1	*Discopyge tschudii* Heckel, 1846	D	Álvarez-León *et al.*, 2013	Southeastern Pacific, Southwestern Atlantic
	Order Rhinopristiformes			
	Family Platyrhinidae			
2	*Platyrhinoidis triseriata* (Jordan & Gilbert, 1880)	D	Álvarez-León *et al.*, 2013	Eastern Pacific: California to Mexico
	Family Trygonorrhinidae			
3	*Zapteryx brevirostris* (Müller & Henle, 1841)	D	Álvarez-León *et al.*, 2013	Southwestern Atlantic: Brazil to Argentina
4	*Zapteryx exasperata* (Jordan & Gilbert, 1880)	D	Rubio & Ruíz, 1993	Eastern Pacific: south California to Gulf of California, and Peru
	Order Rajiformes			
	Family Arhynchobatidae			
5	*Bathyraja aguja* (Kendall & Radcliffe, 1912)	D	Álvarez-León *et al.*, 2013	Southeastern Pacific: Peru
6	*Bathyraja richardsoni* (Garrick, 1961)	D	Álvarez-León *et al.*, 2013	North Atlantic and southeastern Pacific.
7	*Bathyraja spinosissima* (Beebe & Tee-Van, 1941)	D	Álvarez-León *et al.*, 2013	North Pacific: Sea of Okhotsk, Oregon (U.S.A.)
8	*Pseudoraja fischeri* Bigelow & Schroeder, 1954	D	Álvarez-León *et al.*, 2013	Western Atlantic
9	*Sympterygia brevicaudata* (Cope, 1877)	D	Rubio, 1987	Southeastern Pacific: Ecuador to Chile (if valid)

	Family Rajidae			
10	*Amblyraja hyperborea* (Collett, 1879)	C	McEachran & Dunn, 1998	Cosmopolitan, circumpolar, North Atlantic, western Arctic Ocean, and South Pacific (New Zealand and Tasmania
11	*Beringraja cortezensis* McEachran & Miyake, 1988	C	Robertson & Allen, 2015	Gulf of California.
12	*Breviraja colesi* Bigelow & Schroeder, 1948	D	Álvarez-León *et al.*, 2013	Western Atlantic: Florida (U.S.A.), Bahamas and Cuba
13	*Leucoraja garmani* (Whitley, 1939)	D	Álvarez-León *et al.*, 2013	Western Atlantic: Massachusetts to Florida (U.S.A.)
14	*Leucoraja lentiginosa* (Bigelow & Schroeder, 1962)	D	Álvarez-León *et al.*, 2013	Gulf of Mexico
	Family Gurgesiellidae			
15	*Fenestraja ishiyamai* (Bigelow & Schroeder, 1962)	D	Álvarez-León *et al.*, 2013	Western Atlantic
	Order Myliobatiformes			
	Family Dasyatidae			
16	*Fontitrygon geijskesi* (Boeseman, 1948)	D	Álvarez-León *et al.*, 2013	Western Central Atlantic: Suriname to northern Brazil
17	*Hypanus sabinus* (Lesueur, 1824)	D	Dahl, 1958	Western Atlantic, from North Carolina (U.S.A.) and northern and western Gulf of Mexico. ICN-MHN: 4025 is located in the Putumayo River and therefore it was considered an invalid record
18	*Hypanus say* (Lesueur, 1817)	D	Dahl, 1958	Western Atlantic: Massachusetts (U.S.A.) to Brazil
	Family Myliobatidae			
19	*Myliobatis freminvillei* Lesueur, 1824	D	Álvarez & Barreto, 1975	Western Atlantic: Massachusetts (U.S.A.) and Brazil to Argentina
	Family Urotrygonidae			
20	*Urotrygon microphthalmum* Delsman, 1941	D	Mejía-Falla *et al.*, 2007	Western Atlantic: Venezuela to northeastern Brazil
21	*Urotrygon nana* Miyake & McEachran, 1988	D	Tobón, 2001	Eastern Pacific: Mexico to Panama

Table 4. Species that although it has museum number, visual o catch record in Colombian waters, they are considered a bad identification.

