



Fish Biodiversity in Three Northern Islands of the Seaflower Biosphere Reserve (Colombian Caribbean)

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BACKGROUND

The archipelago of San Andres, Providence and Santa Catalina was declared by the United Nations Educational, Scientific and Cultural Organization (UNESCO) as the Seaflower Biosphere Reserve in the year 2000. With 180,000 km², the archipelago boasts a variety of ecosystems and relatively high levels of biodiversity within the region. In light of the urgent need to appraise the value of marine biodiversity within the reserve and understand its role in contributing to food security for the resident human population, the Colombian government has organized three annual expeditions to three different northern islands. The dataset presented here summarizes the information on fish biodiversity collected in three of the reserve's northern islands, namely Roncador, Serrana, and Serranilla during 2015–2017. In order to include all the information about the Colombian northern islands of the archipelago, data from Quitasueño were also added despite it has not been visited yet by this series of annual expeditions.

DATA DESCRIPTION

Study Area

The archipelago of San Andres, Old Providence and Santa Catalina (Colombia) occupies a relatively small, yet important portion of the central western Caribbean Sea between 82 and 86°W meridians and 12 and 16°N parallels. The three main islands are populated by “raizales” (i.e., an Afrocolombian ethnic group mainly dedicated to fishing and trade among the islands of the reserve), mainland Colombians, and foreigners. According to the national laws, fishing is only allowed for raizales, yet enforcement is weak and illegal fishing by fleets from Jamaica, Nicaragua, Honduras, and others, is common. Enforcement is particularly challenging on the smallest islands of the reserve, as these are patrolled by an often small number of officials and vessels of the Colombian naval force. The archipelago encompasses about three fourths of the more than one hundred Colombian coralline formations. Since 2014 the Colombian government through the Comisión Colombiana del Océano (CCO) has carried out three annual scientific expeditions to the reserve visiting one island at a time. To date, three northern islands have been intensively surveyed, namely Roncador in 2015 (13.533333 N, –80.05 W), Serrana in 2016 (14.383333 N, –80.2 W), and Serranilla in 2017 (15.833333 N, –79.833333 W).

Methods

Here we compile a fish biodiversity dataset for Roncador, Serrana, and Serranilla from various sources. The first one is a published checklist of species ($n = 653$) distributed in 121 families constructed based on 28 papers (peer-reviewed and non-peer-reviewed) published since 1944, as well as on unpublished data gathered by the authors over the past two decades (Bolaños-Cubillos et al., 2015). The second source corresponds to a series of unpublished biological records which are partially available at the Biodiversity Information System of Colombia (SIB Colombia) and were collected during the 2015, 2016, and 2017 Seaflower Expeditions (Acero, 2018; Acero et al., 2018; Polanco, 2018). The third and last source comprised a list of species found on the deep shelves and upper slopes of the islands of the reserve (Polanco, 2015; Robertson and Van Tassell, 2015). For the sake of completeness, all information available from Quitasueño (the only northern island of this archipelago not visited yet by these series of expeditions), usually from Robertson and Van Tassell (2015) or from unpublished short visits by Colombian scientist, is included.

During the expeditions organized by the CCO data were collected by scuba diving as well as snorkeling over a total of 250 man-hours of underwater observation, using the 30-min timed free swim method in depths ranging between 0 and 35 m. As our main objective was to focus on species richness, six ecological units (INVEMAR-ANH, 2012) were surveyed, namely Octocoral-Sponges, Macroalgae-Octocoral-Sponge Meadows, Bioturbated Sediment—Calcareous Algae, Leafy Algae over Rubble, *Acropora palmata*-Octocorals, Seagrass Meadow and Encrusting Algae-Encrusting Sponge-Octocoral, and Coral Mixture. Specimens collected or photographed by several expedition members were also identified and included. In the case of Serranilla, seven species were recorded by video cameras during the project “Elasmobranch diversity and abundance estimates using baited remote underwater video stations” developed by Colombia Azul Foundation, Universidad de los Andes, and Florida International University. Scientific names of species follow the Catalog of Fishes (Eschmeyer et al., 2018) and the classification follows Eschmeyer et al. (2018) for cartilaginous fishes and Betancur-R et al. (2017) for bony fishes.

Description of the Dataset

The dataset presented here comprises a depurated inventory of the fish species reported from Roncador, Serrana, and Serranilla (the three of them already visited by the recent CCO expeditions), as well as from Quitasueño, the largest and westernmost island, which has not been yet visited by the CCO expeditions. The dataset includes all the fish species observed during the expeditions carried out between 2015 and 2017 (Table 1) plus the reports previously published in Bolaños-Cubillos et al. (2015), Polanco (2015), and Robertson and Van Tassell (2015). The six fields included per species within this dataset are listed and described in detail below.

Taxon ID and Scientific Name ID: This field includes a unique and stable-through-time alphanumeric identifier (taxonomic

identifier) provided by Life Science Identifier (LSID), recovered from World Register of Marine Species (WoRMS) (AphiaID).

Basis of record: As the data set includes records based on human observations, machine observations (Baited Remote Underwater Video Stations - BRUVs) or preserved specimens this field contains this specific information for each species.

Bibliographic Citation: This field includes the reference that explicitly reports the species on the northern islands of the Seaflower Biosphere Reserve.

Reference: URLs associated to georeferenced occurrences of the species found in the dataset.

Locality: Specific localities where the species have been recorded in the northern islands are presented in this field. Four localities were defined considering the islands Quitasueño, Roncador, Serrana, Serranilla, and a locality named North for species found on the northern area among the banks.

Locality ID: The Marine Regions Geographic Identifier (MRGID) provided by mariregions.org for each island and the MRGID for the Seaflower Marine Protected Area for the locality named “North.”

Outcomes and Discussion

A total of 411 species are recorded here for our study area, that is the northern islands of the reserve (i.e., Roncador, Serrana, and Serranilla) and the westernmost island Quitasueño. Considering that a total of 1,694 fish species (including shelf and slope fishes) are reported for the Greater Caribbean region (Robertson and Van Tassell, 2015), our study area harbors 24% (i.e., close to one fourth) of the region's fish species richness. Fifty four percent of the species reported here (i.e., 220) were inventoried by the authors (Table 1) during expeditions to Roncador in 2015 ($n = 140$), Serrana in 2016 ($n = 155$), and Serranilla in 2017 ($n = 166$). With 1,577 fish species reportedly native to and resident in the shallow waters (<100 m) of the Greater Caribbean (Robertson and Van Tassell, 2015), our findings demonstrated that just three of the smallest islands of the reserve encompass a remarkable proportion (i.e., 14%) of Greater Caribbean marine fish species richness. This high diversity is concentrated in an area less than 5% of Greater Caribbean extension. Interestingly, only 42% species ($n = 92$) were common to the three islands. When clustering sites based on fish community structure using the Jaccard index of similarity, relatively low values are observed between pairs of islands indicating that each island harbors relatively distinct fish communities. The fish faunas of Roncador and Serrana, for instance, are 62% similar, and those of Roncador and Serranilla are alike only by 52%. This result emphasizes the urgent need to protect the valuable and unique fish assemblages of these and other small islands and banks comprising the archipelago.

