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ZOOLOGÍA

Checklist and new records of coastal-marine fishes of the Department of Atlántico (Colombian Caribbean)

Lista anotada y nuevos registros de los peces marino-costeros del departamento del Atlántico (Caribe colombiano)

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ABSTRACT

This first checklist of coastal marine fish inhabiting the Department of Atlántico (Colombian Caribbean) was compiled through an exhaustive review of published information, databases, other unpublished sources, and primary data. We recorded 272 fish species, of which twenty were first reported for this region. Carangidae, Lutjanidae, and Scombridae were the richest families, which together represent 14 % of the total number of species. According to the Red List of Marine Fishes of Colombia, 37 species show some degree of threat. Most species are demersal, associated with soft bottoms. However, a significant number of species were also found associated with hard substrates, suggesting that fish congregate around these less abundant substrates, as the coastline is mainly dominated by fine sediments. This study reveals that this region has higher fish richness than previously thought and highlights the need to carry out further studies to increase the knowledge of the ichthyofauna, framed in the environmental setting of the Department's coastal zone and the anthropogenic influence on the group in question. Better knowledge of the richness of ichthyic species contributes indirectly to the improvement of current management plans for marine biodiversity conservation.

Keywords: Fish inventory, ichthyofauna, sedimentary environments.

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RESUMEN

Esta primera lista de verificación de los peces marinos costeros del departamento del Atlántico (Caribe colombiano) fue elaborada mediante una revisión exhaustiva de: información publicada, bases de datos, otras fuentes no publicadas y datos primarios. Se registraron 272 especies de peces, de las cuales veinte son reportadas por primera vez para esta región. Carangidae, Lutjanidae y Scombridae, fueron las familias más ricas, que en conjunto representan el 14 % del total de las especies. Según la Lista Roja de peces marinos de Colombia 37 especies muestran algún grado de amenaza. La mayoría de las especies son demersales, asociadas a fondos blandos. Sin embargo, también se encontró un número importante de especies asociadas a sustratos duros, lo que sugiere que los peces se congregan en torno a estos sustratos menos abundantes, ya que en el litoral predominan los sedimentos finos. Este estudio revela la gran riqueza de peces en el departamento y señala la necesidad de realizar más estudios para profundizar en el conocimiento de la ictiofauna, enmarcados en las características ambientales de la zona costera del departamento y la influencia antrópica sobre el grupo en cuestión. Un mejor conocimiento de la riqueza de especies ícticas contribuye indirectamente al mejoramiento de los actuales planes de gestión para la conservación de la biodiversidad marina.

Palabras clave: Inventario de peces, ictiofauna, ambientes sedimentarios.

INTRODUCTION

The Department of Atlántico (DA) includes the last extension of the Magdalena River along its left flank, from the separation of the Canal del Dique to the south to its mouth at the Caribbean Sea (CRA 2016). This Department has two-thirds of its territory surrounded by the river and the sea, determining several geographic conditions including relief, structure, and water resources (Invemar 2007). Coastal lagoons, deltas, beaches, and mangrove forests are among the coastal marine ecosystems present in the department. These ecosystems provide favorable habitats for the establishment of fish communities, either resident or migratory (CRA 2016).

However, the marine coastal fish fauna in this region is understudied, only a few studies focused on fishery resource species have been found, however, these studies aim to describe species of economic interest in the area, while other isolated publications are new records (Arrieta and Muños 2003, Incoder 2004, 2006, Roa-Varón *et al.* 2007, Polanco *et al.* 2010, Caiafa *et al.* 2011, 2013, Anguila *et al.* 2016, Galvis and Díaz 2019). One of these ecological studies carried out about community structure was conducted in the Mallorquín area (Arrieta and Muños 2003) and described the fish community of a tropical coastal lagoon with estuarine characteristics; this area plays a fundamental role in the larval development phase of many the marine species of the Department (Invemar 2007). In 2004 the Colombian Institute for Rural Development (INCODER for its Spanish acronym) conducted a monitoring of the fishing activity in the DA, where a fish species list was presented. In 2006, the same institution produced a fishing characterization bulletin for the municipality of Puerto Colombia, which was used as a basis for the development of the Department's fishery management, providing information about catches during the study period (INCODER 2004, 2006). More recently, the Corporación Autónoma Regional del Atlántico (CRA) generated an atlas of marine-coastal flora and fauna, recording 62 fish species (CRA 2016).

Fish are the most numerous vertebrates in the world, with at least 35 768 known species, 17 762 (49.6 %) of which are found in the marine environment (Fricke *et al.* c2021, Webb *z.* 2021). The 17 762 valid species of marine fish are included in the Superclass Pisces, which is subdivided into four major classes. With Bony fishes are found in the Class Actinopterygii, with 16 503 species; sharks, and rays in the Class Elasmobranchii, with 1202 species; chimaeras in the Class Holocephali, with 55 species; and coelacanths in the Class Coelacanthi,with two species (Webb *et al.* 2021). These animals have been documented for most coastal zone ecosystems and localities in the Colombian Caribbean. A list of 1329 fish species (Acero P. *et al.* 2023) is the current

reference for inventories and taxonomic studies for the Colombian Caribbean. However, in many cases the specific locations of the records are unknown, the entire Department has not been covered, or the taxonomic, fishing, threats, conservation, and management status, especially those of commercial interest, has not been updated.

Coastal areas show remarkable biodiversity that constitutes a fundamental natural capital, forming one of the most productive systems on the planet (Invemar 2007, 2020). The marine biodiversity originates diverse types of ecosystem services such as support (e.g., biological production processes and energy flow), regulation (e.g. absorption of CO_2 and pollutants), cultural (e.g. tourism), and provisioning services (e.g. food from fishing) (Millennium Ecosystem Assessment 2005).

Practices such as fisheries and aquaculture directly increase people's food supply, providing highly nutritious animal protein and essential micronutrients, jobs, and income (FAO 2022). The fishes play an ecological role of great importance, fulfilling multiple ecological functions that influence ecosystem functioning, such as contributing and transporting nutrients to marine ecosystems, performing herbivory, contributing to sediment flow, controlling harmful or invasive species, as well as being indicators of water quality (Ibarra 2005, Helfman *et al.* 2009, Layman *et al.* 2013). Hence their characterization is critical because it is an excellent tool to help decision-making in environmental matters.

This study presents a checklist of the marine fish of the DA based on different bibliographic sources and some additional records from field observations and museum specimens. This work contributes to the knowledge of the ichthyofauna in the region and highlights the fish richness of the Department. It also provides a starting point for future verification of unusual records that do not have biological material collected and deposited in a reference collection.

MATERIALS AND METHODS

Study Area

The coastal area of the DA is in the Colombian Caribbean between 0°41' and 11°6' North, and 74°47' and 75°26' West (Fig. 1). Its coastline is 72 km long (Gracia *et al.* 2018). This department is included in the definition of the Colombian coastal zone according to the National Environmental Policy for the Sustainable Development of Oceanic Spaces and Coastal and Insular Zones of Colombia for its acronym in Spanish-PNAOCI (Maldonado *et al.* 2000). The coastal-maritime zone is between the average low tide line and the outer margin of the continental shelf (200m). Although the PNAOCI policy limits the marine-coastal zone to 200m, this annotated list includes some records that exceed this bathymetric range because they are part of offshore scientific research conducted off the Department coast.

