Inventory of ascidians (Tunicata, Ascidiacea) from the National Park La Restinga, Isla Margarita, Venezuela

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Abstract: Although ascidians form a conspicuous part of sessile assemblages in the Caribbean, no specialized inventories have been developed in Venezuela, except for a list of 15 species reported from Margarita Island (1984). Here we present the results of a taxonomic workshop held in the Universidad de Oriente, Boca del Rio, Margarita Island during April 20-25 of 2009, sponsored by the NaGISA-Caribbean Sea program. La Restinga National park was surveyed and we found 29 species belonging to 19 genera and 10 families. The most abundant colonial species were *Clavelina oblonga, Aplidium accarense, Polyclinum constellatum, Distaplia bermudensis, Symplegma rubra, S. brakenhielmi, Botrylloides nigrum* and *Ecteinascidia turbinata*. Among the solitary ascidians *Phallusia nigra, Ascidia curvata, Microcosmus exasperatus, Styela canopus, Styela* sp.1 and *Styela* sp. 2 were the most abundant. The ascidian diversity in this lagoon is one of the highest for similar habitats in the Caribbean and seven species are new registers for Venezuela (*Ascidia curvata, Ecteinascidia styeloides, Aplidium accarense, Distaplia stylifera, Tridemnum orbiculatum, Symplegma rubra,* and *S. brakenhielmi*). One point of concern for the conservation of la Restinga National Park is the presence of possible introduced species, and some management procedures are suggested.
Keywords: *Urochordata, taxonomy, South Caribbean, mangrove, coastal lagoon, conservation, bioinvasion.*

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Resumo: Apesar das ascídias formarem uma parte conspícua das comunidades incrustantes no Caribe, nenhum inventário especializado foi realizado na Venezuela, com exceção de uma lista de 15 espécies registradas na Ilha Margarita (1984). Aqui apresentamos os resultados de um workshop de taxonomia realizado na Universidad de Oriente, Boca del Rio, Margarita Island em 20-25 de abril de 2009, como parte do programa NaGISA-Caribbean Sea program. O Parque Nacional La Restinga foi estudado e encontradas 29 espécies pertencendo a 19 gêneros e 10 famílias. As espécies coloniais mais abundantes foram *Clavelina oblonga, Aplidium accarense, Polyclinum constellatum, Distaplia bermudensis, Symplegma rubra, S. brakenhielmi, Botrylloides nigrum* e *Ecteinascidia turbinata.* Entre as espécies solitárias, *Phallusia nigra, Ascidia curvata, Microcosmus exasperatus, Styela canopus, Styela* sp.1 e *Styela* sp. 2 foram as mais abundantes. A diversidade de ascídias nesta laguna é uma das maiores neste tipo de habitat no Caribe e sete espécies representam novos registros para a Venezuela (*Ascidia curvata, Ecteinascidia styeloides, Aplidium accarense, Distaplia stylifera, Tridemnum orbiculatum, Symplegma rubra,* e *S. brakenhielmi*). Uma questão de preocupação para a conservação do Parque Nacional La Restinga é a presença de possíveis espécies exóticas, portanto algumas medidas de manejo são sugeridas.
Palavras-chave: *Urochordata, taxonomia, Caribe Sul, manguezal, laguna costeira, conservação, bioinvasão.*

Introduction

Ascidians are one of the most conspicuous invertebrate groups in coastal benthic assemblages. In the Caribbean, inventories of ascidian species have been done at Netherlands Antilles (Millar 1962, Goodbody 1984a), Guadeloupe (Monniot, C. 1983a, b, c & Monniot, F. 1983a, b, c), Jamaica (Goodbody 1993, 2003), Cuba (Zanui 1990), Belize (Goodbody 2000, 2004) and Panama (Rocha et al. 2005). In Venezuela, however, no specialized inventories have been developed except for the list of 15 species presented by Goodbody (1984b) for Margarita Island. In general, reports of ascidians from the Venezuelan Coast come mainly from ecological studies such as Sutherland (1980), Montes (1985), Álvarez (1989) and Orihuela et al. (1991) and the status of endemic, regional or even invasive ascidians in Venezuela is completely unknown (Zoppi de Roa 2003). This situation has prevented detailed descriptions of macrobenthic assemblages such as those growing on mangrove roots, coral reefs, rocky shores and *Thalassia* beds (Conde & Carmona-Suárez 2003, Miloslavich et al. 2005).