Another point worth remarking is the consistent absence (or at least rarity) of several large-bodied, commercially valuable species throughout the reserve threatened by overfishing (Chasqui et al., 2017). Most striking is the absence of the Nassau grouper, *Epinephelus striatus*, one of the most typical large epinephelines of Caribbean coral reefs (Bent-Hooker, 2012).

TABLE 1 | Inventory of the species observed in three of the northern islands of the Reserve Roncador, Serrana and Serranilla with some additional records from Quitasueño and the northern water territories.

Family and species	Location	References
CHIMAERIDAE		
<i>Chimaera cubana</i>	North	Bolaños-Cubillos et al., 2015
GINGLYMOSTOMATIDAE		
<i>Ginglymostoma cirratum</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero, 2018; Acero et al., 2018
LAMNIDAE		
<i>Isurus oxyrinchus</i>	North	Bolaños-Cubillos et al., 2015
SCYLIORHINIDAE		
<i>Scyliorhinus retifer</i>	Quitasueño	Robertson et al., 2015
TRIAKIDAE		
<i>Mustelus canis insularis</i>	North	Bolaños-Cubillos et al., 2015
CARCHARHINIDAE		
<i>Carcharhinus acronotus</i>	Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Carcharhinus altimus</i>	North	Bolaños-Cubillos et al., 2015
<i>Carcharhinus falciformis</i>	North	Bolaños-Cubillos et al., 2015
<i>Carcharhinus leucas</i>	North	Bolaños-Cubillos et al., 2015
<i>Carcharhinus limbatus</i>	North	Bolaños-Cubillos et al., 2015
<i>Carcharhinus obscurus</i>	North	Bolaños-Cubillos et al., 2015
<i>Carcharhinus perezii</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Fundación Colombia Azul et al., 2017
<i>Carcharhinus plumbeus</i>	North	Bolaños-Cubillos et al., 2015
<i>Galeocerdo cuvier</i>	Serranilla	Bolaños-Cubillos et al., 2015; Fundación Colombia Azul et al., 2017
<i>Negaprion brevirostris</i>	Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Prionace glauca</i>	North	Bolaños-Cubillos et al., 2015
<i>Rhizoprionodon porosus</i>	North	Bolaños-Cubillos et al., 2015
<i>Rhizoprionodon terraenovae</i> *D	Serranilla	Fundación Colombia Azul et al., 2017
SPHYRNIDAE		
<i>Sphyrna lewini</i>	Serrana	Bolaños-Cubillos et al., 2015
<i>Sphyrna mokarran</i>	Serranilla	Bolaños-Cubillos et al., 2015; Fundación Colombia Azul et al., 2017
HEXANCHIDAE		
<i>Hepranchias perlo</i>	North	Bolaños-Cubillos et al., 2015
<i>Hexanchus nakamurai</i>	North	Bolaños-Cubillos et al., 2015
SQUALIDAE		
<i>Squalus cubensis</i>	North	Bolaños-Cubillos et al., 2015
NARCINIDAE		
<i>Narcine bancroftii</i>	North	Bolaños-Cubillos et al., 2015
RHINOBATIDAE		
<i>Pseudobatos percellens</i>	Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
RAJIDAE		
<i>Fenestraja sinusmexicanus</i>	Quitasueño	Polanco, 2015
<i>Leucoraja garmani</i>	Quitasueño	Polanco, 2015

(Continued)

TABLE 1 | Continued

Family and species	Location	References
UROTRYGONIDAE		
<i>Urobatis jamaicensis</i>	Serrana	Bolaños-Cubillos et al., 2015
DASYATIDAE		
<i>Hypanus americanus</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Hypanus sabinus</i> *D	Serranilla	Acero et al., 2018
MYLIOBATIDAE		
<i>Aetobatus narinari</i>	Serrana	Bolaños-Cubillos et al., 2015
MEGALOPIDAE		
<i>Megalops atlanticus</i>	North	Bolaños-Cubillos et al., 2015
ALBULIDAE		
<i>Albula vulpes</i>	Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
CONGRIDAE		
<i>Conger esculentus</i>	North	Bolaños-Cubillos et al., 2015
<i>Heteroconger longissimus</i>	Roncador, Serrana	Bolaños-Cubillos et al., 2015
<i>Pseudoplichthys splendens</i>	Quitasueño	Polanco, 2015
<i>Rhynchoconger gracilior</i>	Quitasueño	Polanco, 2015
MURAENIDAE		
<i>Anarchias similis</i>	Quitasueño	Robertson et al., 2015
<i>Echidna catenata</i>	Roncador, Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Enchelycore nigricans</i>	North	Bolaños-Cubillos et al., 2015
<i>Gymnothorax conspersus</i>	North	Bolaños-Cubillos et al., 2015
<i>Gymnothorax funebris</i>	Roncador, Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Gymnothorax maderensis</i>	North	Bolaños-Cubillos et al., 2015
<i>Gymnothorax millaris</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Gymnothorax moringa</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Gymnothorax vicinus</i>	Roncador, Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Uropterygius macularius</i>	North	Bolaños-Cubillos et al., 2015
NETTASTOMATIDAE		
<i>Hoplunnis macrura</i>	Quitasueño	Robertson et al., 2015
<i>Hoplunnis tenuis</i>	Quitasueño	Polanco, 2015
OPHICHTHIDAE		
<i>Ahlia egmontis</i>	Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Callechelys bilinearis</i>	North	Bolaños-Cubillos et al., 2015
<i>Myrichthys breviceps</i>	Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Myrichthys ocellatus</i>	North	Bolaños-Cubillos et al., 2015
<i>Myrophis platyrhynchus</i>	Quitasueño	Robertson et al., 2015
<i>Ophichthus ophis</i>	Serranilla	Acero et al., 2018
<i>Ophichthus spinicauda</i>	North	Bolaños-Cubillos et al., 2015

(Continued)