Fish Richness

The species in the list were obtained from four different sources of information:

1. An exhaustive review of published articles, bulletins, books, and gray literature was carried out using the Scopus database for published articles, Google Scholar for books and theses, and a final search in Google for fishery reports, atlases, and bulletins. Different combinations of the following keywords were used for the search: "fish", "marine fish", "Colombian Caribbean" and "Department of Atlántico".

2. Unpublished information, such as records of deep-sea species collected by foreign vessels (RV Oregon I-II) in the 1960s and 1970s, which were obtained from a review of reference material deposited in the biological collections of the following museums: FLMNH=Florida Museum of Natural History, ANSP=Academy of Natural Sciences, Philadelphia University and USNM=Smithsonian Institution, National Museum of Natural History. Records were also obtained from the review of material deposited inUARC= Museum of Scientific Collections, Universidad del Atlántico.

3. Review of fishery data from 2012 to 2021 stored in the Colombian Fisheries Statistical Service Information System (SEPEC) and records of species found in the Marine Biodiversity Information System (SIBM) that correspond to material stored in the fish collection of the Museum of Marine Natural History of Colombia - MAKURIWA.

4. Primary information obtained from field observations performed between 2017 and 2021. The individuals were recorded in the intertidal zone, from fishing and snorkeling activities in the localities of Puerto Velero, Caño Dulce, Puerto Caimán, and Palmarito. A photo-

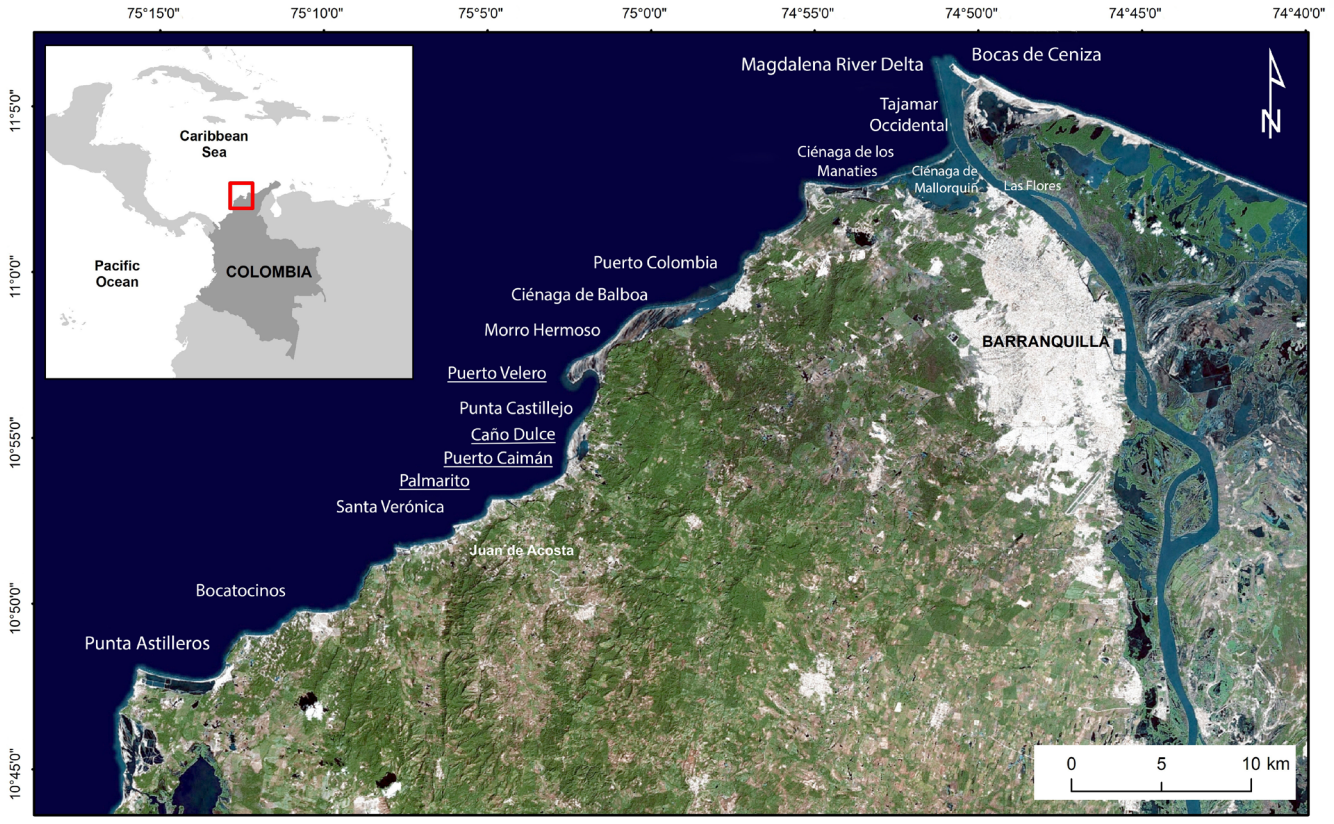

Figure 1. Delimitation of the coastal marine zone of the Department of Atlántico (Colombian Caribbean) and localities where records are available (Table S1). The underlined localities correspond to the sampling sites where field observations were carried out.

graphic record of these species was obtained. The species were identified following Carpenter (2002a, b), ARAP (2011), and Robertson *et al.* (c2019).

These four sources were placed in two groups and four categories according to the available support: The first group is composed of CONFIRMED SPECIES, that means, species with a voucher present in a national or international collection (Category A), and species with photographic evidence (Category B); the other group is UNCONFIRMED SPECIES, that is, species that were cited in literature, but no physical or photographic records were found (Category C), and species recorded in the monthly fish landings of SEPEC (Category D). This second group, despite containing unconfirmed species, is fundamental in the construction of knowledge since it constitutes the basis for future work to confirm the identity of these species.

The checklist follows the phylogenetic classification of Nelson *et al.* (2016) for cartilaginous fishes and Betancur-R *et al.* (2017) for bony fishes. The zoological nomenclature of the species follows the World Register of Marine Species (WoRMS Editorial Board c2021) and Eschmeyer's Catalog of Fishes (Fricke *et al.* c2021); the habitats of each species were consulted in Froese and Pauly (c2021) and the classification of species at risk was made following the Red Book of Marine Fishes of Colombia (Chasqui *et al.* 2017) which applies the categories established by the IUCN (IUCN c2021).