The survey reported here was done in the National Park La Restinga where diverse and abundant assemblages of tunicates grow on the mangrove roots (Cervigon & Gomez 1986, Orihuela et al. 1991, Díaz et al. 1992). La Restinga has been preserved as a national park since 1974 because of its highly diverse habitat contrasting with the arid vegetation of the terrestrial environment surrounding it (Presidential Ordinance nº 1591). This important system attracted the interest of many scientists whose studies included ecological aspects of primary production and planktonic biomass (Gómez 1983), polychaetes (Díaz & Liñero 2009), mollusks (González 1976, Nirchio et al. 1991, Bigatti et al. 2005, Miloslavich et al. 2007, Buitrago et al. 2009), crustaceans (Scelzo 1972, López Greco et al. 2001, Bolaños et al. 2004), fishes (Gómez 1981, Fuentes et al. 2003, Marín et al. 2003), and mangrove root fouling (Orihuela et al. 1991). However, a few studies described the ascidian fauna and only 15 species have been reported (Goodbody 1984b, Orihuela et al. 1991), representing a very small diversity for a Caribbean lagoon bordered by mangrove habitat. Although a few lagoons have been studied in the Caribbean, those better known usually contain between 25-40 species of ascidians (Toffart 1983, Goodbody 2004). Our survey increased the registers of ascidians in the mangrove complex La Restinga to at least 29 species.

Material and Methods

1. Study site

La Restinga is a coastal hypersaline lagoon located in the central part of Margarita Island, Venezuela. The lagoon has an area of 30 km^2, maximum depth of 6 m and is formed by a complex system of channels and ponds bordered by mangrove habitats. Detailed description of the environmental characteristics of the lagoon is provided by Cabrera & Penoth (1988), Gómez (1991), Orihuela et al. (1991), Ramírez (1996) and Salazar et al. (2003).

In general, the ascidians attach to the mangrove prop roots of *Rhizophora mangle*, usually in large biomass, and represent an important portion of the fouling community (Sutherland 1980, Álvarez 1989, Díaz et al. 1992, Farnsworth & Ellison 1996, Goodbody 2000).

This survey was performed in four sites inside La Restinga: Entrance, Mánamo, La Tortuga and La Isleta (Figure 1). The Entrance (10° 58' 50" N and 64° 9' 55" W), Mánamo (10° 58' 49" N and 64° 9' 22" W) and La Isleta (10° 59' 13" N and 64° 09' 17" W) have a stable salinity around 36-38% and strong tidal currents (Gómez 1991). La Tortuga (11° 00' 07" N and 64° 09' 47" W) is a hypersaline area, presenting salinity up to 45% (Gómez 1991). The movement of fishing

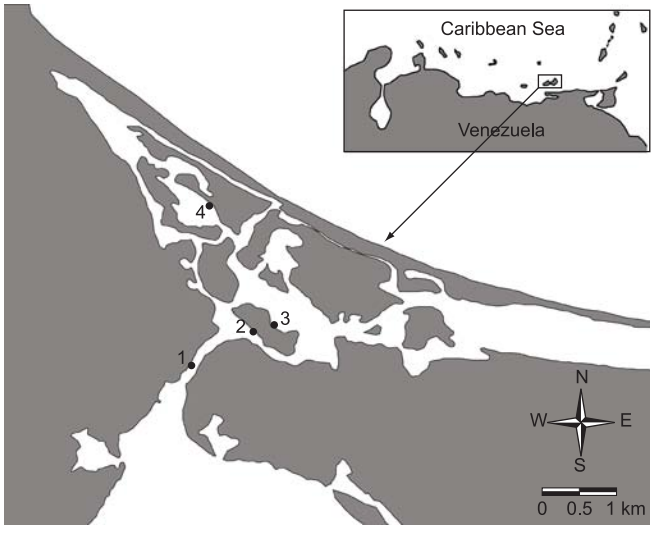

Figure 1. Map of la laguna of La Restinga National Park, Margarita Island, Venezuela. 1 - Entrance, 2 – Mánamo, 3 – La Isleta , 4 – La Tortuga. Insert showing location of Magarita Island.

and leisure boats is intense, increasing both the water hydrodynamics and the potential for species transport.