TABLE 1 | Continued

Family and species	Location	References
CHLOPSIDAE		
<i>Kaupichthys hyoproridaes</i>	North	Bolaños-Cubillos et al., 2015
MORINGUIDAE		
<i>Moringua edwardsi</i>	North	Bolaños-Cubillos et al., 2015
CLUPEIDAE		
<i>Harengula humeralis</i>	North	Bolaños-Cubillos et al., 2015
<i>Jenkinsia lamprotaenia</i>	North	Bolaños-Cubillos et al., 2015
<i>Jenkinsia majua</i>	North	Bolaños-Cubillos et al., 2015
ENGRAULIDAE		
<i>Anchoa lamprotaenia</i>	North	Bolaños-Cubillos et al., 2015
ARGENTINIDAE		
<i>Glossanodon pygmaeus</i>	Quitásueño	Robertson et al., 2015
SYNODONTIDAE		
<i>Saurida brasiliensis</i>	Quitásueño	Robertson et al., 2015
<i>Saurida caribbaea</i>	Quitásueño	Polanco, 2015
<i>Saurida normani</i>	North	Bolaños-Cubillos et al., 2015
<i>Synodus intermedius</i>	Roncador, Serrana	Bolaños-Cubillos et al., 2015
<i>Synodus synodus</i>	Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
CHLOROPHTHALMIDAE		
<i>Chlorophthalmus agassizi</i>	Quitásueño	Polanco, 2015
PARAZENIDAE		
<i>Cyttopsis rosea</i>	Quitásueño	Polanco, 2015
<i>Parazen pacificus</i>	Quitásueño	Polanco, 2015
ZENIONTIDAE		
<i>Zenion hololepis</i>	Quitásueño	Polanco, 2015
GRAMMICOLEPIDIDAE		
<i>Xenolepidichthys dalgleishi</i>	Quitásueño	Polanco, 2015
MERLUCCIIDAE		
<i>Steindachneria argentea</i>	Quitásueño	Polanco, 2015
<i>Merluccius albidus</i>	Quitásueño	Polanco, 2015
POLYMIXIIDAE		
<i>Polymixia lowei</i>	North	Bolaños-Cubillos et al., 2015
BERYCIDAE		
<i>Beryx splendens</i>	Quitásueño	Polanco, 2015
TRACHICHTHYIDAE		
<i>Hoplostethus occidentalis</i>	Quitásueño	Polanco, 2015
HOLOCENTRIDAE		
<i>Holocentrus adscensionis</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero, 2018; Acero et al., 2018
<i>Holocentrus rufus</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero, 2018; Acero et al., 2018
<i>Myripristis jacobus</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero, 2018; Acero et al., 2018
<i>Ostichthys trachypoma</i>	North	Bolaños-Cubillos et al., 2015
<i>Neoniphon marianus</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero, 2018; Acero et al., 2018

(Continued)

TABLE 1 | Continued

Family and species	Location	References
<i>Sargocentron coruscum</i>	North	Bolaños-Cubillos et al., 2015
<i>Sargocentron vexillarium</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
OPHIDIIDAE		
<i>Lepophidium entomelan</i>	North	Bolaños-Cubillos et al., 2015
<i>Lepophidium kallion</i>	North	Polanco, 2015
<i>Lepophidium marmoratum</i>	North	Bolaños-Cubillos et al., 2015
<i>Lepophidium staurophor</i>	North	Bolaños-Cubillos et al., 2015
<i>Neobythites marginatus</i>	Quitásueño	Polanco, 2015
<i>Neobythites multiocellatus</i>	Quitásueño	Robertson et al., 2015
APOGONIDAE		
<i>Apogon binotatus</i>	North	Bolaños-Cubillos et al., 2015
<i>Apogon lachneri</i>	Serrana	Bolaños-Cubillos et al., 2015
<i>Apogon maculatus</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Apogon pseudomaculatus</i>	North	Bolaños-Cubillos et al., 2015
<i>Apogon quadrisquamatus</i>	Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Apogon townsendi</i>	Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Astrapogon puncticulatus</i>	North	Bolaños-Cubillos et al., 2015
<i>Astrapogon stellatus</i>	North	Bolaños-Cubillos et al., 2015
<i>Phaeoptyx conklini</i>	North	Bolaños-Cubillos et al., 2015
<i>Paroncheilus affinis</i>	Quitásueño	Robertson et al., 2015
GOBIIDAE		
<i>Bathygobius soporator</i>	North	Bolaños-Cubillos et al., 2015
<i>Coryphopterus dicrus</i>	Roncador	Bolaños-Cubillos et al., 2015
<i>Coryphopterus eidolon</i>	Roncador	Bolaños-Cubillos et al., 2015
<i>Coryphopterus lipernes</i>	North	Bolaños-Cubillos et al., 2015
<i>Coryphopterus personatus</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Coryphopterus tortugae</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Cryptopsilotris batrachodes</i> *MP	Serranilla	Acero et al., 2018
<i>Elacatinus evelynae</i>	Roncador, Serrana	Bolaños-Cubillos et al., 2015
<i>Elacatinus horsti</i>	Roncador, Serrana	Bolaños-Cubillos et al., 2015
<i>Elacatinus illecebrosus</i>	Roncador	
<i>Elacatinus lori</i>	North	Bolaños-Cubillos et al., 2015
<i>Elacatinus louisae</i>	Roncador, Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Elacatinus prochilos</i>	Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Elacatinus serranilla</i>	Serranilla	Robertson et al., 2015
<i>Gnatholepis thompsoni</i>	Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Nes longus</i>	North	Bolaños-Cubillos et al., 2015

(Continued)