RESULTS

This list summarizes 272 species of marine-coastal fish for the DA, classified in 51 orders plus three *Incertae sedis* (taxa without exact placement in the classification according to Betancur-R *et al.* 2017), 103 families, and 183 genera (Table 1) (Figs. 2 a-x). The dominant order was Perciformes, with 21 species (7.9 %), followed by Lutjaniformes with 19 species (6.9 %). The richest families were Carangidae (fourteen species; 5.2 %), Lutjanidae (twelve species; 4.5 %), and Scombridae (eleven species; 4.1 %). Soft bottom demersal habitats were the best represented with 134 species (49.2 %), followed by rocky bottom demersal habitats with 74 species (27.2 %), and pelagic habitats with

64 species (23.5 %). Twenty species (7 %) are new records for the Department of Atlántico: *Aetobatus narinari* (Euphrasen, 1790), Fig. 2b; *Echidna catenata* (Bloch, 1795), Fig. 2c; *Ophioblennius macclurei* (Silvester, 1915), Fig. 2k; *Malacoctenus delalandii* (Valenciennes, 1836), Fig. 2l; *Microspathodon chrysurus* (Cuvier, 1830), *Stegastes leucostictus* (Müller and Troschel, 1848), Fig. 2n; *Chaetodon ocellatus* (Bloch, 1787), Fig. 2o; *Haemulon flavolineatum* (Desmarest, 1823), Fig. 2p; *Halichoeres maculipinna* (Müller and Troschel, 1848), Fig. 2r; *Menticirrhus littoralis* (Holbrook, 1847), Fig. 2s; *Aluterus scriptus* (Osbeck, 1765), Fig. 2t; *Lactophrys trigonus* (Linnaeus, 1758), Fig. 2u; *Canthigaster rostrata* (Bloch, 1786), Fig. 2v; *Pterois volitans* (Linnaeus, 1758), Fig. 2x; *Gymnothorax funebris* Ranzani, 1839; *Anchoa parva* (Meek & Hildebrand, 1923); *Trinectes paulistanus* (Miranda Ribeiro, 1915); *Cathorops mapale* Betancur-R. & Acero P., 2005; *Hyporhamphus unifasciatus* (Ranzani, 1841); and *Lagocephalus* sp. *G. funebris* is listed as a new sighting for the department but it has no photographic support. Thirty-seven species (13.5 %) are included in the Colombian fish red list (Table 3, Chasqui *et al.* 2017).

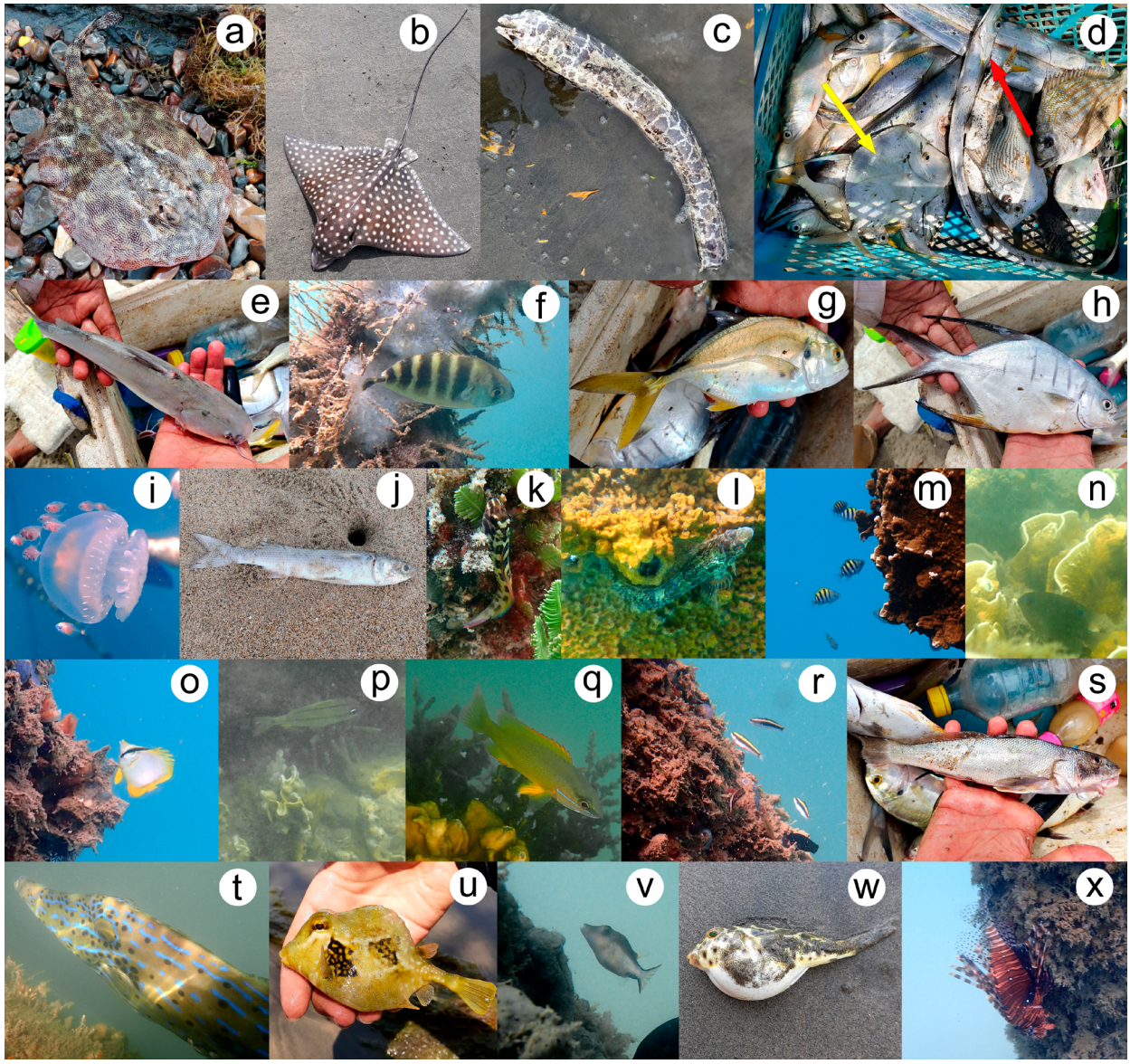

Figure 2. Photographic records of some species observed between 2017 and 2021 in different localities of the Department of Atlántico. a. *Urobatis jamaicensis*, b. *Aetobatus narinari*, c. *Echidna catenata*, d. *Selene vomer* (Yellow arrow), *Trichiurus lepturus* (Red arrow) and others e. *Bagre marinus*, f-g. *Caranx hippos*, h. *Trachinotus goodei*, i. Carangidae, j. *Mugil liza*, k. *Ophioblennius macclurei*, l. *Malacoctenus delalandii*, m. *Abudefduf saxatilis*, n. *Stegastes leucostictus*, o. *Chaetodon ocellatus*, p. *Haemulon flavolineatum*, q. *Lutjanus apodus*, r. *Halichoeres maculipinna*, s. *Menticirrhus littoralis*, t. *Aluterus scriptus*, u. *Lactophrys trigonus*, v. *Canthigaster rostrata*, w. *Sphoeroides testudineus*, x. *Pterois volitans*.

DISCUSSION

The species identified by the Department of Atlántico (272) represent 20 % of those recorded for the Colombian Caribbean (1329, Acero P. et al. 2023), a significant number considering its small coastline in the country. Perciformes was the dominant order, which agrees with the studies in the Colombian Caribbean on adults and juveniles by Polanco *et al.* (2010) and with fish larvae by Medellín-Mora *et al.* (2013), although the classification used for this study (Betancur-R *et al.* 2017) was different from that of the previously mentioned studies, as they followed the classification of Nelson (2006).