No	Category	Support	Comments
	Superorder Squalomorphi		
	Order Heterodontiformes		
	Family Heterodontidae		
1	*Heterodontus quoyi* (Fréminville, 1840)	PNNG 680, 1250	These records were verified by the authors and belongs to *H. mexicanus*.
	Order Carcharhiniformes		
	Family Carcharhinidae		
2	*Carcharhinus signatus* (Poey, 1868)	Record SGC	
3	*Rhizoprionodon terraenovae* (Richardson, 1837)	FLMNH 222229	Western Atlantic: Canada to Yucatan, Mexico.
	Superorder Batoidei		
	Order Rhinopristiformes		
	Family Rhinobatidae		
1	*Pseudobatos lentiginosus* (Garman, 1880)	INV-PEC 8199	Western Atlantic: Southeast USA and coastal regions of the Gulf of Mexico from North Carolina to Yucatán.
	Order Rajiformes		
	Family Rajidae		
2	*Dipturus oregoni* (Bigelow & Schroeder, 1958)	García, 2017	Western Central Atlantic: apparently restricted to the Gulf of Mexico. *Capture record with coordinates in Colombia (R/V Oregon II, 1970) could correspond to a bad identification.*
	Order Myliobatiformes		
	Family Dasyatidae		
3	*Bathytoshia centroura* (Mitchill, 1815)	Catch Anguila *et al.* (2016b)	Western Atlantic: Georges Bank and Cape Cod south to Florida and in the northeastern Gulf of Mexico (USA), and in the Bahamas. South of Brazil, Uruguay and Argentina.
	Family Urotrygonidae		
4	*Urotrygon simulatrix* Miyake & McEachran, 1988	USNM 222562, 222636, 222642, 222640	Eastern central Pacific: known only from the Gulf of Panama, Panama.

This review allowed to update the taxonomy and systematics of the group. Modifications to the scientific name of two sharks and 20 rays and skates were identified, as well as changes to some batoid orders, families and genera with exclusive distribution in the American continent (Last *et al*., 2016 b,c). The most significant results for sharks were: 1) the division of *Ginglymostoma cirratum* into separate species, with *G. cirratum* for the Atlantic and Caribbean, whereas Pacific populations received the name *Ginglymostoma unami*. 2) The separation of *Carcharhinus porosus* as a species exclusively for the Caribbean and the resurrection of *C. cerdale* as the valid species for the Pacific. 3) The description of a new angel shark species (*Squatina david*) based on specimens from the Colombian Caribbean (holotype), and consequently, according to Vaz & Carvalho (2018), this species replaces *S. dumeril*; so that the specimens previously identified as *S. dumeril* possibly correspond to *S. david*. 4) The first record of the sleeper shark (*Somniosus* sp.) for deep waters of the southern Caribbean of Colombia; although it was not possible to confirm the species, the authors (Acero-P *et al*., 2018) remarked that it is highly possible that the specimen could be the Greenland shark, *S. microcephalus* (Bloch & Schneider, 1801).

The batoid group presented the greatest quantity of modifications over the past few years, such as: Changes to the genus of the species *Torpedo nobiliana* and *Torpedo tremens* that are now valid as *Tetronarce nobiliana* and *Tetronarce tremens* (Carvalho *et al*., 2016a). The union of the old orders *Rhinobatiformes* and *Pristiformes* into *Rhinopristiformes*, as well as the modification of the genus *Rhinobatos* into the genus *Pseudobatos* for guitarfish from the American continent (Last *et al*., 2016b). Within this same order, species from the genus *Zapteryx* were taken out of the *Rhinobatidae* Family and assigned to the *Trygonorrhinidae* Family (Last & Séret, 2016).

Within the Rajidae Family, the genus *Raja* was modified for neotropical species, and is now recognized as *Rostroraja* (Last *et al*., 2016c). The species name *Anacanthobatis americanus* was changed to *Schroederobatis americana* (Last *et al*., 2016c; Séret *et al*., 2016). Within the Dasyatidae Family, the genus name *Dasyatis* was changed to *Hypanus*, valid only for the rays of this family on the American continent (Last *et al*., 2016d).

