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DEEP-WATER OCTOCORALS (ANTHOZOA: CNIDARIA) COLLECTED FROM THE COLOMBIAN CARIBBEAN DURING 'MACROFAUNA EXPLORATIONS' 1998-2002*

Isabel Cristina Chacón-Gómez[1], *Javier Reyes*[2] *and Nadiezhda Santodomingo*[3]

1 *Universidad Nacional de Costa Rica. Heredia, San José, Costa Rica. icchacongomez@gmail.com*
2 *Instituto de Investigaciones Marinas y Costeras-INVEMAR, Museo de Historia Natural Marina de Colombia, Grupo de investigación sobre Taxonomía, Sistemática y Ecología Marina.Cerro Punta de Betín, Santa Marta, Colombia. j_reyes_forero@hotmail.com*
3 *Natural History Museum, Cromwell Road, SW7 5BD, London, United Kingdom.nadiasantodomingo@hotmail.com*

ABSTRACT

Octocorals are being included in a great variety of worldwide studies with the aim of analyzing taxonomy, ecology, biogeography, genetics and geochemistry, among other aspects. The study described here includes samples collected during the 'Macrofauna' explorations carried out by the Instituto de Investigaciones Marinas y Costeras-INVEMAR between 1998 and 2002 from shallow (20 m) to deep (500 m) waters. A total of 280 museum containers were examined. Samples were collected at 32 stations distributed along the continental shelf and upper slope of Colombian Caribbean. A total of 44 species have been recognized, 21 of them identified to species level and 23 to genus level; the species are included in 22 genera and nine families (Plexauridae, Gorgoniidae, Ellisellidae, Primnoidae, Anthothelidae, Clavulariidae, Keroeididae, Acanthogorgiidae, Chrysogorgiidae). Eight species and two genera are first records for Colombia.

KEY WORDS: Gorgonacea, Alcyonaria, Taxonomy, Colombia, Caribbean.

RESUMEN

Octocorales (Anthozoa: Cnidaria) recolectados durante las exploraciones Macrofauna (20-500 m de profundidad) a lo largo del Caribe colombiano. Los octocorales están siendo incluidos en una variedad de estudios a nivel mundial, buscando el análisis de su taxonomía, ecología, biogeografía, genética, geoquímica, entre otros. El estudio que se describe a continuación incluye las muestras recolectadas durante las exploraciones llevadas a cabo por el Instituto de Investigaciones Marinas y Costeras-INVEMAR entre 1998 y 2002 desde aguas someras (20 m) hasta profundidades de 500 m. Se examinaron un total de 280 lotes de museo. Las muestras fueron recolectadas en 32 estaciones distribuidas a lo largo del talud y la plataforma continental del Caribe colombiano. Se reconocieron un total de 44 especies; 21 de ellas identificadas a nivel de especie y 23 a nivel de género; se encuentran distribuidas

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en 22 géneros y nueve familias (Plexauridae, Gorgoniidae, Ellisellidae, Primnoidae, Anthothelidae, Clavulariidae, Keroeididae, Acanthogorgiidae, Chrysogorgiidae). Ocho especies y dos géneros son primeros registros para Colombia.

PALABRAS CLAVES: Gorgonacea, Alcyonaria, Taxonomía, Colombia, Caribe.

INTRODUCTION

Octocorals, also known as alcyonarians, are distributed worldwide within a large depth range through the oceans. Thus, they are conspicuous anthozoans in a variety of sea environments and have been studied since the nineteenth century. Alcyonarians have a three-dimensional structure and provide shelter to other invertebrates and fishes (Sánchez *et al.*, 1998; Witherell and Coon, 2001; Krieger and Wing, 2002). Additionally, their plasticity, allows them great morphological and physiological variety (Bayer, 1961; Grasshoff, 1976; Fabricius and Alderslade, 2001). Therefore, diagnostic characters are difficult to define and their taxonomy is incomplete (Bayer, 1961; Sánchez and Wirshing, 2005; Sánchez, 2007). Octocorals have not had comparable research to that of scleractinian corals, partly because of the difficulty in differentiating species (Sánchez and Wirshing, 2005). Thus, many studies are limited by the uncertainty of species identification. There are still some cases in which the identification to genus level is a valid option even in the most important collections (Stephen D. Cairns. Smithsonian National Museum of Natural History. Washington D.C.,U.S.A. 2005. Pers. Comm.), since trying to attain species level identification can be subjective or erroneous because of lack of taxonomic revisions and keys, which is given because the characters combinations can be ambiguous (Bayer, 1961; Sánchez and Wirshing, 2005).

Technological development has helped to enhance our knowledge of alcyonarians. Molecular techniques (Sánchez *et al.*, 2003; McFadden *et al.*, 2006) are currently being included in studies about cnidarians collected in deep waters, analyzing communities or populations, as another tool to comprehend the taxonomy and systematics of the group. Geochemistry is used to understand palaeoenvironments and climate change in octocoral axes (Allard *et al.*, 2005; Bond *et al.*, 2005; Spero *et al.*, 2005), and there are also studies aiming to find some alternative applications of octocoral tissues as medical resources (Ehrlich *et al.*, 2006). Nevertheless, it should be noted that a morphological approach is the starting point for taxonomic studies.

