

The distribution of seagrasses in Dominica, Lesser Antilles

S.C.C. Steiner, K.J. Macfarlane, L.M. Price & D.A. Willette

Institute for Tropical Marine Ecology Inc. (ITME), P.O. Box 944, Roseau, Commonwealth of Dominica;
admin@itme.org

Received 15-VII-2009. Corrected 07-III-2010. Accepted 12-VII-2010.

Abstract: Seagrass beds are the largest organism-built marine habitat in Dominica, yet have only been surveyed since 2007. Standardized examinations along a depth gradient between 0 and 24m, focusing on magnoliophyte species composition and benthic cover of shoots at 17 seagrass bed sites, were carried out between September 10 and December 7, 2008. The Cymodoceaceae *Syringodium filiforme* (Kuetzing 1860) and *Halodule wrightii* (Ascherson 1868), as well as the Hydrocharitaceae *Halophila decipiens* (Ostenfeld 1902), *H. stipulacea* (Foskal & Ascherson 1867) and *Thalassia testudinum* (Banks ex König 1805) displayed distinct regional and horizontal distribution patterns. *Syringodium filiforme* is the island's dominant seagrass along the western and northern coasts, occurring at depths between 2 and 18m and with a mean benthic cover ranging from 0.9-10% along the West coast. Along the North coast it grew between 0.2 and 1m depth with a mean maximum benthic cover of 48.9%. *Halodule wrightii* grew along the North and West coasts, in depths between 1 and 14m in areas of recent and chronic disturbances. Its delicate morphology and sparse benthic cover (<0.1%) did not constitute seagrass beds. *Halophila decipiens* grew along the deep, shallow and lateral margins of west coast *S. filiforme* beds and monospecifically in depths between 3 and 24m. *Halophila stipulacea*, an invasive species, was widespread along 45km of the West coast and was found in depths between 5 and 24m. Both *Halophila* species formed extensive beds at depths beyond the survey limit of 24m thus playing a potentially important role in the resettlement of shallow areas after storms. *H. decipiens* and *H. stipulacea* are currently the second and third most common seagrasses on the island respectively, despite their absence along the North coast. *T. testudinum* was confined to North coast's sheltered reef flats at depths 1m or less with mean a benthic cover ranging from 2 to 76%. It grew monospecifically in the most turbulent and in the calmest locations, yet intermixed with *S. filiforme* in areas of moderate turbulence. Strong surge along the West coast (October 15-16, 2008), associated with Hurricane Omar, caused uprooting and burial of seagrass beds in varying degrees, in particular along the shallow margins between 2 and 10m depth. This event also demonstrated the dynamic nature of Dominica's shallow seagrass bed margins and the resistance level of individual beds to storm disturbances. Rev. Biol. Trop. 58 (Suppl. 3): 89-98. Epub 2010 October 01.

Key words: Seagrasses, *Syringodium*, *Halodule*, *Halophila*, *Thalassia*, Dominica.

Seagrass beds throughout the world provide many ecological and economic benefits to the coastal regions they line, including their role as a nursery for juvenile fishes and invertebrates (Randell 1965, Nagelkerken *et al.* 2000, Beck *et al.*, 2001, Peterson & Heck 2001) and shelter for adult organisms (Baelde 1990, Boström & Mattila 1999, Danovaro & Gambi 2002); as well as their functions to stabilize shorelines through wave attenuation

(Fonseca & Fisher 1986, Fonseca & Cahalan 1992, Grizzle *et al.* 1996, Chen *et al.* 2007), decrease suspended material in the water column (Agawin & Duarte 2002, Marbà *et al.* 2006), recycle nutrients, increase oxygen loads and sequester CO₂ (Lee & Dunton 1999, Gacia *et al.* 2005, Suzuki *et al.* 2003). Seagrass beds also rank among the most productive ecosystems on the planet in terms of biomass and species diversity (Constanza *et al.* 1998,