TABLE 1 | Continued

Family and species	Location	References
<i>Risor ruber</i>	North	Bolaños-Cubillos et al., 2015
<i>Tigriogobius dilepis</i>	Roncador	Bolaños-Cubillos et al., 2015
<i>Varicus bucca</i>	Serrana	Robertson et al., 2015
AULOSTOMIDAE		
<i>Aulostomus maculatus</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero, 2018; Acero et al., 2018
FISTULARIIDAE		
<i>Fistularia tabacaria</i> *	Serranilla	Acero et al., 2018
SYNGNATHIDAE		
<i>Bryx dunckeri</i>	North	Bolaños-Cubillos et al., 2015
<i>Microphis lineatus</i>	North	Bolaños-Cubillos et al., 2015
<i>Syngnathus pelagicus</i>	Roncador	
DACTYLOPTERIDAE		
<i>Dactylopterus volitans</i>	Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
CALLIONYMIDAE		
<i>Callionymus bairdi</i>	North	Bolaños-Cubillos et al., 2015
<i>Foetorepus agassizi</i>	Quitásueño	Polanco, 2015
MULLIDAE		
<i>Mullidichthys martinicus</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero, 2018; Acero et al., 2018
<i>Pseudupeneus maculatus</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero, 2018; Acero et al., 2018
GEMPYLIDAE		
<i>Gempylus serpens</i>	North	Bolaños-Cubillos et al., 2015
<i>Nealotus tripes</i>	North	Bolaños-Cubillos et al., 2015
<i>Promethichthys prometheus</i>	Quitásueño	Polanco, 2015
NOMEIDAE		
<i>Nomeus gronovii</i>	North	Bolaños-Cubillos et al., 2015
SCOMBRIDAE		
<i>Acanthocybium solandri</i>	Serrana	Bolaños-Cubillos et al., 2015
<i>Euthynnus alletteratus</i>	North	Bolaños-Cubillos et al., 2015
<i>Katsuwonus pelamis</i>	North	Bolaños-Cubillos et al., 2015
<i>Scomberomorus cavalla</i>	North	Bolaños-Cubillos et al., 2015
<i>Scomberomorus regalis</i>	North	Bolaños-Cubillos et al., 2015
<i>Thunnus atlanticus</i>	North	Bolaños-Cubillos et al., 2015
<i>Thunnus obesus</i>	North	Bolaños-Cubillos et al., 2015
POLYNEMIDAE		
<i>Polydactylus virginicus</i>	North	Bolaños-Cubillos et al., 2015
SPHYRAENIDAE		
<i>Sphyræna barracuda</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero, 2018; Acero et al., 2018
<i>Sphyræna picudilla</i>	Roncador, Serrana	
CARANGIDAE		
<i>Alectis ciliaris</i>	North	Bolaños-Cubillos et al., 2015
<i>Caranx bartholomaei</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Caranx crysos</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero, 2018; Acero et al., 2018

(Continued)

TABLE 1 | Continued

Family and species	Location	References
<i>Caranx hippos</i>	Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Caranx latus</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Caranx lugubris</i>	Roncador, Serrana	Bolaños-Cubillos et al., 2015
<i>Caranx ruber</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero, 2018; Acero et al., 2018
<i>Decapterus macarellus</i>	Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Decapterus punctatus</i>	Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Elagatis bipinnulata</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Seriola dumerili</i>	North	Bolaños-Cubillos et al., 2015
<i>Seriola fasciata</i>	Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Seriola rivoliana</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Trachinotus falcatus</i>	North	Bolaños-Cubillos et al., 2015
<i>Trachinotus goodiei</i>	Roncador, Serrana	Bolaños-Cubillos et al., 2015
CORYPHAENIDAE		
<i>Coryphaena hippurus</i>	Roncador, Serrana	Bolaños-Cubillos et al., 2015
ECHENEIDAE		
<i>Echeneis naucrates</i>	Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Echeneis neucratoides</i>	North	Bolaños-Cubillos et al., 2015
<i>Phtheichthys lineatus</i>	North	Bolaños-Cubillos et al., 2015
<i>Remora brachyptera</i>	Serrana	Robertson et al., 2015
RACHYCENTRIDAE		
<i>Rachycentron canadum</i>	North	Bolaños-Cubillos et al., 2015
BOTHIDAE		
<i>Bothus lunatus</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
PARALICHTHYIDAE		
<i>Ancylosetta microctenus</i>	Quitásueño	Polanco, 2015
<i>Citharichthys dinoceros</i>	Quitásueño	Polanco, 2015
GRAMMATIDAE		
<i>Gramma loreto</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero, 2018; Acero et al., 2018
<i>Gramma melacara</i>	Roncador, Serrana	Bolaños-Cubillos et al., 2015
OPISTOGNATHIDAE		
<i>Opistognathus aurifrons</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Opistognathus maxillosus</i>	North	Bolaños-Cubillos et al., 2015
<i>Opistognathus whitehursti</i>	North	Bolaños-Cubillos et al., 2015
POMACENTRIDAE		
<i>Abudefduf saxatilis</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero, 2018; Acero et al., 2018
<i>Abudefduf taurus</i>	Roncador	Bolaños-Cubillos et al., 2015
<i>Chromis cyanea</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero, 2018; Acero et al., 2018

(Continued)

TABLE 1 | Continued

Family and species	Location	References
<i>Chromis insolata</i>	Roncador	Bolaños-Cubillos et al., 2015
<i>Chromis multilineata</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Microspathodon chrysurus</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Stegastes adustus</i>	Roncador, Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Stegastes diencaeus</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero, 2018; Acero et al., 2018
<i>Stegastes leucostictus</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero, 2018; Acero et al., 2018
<i>Stegastes partitus</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero, 2018; Acero et al., 2018
<i>Stegastes planifrons</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Stegastes xanthurus</i>	Roncador, Serrana	Bolaños-Cubillos et al., 2015; Acero, 2018
ATHERINIDAE		
<i>Atherina harringtonensis</i>	Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Atherinomorus stipes</i>	North	Bolaños-Cubillos et al., 2015
BELONIDAE		
<i>Ablennes hians</i>	North	Bolaños-Cubillos et al., 2015
<i>Platybelone argalus argalus</i>	North	Bolaños-Cubillos et al., 2015
<i>Strongylura notata</i>	North	Bolaños-Cubillos et al., 2015
<i>Tylosurus acus acus</i>	North	Bolaños-Cubillos et al., 2015
<i>Tylosurus crocodilus crocodilus</i>	North	Bolaños-Cubillos et al., 2015
EXOCOETIDAE		
<i>Cheilopogon cyanopterus</i>	Quitásueño	Robertson et al., 2015
<i>Cheilopogon exsiliens</i>	North	Bolaños-Cubillos et al., 2015
<i>Cheilopogon melanurus</i>	North	Bolaños-Cubillos et al., 2015
<i>Cypselurus comatus</i>	North	Robertson et al., 2015
<i>Exocoetus obtusirostris</i>	Quitásueño	Robertson et al., 2015
<i>Exocoetus volitans</i>	Quitásueño	Robertson et al., 2015
<i>Hirundichthys affinis</i>	North	Bolaños-Cubillos et al., 2015
<i>Parexocoetus hillianus</i>	North	Bolaños-Cubillos et al., 2015
<i>Prognichthys occidentalis</i>	North	Bolaños-Cubillos et al., 2015
HEMIRAMPHIDAE		
<i>Hemiramphus balao</i>	North	Robertson et al., 2015
<i>Hemiramphus brasiliensis</i>	Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
MUGILIDAE		
<i>Mugil curema</i>	North	Bolaños-Cubillos et al., 2015
<i>Mugil trichodon</i>	North	Bolaños-Cubillos et al., 2015
GOBIESOCIDAE		
<i>Gobiesox punctulatus</i>	Serranilla	Bolaños-Cubillos et al., 2015
BLENNIIDAE		
<i>Entomacrodus nigricans</i>	North	Bolaños-Cubillos et al., 2015