A great variety of approaches to this group are known, especially in regard to taxonomic issues (Grasshoff, 2001). Literature by Bayer (1961, 1981) describing his research on octocoral taxonomy has been used since the sixties and still remains one of the most comprehensive resources (De Victor and Morton, 2007). Deichmann (1936) and Bayer (1949, 1952, 1957, 1959) included complete morphological descriptions and detailed illustrations for Caribbean fauna in their publications. Besides these authors, some important revisions have been published about octocoral taxonomy in the Western Atlantic (Cairns, 2001; Cairns and Bayer, 2002). Other studies describing octocoral occurrences for different regions around the world have been carried out. Just to mention a few of them, some examples are Grasshoff (1999), Fabricius and Alderslade (2001) in the Pacific and Indian Oceans. The high octocoral diversity of the Red Sea was described in the works of Grasshoff (1976) and Benayahu (1985). There are also some collections from Southern Africa (Williams 1992a, 1992b, 2000), the eastern Northern Atlantic and Mediterranean Sea (Grasshoff, 1973).

Studies in the Caribbean were undertaken by Jordan-Dahlgren (1989) in Yucatán; Keith (1992) studied shallow water gorgonians in Honduras; Muzik (1981) and Lasker and Coffroth (1983) studied them in Belize. In South America, octocorals fauna is still poorly known as Marques and Castro (1995) indicated. There are a few examples of taxonomical studies carried out in South America, such as Medeiros and Castro (1996, 1999) who studied octocorals off Brazil, González-Brito (1970), Márquez *et al.* (1997) and Rada and Ruiz (2002) studied them in Venezuela. Sánchez and Wirshing (2005) provided a field key to the identification of tropical Western Atlantic zooxanthelate octocorals.

Colombia is one of the megabiodiverse countries (IUCN, 2011), and consequently it is ambitious to know all the species that occupy Colombian oceans. The most representative studies about taxonomy and ecology of Colombian octocorals have been attributed to Botero (1987), Sánchez (1994, 1998, 1999, 2001) and Sánchez *et al*. (1997) in shallow coral reefs, and Lattig-Matiz (2000) and Reyes *et al.* (2005) in deep waters. This paper presents a checklist of octocorals collected during the 'Macrofauna explorations' carried out by the Instituto de Investigaciones Marinas y Costeras-INVEMAR (Colombian Marine and Coastal Research Institute) between 1998 and 2002 along the Colombian Caribbean continental shelf and upper slope.

MATERIAL AND METHODS

Samples were collected by trawling at 32 sampling stations, distributed along the continental shelf and upper slope (20 to 500 m) off the Colombian Caribbean (Figure 1, Table 1). Trawls were carried out using a demersal trawling semiballoon net (Gracia, 2000; Rachello, 2003), varying by location, during the explorations performed by INVEMAR. All the samples were preserved in museum pots with 70 % ethanol solution. A total of 280 museum containers were examined. Each relevant structure of the samples was analyzed for identification with the aid of taxonomy keys and comparisons with descriptions found in the various references. Sclerite preparations for photographs were made as suggested by Bayer (1961) and the photographs were taken using a light microscope with a digital camera attached to it. The complete information has been systematized into the Marine Biodiversity Information System (INVEMAR 2009), a database in which each morphotype is described, with taxonomic notes about the identification, collection information, and detailed images of the samples and its structures. Identifications were mostly based on literature, but some species have been also confirmed comparing them to samples and type material deposited in the Smithsonian National Museum of Natural History, Washington.

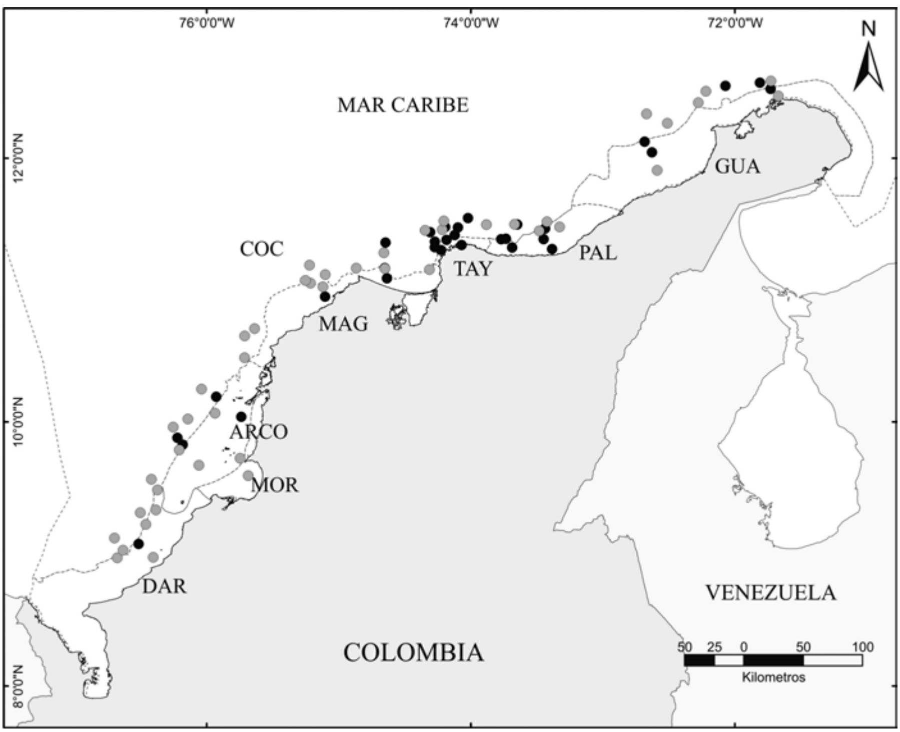

Figure 1. Map of the study area with the sampling stations of the expeditions. Sampling stations where octocorals were collected are highlighted with black dots and the grey dots are all the sampling stations. (modified from INVEMAR file).

Table 1. Sampling stations where octocorals were collected, depth and geographical coordinates. Coordinates are given as part of the table, since the numbers are a result of a software conversion. Therefore they are written in separate columns, but the meaning is the same. For example where it appears 73 45.00 17. 00 it means 73º 45.17'. The lines are needed because of the size and amount of numbers.