The species *Manta birostris* was moved into the genus *Mobula* (White *et al*., 2018), whereas the *Aetobatus narinari* family name was changed; the family name Aetobatidae was revived, and the species was separated into different species for the Pacific (*Aetobatus laticeps*) and Atlantic (*Aetobatus narinari*) (Last *et al*., 2016). Another significant change occurred for the species *Himantura pacifica* and *H. schmardae*, which were moved from the family Dasyatidae into the family Potamotrygonidae,

and were also assigned a new genus and are now recognized as *Styracura pacifica* and *Styracura schmardae* (Carvalho *et al*., 2016b). Finally, *Urotrygon asterias*, *U. caudispinosus* and *U. serrula* are now synonymous with *U. munda* (Weigmann, 2016).

Conclusions

The 138 elasmobranch species confirmed for Colombia represented 12.1 % of the known worldwide elasmobranch richness (Weigmann, 2016); this means that Colombia is the third country in terms of elasmobranch diversity in Latin America, behind Mexico (214, del Moral-Flores *et al*., 2015) and Brazil (165, Rosa & Gadig, 2014), and before Argentina (105, PAN-Tiburones, 2009) and Chile (92, Lamilla & Bustamante, 2005). There were also 25 potential species records that were not confirmed for Colombia, which could increase richness to 163 species, representing 15.10 % of worldwide elasmobranch species richness.

Compared with neighboring and/or bordering countries, Colombia has more shark and ray species than Venezuela (74, Cervigón, 1999; Robertson *et al*., 2015), Ecuador (94, Martínez-Ortiz & García-Domingo, 2013), and Peru (115, Cornejo *et al*., 2015). However, it should be noted that the published checklists of Venezuela and Ecuador have not been updated.

Comparing basins, the 90 Caribbean elasmobranch species represented 86.5 % of the species reported for the Greater Caribbean coastal zone (Robertson *et al*., 2015) and 42.2 % of the species reported for the North West Atlantic (Weigmann, 2016), whereas representativeness was lower for the Pacific basin, with 58.2 % of the species reported by Robertson & Allen (2015) for the Tropical Eastern Pacific and 43.8 % of the species to the North Eastern Pacific (Weigmann, 2016). Shark and batoid richness for the Colombian Caribbean was greater than that of Venezuela and Panama (Robertson *et al*., 2015), whereas shark and batoid richness for the Pacific was lower than that reported by Martínez-Ortiz & García-Domingo (2013) for Ecuador (61 shark species and 43 batoid species), by Cornejo *et al*. (2015) for Peru (66 shark species and 43 batoids species) and by Espinoza *et al*. (2018) for Costa Rica (81 elasmobranch species). However, it should be noted that Peru and Ecuador are strongly influenced by fauna from temperate waters of the southern Pacific, which increases significantly their diversity, as they provide species from different biogeographic provinces. Elasmobranch richness for the tropical zone of the Pacific basin of Colombia was greater than that of Panama in both coasts and greater than those of Costa Rica in the Caribbean Sea (Robertson & Allen, 2015; Espinoza *et al*., 2018).

Despite the great species richness found in a regional context, Colombia was far below shark biodiversity hotspots, which have been identified in southeastern Japan, Taiwan, and Australia, with nearly 85 species per 1°x 1°cell. The elasmobranch endemism level was also very low in Colombian waters in comparison with endemism hotspots identified by Lucifora *et al*. (2011), which were also located in southern Japan, Taiwan, Australia, as well as southern Brazil and the southeastern United States.

Shark richness values for the Caribbean and Pacific of Colombia agreed to bimodal distribution patterns described by Lucifora *et al*. (2011), who suggested a greater number of species towards intermediate latitudes of the northern and southern hemispheres than towards the tropics. However, these authors reported species numbers below those found in this study for Colombian Caribbean and Pacific waters. This could be due to the low number of studies on richness carried out in Colombia that are available in scientific journals with large circulation, as most publications have been published in Spanish, resulting in information available at the national level not being visible to researchers from other countries.