2. Field and laboratory work

The survey was performed on 20th and 21st of April 2009, with an effort of 1 hour snorkeling in each site by 14 divers. Specimens were photographed before collection for color and shape assessment of living animals. Samples were relaxed for 2 hours in a menthol-saturated sea-water solution and fixed in 5% seawater formalin.

Dissection followed routine methods (Monniot, C & Monniot, F 1972) and the literature for Caribbean ascidians and adjacent regions was consulted for identification (Berrill 1932, Van Name 1945, Millar 1962, 1978, Van der Sloot 1969, Monniot, C. 1972a, b, 1983a, b, c, Monniot, F. 1972, 1983a, b, c, Millar & Goodbody 1974, Monniot, C & Monniot, F 1984, Goodbody 1984a, 1984b, 1993, 1994, 2000, 2003, 2004, Goodbody & Cole 1987, 2006, Zanui 1990, Rocha et al. 2005).

Voucher specimens of all sampled species are deposited in the reference collections of the Museo Marino de Margarita, Isla Margarita and Museo Oceanológico "Benigno Roman" de la Estación de Investigaciones Marinas de Margarita (EDIMAR) - Fundación La Salle de Ciencias Naturales**.**

Results

We found 29 species belonging to 19 genera and 10 families (Table 1). Colonial species were abundant, usually covering soli-

Table 1. List of the species found at La Restinga National Park, Boca del Río, Isla Margarita, Venezuela. The number of Xs correspond to the relative visual abundance of the species comparing the four sites.

	Mánamo	**La Tortuga**	**Entrance**	**La Isleta**
Corellidae				
Rhodosoma turcicum (Savigny, 1816)	-	-	XX	-
Ascidiidae				
Phallusia nigra Savigny, 1816	XXX	X	XXX	XX
Ascidia curvata (Traustedt, 1882)	XX	-	XX	X
Ascidia sp.	X	X	X	X
Perophoridae				
Ecteinascidia styeloides (Traustedt, 1882)	-	-	X	X
Ecteinascidia turbinata Herdman, 1880	XXX	X	XXX	XX
Perophora viridis Verrill, 1871	-	-	X	-
Clavelinidae				
Clavelina oblonga Herdman, 1880	XXX	X	XXX	XXX
Polyclinidae				
Aplidium accarense (Millar, 1953)	XXX	X	XXX	XX
Polyclinum constellatum Savigny, 1816	X	XXX	X	X
Holozoidae				
Distaplia bermudensis Van Name, 1902	XX	-	XXX	X
Distaplia stylifera (Kowalevsky, 1874)	-	-	XX	X
Didemnidae				
Diplosoma listerianum (Milne-Edwards, 1841)	X	XX	X	X
Lissoclinum fragile (Van Name, 1902)	XX	-	X	X
Lissoclinum sp.	X	-	X	X
Didemnum cineraceum (Sluiter, 1898)	-	-	X	-
Didemnum duplicatum Monniot, 1983	X	-	-	-
Didemnum perlucidum Monniot, 1983	-	-	XX	X
Tridemnum orbiculatum (Van Name, 1902)	X	-	X	-
Styelidae				
Symplegma brakenhielmi (Michaelsen, 1904)	XXX	X	XXX	XXX
Symplegma rubra Monniot, 1972	XXX	-	XXX	X
Botrylloides nigrum (Herdman, 1886)	XXX	XX	XXX	XXX
Botrylloides sp.	XXX	X	X	X
Styela canopus Savigny, 1816	X	X	XXX	XX
Styela sp. 1	XXX	XX	XXX	XXX
Styela sp. 2	XX	X	X	XX
Pyuridae				
Microcosmus exasperatus Heller, 1878	XXX	XX	XXX	XXX
Herdmania pallida (Heller, 1878)	-	-	X	-
Molgulidae				
Molgula occidentalis Traustedt, 1883	X	-	X	-
TOTAL	22	14	28	22