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TABLE 1 | Continued

Family and species	Location	References
<i>Ophioblennius macclurei</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
CHAENOPSIDAE		
<i>Acanthemblemaria aspera</i> *	Serrana	
<i>Acanthemblemaria maria</i> *	Serranilla	Acero et al., 2018
<i>Acanthemblemaria spinosa</i> *	Serrana	
<i>Emblemaria caycedoi</i>	North	Bolaños-Cubillos et al., 2015
<i>Emblemariopsis</i> sp. *	Serrana	
<i>Lucayablennius zingaro</i>	Roncador, Serrana	Bolaños-Cubillos et al., 2015
LABRISOMIDAE		
<i>Brockius albigenys</i>	North	Bolaños-Cubillos et al., 2015
<i>Gobioclinus bucciferus</i>	North	Bolaños-Cubillos et al., 2015
<i>Gobioclinus gobio</i>	North	Bolaños-Cubillos et al., 2015
<i>Gobioclinus guppyi</i>	North	Bolaños-Cubillos et al., 2015
<i>Brockius nigricinctus</i>	Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Labrisomus nuchipinnis</i>	Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Malaccoctenus aurolineatus</i>	Roncador, Serrana	Bolaños-Cubillos et al., 2015
<i>Malaccoctenus boehlkei</i>	Roncador, Serrana	Bolaños-Cubillos et al., 2015
<i>Malaccoctenus erdmani</i>	Serrana	
<i>Malaccoctenus gilli</i>	Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Malaccoctenus macropus</i>	Roncador, Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Malaccoctenus triangulatus</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
CHAENOPSIDAE		
<i>Stathmonotus gymnoderms</i> *MP	Serranilla	Acero et al., 2018
TRIPTERYGIIDAE		
<i>Enneanectes pectoralis</i>	North	Bolaños-Cubillos et al., 2015
CAPROIDAE		
<i>Antigonia capros</i>	North	Bolaños-Cubillos et al., 2015
<i>Antigonia combatia</i>	Quitásueño	Polanco, 2015
GERREIDAE		
<i>Eucinostomus argenteus</i>	North	Bolaños-Cubillos et al., 2015
<i>Eucinostomus lefroyi</i> *	Serranilla	Acero et al., 2018
<i>Gerres cinereus</i>	North	Bolaños-Cubillos et al., 2015
HAEMULIDAE		
<i>Anisotremus surinamensis</i>	Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Anisotremus virginicus</i>	North	Bolaños-Cubillos et al., 2015
<i>Brachygenys chrysgyreus</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Haemulon album</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero, 2018; Acero et al., 2018

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Family and species	Location	References
<i>Haemulon aurolineatum</i>	Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Haemulon carbonarium</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Haemulon flavolineatum</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero, 2018; Acero et al., 2018
<i>Haemulon macrostomum</i>	Serrana	Bolaños-Cubillos et al., 2015
<i>Haemulon melanurum</i>	Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero, 2018; Acero et al., 2018
<i>Haemulon parra</i>	Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Haemulon plumieri</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero, 2018; Acero et al., 2018
<i>Haemulon sciurus</i>	Serrana	Bolaños-Cubillos et al., 2015
<i>Haemulon striatum</i>	North	Bolaños-Cubillos et al., 2015
<i>Haemulon vittatum</i>	Serrana	Bolaños-Cubillos et al., 2015
LUTJANIDAE		
<i>Apsilus dentatus</i>	North	Bolaños-Cubillos et al., 2015
<i>Etelis oculatus</i>	North	Bolaños-Cubillos et al., 2015
<i>Lutjanus analis</i>	Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Lutjanus apodus</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero, 2018; Acero et al., 2018
<i>Lutjanus buccanella</i>	North	Bolaños-Cubillos et al., 2015
<i>Lutjanus cyanopterus</i>	North	Bolaños-Cubillos et al., 2015
<i>Lutjanus griseus</i>	Serrana	Bolaños-Cubillos et al., 2015
<i>Lutjanus jocu</i>	Roncador, Serrana	Bolaños-Cubillos et al., 2015
<i>Lutjanus mahogoni</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero, 2018; Acero et al., 2018
<i>Lutjanus purpureus</i>	North	Bolaños-Cubillos et al., 2015
<i>Lutjanus synagris</i>	Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Lutjanus vivanus</i>	North	Bolaños-Cubillos et al., 2015
<i>Ocyurus chrysurus</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Pristipomoides macrophthalmus</i>	North	Bolaños-Cubillos et al., 2015
<i>Rhomboplites aurubens</i>	North	Bolaños-Cubillos et al., 2015
MALACANTHIDAE		
<i>Caulolatilus cyanops</i>	North	Bolaños-Cubillos et al., 2015
<i>Malacanthus plumieri</i>	Roncador, Serrana, Serranilla	Acero, 2018; Acero et al., 2018
POMACANTHIDAE		
<i>Centropyge argi</i>	Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Holacanthus ciliaris</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero, 2018; Acero et al., 2018
<i>Holacanthus tricolor</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero, 2018; Acero et al., 2018
<i>Pomacanthus arcuatus</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero, 2018; Acero et al., 2018
<i>Pomacanthus paru</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018

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Family and species	Location	References
PRIACANTHIDAE		
<i>Cookeolus japonicus</i>	North	Bolaños-Cubillos et al., 2015
<i>Heteropriacanthus cruentatus</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Priacanthus arenatus</i> *	Serranilla	Acero et al., 2018
SCIAENIDAE		
<i>Equetus lanceolatus</i>	Roncador, Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Equetus punctatus</i>	Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero, 2018; Acero et al., 2018
<i>Pareques acuminatus</i>	Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero, 2018; Acero et al., 2018
URANOSCOPIDAE		
<i>Kathetostoma cubana</i>	North	Polanco, 2015
LABRIDAE		
<i>Bodianus rufus</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Clepticus parrae</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero, 2018; Acero et al., 2018
<i>Doratonotus megalepis</i> *	Serranilla	Acero et al., 2018
<i>Halichoeres bivittatus</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Halichoeres cyanocephalus</i>	Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Halichoeres garnoti</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero, 2018; Acero et al., 2018
<i>Halichoeres maculipinna</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Halichoeres pictus</i>	Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Halichoeres poeyi</i>	Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Halichoeres radiatus</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Lachnolaimus maximus</i>	Roncador, Serrana	Bolaños-Cubillos et al., 2015
<i>Thalassoma bifasciatum</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero, 2018; Acero et al., 2018
<i>Xyrichthys martinicensis</i>	Roncador	Bolaños-Cubillos et al., 2015
<i>Xyrichthys novacula</i>	North	Bolaños-Cubillos et al., 2015
<i>Xyrichthys splendens</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
SCARIDAE		
<i>Cryptotomus roseus</i>	North	Bolaños-Cubillos et al., 2015
<i>Nicholsina usta</i>	Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Scarus coelestinus</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Scarus coeruleus</i>	North	Bolaños-Cubillos et al., 2015
<i>Scarus guacamaia</i>	North	Bolaños-Cubillos et al., 2015
<i>Scarus iseri</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero, 2018; Acero et al., 2018
<i>Scarus taeniopterus</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero, 2018; Acero et al., 2018