REGION	STATION INV	STATION	DEPTH	INITIAL LAT (N)			INITIAL LONG (S)		
PALOMINO	INV 011	E112	300	11°	22	22	73°	45	17
		E113	300	11°	22	22	73°	45	17
	INV 049	E104	20	11°	17	32	73°	27	6
		E105	21	11°	17	41	73°	27	58
	INV 048	E102	70	11°	23	83	73°	27	78
		E103	71.6	11°	24	4	73°	27	62
	INV 050	E108		11°	18	28	73°	46	50
		E109	71	11°	18	31	73°	46	29
	INV 047	E100	150	11°	25	34	73°	27	40
		E101	153	11°	25	46	73°	27	9
	INV 051	E110	150	11°	20	31	73°	46	0
		E111	152	11°	20	30	73°	46	28
	INV 052	E114	498	11°	27	64	73°	40	14
		E115	504	11°	27	64	73°	40	14
TAYRONA	INV 013	E034	500-510	11°	27	0.6	74°	1	0.8
	INV 014	E036	296-304	11°	24	59	74°	10	48
	INV 017	E042	500-488	11°	19	22	74°	17	0.3
	INV 019	E008	200	11°	23	25	74°	12	46
		E080	200	11°	23	25	74°	12	46
	INV 054	E116	35	11°	20	5	74°	5	25
		E117	20.4	11°	19	86	74°	5	28
	INV 059	E126	26.6	11°	18	3	74°	9	36
		E127	39.5	11°	18	29	74°	9	70
	INV 055	E118	76	11°	21	29	74°	6	17
		E119	74	11°	21	24	74°	5	82
	INV 058	E124	72.3	11°	20	1	74°	9	60
	INV 056	E120	151	11°	22	67	74°	8	41
		E121	150	11°	22	73	74°	8	56
	INV 057	E122	150	11°	22	74	74°	10	50
		E123	154	11°	22	90	74°	10	17

REGION	STATION INV	STATION	DEPTH	INITIAL LAT (N)			INITIAL LONG (S)		
GUAJIRA	INV 002	E093	496	12°	31	48	72°	7	58
	INV 046	E98	21.4	11°	53	5	72°	36	39
		E99	22	11°	53	22	72°	36	72
	INV 041	E87	72	12°	29	45	71°	43	40
		E88	73	12°	29	18	71°	43	52
	INV 045	E96	70	12°	3	24	72°	38	17
		E97	70.1	12°	3	17	72°	37	78
	INV 042	E89	152	12°	30	35	71°	44	19
		E90	150	12°	29	93	71°	45	21
	INV 043	E94	151	12°	6	45	72°	39	49
MAGDALENA	INV 020	E044	470-476	11°	15	16	74°	39	12
	INV 061	E128	20	11°	5	58	74°	40	37
		E129	20	11°	5	46	74°	40	35
	INV 064	E134	20.9	10°	56	36	75°	6	29
		E135	20	10°	56	25	75°	6	36
	INV 062	E130	70.4	11°	8	65	74°	41	10
ARCO	INV 029	E075	296-290	10°	9	12	76°	0	24
	INV 032	E149	507-514	9°	48	58	76°	16	27
		E150	500-516	9°	48	58	76°	16	27
	INV 072	E152	71	9°	59	65	75°	46	95
	INV 073	E155	160	9°	47	12	75°	13	45
		E156	155	9°	46	61	76°	13	72
DAR	INV 077	E164	70	9°	0	63	76°	33	74

RESULTS AND DISCUSSION

A total of 44 species have been recognized, included in 22 genera and nine families: Plexauridae, Gorgoniidae, Ellisellidae, Primnoidae, Anthothelidae, Clavulariidae, Keroeididae, Acanthogorgiidae, Chrysogorgiidae. It was possible to reach the species level for 21 of them, and the other were identified to genus level (Table 2).

Table 2. Identification of samples collected in Colombian continental Caribbean margin and the region where they were collected. TAY: Tayrona; GUA: Guajira; PAL: Palomino; ARCO: Archipielagos coralinos; DAR: Darien; MAG: Magdalena; *New records for Colombia. +: Species which were collected in a larger depth range, than that one in literature. ∞ Although it is known that *Lophogorgia* and *Leptogorgia* were synonymised by Grasshoff (1988), for this study the identification was based on Bayer (1961) because the specimens have all the characteristics to be separated as two different genera as Bayer (1961) stated, probably because the region studied, which is more likely Bayer's (1961) region than Grasshoff's (1988).