Figure 2. a) *Rhodosoma turcicum* (Savigny, 1816); b) *Phallusia nigra* Savigny, 1816; c) *Ascidia curvata* (Traustedt, 1882) covered by *Symplegma brakenhielmi*; d) *Ecteinascidia turbinata* Herdman, 1880; e) *Ecteinascidia styeloides* (Traustedt, 1882); f) *Perophora viridis* Verrill, 1871; g) *Clavelina oblonga* Herdman, 1880; h) *Aplidium accarense* (Millar, 1953); i) *Polyclinum constellatum* Savigny, 1816. Photos credits: a, e, f, g) RMR; b) AKC; c,d) CH; h. SMP; i) EGC.

Figure 3. a, b, c) *Polyclinum constellatum* Savigny, 1816; d, e) *Distaplia bermudensis* Van Name, 1902; f, g) *Distaplia stylifera* (Kowalevsky, 1874); h) *Diplosoma listerianum* (Milne-Edwards, 1841); i) *Didemnum cineraceum* (Sluiter, 1898). Photos credits: a, d) EGC; b) SMP; c) RMR; e, f) AP; g) JP; h) MCD; i)AKC.

Figure 4. a) *Didemnum perlucidum* Monniot, 1983; b) *Trididemnum orbiculatum* (Van Name, 1902); c,d) *Symplegma brakenhielmi* (Michaelsen, 1904); e) *Symplegma rubra* Monniot, 1972; f, g) *Botrylloides nigrum* (Herdman, 1886); h) *Botrylloides* sp.; i) *Styela canopus* Savigny, 1816. Photos credits: a, b, i) RMR; c) SMP; d, e, h) EGC; f) CH.

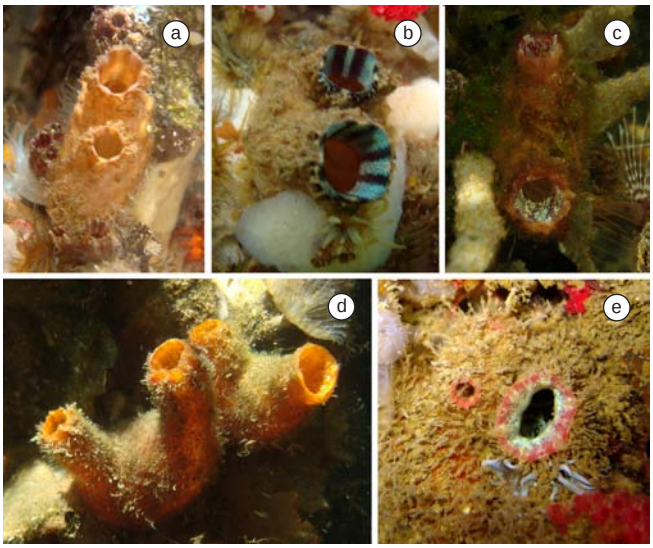

Figure 5. a) *Styela* sp. 2; b) *Styela* sp. 1; c) *Herdmania pallida* (Heller, 1878); d) *Microcosmus exasperatus* Heller, 1878; e) *Molgula occidentalis* Traustedt, 1883. Photos credits: a, b, c) RMR; d) EGC; e) AP.

tary animals. The most abundant species were *Clavelina oblonga, Aplidium accarense, Polyclinum constellatum, Distaplia bermudensis, Symplegma rubra, S. brakenhielmi, Botrylloides nigrum* and *Ecteinascidia turbinata*. Among the solitary ascidians *Phallusia nigra, Ascidia curvata, Microcosmus exasperatus, Styela canopus, Styela* sp.1 and *Styela* sp. 2 were the most abundant.