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TABLE 1 | Continued

Family and species	Location	References
<i>Scarus vetula</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero, 2018; Acero et al., 2018
<i>Sparisoma atomarium</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero, 2018; Acero et al., 2018
<i>Sparisoma aurofrenatum</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero, 2018; Acero et al., 2018
<i>Sparisoma chrysopterygum</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero, 2018; Acero et al., 2018
<i>Sparisoma radians</i>	Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Sparisoma rubripinne</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Sparisoma viride</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero, 2018; Acero et al., 2018
LOBOTIDAE		
<i>Lobotes surinamensis</i>	North	Bolaños-Cubillos et al., 2015
EPHIPPIDAE		
<i>Chaetodipterus faber</i>	North	Bolaños-Cubillos et al., 2015
SPARIDAE		
<i>Calamus bajonado</i>	North	Bolaños-Cubillos et al., 2015
<i>Calamus calamus</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero, 2018; Acero et al., 2018
CHAETODONTIDAE		
<i>Chaetodon capistratus</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero, 2018; Acero et al., 2018
<i>Chaetodon ocellatus</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero, 2018; Acero et al., 2018
<i>Chaetodon sedentarius</i>	Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Chaetodon striatus</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero, 2018; Acero et al., 2018
<i>Prognathodes aculeatus</i>	Roncador, Serrana	Bolaños-Cubillos et al., 2015
ANTENNARIIDAE		
<i>Antennarius pauciradiatus</i> *	Roncador	
<i>Histrio histrio</i> *	Roncador	Bolaños-Cubillos et al., 2015
OGCOEPHALIDAE		
<i>Dibranchius atlanticus</i>	Quitassueño	Polanco, 2015
<i>Malthopsis gnoma</i>	Quitassueño	Polanco, 2015
<i>Ogcocephalus pumilus</i>	Quitassueño	Robertson et al., 2015
<i>Zalieutes mcgintyi</i>	Quitassueño	Polanco, 2015
TRIACANTHODIDAE		
<i>Hollardia hollardi</i>	Quitassueño	Polanco, 2015
<i>Parahollardia schmidti</i>	Quitassueño	Polanco, 2015
DIODONTIDAE		
<i>Chilomycterus antillarum</i> *	Serrana	Acero, 2018
<i>Diodon holocanthus</i>	Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Diodon hystrix</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
TETRAODONTIDAE		
<i>Canthigaster rostrata</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero, 2018; Acero et al., 2018

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TABLE 1 | Continued

Family and species	Location	References
<i>Sphoeroides dorsalis</i>	Quitassueño	Robertson et al., 2015
<i>Sphoeroides spengleri</i>	Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Polanco, 2018
BALISTIDAE		
<i>Balistes capriscus</i>	Roncador	
<i>Balistes vetula</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero, 2018; Acero et al., 2018
<i>Canthidermis maculata</i>	North	Bolaños-Cubillos et al., 2015
<i>Canthidermis sufflamen</i>	Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero, 2018; Acero et al., 2018
<i>Melichthys niger</i>	Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Xanthichthys ringens</i>	North	Bolaños-Cubillos et al., 2015
MONACANTHIDAE		
<i>Aluterus scriptus</i>	Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Cantherines macrocerus</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero, 2018; Acero et al., 2018
<i>Cantherines pullus</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Monacanthus ciliatus</i> *	Serranilla	Acero et al., 2018
<i>Monacanthus tuckeri</i>	North	Bolaños-Cubillos et al., 2015
<i>Stephanolepis setifer</i> *	Roncador	
OSTRACIIDAE		
<i>Acanthostracion polygonius</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Acanthostracion quadricornis</i>	Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Lactophrys bicaudalis</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Lactophrys trigonus</i>	Roncador	Bolaños-Cubillos et al., 2015
<i>Lactophrys triquetter</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero, 2018; Acero et al., 2018
ACANTHURIDAE		
<i>Acanthurus chirurgus</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero, 2018; Acero et al., 2018
<i>Acanthurus coeruleus</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero, 2018; Acero et al., 2018
<i>Acanthurus tractus</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero, 2018; Acero et al., 2018
ACROPOMATIDAE		
<i>Synagrops bellus</i>	Quitassueño	Polanco, 2015
<i>Synagrops spinosus</i>	Quitassueño	Polanco, 2015
<i>Synagrops trispinosus</i>	Quitassueño	Polanco, 2015
PEMPHERIDAE		
<i>Pempheris schomburgkii</i>	Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
CIRRITIDAE		
<i>Amblycirrhitus pinos</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
KYPHOSIDAE		
<i>Kyphosus cinerascens</i> *	Serrana, Serranilla	Acero et al., 2018
<i>Kyphosus sectatrix</i>	Roncador, Serrana, Serranilla	Acero et al., 2018

(Continued)