SUBORDER-Family	Species	Region	Sampling Station where present	Depth range in literature (m)	Depth range in this study (m)
STOLONIFERA					
Clavulariidae	*Carijoa riisei* Duchassaing and Michelotti	GUA, PAL TAY, ARCO	E 87- 90, 97-99, 102	5-30 (Sánchez, 1994)	20.1-150+.
SCLERAXONIA					
Anthothelidae	*Diodogorgia nodulifera* Hargitt	GUA, PAL TAY, DAR	E 96-105, 108-110, 112 116-124, 161	36-183 (Bayer, 1961)	20-300+
HOLAXONIA					
Keroeididae	*Thelogorgia vossi* Bayer	TAY	E 8	70-549 (Bayer, 1991)	200-206
Acanthogorgiidae	*Muricella* sp.*	PAL, TAY, ARCO	E 102-105, 112-113, 108-110, 115, 118, 155	-	20-500
	Acanthogorgia schrammi Duchassaing and Michelotti	PAL, TAY,	E 102	36- - (Bayer,1961)	70-304
	Acanthogorgia aspera Pourtales	PAL, TAY, ARCO	E 102, 118, 155, 156	100-1300 (Bayer, 1961)	70-160+
Plexauridae	*Thesea* sp.	GUA, PAL , TAY	E 89, 90, 94, 97, 98, 100, 102-105, 108, 118-121	-	20-154
	Thesea parviflora Deichmann	GUA, PAL, TAY	E 97, 99-105, 109, 112, 119, 120, 121	216- -(Deichmann, 1936)	70-300
	Thesea bicolor Deichmann	PAL	E 108	366- --(Deichmann, 1936)	70
	Thesea solitaria Pourtalés	TAY	E 80	185-318 (Deichmann, 1936)	200
	*Scleracis guadaloupensis** Duchassaing and Michelotti	TAY	E 80	76-350 (Deichmann, 1936)	200
	Acanthomuricea sp.*	GUA, TAY	E 88-90, 118	-	73-152
	Villogorgia sp.	PAL	E 112	-	300
	Villogorgia nigrescens Duchassaing and Michelotti	TAY	E 8	102-450 (Deichmann, 1936)	200
	Placogorgia tenuis Verrill	TAY, ARCO	E 8, 80, 155, 156	102-480(Deichmann, 1936)	155-200
	*Placogorgia atlantica** Wright and Studer	TAY	E 80, 124	102-480(Deichmann, 1936)	72-300+
	Muricea elongata Lamouroux	TAY	E 116	-	35
	*Hypnogorgia pendula** Duchassaing and Michelotti	ARCO	E 155	137-183 (Deichmann, 1936)	160
	Swiftia exserta Ellis and Solyer	PAL, DAR	E 102, 104, 108, 161	30-175 (Goldberg, 2001)	20-70+

Continue Table 2.

SUBORDER-Family	Species	Region	Sampling Station where present	Depth range in literature (m)	Depth range in this study (m)
Gorgoniidae	*Leptogorgia medusa** Bayer	PAL	E 108	24-27 (Bayer, 1961)	70+
	Leptogorgia setacea (Pallas)	GUA, PAL, TAY	E 88, 104, 105, 108-111, 117-119, 124, 127	-	20-152
	Lophogorgia sp 1.∞	GUA	E 88, 90	-	73-150
	Lophogorgia sp 2. ∞	MAG	E 44	-	474
	Lophogorgia sp. 3 ∞	GUA	E 88	-	73
	*Lophogorgia cardinalis** Bayer ∞	GUA, PAL	E 88, 89, 90, 96, 102, 103, 114	27-309 (Bayer, 1961)	70-498+
	*Lophogorgia punicea** Milne Edwards and Haime ∞	MAG	E 134, 135	18-73 (Bayer, 1961)	20
	Lophogorgia (sp. *indet* (*b*)) Bayer ∞	MAG	E 130	-	70.4
	*Tobagogorgia hardyi** Sánchez	PAL, TAY	E 102, 103, 116, 118, 055, 119, 126, 127	-	27-74
Ellisellidae	*Ctenocella* sp.	PAL	E 102, 104, 111	-	20-152
	Viminella sp.1	GUA, PAL, TAY, ARCO, DAR	E 8, 80, 96, 97, 98, 99, 100, 102-105, 108-109, 112, 119, 122, 124, 161	20-500 (Bayer and Grasshoff, 1994)	20-206
	Viminella sp. 2	GUA, PAL, TAY	E 97-101, 111, 118, 119, 121, 151	20-500 (Bayer and Grasshoff, 1994)	21-152
	Verrucella sp.1	TAY, ARCO	E 80, 155, 156	20-500 (Bayer and Grasshoff, 1994)	155-26
	Verrucella sp.2	ARCO	E 155, 156	20-500 (Bayer and Grasshoff, 1994)	155-160
	Verrucella sp.3	TAY	E 80	20-500 (Bayer and Grasshoff, 1994)	200-206
	Verrucella sp.4	TAY	E 80	20-500 (Bayer and Grasshoff, 1994)	200-206
	Nicella sp.1*	TAY	E 8, 80	-	200-206
	Nicella sp.2*	TAY	E 8	-	200-206
	*Riisea paniculata** Duchassaing and Michelotti	TAY, ARCO	E 80, 155	139-480 (Deichmann, 1936)	160-206
Chrysogorgiidae	*Chrysogorgia* sp.	ARCO, MAG	E 44, 152, 155		70-476
	Chrysogorgia elegans * Verrill	GUA, PAL, TAY, ARCO	E 93, 34, 149, 150, 115	182-1716 (Cairns, 2001)	484-516
	Chrysogorgia desbonni Duchassaing and Michelotti	ARCO	E 75	153-595 (Deichmann, 1936; Cairns, 2001)	290-296
	*Chrysogorgia thyrsiformis** Deichmann	ARCO	E 155	146-526 (Cairns, 2001)	160
	Trichogorgia lyra Bayer and Muzik	GUA, PAL, TAY, MAGand DAR	E 88, 90, 102-105, 108, 117, 118, 126, 127, 128, 129, 161	23-183 (Bayer and Muzik, 1976)	20-150
Primnoidae	*Callogorgia* sp.	TAY	E 8, 42, 80	-	200-500

The main taxonomic difficulties were due to limiting characters; for example, in family Ellisellidae, most of which are whip like colonies, and sclerite size variation is just a few micrometers, the majority of them have similar colors. Thus, two *Viminella* species were recognized and the principal differences were based on the polyp's arrangement along the axis. In the first one, the polyps are aligned on each side of the axis, being very close to each other, directly opposite to a polyp on the other side, and alternating between various sizes. In the other one, the polyps are also aligned on each side of the axis, but not so close together, not directly opposite to the polyp on the other side, and they only alternate between two main general sizes. In genus *Verrucella*, four species were distinguished by the colony sizes and pattern, and arrangement of polyps. The colonies of sp. 1, sp. 2 and sp. 4 are typically flabellate (fan-shaped), with their branches directed to all the sides, with only some dichotomous divisions; and those of sp. 3 has dichotomous branching all over the colony and the branches grow only in one direction. In the other hand, sp. 1, sp. 3 and sp. 4 have their polyps facing the anterior side of the colony, while sp. 2 has them laterally aligned on each side of the axis. Sp. 1 and sp. 4 have them in an opposite position to each other on the other side and the other two have them alternating between them and not so close to each other.