Five species were not identified either because of the lack of enough taxonomic characters or because they did not match with any Atlantic species: *Ascidia* sp., *Lissoclinum* sp., *Botrylloides* sp., *Styela* sp. 1 and *Styela* sp. 2. *Ascidia* sp. is very similar to *Ascidia curvata* but with red or orange vessels in the tunic, easily seen around the siphons. *Lissoclinum* sp. is white in the field but turns brown or orange in formalin. The colony contains a thin layer of more or less dense spicules (sometimes almost none) on the surface and the preserved zooids are very opaque with brown pigment and orange stigmata. The tunic is soft and extensively adheres to the zooids, at least in freshly fixed animals, which made it very difficult to pull out zooids in good condition for identification. Reproductive structures were not available for examination. Larvae present three adhesive papillae and four pairs of finger-like ampullae. *Botrylloides* sp. (Figure 4h) presents a uniform orange colony with long linear systems. Neither gonads or larvae were available for identification. *Styela* sp. 1 and *Styela*. sp. 2 present very similar internal structure but are considered separate species because of the different appearance of living animals. *Styela* sp. 1 has a white tunic and wide oral siphons; both siphons have wide radial blue bands inside (Figure 5b). In *Styela* sp. 2 the tunic is a light brown or rose, without the blue bands on the siphons but with many irregular tunic projections around both siphons (Figure 5a). In both species the body is elongate with a variable number of gonads in each side: *Styela* sp. 1 has 3-8 (right side) and 2-5 (left side); *Styela* sp. 2 has 5-7 (right side) (one specimen had no gonads on the right side), and 4-6 (left side). The structure of the gonads is also very similar with long tubular ovaries surrounded by orange elongate male follicles, not very dense or ramified, positioned vertically with only the proximal end attached to the body wall. The follicles of *Styela* sp. 1 were usually shorter than the ones in *Styela* sp. 2.

The Entrance was the most diverse site with 28 species, and La Tortuga was the least rich with 14 species (Table 1). The list of sampled species with a visual estimate of abundance is presented in Table 1 and photos of the species in the field are presented in Figures 2-5.

Discussion

Although the survey presented here was short and covered only four sites in the lagoon, we sampled 29 species of ascidians, a relatively high richness when compared to other Caribbean lagoons with mangrove habitats: 25 in Guadeloupe (Toffart 1983), 30 in Puerto Rico (Toffart 1983), 11 in Trinidad (Toffart 1983), 7 in Florida (Toffart 1983), 23 in Piscadera Baai, Curaçao (Goodbody 1984b), 15 in Lac, Bonaire (Goodbody 1984b), 55 in Pelican Cays, Belize (Goodbody 2000), 40 in Twin Cays, Belize (Goodbody 2004), 39 in Port Royal, Jamaica (Goodbody 2003), 29 in Almirante Bay, Bocas del Toro, Panama (Rocha et al. 2005).

Two previous studies reported 15 species for La Restinga (Goodbody 1984b, Orihuela et al. 1991) (Table 2). Among the species reported by Goodbody (1984b) and Orihuela et al. (1991), we did not encounter *Ascidia interrupta, Didemnum conchyliatum, Symplegma viride* and *Styela plicata*. The first two are common Caribbean species and new surveys can reveal their presence in the area. *Symplegma viride* could be easily confounded with *S. brakenhielmi* since differences between these species are subtle (see Monniot 1972b, 1983b for descriptions). *Styela plicata* is an introduced species in the Atlantic (Barros et al. 2009) found usually in high densities in harbors and marinas. Since we surveyed the same site mentioned by Goodbody (1984b) – "Puente de la Restinga" (= Entrance) and did not find any individuals, either the species has disappeared from the area or it was misidentified and perhaps was our *Styela* sp. 1 or *Styela* sp. 2.

Considering the list of known species for Venezuela, 30 species have been previously reported (Table 2). *Ascidia curvata, Ecteinascidia styeloides, Aplidium accarense, Distaplia stylifera, Tridemnum orbiculatum, Symplegma rubra,* and *S. brakenhielmi* are new records for this country but all species are widespread in the Caribbean. *Aplidium accarense,* though, was first described for Ghana, Africa (Millar 1953) and is also known from south Brazil where it is suspected to be introduced (Rocha et al. 2009). Molecular data would be helpful to better understand the genetic structure between the populations of *A. accarense* in the American and African Coasts. *Distaplia stylifera* is considered by Van Name (1945) as a synonymy of *D. bursata*. Both are very similar indeed because the description of *D. bursata* fits in the wide range of character variation reported for *D. stylifera*, for which the majority of records of are in the Indo-Pacific. In the Caribbean it was reported from the west coast of Florida, Jamaica and Colombia (Van Name 1945), but recent studies did not list the species in Jamaica (Goodbody 1993, 2003), Guadeloupe (Monniot, F 1983c) or Belize (Goodbody 2000, 2004). In Bocas del Toro, Panama, it occurs in the marina of the city, but only on artificial substrata (RMR, unpublished data). All this evidence also suggests that *D. stylifera* is not native in the Caribbean.