TABLE 1 | Continued

Family and species	Location	References
<i>Kyphosus vaigiensis</i>	Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
PERCOPHIDAE		
<i>Bembrops anatirostris</i>	Quitásueño	Polanco, 2015
<i>Bembrops macromma</i>	Quitásueño	Polanco, 2015
<i>Bembrops magnisquamis</i>	Quitásueño	Polanco, 2015
<i>Bembrops ocellatus</i>	Quitásueño	Polanco, 2015
<i>Bembrops quadrisella</i>	Quitásueño	Polanco, 2015
SERRANIDAE		
<i>Alphesthes afer</i>	North	Bolaños-Cubillos et al., 2015
<i>Bullisichthys caribbaeus</i>	Quitásueño	Polanco, 2015
<i>Cephalopholis cruentata</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero, 2018; Acero et al., 2018
<i>Cephalopholis fulva</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero, 2018; Acero et al., 2018
<i>Epinephelus adscensionis</i>	North	Bolaños-Cubillos et al., 2015
<i>Epinephelus guttatus</i>	Roncador, Serrana	Bolaños-Cubillos et al., 2015
<i>Epinephelus itajara</i>	Roncador	Bolaños-Cubillos et al., 2015
<i>Epinephelus morio</i>	North	Bolaños-Cubillos et al., 2015
<i>Epinephelus striatus</i>	North	Bolaños-Cubillos et al., 2015
<i>Hypoplectrus aberrans</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Hypoplectrus indigo</i>	Roncador, Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Hypoplectrus maculiferus</i>	Serrana	
<i>Hypoplectrus chlorurus</i>	Serrana	Bolaños-Cubillos et al., 2015
<i>Hypoplectrus gummigutta</i>	North	Bolaños-Cubillos et al., 2015
<i>Hypoplectrus guttavarius</i>	Serrana	Bolaños-Cubillos et al., 2015
<i>Hypoplectrus nigricans</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero, 2018; Acero et al., 2018
<i>Hypoplectrus providencianus</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Hypoplectrus puella</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Hypoplectrus randallorum</i>	North	Bolaños-Cubillos et al., 2015
<i>Hypoplectrus unicolor</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Hyporthodus flavolimbatus</i>	North	Bolaños-Cubillos et al., 2015
<i>Hyporthodus mystacinus</i>	North	Bolaños-Cubillos et al., 2015
<i>Hyporthodus niveatus</i>	North	Bolaños-Cubillos et al., 2015
<i>Liopropoma rubre</i>	Serrana	Bolaños-Cubillos et al., 2015
<i>Mycteroperca bonaci</i>	Serrana	Bolaños-Cubillos et al., 2015
<i>Mycteroperca interstitialis</i>	Roncador, Serrana	Bolaños-Cubillos et al., 2015
<i>Mycteroperca phenax</i>	Roncador	

(Continued)

TABLE 1 | Continued

Family and species	Location	References
<i>Mycteroperca tigris</i>	Roncador, Serrana	Bolaños-Cubillos et al., 2015
<i>Mycteroperca venenosa</i>	Roncador, Serrana	Bolaños-Cubillos et al., 2015; Acero, 2018
<i>Paranthias furcifer</i>	North	Bolaños-Cubillos et al., 2015
<i>Plectranthias garrupellus</i>	Serrana	Robertson et al., 2015
<i>Pronotogrammus martinicensis</i>	Serrana	Polanco, 2015
<i>Pseudogramma gregoryi</i>	North	Bolaños-Cubillos et al., 2015
<i>Rypticus saponaceus</i>	Roncador, Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Serranus baldwini</i>	Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Serranus flaviventris</i>	Quitásueño	Robertson et al., 2015
<i>Serranus tabacarius</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero et al., 2018
<i>Serranus tigrinus</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero, 2018; Acero et al., 2018
<i>Serranus tortugarum</i> *	Serranilla	Polanco, 2018
SCORPAENIDAE		
<i>Pontinus castor</i>	North	Robertson et al., 2015
<i>Pterois voltans</i>	Roncador, Serrana, Serranilla	Bolaños-Cubillos et al., 2015; Acero, 2018; Acero et al., 2018
<i>Scorpaena plumieri</i>	Roncador, Serrana	
SETARCHIDAE		
<i>Ectreposebastes imus</i>	Quitásueño	Polanco, 2015
<i>Setarches guentheri</i>	Quitásueño	Polanco, 2015
PERISTEDIIDAE		
<i>Peristedion brevirostre</i>	North	Robertson et al., 2015
<i>Peristedion greyae</i>	Quitásueño	Polanco, 2015
<i>Peristedion longispatha</i>	Quitásueño	Polanco, 2015
<i>Peristedion truncatum</i>	Quitásueño	Polanco, 2015
TRIGLIDAE		
<i>Bellator brachyichir</i>	Quitásueño	Polanco, 2015
<i>Bellator militaris</i>	Quitásueño	Robertson et al., 2015

Species with asterisk (*) correspond to new reports for the area. Species with asterisk (*D) or (*MP) corresponds to contributions of Diego Cardeño, PhD candidate Stony Brook University and Professors Paula Quiceno y Mario Londoño, Universidad de Antioquia, respectively. Species observed during the Seaflower Expedition (2015–2017) field work including in the reference (Fundación Colombia Azul et al., 2017; Acero, 2018; Acero et al., 2018; Polanco, 2018).

High levels of overfishing are also apparent for large-bodied parrotfishes. The rarity of the blue parrotfish *Scarus coeruleus*, and the absence of the rainbow parrotfish *S. guacamaia*, suggest that these have been likely extirpated from the islands for several decades (Acero and Polanco, 2017). Serranilla has particularly depleted grouper populations. The yellowmouth grouper *Mycteroperca interstitialis*, the tiger grouper *M. tigris*, and the yellowfin grouper *M. venenosa*, for instance, have never been observed by any contemporary researcher in that island. Other relatively valuable fishes such as the greater amberjack *Seriola dumerili*, the permit *Trachinotus falcatus*, and the jolthead

porgy *Calamus bajonado* are also commercially extinct or very close to extinct throughout the reserve.

The reserve is, however, a natural laboratory where several actively speciating groups show high species richness. About two thirds of the 18 recognized species of *Hypoplectrus*, a genus of small hermaphroditic serranids endemic to the Greater Caribbean, occur in the reserve with at least nine of them on the northern islands. *Elacatinus*, a genus of cleaning and sponge dwelling gobies also endemic to the western tropical Atlantic, includes 35% of its 20 recognized species on the reserve reefs, five of them in them occurring on the northern islands. Those genera, as well as several others, must be studied in detail to help understand Caribbean connectivity patterns and develop suitable management strategies.

Lastly, 9% ($n = 19$) of the species detected during the CCO Colombian expeditions are new reports for the reserve or at least to its northern part. These species are distributed in 15 families, namely Carcharhinidae (*Rhizoprionodon terraenovae*), Dasyatidae (*Hypanus sabinus*), Gobiidae (*Cryptopsilotris batrachodes*), Fistulariidae (*Fistularia tabacaria*), Chaenopsidae (*Acanthemblemaria aspera*, *A. maria*, *A. spinosa*, *Emblemariopsis* sp.), Labrisomidae (*Stathmonotus gymnodermis*), Gerreidae (*Eucinostomus lefroyi*), Priacanthidae (*Priacanthus arenatus*), Labridae (*Doratonotus megalepis*), Antennariidae (*Antennarius pauciradiatus*, *Histrio histrio*), Diodontidae (*Chilomycterus antillarum*), Monacanthidae (*Monacanthus ciliatus*, *Stephanolepis setifer*), Kyphosidae (*Kyphosus cinerascens*), and Serranidae (*Serranus tortugarum*). Obtaining such high percentage of new reports through a relatively limited sampling effort indicates that if scientific fish ichthyocides were used the biodiversity of this unique Caribbean region will be more thoroughly evaluated and perhaps currently reported levels would most likely increase.