Also in the family Plexauridae there were some difficulties to identify the samples to species level, because they exhibit multiple modifications among genera that belong to this family and their diagnostic characters (Sánchez and Wirshing, 2005). For example, in the literature it is still not clear which diagnostic characters are used to reach the species level in the genus *Thesea*. Hence, the Colombian samples identified as *Thesea* exhibited most of the characters but they were not completely similar to those described in bibliography. For instance *Thesea solitaria* Pourtalés, 1868 presents the same whip-like colonies and sclerites, but instead of the original description (never branched), some Colombian specimens were branched. *Thesea parviflora* Deichmann, 1936 was common along the Colombian Caribbean and the specimens collected in this study were the most similar to the original description for the species in literature: colony shape (branching, whip-like, slender, scarce and flexible) texture, and calicular structure (shape and size) are also similar, but sclerites differ in size, distribution and color. The other species described for this genus (*T. hebes*, *T. grandiflora*, *T. plana*, and *T. rugosa*) are not morphologically similar to the samples collected in the study area. Additionally, in the collection of The National Museum of Natural History-Smithsonian Institution inWashington, DC there are several museum containers full of *Thesea* samples, identified also as *Thesea* sp. *Viminella* sp. is also such a case; this genus has many taxonomical problems and is still being discussed by researchers, as some other genera in the Ellisellidae family (Bayer and Grasshoff, 1994).

Eight species and two genera were new records for Colombia: *Hypnogorgia pendula* Duchassaing and Michelotti, 1864 (Figures 2; 3A), *Acanthomuricea* sp. (Figures 2; 3B), *Scleracis guadaloupensis* Duchassaing and Michelotti, 1860 (Figures 2, 3C), *Placogorgia atlantica* Wright and Studer, 1889 (Figures 2; 3D)*, Muricella* sp. (Figures 2; 3E)*, Lophogorgia cardinalis*(Figures 2; 3F)*, Lophogorgia punicea* (Figures 2; 3G)*, Chrysogorgia thyrsiformis* Deichmann, 1936 (Figures 2; 3H), *Riisea paniculata* (Figures 2, 3I) and *Leptogorgia medusa* Bayer, 1952 (Figures 2; 3J). There were also some specimens of *Tobagogorgia hardyi* Sánchez, 2007 (Figures 2; 3K) a species described recently (Chacón-Gómez *et al*., 2008). Most of the former species have already been reported for adjacent waters to the Colombian Caribbean, such as Venezuela (Rada and Ruiz, 2002), Brazil (Medeiros and Castro, 1999), and also other Caribbean regions (Bayer, 1961; Bayer and Grasshoff, 1994; Cairns, 2001). Thus, the geographic ranges of these species were extended to Colombia, suggesting that information gaps about the distribution of species are still imminent and should be clarified as soon as possible, by means of exhaustive

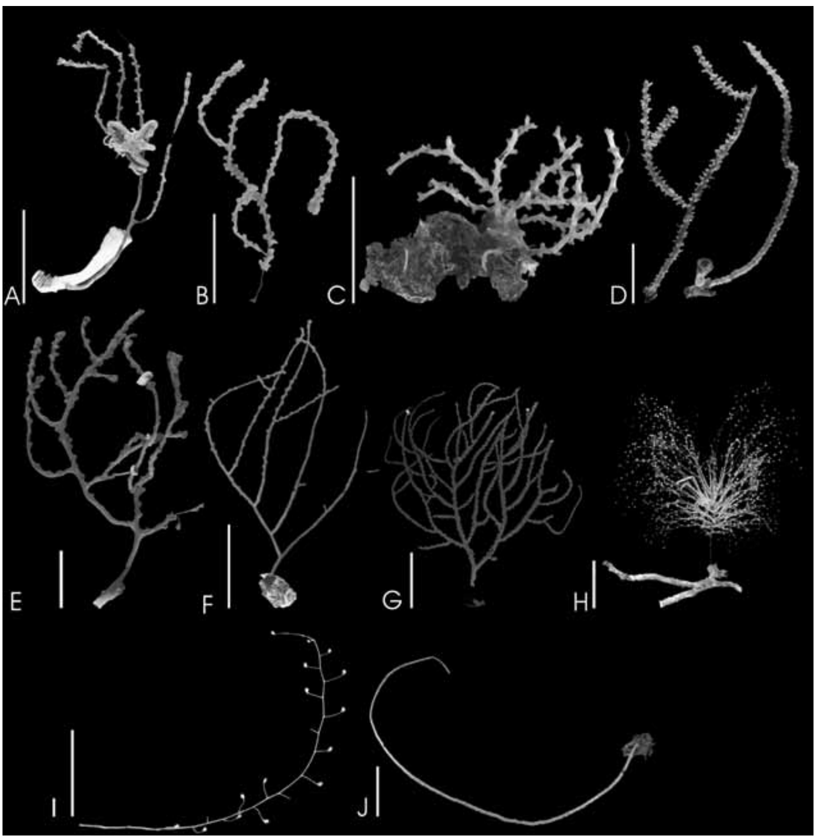

Figure 2. Species that are new records for Colombian Caribbean. A. *Hypnogorgia pendula* INV CNI1907; B. *Acanthomuricea* sp. INV CNI1902; C. *Scleracis guadaloupensis* INV CNI1901; D. *Placogorgia atlantica* INV CNI1403; E. *Muricella* sp. INV CNI1977; F. *Lophogorgia cardinalis* INV CNI1908; G. *Lophogorgia punicea* INV CNI 1755; H. *Chrysogorgia thyrsiformis* INV CNI1739; I. *Riisea paniculata* INV CNI1408; J. *Leptogorgia medusa* INV CNI1929; K. *Tobagogorgia hardyi* INV CNI1894. Scale: 25 mm.