This is a preliminary inventory for the DA as there are still several localities, depths, and ecosystems to be studied in detail, which could significantly increase the number of species. The demersal fish species associated with the soft bottoms of the continental shelf stand out; it is also noticeable the large number of ichthyofauna found associated with rocky bottoms or coral reefs. This is a relevant finding due to the limited presence of these ecosystems in the Department. For instance, in Puerto Velero some of the new records associated with rocky bottoms or coral communities may be due to the presence of an international marina that provides an artificial hard substrate. Records of the species *Ophioblennius macclurei*, *Malacoctenus delalandii*, *Microspathodon chrysurus*, *Stegastes leucostictus*, *Chaetodon ocellatus*, *Halichoeres maculipinna*, *Aluterus scriptus*, and *Canthigaster rostrata* were associated with the artificial hard substrates in this marina, where also fourteen species of Cnidaria were documented previously (Gracia *et al.* 2021). Biological monitoring in this marina is of vital importance because of the implications associated with the movement of boats and the possible arrival of non-native species or secondary invasions, which has been documented for mollusks (Gracia and Rangel-Buitrago 2020) and cnidarians (Durán-Fuentes *et al.* 2021). The invasive species *Pterois volitans* was observed in the artificial substrates at about 4 m depth in this marina and surrounding area (Fig. 2x). According to local fishermen, this species is commonly caught and consumed by the local population.

The physical, chemical, and biological characteristics of the ecosystems present in the DA are shaped in part by the continuous discharge of sediment and freshwater from the Magdalena River (Restrepo *et al.* 2006). Many studies demonstrate effects on the biological cycle of fish in juvenile and adult stages due to physicochemical conditions like those in the Department (Yujun *et al.* 2008, Yang *et al.* 2010, Kemp *et al.* 2011, Hess *et al.* 2015, Järvenpää *et al.* 2019). These effects may limit the number of species present in the marine-coastal zones of the DA but may also create a beneficial space for juveniles of different species, as increased turbidity may decrease predation rates of these stages (Newport *et al.* 2021). Preliminary environmental data obtained in Puerto Velero showed an average salinity of 29.3 ± 1.7 and a Horizontal Water Transparency average of 100 cm (100 ± 63.1 cm) (both bi-weekly measurements from February 2019 to February 2020) (Gracia *et al.* 2021). In the same location highly variable sedimentation rates were observed from July 2019 to February 2020 the mean was 39.5± 38.6 mg/cm²/d, but as the standard error indicates, it is quite variable. From August to early November the mean was low, 10.5 ± 7.6 mg/cm²/d, but increased sharply to 83.6 ± 27.9 mg/cm²/d from the second half of November 2019 to the end of February 2020 (Gracia *et al.* 2021). This suggests the need to implement physiological and developmental studies in fish species, which will allow understanding various aspects of adaptation and tolerance to these environmental conditions such as those present in this sector of the Colombian Caribbean.

Human activities such as overfishing or pollution are causing a global decline in marine biodiversity (Butchart *et al.* 2010, Cinner *et al.* 2018). Some of the listed species for the DA may be subject to this anthropogenic influence since 37 showed some degree of threat (Chasqui *et al.* 2017). Nine threatened species are sharks, one of the most overexploited resources and with difficult resilience due to their life strategy (Acero and Polanco 2017). Another case of these 37 species is *Epinephelus itajara*, which is critically endangered (Table 3) and has been documented in local newspapers as being fished around Puerto Colombia without any control (Comas c2016, Herrera c2023).

Records from published sources were mainly species of economic interest for the local population. In contrast, species that are not of economic value were obtained from mostly unpublished sources. The best-represented species in the department were *Caranx hippos* registered in fourteen localities, *Mugil liza* in twelve localities, and *Megalops atlanticus* in ten localities (Table S1). These three species are recognized as common resource species for local human consumption (Caiafa *et al.* 2011, CRA 2016, Chasqui *et al.* 2017, AUNAP-UNIMAGDALENA c2021).

Table 1. Checklist of marine-coastal fishes of the Department of Atlántico. The column of the support category includes: A. Confirmed species with voucher specimens present in a national or international collection, B. Confirmed species with photographic evidence, C. Unconfirmed species, cited in literature and D. Unconfirmed species, recorded in the monthly fish landings of SEPEC. The taxonomy column presents the species classification, accepted name and remarks of other names used in the cited literature, and author. The references column listing the references that include the species record following: 1. SIBM (2021); 2. Anguila *et al.* (2016); 3. AUNAP-UNIMAGDALENA (2021); 4. CRA (2016); 5. Invemar (2007); 6. Chasqui *et al.* (2017); 7. Arrieta and Muños (2003); 8. CRA (2005); 9. Invemar (2005); 10. Online catalog of the fish collection of the Academy of Natural Sciences of Drexel University (2021); 11. Digitalized data in Fishnet2 of the Florida Museum of Natural History Fish collection (2021); 12. Online catalog of the fish collection of the Smithsonian Institution, National Museum of Natural History (2021); 13. Caiafa (2013); 14. Galvis and Díaz (2019); 15. Roa-Varón *et al.* (2007); 16. Garrido-Linares (2004); 17. Saavedra-Díaz (2000); 18. Polanco (2015); 19. Saavedra-Díaz *et al.* (2004); 20. Saavedra-Díaz *et al.* (2003); 21. Sánchez and Acero (2016); 22. Roa-Varón *et al.* (2003); 23. Barrera-García *et al.* (2008). The reference material column follows Sabaj (c2022): A. MHNMC- Museo de Historia Natural Marina de Colombia, B. ANSP- The Academy of Natural Sciences of Drexel University, C. UF- Florida Museum of Natural History, D. USNM- Smithsonian Institution, National Museum of Natural History, E. photographic records and F. Field survey G. UARC- Museum of Scientific Collections, Universidad del Atlántico. * Indicates first report of the species in the department.