DATA AVAILABILITY

The dataset “Fish biodiversity in three northern islands of the Seaflower Biosphere Reserve (Colombian Caribbean),” which includes the most recently updated list of species in the northern area of the reserve, was assembled using the Darwin Core standard (DwC) and is available through the Integrated Publishing Tool of the Ocean Biogeographic Information System (OBIS) and the Global Biodiversity Information Facility (GBIF) Colombian nodes (SIBM-SIB Colombia) (IPT link: https://ipt.biodiversidad.co/sibm/resource?r=fish_biodiversity_northern_islands_seaflower_biosphere_reserve_colombian_caribbean;

REFERENCES

- Acero, P. A. (2018). *Biodiversidad íctica de la Isla Cayo Serrana durante la Expedición Seaflower 2016 - Proyecto Colombia BIO*. Version 2.4. Universidad Nacional de Colombia. Occurrence dataset. doi: 10.15472/awzfyz
- Acero, P. A., and Polanco, F. A. (2017). Biodiversidad íctica de los mares colombianos: riqueza amenazada. *Rev. Acad. Colomb. Cienc. Ex. Fis. Nat.* 41, 200–212. doi: 10.18257/raccefyn.480
- Acero, P. A., Polanco, F. A., Tavera, J. J., and Bola-os-Cubillos, N. (2018). *Universidad Nacional de Colombia*. Available online at: https://ipt.biodiversidad.co/sibm/resource?r=fish_biodiversity_northern_islands_seaflower_biosphere_reserve_colombian_caribbean

GBIF Portal: <http://www.gbif.org/dataset/d8e8b1bf-0b56-4cc0-bf75-c9283fad4aa2>; DOI: <http://doi.org/10.15472/ygq6i9>, <http://doi.org/10.15472/7roc4>). Future updates of this list will be published in the latter repository. Changes incorporated to each new version of the list will be summarized in the respective metadata section of the electronic resource.

AUTHOR CONTRIBUTIONS

AA, JT, AP, and NB-C built the database. AA, AP, and JT contributed to the writing and correction of the manuscript. AP and AA devised the data set. All the four authors reviewed the final version of the manuscript and contributed to the discussion.

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- [biodiversidad.co/sibm/resource?r=fish_biodiversity_northern_islands_seaflower_biosphere_reserve_colombian_caribbean](https://ipt.biodiversidad.co/sibm/resource?r=fish_biodiversity_northern_islands_seaflower_biosphere_reserve_colombian_caribbean)
- Bent-Hooker, H. (2012). *Los grandes serránidos de la Reserva de Biosfera Seaflower, Caribe insular colombiano: evaluación de la pesca y de las agregaciones reproductivas*. Master thesis, Universidad Nacional de Colombia, Sede Caribe, San Andrés Isla.
- Betancur-R, R., Wiley, E. O., Arratia, G., Acero, P. A., Bailly, N., Miya, M., et al. (2017). Phylogenetic classification of bony fishes. *BMC Evol. Biol.* 17:162. doi: 10.1186/s12862-017-0958-3
- Bolaños-Cubillos, N., Abril, A., Bent Hooker, H., Caldas, J. P., and Acero, P. A. (2015). Lista de peces conocidos del archipiélago de San Andrés, Providencia

- y Santa Catalina, Reserva de Biosfera Seaflower, Caribe occidental colombiano. *Bol. Invest. Mar. Cost.* 44, 127–162. doi: 10.25268/bimc.invemmar.2015.44.1.24
- Chasqui, V. L., Polanco, F. A., Acero, P. A., Mejía-Falla, P. A., Navia, A. F., Zapata, L. A., et al. (eds.). (2017). Libro rojo de peces marinos de Colombia. Serie Publicaciones Generales Invemar 93. (Santa Marta: Instituto de Investigaciones marinas y Costeras INVEMAR, Ministerio de Ambiente y Desarrollo Sostenible), 552 p.
- Eschmeyer, W. N., Fricke, R., and van der Laan, R. (eds.). (2018). *Catalog of Fishes: Genera, Species, References*. Available online at: <http://researcharchive.calacademy.org/research/ichthyology/catalog/fishcatmain.asp> (Accessed September 21, 2018).
- Fundación Colombia Azul, Universidad de los Andes, and Florida International University (2017). *Elasmobranchios de la Isla Cayo Serranilla durante la Expedición Seaflower 2017 - Proyecto Colombia BIO*. Versión 1.0. 95 registros, aportados por: Cardeosa C, Monsalve S y Cáceres C. Conjunto de datos/Registros biológicos. Available online at: http://ipt.biodiversidad.co/sibm/resource?r=fca_elasmo_seaflower_2017
- INVEMAR-ANH (2012). *Línea Base Ambiental en el Área de Régimen Común Jamaica - Colombia Como Aporte al Aprovechamiento Sostenible de los Recursos Marinos Compartidos*. Convenio 016-2010 ANH-Invemar. (Santa Marta), 774 p. Available online at: <http://anh.invemmar.org.co/cotros-productos>
- Polanco, F. A. (2015). *Dynamics of the Continental Slope Demersal Fish Community in the Colombian Caribbean*. Dissertation/Doctoral thesis, Universidad Nacional de Colombia and Justus Liebig University, Giessen, 189 p.
- Polanco, F. A. (2018). Instituto de Investigaciones Marinas y Costeras - INVEMAR. Available online at: https://ipt.biodiversidad.co/sibm/resource?r=peces_unidades_ecologicas_someras_serranilla2017-proyecto_colombia_bio&https://ipt.biodiversidad.co/sibm/resource?r=peces_unidades_ecologicas_someras_serranilla2017-proyecto_colombia_bio&
- Robertson D. R., Peña E. A., Posada J. M., Claro R. (2015) *Peces Costeros del Gran Caribe: sistema de Información en línea. Version 1.0 Instituto Smithsonian de Investigaciones Tropicales*. Balboa: República de Panamá
- Robertson, D. R., and Van Tassell, J. (2015). *Shorefishes of the Greater Caribbean: Online Information System*. Version 1.0 Smithsonian Tropical Research Institute, Balboa.
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