surveys including deep waters. *Muricella* and *Acanthomuricea* are genera known before from Pacific waters. Although these genera display many uncertain identifications (Fabricius and Alderslade, 2001), the Caribbean specimens were identified as belonging to them, according to literature (Grasshoff, 1999; Fabricius and Alderslade, 2001) and were confirmed by comparisons with collection specimens. Other evidence concerning the presence of Pacific species in Colombian Caribbean waters has been found around this area, for example, the solitary coral *Tethocyathus prahli* (Lattig and Cairns, 2000), known as fossil in the Pacific Panama coast; the fish *Quadratus ancon* (Mok *et al*., 2001), genus distributed in the Western Pacific, and the ophiuroid *Ophiosizygus disacanthus* (Borrero-Pérez and Benavides-Serrato, 2004), previously described from Japan.

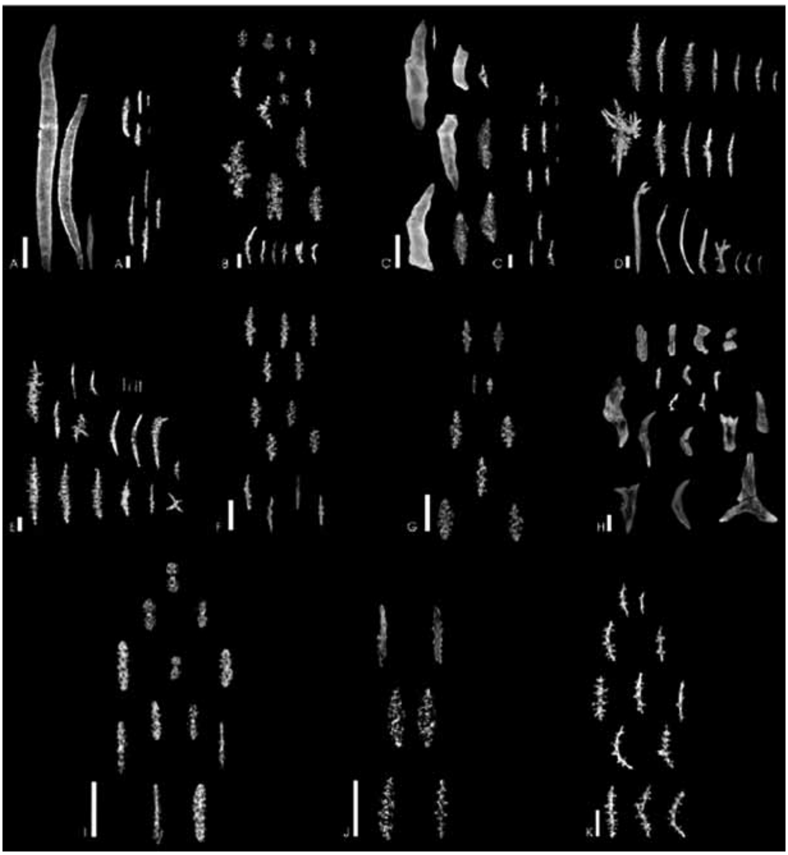

Figure 3. Sclerites of the species that are new records for Colombian Caribbean. A. *Hypnogorgia pendula* INV CNI1907; B. *Acanthomuricea* sp. INV CNI1902; C. *Scleracis guadaloupensis* INV CNI1901; D. *Placogorgia atlantica* INV CNI1403; E. *Muricella* sp. INV CNI1977; F. *Lophogorgia cardinalis* INV CNI1908; G. *Lophogorgia punicea* INV CNI 1755; H. *Chrysogorgia thyrsiformis* INV CNI1739; I. *Riisea paniculata* INV CNI1408; J. *Leptogorgia medusa* INV CNI1929; K. *Tobagogorgia hardyi* INV CNI1894. Scale: 0.1 mm; A´ C´ 1mm.

Most species (about 80 %) were aggregated in the northeastern Colombian Caribbean, which includes three eco–physiographical regions: La Guajira (GUA), Palomino (PAL) and Tayrona (TAY) (Figure 1). These results agree with other outcomes from Macrofauna surveys, which suggest that the northeastern region (GUA-PAL-TAY) is characterized by a high biodiversity (Lattig and Reyes, 2001; Navas and Campos, 2001; Saavedra *et al.,* 2004; Reyes *et al.*, 2005). According to Jiménez-Valverde and Hortal (2003), species accumulation curves could be very useful to compare octocoral diversity in specific areas, but if the area sampled (seafloor topography, general conditions) and the processes to collect are dissimilar at each sampling point or station because of those differences, one would not expect an accurate outcome. Because the features of the sampling areas were remarkably different to each other, it was not always possible to get equal or comparable samples. Therefore, the only accurate data that could be quantitatively analyzed would be the richness of species in terms of number of species at each sampling station to demonstrate that the Northeastern region actually presents a higher biodiversity than other areas at the Colombian Caribbean (Figure 4). But it is clear that a sampling process with comparable collections or samplings should be developed to be able to test that fact. Even though, this high species richness can be assumed because it seems to be linked to local environmental features (Díaz and Gómez, 2000), such as geomorphology of the continental shelf which may or may not provide suitable substrate for attachment, and the upwelling effect, which increases the nutrient availability and, in consequence, there are suitable conditions to the occurrence of suspension feeders such as octocorals.