Support category	Taxonomy	References	Reference Material
	Order Myxiniformes		
	Myxinidae		
A	*Myxine mccoskeri* Wisner and McMillan, 1995	1,17, 18	A
	Order Lamniformes		
	Odontaspididae		
B	*Odontaspis ferox* (Risso, 1810)	2	
	Alopiidae		
D	*Alopias superciliosus* (Lowe, 1841)	3	
	Lamnidae		
D	*Isurus oxyrinchus* Rafinesque, 1810. As *Isurus oxyrhinchus* in 3	3	
	OrderCarcharhiniformes		
	Triakidae		
D	*Mustelus canis* (Mitchill, 1815)	3	
D	*Mustelus norrisi* Springer, 1939	3	
	Carcharhinidae		
C	*Carcharhinus* sp.	4, 5	
D	*Carcharhinus altimus* (Springer, 1950)	3	
D	*Carcharhinus falciformis* (Bibron, 1839)	3	
D	*Carcharhinus leucas* (Valenciennes, 1839)	3	
C	*Carcharhinus limbatus* (Müller and Henle, 1839)	6, 3	
D	*Carcharhinus porosus* (Ranzani, 1839)	3	
D	*Galeocerdo cuvier* (Péron and Lesueur, 1822)	3	
D	*Rhizoprionodon lalandii* (Valenciennes, 1839)	3	
C	*Rhizoprionodon porosus* (Poey, 1861)	6, 3	
	Sphyrnidae		
C	*Sphyrna lewini* (Griffith and Smith, 1834)	6,3	
C	*Sphyrna mokarran* (Rüppell, 1837)	6,3	
	Order Squaliformes		
	Centrophoridae		
D	*Centrophorus granulosus* (Bloch and Schneider, 1801)	3	
	Order Echinorhiniformes		
	Echinorhinidae		
B	*Echinorhinus brucus* (Bonnaterre, 1788)	2, 3	
	Order Rajiformes		

(*Continúa*)

Support category	Taxonomy	References	Reference Material
	Rajidae		
A	*Gurgesiella atlantica* (Bigelow and Schroeder, 1962)	1, 18	A
A	*Schroederobatis americana* (Bigelow and Schroeder, 1962). As *Anacanthobatis americanus* in 1	1, 18	A
	Order Pristiformes		
	Pristidae		
B	*Pristis pristis* (Linnaeus, 1758)	6	
	Order Myliobatiformes		
	Dasyatidae		
B	*Bathytoshia centroura* (Mitchill, 1815). As *Dasyatis centroura* in 2	2	
C	*Dasyatis* sp.	7	
D	*Hypanus americanus* (Hildebrand and Schroeder, 1928)	3	
D	*Hypanus guttatus* (Bloch and Schneider, 1801)	3	
	Urotrygonidae		
A	*Urobatis jamaicensis* (Cuvier, 1816). As *Urolophus jamaicensis* in 1	1	A,E
	Myliobatidae		
B	*Aetobatus narinari* (Euphrasen, 1790)*		E
D	*Mobula birostris* (Walbaum, 1792)	3	
	Order Elopiformes		
	Elopidae		
C	*Elops saurus* Linnaeus, 1766	4, 5, 8	
D	*Elops smithi* McBride, Rocha, Ruiz-Carus and Bowen, 2010	3	
	Megalopidae		
C	*Megalops atlanticus* Valenciennes, 1847. As *Tarpon atlanticus* in 5	3, 4, 5, 7, 9	
	Order Notacanthiformes		
	Halosauridae		
A	*Halosaurus* sp.	1	A
A	*Halosaurus ovenii* Johnson, 1864	1, 18, 19	A
	Order Anguilliformes		
	Colocongridae		
A	*Coloconger meadi* Kanazawa, 1957	1, 18	A
	Congridae		
A	*Bathycongrus bullisi* (Smith and Kanazawa, 1977)	10	B
A	*Pseudophichthys splendens* (Lea, 1913)	1	A
A	*Xenomystax bidentatus* (Reid, 1940)	1, 18	A
	Muraenidae		
B	*Echidna catenata* (Bloch, 1795)*		E
B	*Gymnothorax conspersus* Poey, 1867		C
C	*Gymnothorax funebris* Ranzani, 1839*		F
	Ophichthidae		
A	*Ophichthus cylindroideus* (Ranzani, 1839)	23	
	Nettastomatidae		
A	*Facciolella* sp.	1, 17	A
A	*Hoplunnis megista* Smith and Kanazawa, 1989	10, 11	B, C
	Order Clupeiformes		

(*Continúa*)

Support category	Taxonomy	References	Reference Material
	Clupeidae		
C	*Harengula* sp.	4	
C	*Opisthonema oglinum* (Lesueur, 1818)	4	
	Engraulidae		
A	*Anchoa trinitatis* (Fowler, 1915)	7	G
A	*Anchoa parva* (Meek & Hildebrand, 1923)*		G
B	*Cetengraulis edentulus* (Cuvier, 1829). As *Engraulis endetulus* in 7 and 4	4, 5, 7	E
	Order Alepocephaliformes		
	Alepocephalidae		
A	*Alepocephalus australis* Barnard, 1923	12	D
	Order Siluriformes		
	Ariidae		
C	*Arius* sp.	4	
C	*Ariopsis* sp.	4,9	
C	*Bagre bagre* (Linnaeus, 1766)	4	
B	*Bagre marinus* (Mitchill 1815)	3	E
C	*Cathorops* sp.	9	
A	*Cathorops spixii* (Agassiz, 1829)	5, 8	G
A	*Cathorops mapale* Betancur-R. & Acero P., 2005*		G
A	*Notarius bonillai* (Miles, 1945). As *Ariopsis bonillae* in all.	4, 5, 7, 8	G
A	*Notarius grandicassis* (Valenciennes, 1840)	1, 3, 21	A
C	*Sciades proops* (Valenciennes, 1840). As *Arius proops* in 5, 7 and 8	3, 5, 7, 8, 9	
	Order Argentiniformes		
	Argentinidae		
A	*Argentina brucei* Cohen and Atsaides, 1969	1	A
A	*Argentina striata* Goode and Bean, 1896	1, 18	A
	Order Stomiatiformes		
	Gonostomatidae		
A	*Sigmops elongatus* (Günther, 1878). As *Sigmops elongatum* in all	1, 19	A
	Phosichthyidae		
A	*Pollichthys mauli* (Poll, 1953)	1, 18, 19	A
	Sternoptychidae		
A	*Polyipnus asteroides* Schultz, 1938	1, 18, 19	A
A	*Polymetme thaeocoryla* Parin & Borodulina, 1990. As *Polymetme corythaeola* in 1	1, 19	A
	Order Aulopiformes		
	Chlorophthalmidae		
A	*Chlorophthalmus agassizi* Bonaparte, 1840	1, 18, 19	A
	Ipnopidae		
A	*Bathypterois bigelowi* Mead, 1958	1, 18	A
	Synodontidae		
A	*Synodus poeyi* Jordan, 1887	1	A
A	*Synodus synodus* (Linnaeus, 1758)	1	A
A	*Synodus foetens* (Linnaeus, 1766)	1	A
	Order Myctophiformes		

(*Continúa*)