The Entrance was the richest site in species. Among the sampled species, only *Didemnum duplicatum* was not registered in The Entrance, but many white didemnids were observed but not collected because this was the last site visited and we were trying to not re-collect similar organisms. White didemnids, though, can not be certainly identified by pictures and it is possible that we will find not only *D. duplicatum* but other species in this site. Tidal currents in The Entrance may prevent sedimentation on the sessile community, usually a negative factor that causes mortality to recruits and juveniles (Young & Chia 1984) and disturbs water filtration by the adults (Petersen 2007). At La Tortuga the high salinity seems to be strongly selecting against the survival of some species and only half of the species encountered during this study was registered at La Tortuga. *Polyclinum constellatum* was especially abundant at this site as ball-shaped colonies filled with a gelatinous tunic with the

Table 2. List of known species for Venezuela.

	La Tortuga[1]	Margarita island[1]	Los Testigos[1]	Cubagua Island[2]	Aves Island[3]	Chacopata Bay, Sucre[3]	Mochima Bay, Sucre[4]	Buche Bay[5]	La Restinga, Margarita Isl.[6]	La Restinga, Margarita Isl.[7,8]	Margarita Island[7]
Diazonidae											
Rhopalaea abdominalis (Sluiter, 1898)	X	-	-	-	-	-	-	-	-	-	-
Corellidae											
Rhodosoma turcicum (Savigny, 1816)	-	-	-	-	-	-	X	-	-	-	-
Ascidiidae											
Ascidia interrupta Heller, 1878	-	-	-	-	-	-	-	-	-	X	-
Phallusia nigra Savigny, 1816	-	-	-	-	-	-	X	-	X	X	-
Perophoridae											
Ecteinascidia conklini Berrill, 1932	-	-	-	-	-	-	-	X	-	-	-
Ecteinascidia turbinata Herdman, 1880	-	-	-	-	-	-	-	-	-	X	-
Perophora bermudensis Berrill, 1932	-	-	-	-	X	-	-	-	-	-	-
Clavelinidae											
Clavelina oblonga Herdman, 1880	-	-	-	-	-	-	-	-	-	X	-
Polyclinidae											
Aplidium bermudae (Van Name, 1902)	-	-	-	X	-	-	-	-	-	-	-
Aplidium funginum (Sluiter, 1898)	X	-	-	-	-	-	-	-	-	-	-
Polyclinum constellatum Savigny, 1816	-	-	-	-	-	-	-	X	-	X	X
Polycitoridae											
Eudistoma hepaticum (Van Name, 1921)	-	-	-	-	-	-	-	-	-	-	X
Eudistoma olivaceum (Van Name, 1902)	-	-	-	-	-	-	-	-	-	-	X
Holozoidae											
Distaplia bermudensis Van Name, 1902	-	-	-	-	-	-	-	-	-	X	-
Didemnidae											
Didemnum conchyliatum (Sluiter, 1898)	-	-	-	-	-	-	-	-	-	X	-
Didemnum duplicatum Monniot, 1983	-	-	-	-	-	-	-	-	-	X	-
Didemnum vanderhorsti Van Name, 1924	-	-	-	-	-	-	-	-	-	-	X
Diplosoma listerianum (Milne-Edwards, 1841)	-	-	-	-	-	-	-	-	X	X	X
Styelidae											
Botrylloides nigrum (Herdman, 1886)	-	X	-	-	-	-	-	X	X	X	-
Symplegma viride Herdman, 1886	-	-	-	-	-	-	-	X	X	X	-
Styela canopus Savigny, 1816	-	-	-	-	-	-	-	X	-	X	-
Styela plicata (Lesueur, 1823)	-	-	-	-	-	-	X	-	X	X	-
Polycarpa appropinquata (Sluiter, 1898):	X	-	-	-	-	-	-	-	-	-	-
Polycarpa aurita (Sluiter, 1890)	X	-	-	-	-	-	-	-	-	-	-
Polycarpa nivosa (Sluiter, 1898)	-	-	?	-	-	-	-	-	-	-	-
Polycarpa spongiabilis (Traustedt, 1883)	X	-	-	-	-	-	X	-	-	-	-
Pyuridae											
Microcosmus exasperatus Heller, 1878	-	-	-	-	-	-	-	X	-	X	-
Herdmania pallida (Heller, 1878)	-	-	-	-	-	-	X	-	-	X	-
Pyura vittata (Stimpson, 1852)	-	-	-	-	-	-	X	-	X	-	-
Molgulidae											
Molgula occidentalis Traustedt, 1883	-	-	-	-	-	X	-	-	-	-	-