A remarkable richness of species was found in the sampling stations Dibulla (PAL: E 102, 13 species) and La Aguja (TAY: E 80, 13 species) (Table 1), which could be related to the development of azooxanthellate coral communities. The three-dimensional configuration built by the scleractinians *Cladocora debilis* Milne Edwards and Haime, 1849*, Madracis myriaster* (Milne-Edwards and Haime, 1849) and *Anomocora fecunda* (De Pourtalès, 1871), and octocorals provides shelter for a high diversity of invertebrates and fishes at these localities (Reyes *et al*., 2005). Moreover, it appears that the presence of octocorals contributes to enhanced diversity of other invertebrates, since mollusks, ophiuroids, crustaceans, foraminifera, hydroids, bryozoans, and polychaetes were found attached to the colonies. Thus, the important role of octocorals in tropical deep sea marine communities requires an ecosystem perspective.

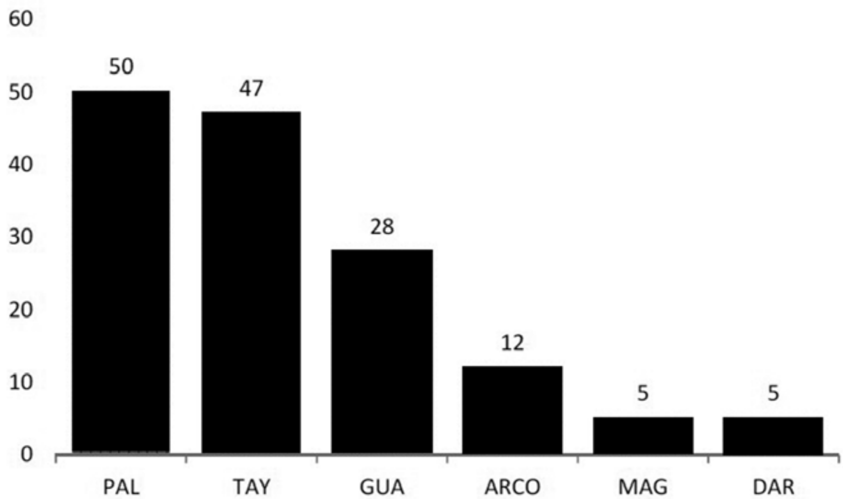

Figure 4. Number of different species found at each sampling area. X axis: Sampling areas. Y axis: number of species present at each one.

The results of this study indicate that the most common species in the Colombian continental shelf were *Diodogorgia nodulifera* Hargitt, 1901 (Figures 5A and 6A), *Trichogorgia lyra* Bayer and Muzik, 1976 (Figure 5 B) *Thesea* sp. (Figures 5B and 6B) and *Viminella* sp. (Figures 5 D, 6 C), since they were found and collected in almost all the regions, becoming the most abundant and most widespread (Figure 1), and they were found up to 200 m depth. In deeper waters, the most common species collected was *Chrysogorgia elegans* Verrill, 1883 (Family Chrysogorgiidae). It was also recurrent to find species in shallower water that were already reported, such as *Carijoa riisei* Duchassaing and Michelotti, 1860 and *Acanthogorgia aspera* Pourtales, 1867. *Thesea parviflora* Deichmann, 1936 and *Leptogorgia setacea* (Pallas), 1766, which appeared only in three regions: Guajira (GUA); Tayrona (TAY) and Palomino (PAL), where they occur frequently up to 200 m depth.

In the Colombian Caribbean, a preliminary list (unpublished data, J. A. Sánchez) includes about 90 shallow water octocoral species belonging to 25 genera, mostly plexaurids and gorgoniids. In the present study, five genera are recorded for the first time (*Muricella*, *Acanthomuricea*, *Hypnogorgia*, *Scleracis, Riisea*) therefore a total of 30 genera are now known for the Colombian Caribbean waters. According to Bayer (1961), around 40 genera are known for the West Indian region (exclusive of Pennatulacea and Alcyonacea), suggesting that 75 % of genera in the Caribbean region inhabit Colombian waters. This study increases the knowledge about octocorals in Colombian Caribbean and has brought to light some of the species living in deep waters. However, further research about taxonomy and systematics, which includes scanning electron microscope and molecular techniques, should be undertaken in order to identify specimens at species level and to describe the wide phenotypic variation of this group.