Support category	Taxonomy	References	Reference Material
	Neoscopelidae		
A	*Neoscopelus macrolepidotus* Johnson, 1863	1, 15, 18	A
	Order Zeiformes		
	Parazenidae		
A	*Cyttopsis rosea* (Lowe, 1843)	1, 18, 22	A
	Zeniontidae		
A	*Zenion hololepis* (Goode and Bean, 1896)	1	A
	Order Gadiformes		
	Bregmacerotidae		
A	*Bregmaceros atlanticus* Goode and Bean, 1886	1, 18	A
	Macrouridae		
A	*Coelorinchus caelorhincus* (Risso, 1810)	1, 18	A
A	*Coelorinchus caribbaeus* (Goode and Bean, 1885)	1, 18	A
A	*Coryphaenoides zaniophorus* (Vaillant, 1888)	1, 18	A
A	*Malacocephalus occidentalis* Goode and Bean, 1885	1, 15, 18	A
A	*Nezumia aequalis* (Günther, 1878)	1, 18	A
	Bathygadidae		
A	*Bathygadus* sp.	1	A
A	*Bathygadus macrops* Goode and Bean, 1885	1, 15, 18	A
	Merlucciidae		
A	*Merluccius albidus* (Mitchill, 1818)	12	D
	Moridae		
A	*Laemonema goodebeanorum* Meléndez C. and Markle, 1997	1, 12, 15, 18	A,D
A	*Physiculus fulvus* Bean, 1884	1, 15	A
	Steindachneriidae		
A	*Steindachneria argentea* Goode and Bean, 1896	1, 12, 15, 18	A, D
	Order Polymixiiformes		
	Polymixiidae		
A	*Polymixia lowei* Günther, 1859	12	D
	Order Trachichthyiformes		
	Trachichthyidae		
A	*Hoplostethus occidentalis* Woods, 1973	1,12, 18	A, D
	Order Holocentriformes		
	Holocentridae		
C	*Holocentrus adscensionis* (Osbeck, 1765)	4	
	Order Ophidiiformes		
	Bythitidae		
A	*Diplacanthopoma brachysoma* Günther, 1887	1, 18	A
	Ophidiidae		
A	*Dicrolene introniger* Goode and Bean, 1883	11	C
A	*Lamprogrammus brunswigi* (Brauer, 1906)	12	D
A	*Lepophidium* sp.	1	A
A	*Lepophidium brevibarbe* (Cuvier, 1829)	1, 18	A
A	*Neobythites gilli* Goode and Bean, 1885	1, 15, 16	A
A	*Neobythites marginatus* Goode and Bean, 1886	1, 18, 22	A

(*Continúa*)

Support category	Taxonomy	References	Reference Material
A	*Neobythites multiocellatus* Nielsen, Uiblein and Mincarone, 2009	12	D
A	*Neobythites ocellatus* Günther, 1887	12	D
	Order Batrachoidiformes		
	Batrachoididae		
C	*Batrachoides surinamensis* (Bloch and Schneider, 1801)	5, 7	
A	*Porichthys plectrodon* Jordan and Gilbert, 1882	1	A
	Order Scombriformes		
	Gempylidae		
A	*Promethichthys prometheus* (Cuvier, 1832)	12	D
D	*Ruvettus pretiosus* Cocco, 1833	3	
	Scombridae		
D	*Acanthocybium solandri* (Cuvier, 1832)	3	
D	*Auxis thazard* (Lacepède, 1800)	3	
D	*Euthynnus alletteratus* (Rafinesque, 1810)	3	
C-D	*Scomberomorus brasiliensis* Collette, Russo and Zavala-Camin, 1978	3,4	
C-D	*Scomberomorus cavalla* (Cuvier, 1829)	3,4	
C	*Scomberomorus maculatus* (Mitchill, 1815)	5	
C	*Scomberomorus regalis* (Bloch, 1793). As *Scomberomorus regelis* in 5	5	
C-D	*Sarda sarda* (Bloch, 1793)	3, 4	
C	*Thunnus* sp.	4	
C	*Thunnus alalunga* (Bonnaterre, 1788)	4	
D	*Thunnus albacares* (Bonnaterre, 1788)	3	
	Trichiuridae		
A	*Trichiurus lepturus* Linnaeus, 1758	3, 5, 7, 8	E
	Order Syngnathiformes		
	Aulostomidae		
A	*Aulostomus maculatus* Valenciennes, 1841	1	A
	Fistulariidae		
A	*Fistularia tabacaria* Linnaeus, 1758	1	A
	Mullidae		
A	*Pseudupeneus maculatus* (Bloch, 1793)	1,4	A
	Order Kurtiformes		
	Apogonidae		
A	*Apogon robinsi* Böhlke and Randall, 1968. As *Apogon affinis* in 1	1	A
A	*Paroncheilus affinis* (Poey, 1875) As *Apogon affinis* in 1	1	A
	Order Gobiiformes		
	Gobiidae		
A	*Bollmannia* sp.	1	A
A	*Bollmannia boqueronensis* Evermann and Marsh, 1899	1	A
C	*Gobioides broussonnetii* Lacepède, 1800	5, 7	
	Order Carangiformes		
	Carangidae		
D	*Caranx bartholomaei* Cuvier, 1833	3	
C-D	*Caranx crysos* (Mitchill, 1815)	3, 4, 9	
B	*Caranx hippos* (Linnaeus, 1766)	3, 4, 5, 7, 9, 13	E

(*Continúa*)

Support category	Taxonomy	References	Reference Material
D	*Caranx latus* Agassiz, 1831	3	
B	Carangidae sp.		E
C-D	*Chloroscombrus chrysurus* (Linnaeus, 1766)	3, 5, 7	
D	*Elagatis bipinnulata* (Quoy and Gaimard, 1825)	3	
C	*Oligoplites saurus* (Bloch and Schneider, 1801)	5, 7	
C-D	*Selar crumenophthalmus* (Bloch, 1793)	3, 4	
A	*Selene vomer* (Linnaeus, 1758)	3, 5, 7	B, G
C	*Seriola* sp.	4	
C	*Seriola fasciata* (Bloch, 1793)	3	
C	*Trachinotus* sp.	4	
D	*Trachinotus carolinus* (Linnaeus, 1766)	3	
A	*Trachinotus goodei* Jordan and Evermann, 1896	4	B
	Coryphaenidae		
D	*Coryphaena hippurus* Linnaeus, 1758	3	
	Rachycentridae		
D	*Rachycentron canadum* (Linnaeus, 1766)	3	
	Order Pleuronectiformes		
	Cyclopsettidae		
A	*Citharichthys cornutus* (Günther, 1880)	1	A
A	*Citharichthys spilopterus* Günther, 1862	5, 7	G
A	*Citharichthys* sp.		G
A	*Syacium micrurum* Ranzani, 1842	1	A
A	*Syacium papillosum* (Linnaeus, 1758)	1	A
A	*Syacium gunteri* Ginsburg, 1933	1	A
	Achiridae		
C	*Achirus achirus* (Linnaeus, 1758)	5, 7	
A	*Achirus lineatus* (Linnaeus, 1758)	1, 5, 7	A
A	*Trinectes inscriptus* (Gosse, 1851)	1	A
A	*Trinectes paulistanus* (Miranda Ribeiro, 1915)*		G
	Bothidae		
A	*Engyophrys senta* Ginsburg, 1933	1	A
A	*Bothus lunatus* (Linnaeus, 1758)	1	A
A	*Bothus ocellatus* (Agassiz, 1831)	1	A
A	*Monolene megalepis* Woods, 1961	1	A
A	*Trichopsetta caribbaea* Anderson and Gutherz, 1967	1	A
	Cynoglossidae		
A	*Symphurus ginsburgi* Menezes and Benvegnú, 1976	1, 18, 19	A
A	*Symphurus hernandezi* Saavedra-Díaz, Munroe and Acero, 2003	1, 18, 20	A
C	*Symphurus plagusia* (Bloch & Schneider, 1801)	5	
A	*Symphurus marginatus* (Goode and Bean, 1886)	1, 18	A
	Poecilopsettidae		
A	*Poecilopsetta inermis* (Breder, 1927)	1, 18, 19	A
	Incertae sedis Carangaria		
	Centropomidae		
C	*Centropomus* sp.	5	