This demonstrates that although Colombia cannot be considered an elasmobranch diversity or endemism hotspot globally, there is great biodiversity representation of these species regionally, especially of amphi-American species. This is particularly important as several areas with moderate shark richness have shown high functional richness, suggesting that these species play unique roles, that they are not very redundant and are therefore very important for maintaining the structure and function of marine ecosystems. In this regard, the Pacific and Caribbean coasts of Colombia are one of the 15 hotspots of irreplaceability of endemic threatened marine chondrichthyans identified by Dulvy *et al*. (2014). These authors identified these hotspots to guide conservation priorities given that they contain the most unique chondrichthyan biodiversity.

Therefore, detailed knowledge of the richness and distribution of sharks and rays is an important tool for planning diversity management and conservation measures, especially in this type of group that includes an important number of highly migratory species. Finally, if the 11 species of freshwater stingrays confirmed for Colombia (Lasso *et al*., 2016; Do Nascimiento *et al*., 2017) are added to marine elasmobranch species, total richness would be 174 species, representing 15.3% of worldwide richness, a value that confirms the importance of Colombia for the diversity of this taxonomic group.

Conflict of interest

The authors declare having no conflict of interest

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Lista de chequeo de elasmobranquios marinos de Colombia

Resumen. Se llevó a cabo una revisión y actualización de los registros de especies de tiburones y rayas de aguas marinas colombianas. En la literatura se había registrado un total de 206 especies, de las cuales 138 (76 tiburones y 62 rayas) se habian podido confirmar con registros de museo, capturas, fotografías y videos. No se encontró evidencia de 25 especies, pero su distibución incluye países vecinos, por lo que fueron clasificadas como "posible basada en la distribución". Treinta y seis especies se clasficaron como "improbable basada en la distribución" y siete más se consideraron identificaciones erróneas. El inventario de especies confirmadas incluye 57 géneros (30 tiburones y 27 géneros batoideos) y 34 familias (18 tiburones y 16 familias batoideas). De modo notable, hubo una adición de 26 especies confirmadas desde 2007, así como numerosas modificaciones de la sistemática y taxonomía del grupo, especialmente para batoideos. El número total de elasmobranquios confirmados representó el 12.1 % de las especies conocidas en el mundo, y podría aún alcanzar el 14.5 %, lo cual indica que Colombia tiene una de las faunas de peces cartilaginosos más ricas de Latinoamérica, después de México y Brasil. Esto demuestra que, aunque Colombia no puede ser considerada un punto caliente de biodiversidad de elasmobranquios o un sitio de endemismo de elasmobranquios a nivel global, sí tiene una buena representatividad de la biodiversidad de estas especies a nivel regional, especialmente respecto a especies anfi-americanas.

Palabras clave: biodiversidad; tiburones y batoideos; lista de especies; riqueza.

Lista de verificação de elasmobrânquios da Colômbia

Resumo Realizou-se uma revisão e atualização dos registros de espécies de tubarões e arraias de água marinha colombianas. Na literatura se encontrava registro de um total de 206 espécies, das quais 138 (76 tubarões e 62 arraias) foram possíveis de confirmação por meio de registros de museus, capturas, fotografias e vídeos. Não se encontrou evidencia de 25 espécies, mas suas distribuições incluem países vizinhos, sendo então classificadas como "possível com base na distribuição". Trinta e seis espécies se classificaram como "improváveis com base na distribuição" e outras sete se consideraram identificações errôneas. O inventário de espécies confirmadas inclui 57 gêneros (30 tubarões e 27 gêneros de batóides) e 34 famílias (18 tubarões e 16 famílias batóides). Notavelmente, houve uma adição de 26 espécies confirmadas desde 2007, assim como numerosas modificações da sistemática e taxonomia do grupo, especialmente para batóides. O número total de elasmobrânquios confirmados representou um 12.1 % das espécies conhecidas no mundo, e poderia ainda alcançar 14.5 %, o que indica que Colômbia tem uma das faunas mais rica da América Latina em peixes cartilaginosos, depois de México e Brasil. Isto mostra que Colômbia, ainda que possa não ser considerada um ponto de referência de biodiversidade de elasmobrânquios ou um local de endemismo de elasmobrânquios a nível global, possui uma boa representatividade da biodiversidade de estas espécies a nível regional, especialmente com respeito a espécies anfi-americanas.

Palavras-chave: biodiversidade; tubarões e batóides; lista de espécies; riqueza.

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