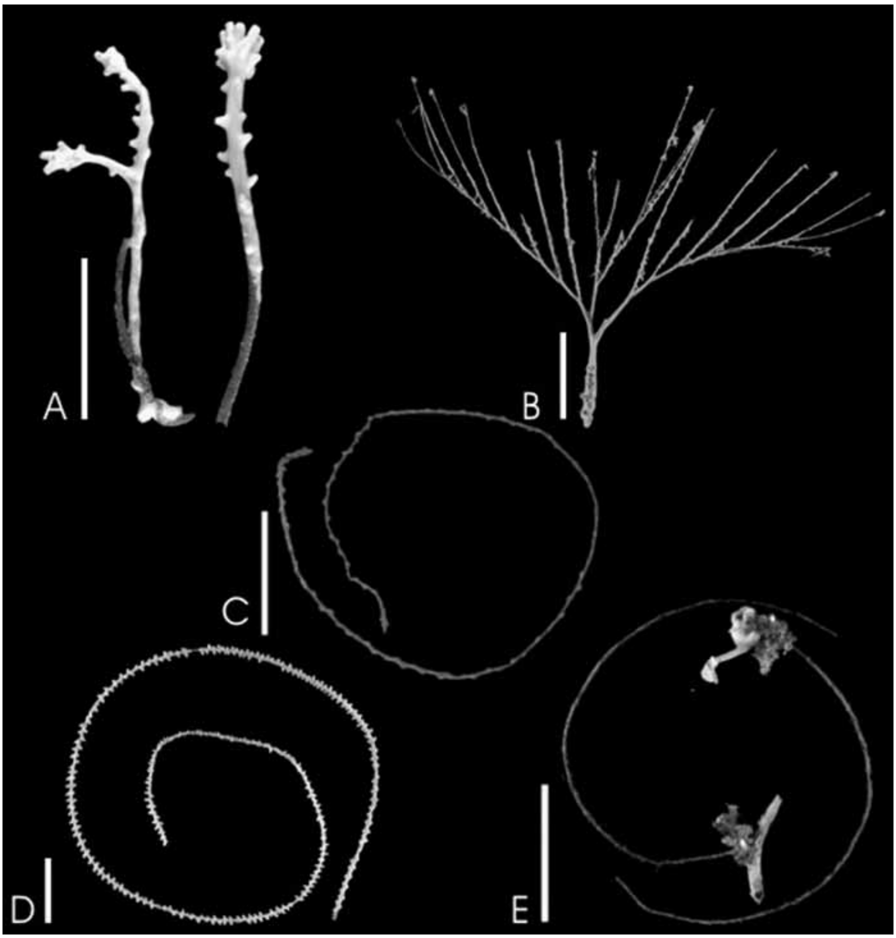

Figure 5. Species most widely distributed: A. *Diodogorgia nodulifera* INV CNI1774; B. *Trichogorgia lyra* INV CNI1842; C. *Thesea* sp. INV CNI1865; D. *Viminella* sp. 1 INV CNI1949. Scale: 25 mm.

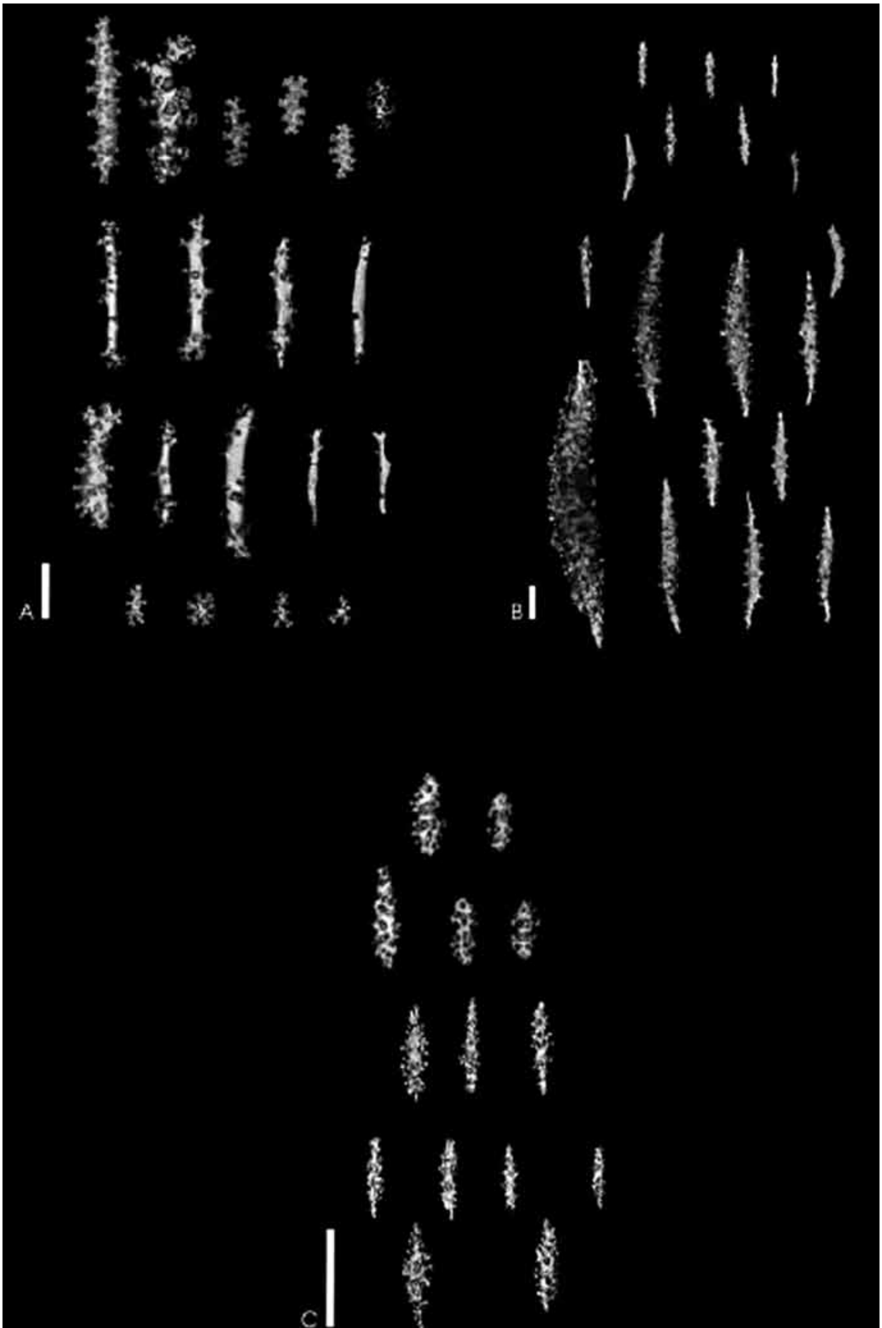

Figure 6. Sclerites of the species most widely distributed: A. *Diodogorgia nodulifera* INV CNI1774; B. *Thesea* sp. INV CNI1865; C. *Viminella* sp. 1 INV CNI1949. Scale: 0.1 mm.

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