(*Continúa*)

Support category	Taxonomy	References	Reference Material
C-D	*Centropomus ensiferus* Poey, 1860	3, 4, 5	
A	*Centropomus undecimalis* (Bloch, 1792)	3, 4, 5, 7, 8	G
	Polynemidae		
C	*Polydactylus virginicus* (Linnaeus, 1758)	5,7	
	Sphyraenidae		
C-D	*Sphyraena barracuda* (Edwards, 1771)	3, 4, 6	
D	*Sphyraena guachancho* Cuvier, 1829	3	
	Order Cichliformes		
	Cichlidae		
C	*Oreochromis* sp.	5	
A	*Oreochromis niloticus* (Linnaeus, 1758)	5, 7, 8, 9	G
	Order Beloniformes		
	Belonidae		
C	*Ablennes hians* (Valenciennes, 1846)	5, 7	
B	Belonidae sp.		E
D	*Tylosurus* sp.	3	
	Hemiramphidae		
A	*Hyporhamphus unifasciatus* (Ranzani, 1841)*		G
	Order Mugiliformes		
	Mugilidae		
C	*Mugil* sp.	9	
A	*Mugil curema* Valenciennes, 1836	4, 5, 7	G
A	*Mugil incilis* Hancock, 1830	3, 4, 5, 7	G
B	*Mugil liza* Valenciennes, 1836	3, 4, 5, 7, 8, 9	E
	Order Blenniiformes		
	Blenniidae		
B	*Ophioblennius macclurei* (Silvester, 1915)*		E
	Labrisomidae		
B	*Malacoctenus delalandii* (Valenciennes, 1836)*		E
	Order Gerreiformes		
	Gerreidae		
C	*Diapterus* sp.	5	
C-D	*Diapterus rhombeus* (Cuvier, 1829)	3, 4, 5, 7	
C	*Diapterus auratus* Ranzani, 1842	4, 5, 7	
C	*Eucinostomus melanopterus* (Bleeker, 1863)	5, 7	
A	*Eugerres plumieri* (Cuvier, 1830)	4, 5, 7, 8, 9	G
D	*Gerres cinereus* (Walbaum, 1792)	3	
	Incertae sedis Ovalentaria		
	Pomacentridae		
B	*Abudefduf saxatilis* (Linnaeus, 1758)	4	E
B	*Microspathodon chrysurus* (Cuvier, 1830)*		E
C	*Stegastes* sp.	4	
C	*Stegastes diencaeus* (Jordan and Rutter, 1897)	4	
B	*Stegastes leucostictus* (Müller and Troschel, 1848)*		E
	Order Ephippiformes		

(*Continúa*)

Support category	Taxonomy	References	Reference Material
	Ephippidae		
C	*Chaetodipterus faber* (Broussonet, 1782)	4	
	Order Chaetodontiformes		
	Chaetodontidae		
B	*Chaetodon ocellatus* Bloch, 1787*		E
	Order Acanthuriformes		
	Acanthuridae		
A	*Acanthurus tractus* Poey, 1860. As *Acanthurus bahianus* in 1	1	A
C	*Acanthurus chirurgus* (Bloch, 1787)	4	
C	*Acanthurus coeruleus* Bloch and Schneider, 1801	4	
	Order Lutjaniformes		
	Haemulidae		
C	*Anisotremus surinamensis* (Bloch, 1791)	4	
C	*Anisotremus virginicus* (Linnaeus, 1758)	4	
C-D	*Conodon nobilis* (Linnaeus, 1758)	3, 4, 5, 7	
C	*Haemulon aurolineatum* Cuvier, 1830	3	
B	*Haemulon flavolineatum* (Desmarest, 1823)*		E
C-D	*Haemulon plumierii* (Lacepède, 1801)	3, 4	
C-D	*Haemulopsis corvinaeformis* (Steindachner, 1868)	3, 4	
	Lutjanidae		
A	*Lutjanus* sp.	5	G
C-D	*Lutjanus analis* (Cuvier, 1828)	3, 4, 8	
B	*Lutjanus apodus* (Walbaum, 1792)	4	E
C	*Lutjanus cyanopterus* (Cuvier, 1828)	4	
B	*Lutjanus griseus* (Linnaeus, 1758)	3, 4	E
C	*Lutjanus jocu* (Bloch and Schneider, 1801)	4, 5, 7	
C-D	*Lutjanus mahogoni* (Cuvier, 1828)	3, 4	
C-D	*Lutjanus purpureus* (Poey, 1866)	3,4	
A	*Lutjanus synagris* (Linnaeus, 1758)	1, 3, 4	A
C-D	*Lutjanus vivanus* (Cuvier, 1828)	3,4	
C-D	*Ocyurus chrysurus* (Bloch, 1791)	3, 4	
C-D	*Rhomboplites aurorubens* (Cuvier, 1829)	3, 4	
	Order Lobotiformes		
	Lobotidae		
C-D	*Lobotes surinamensis* (Bloch, 1790)	3, 4	
	Order Spariformes		
	Sparidae		
B	*Archosargus rhomboidalis* (Linnaeus, 1758)	3, 5, 7	E
	Incertae sedis Eupercaria		
	Labridae		
C	*Bodianus rufus* (Linnaeus, 1758)	4	
B	*Halichoeres maculipinna* (Müller and Troschel, 1848)*		E
A	*Upeneus parvus* Poey, 1852	1	A
	Sciaenidae		
C	*Bairdiella ronchus* (Cuvier, 1830)	4, 5, 7	

(*Continúa*)