[1]Sluiter 1898, [2]Van Name 1945, [3]Millar 1962, [4]Bermúdez & Jimenez 1975, [5]Sutherland 1980, [6]Ramirez, 1996 (based in Galan 1976), [7]Goodbody 1984b, [8]Orihuela et al. 1991.

zooids located only around the outer edge like the ones observed in Port Royal, Jamaica (Goodbody 2003).

One point of concern for the conservation of la Restinga National Park is the presence of possible introduced species, since it is a protected area (Presidential Ordinance n°1591). Other studies identified the presence of introduced species in Venezuela (Montes & Prieto 2005, Perez et al. 2007) but the lack of comprehensive surveys allowed the recognition of only one introduced tunicate, *Styela clava* (Herdman, 1881). Given the fact that it is a cold water species, its identification is doubtful. Ascidians have been recognized as frequent invaders of new areas in recent years (Lambert 2005, 2007) causing major fouling problems for the bivalve aquaculture industry (Carver et al. 2003, LeBlanc et al. 2007). In natural environments they have the potential to displace native species causing reduction of biodiversity. In La Restinga we detected some species that are already widespread in the Caribbean and probably represent historical introductions such as *Microcosmus exasperatus* and *Styela canopus*. The presence of *Ascidia sydneiensis* was only guessed by photos and should be confirmed as well as *Styela plicata*. If present, these species are still not abundant and manual eradication could be tried. If *Aplidium accarense* and *Distaplia stylifera* prove to be introduced they represent a real threat to the diversity of the region, since they grow in large, massive colonies that could smother and displace other species.

The movement of recreational and fishing boats has already been shown to be an important vector for intraregional spread of invaders both in freshwater and marine environments (Johnson et al. 2001, Wasson et al. 2001, Darbyson et al. 2009). Frequent cleaning of the hulls and anchors, and control of water discharge, oyster shells and other shellfish refuse, are important management procedures toward the prevention of species dispersal. Furthermore, artificial substrates are also known as important habitats used by introduced species for first establishment (Glasby et al. 2007). The avoidance of construction of piers or other structures inside the lagoon which would add artificial substrate for colonization of sessile animals and frequent (less than two months) cleaning of existing structures are other prevention measures that should be followed. Managers should also promote periodic monitoring to increase the chances of early detection and possible eradication of introduced species.

Old photos of mangrove roots by CL and AP (2007-2008) showed the presence of a few species not collected in this survey, including *Clavelina picta*, *Ascidia sydneiensis* and a colony with round systems which resembles *Distaplia corolla*. Other cryptic species such as *Corella minuta*, *Perophora* spp. and *Ecteinascidia minuta* frequently found in Caribbean mangrove habitats are also expected in further collections in the area. It is also important to consider that the only two studied Caribbean lagoons that presented a richer community of ascidians than "La Restinga" are those in Belize that were studied for years and include temporary and rare species (Goodbody 2000, 2004). Thus the list here presented is far from complete and we expect to have 35-38 ascidian species in La Restinga lagoon, which would make this mangrove system among the ones with the highest biodiversity in the Caribbean.

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