Support category	Taxonomy	References	Reference Material
D	*Larimus breviceps* Cuvier, 1830	3	
D	*Macrodon ancylodon* (Bloch y Schneider, 1801)	3	
B	*Menticirrhus littoralis* (Holbrook, 1847)*		E
C-D	*Micropogonias furnieri* (Desmarest, 1823)	3, 5, 7	
A	*Protosciaena bathytatos* (Chao y Miller, 1975)	1, 18	A
A	*Protosciaena trewavasae* (Chao and Miller, 1975)	1, 10	A, B
A	*Stellifer naso* (Jordan, 1889)	4, 5, 7	G
	Order Caproiformes		
	Caproidae		
A	*Antigonia capros* Lowe, 1843	1, 22	A
	Order Lophiiformes		
	Ogcocephalidae		
A	*Dibranchus atlanticus* Peters, 1876	1, 18	A
A	*Halieutichthys aculeatus* (Mitchill, 1818)	1, 12	A, E
A	*Malthopsis gnoma* Bradbury, 1998	1, 15, 18	A
A	*Zalieutes mcgintyi* (Fowler, 1952)	1, 18	A
	Chaunacidae		
A	*Chaunax pictus* Lowe, 1846	1, 15, 18	A
A	*Chaunax suttkusi* Caruso, 1989	1, 18	A
	Order Tetraodontiformes		
	Balistidae		
C-D	*Balistes vetula* Linnaeus, 1758	3, 6	
	Diodontidae		
A	*Diodon holocanthus* Linnaeus, 1758	1	A
	Monacanthidae		
B	*Aluterus scriptus* (Osbeck, 1765)*		E
C	*Cantherhines macrocerus* (Hollard, 1853)	4	
	Ostraciidae		
B	*Lactophrys trigonus* (Linnaeus, 1758)*		E
C	*Lactophrys triqueter* (Linnaeus, 1758). As *Rhinesomus triqueter* in 4	4	
	Tetraodontidae		
B	*Canthigaster rostrata* (Bloch, 1786)*		E
B	*Lagocephalus sp**		E
A	*Sphoeroides pachygaster* (Müller and Troschel, 1848)	1	A
A	*Sphoeroides testudineus* (Linnaeus, 1758)	5, 7	A, G
	Order Pempheriformes		
	Bathyclupeidae		
A	*Bathyclupea argentea* Goode and Bean, 1896	1, 18, 22	A
	Epigonidae		
A	*Epigonus pandionis* (Goode and Bean, 1881)	1, 12, 18	A, D
	Acropomatidae		
A	*Synagrops bellus* (Goode and Bean, 1896)	1	A, D
A	*Parascombrops spinosus* (Schultz, 1940). As *Synagrops spinosus in* 14		D
A	*Caraibops trispinosus* (Mochizuki and Sano, 1984). As *Synagrops trispinosus* in all	1	A, D

(*Continúa*)

Support category	Taxonomy	References	Reference Material
A	*Verilus atlanticus* (Mochizuki and Sano, 1984). As *Neoscombrops atlanticus* in 14		D
	Order Centrarchiformes		
	Kyphosidae		
D	*Kyphosus vaigiensis* (Quoy and Gaimard, 1825). As *Kyphosus incisive* in 3	3	
	Cirrhitidae		
C	*Amblycirrhitus pinos* (Mowbray, 1927)	4	
	Order Perciformes		
	Serranidae		
A	*Bathyanthias cubensis* (Schultz, 1958)	1	A
A	*Diplectrum bivittatum* (Valenciennes, 1828)	1	A
C	*Epinephelus* sp.	5	
D	*Epinephelus itajara* (Liechtenstein, 1822)	3	
A	*Hemanthias aureorubens* (Longley, 1935)	22	
D	*Mycteroperca bonaci* (Poey, 1860)	3	
A	*Serranus atrobranchus* (Cuvier, 1829)	1	A
A	*Serranus flaviventris* (Cuvier, 1829)	1	A
	Bembropidae		
A	*Bembrops anatirostris* Ginsburg, 1955	1	A
A	*Bembrops gobioides* (Goode, 1880)	1	A
	Peristediidae		
A	*Peristedion gracile* Goode and Bean, 1896	1	A
A	*Peristedion greyae* Miller, 1967	1, 18	A
A	*Peristedion miniatum* Goode, 1880	1, 17	A
A	*Peristedion longispatha* Goode and Bean, 1886	1, 18	A
	Triglidae		
A	*Bellator brachychir* (Regan, 1914)	11	C
A	*Prionotus punctatus* (Bloch, 1793)	1	A
A	*Prionotus stearnsi* Jordan and Swain, 1885	1	A
	Scorpaenidae		
A	*Neomerinthe beanorum* (Evermann and Marsh, 1900)	1	A
A	*Pontinus longispinis* Goode and Bean, 1896	1, 18	A
B	*Pterois volitans** (Linnaeus, 1758)	14	E
A	*Scorpaena calcarata* Goode and Bean, 1882	1	A
A	*Scorpaena isthmensis* Meek and Hildebrand, 1928	1	A

It is important to remark that more than half (54.2 %) of the reference material information does not have a voucher in a biological collection, a worrying situation because biological collections are the references that provide basic information about the biological diversity of a particular place and time (Trujillo *et al.* 2014). Most of the listed species that have reference material in the collections are the result of research efforts carried out in deep waters of the Colombian Caribbean between 1998 and 2007 (material included as MHNMC, Roa-Varón 2000, Saavedra 2000, Polanco 2010)

Table 2. Marine fish species recorded in the Department of Atlántico included in the Colombian fish red list according to Chasqui ***et al.*** (2017).

Species	Category	Species	Category
Isurus oxyrinchus	DD	*Carcharhinus limbatus*	VU
Carcharhinus porosus	DD	*Sphyrna lewini*	VU
Thunnus alalunga	DD	*Sphyrna mokarran*	VU
Lutjanus jocu	DD	*Sciades proops*	VU
Elops smithi	LC	*Caranx hippos*	VU
Auxis thazard	LC	*Centropomus undecimalis*	VU
Euthynnus alletteratus	LC	*Mugil incilis*	VU
Scomberomorus cavalla	LC	*Mugil liza*	VU
Lutjanus synagris	LC	*Eugerres plumieri*	VU
Alopias superciliosus	NT	*Lutjanus analis*	VU
Galeocerdo cuvier	NT	*Lutjanus cyanopterus*	VU
Rhizoprionodon porosus	NT	*Mycteroperca bonaci*	VU
Hypanus americanus	NT	*Cathorops mapale*	VU
Aetobatus narinari	NT	*Notarius bonillai*	EN
Cetengraulis edentulus	NT	*Balistes vetula*	EN
Thunnus albacares	NT	*Pristis pristis*	CR
Sphyraena barracuda	NT	*Megalops atlanticus*	CR
Ocyurus chrysurus	NT	*Epinephelus itajara*	CR
Carcharhinus falciformis	VU		

CR= Critically endangered, EN= Endangered, VU=Vulnerable, NT=Near threatened, LC=Least concern and DD=Data deficient.

and the review of samples from foreign collections (Polanco 2015). For the species *G. funebris,* which is listed as a new sighting for the department without photographic support, we considered it a valid record as it has been previously included within the area through approximate distribution models (Robertson *et al.* c2019, Polanco. *et al.* 2020).

Despite general assumptions that the fauna of the coastal waters is fairly known, most of them are unconfirmed records and lack reference collections to back them. Despite the uncertainty, all unconfirmed records here were incorporated because they are included in previous regional studies based on approximate species distribution models (Robertson *et al.* c2019, Polanco 2020), that include the continental coastal area of the Colombian Caribbean. This study highlights the need for increased research efforts in the future within the scientific community.

This study is a baseline of species that have been documented as inhabitants of this sector of the Colombian Caribbean. It also reveals the scarce knowledge about this group of organisms in the area, which is an important part of the economy of the fishers and inhabitants. It is recommended to encourage and support the strengthening of local biological collections of coastal-marine fish, as well as population studies, especially for those species with some type of threat at the national level, to establish their status at the local level.

AUTHOR CONTRIBUTIONS

JMT Conceptualization, Methodology, Formal analysis, Investigation, Writing - Original Draft and Visualization, AGC Conceptualization, Methodology, Investigation, Resources, Visualization, Supervision, Project administration, Writing - Review and Editing, APF Validation, Resources, Writing - Review and Editing.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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