Duarte & Chiscano 1999, Duarte 2002). In Dominica, a young volcanic island, the characteristically narrow sublittoral zone provides a comparatively limited area for seagrasses and other light-dependent benthic communities to flourish. The first comprehensive island-wide survey of the distribution and size of benthic marine habitats that encompassed the assessment of seagrasses, was carried out in 2007 by Steiner & Willette (2010). Results from these initial studies included that seagrass beds were (i) found along extensive portions of the West coast, on the reef flats of fringing reefs along North coast, and in the form of a single patch (>100m²) along the East coast, yet absent along the South coast, (ii) that they are the island's largest organism-built habitat covering a minimum of 265ha, more than the equally marginal coral reef systems covering only 72ha and (iii) that five seagrasses have been identified so far, the Cymodoceaceae *Syringodium filiforme* and *Halodule wrightii*, and the Hydrocharitaceae *Halophila decipiens*, *H. stipulacea* and *Thalassia testudinum*. An earlier report by Onuf *et al.* (2003) including seagrass distribution maps encompassing Dominica, was only marginally in accordance to the findings of Steiner & Willette (2010), as it illustrates the distribution of seagrasses, without naming species, at locations along the North, West and East coast that do not have seagrass beds. The Government of Dominica (2005) illustrates the distribution of seagrasses, also without naming species and omitting the largest seagrass beds along the West coast, while claiming the presence of seagrass beds at northern and eastern locations marked by a high-energy rocky sublittoral zone, which is devoid of seagrasses. Similarly inaccurate is the distribution map published by UNEP-WCMC (2007), which shows seagrasses growing around the entire island. The information provided by Onuf *et al.* (2003), the Government of Dominica (2005) and UNEP-WCMC (2007) does not suffice as baseline of Dominica's seagrass resources and highlights the fundamental benefits of field surveys.

All of Dominica's seagrass beds are close to human settlements and are historically and

presently used as fishing areas, locally also referred to as "conch beds". The fisheries are artisanal and the fishing techniques applied include seine net fishing, the use of baited fish pots, spear fishing and occasionally the collection of the gastropods *Strombus gigas* and *S. costatus* and the echinoid *Tripneustes ventricosus*. Visible signs of stresses affecting seagrasses in Dominica are the burial and erosion of seagrasses, the contamination by solid wastes, and pulses in the colonization and growth of epiphytic organisms and macroalgae. Seagrasses are not yet specifically protected by the laws of Dominica or other conservation mechanisms as no major seagrass beds occur within the boundaries of the two existing marine protected areas, the Cabrits National Park and the Scott's Head – Soufrière Marine Reserve. In order to expand our recent understanding of Dominica's largest marine organism-built habitat type, and to provide the primary data based on field surveys, necessary for the sound development of environmental policies, this study examines the species composition and topography within and between seagrass beds at depths ranging from 0 to 24m.

MATERIALS AND METHODS

Seagrass beds at fifteen sites along the West coast and two sites along the North coast (Fig. 1) were surveyed between September 10 and December 7, 2008 (Table 1). The sites were strategically selected to encompass all major areas of seagrass beds as ascertained by Steiner and Willette in 2007. At all west coast sites SCUBA dives were carried out following a compass heading perpendicular to the shoreline. Snorkeling gear was used to examine north coast sites. The coordinates of the starting point, and the heading, length and maximum depth of each transect were recorded for future reference (Table 1). The survey protocol entailed a "downward" and an "upward" transect. During the downward transect, from shore to a depth of 24m or to where no more seagrasses were seen (whichever came first), qualitative descriptions of the seagrass bed

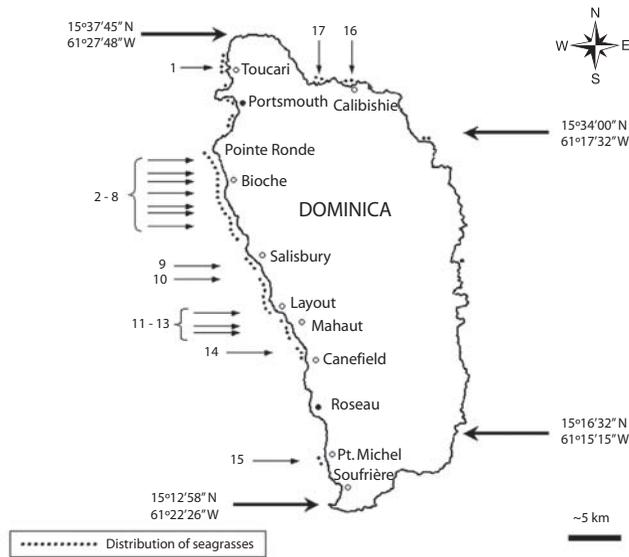


Fig. 1. Study sites along the West coast at 1 Toucari, 2 Espagnol Bay, 3 Dublanc, 4 Bioche, 5 Anse Mulâtre, 6 Anse à Liane, 7 Anse Cola (Colihaut), 8 Geule Leon, 9 Salisbury, 10 Mero (N), 11 Layou (N), 12 Jimmit, 13 Mahaut, 14 Canefield, 15 Pointe Michel, and the North coast at 16 Calibishie and 17 Anse Soldat. Boundaries between the North, East, South and West coast, as delineated for this study, are marked by coordinates. The distribution of seagrasses is illustrated as dotted lines contouring the coastline and is based on Steiner & Willette (2010).

TABLE 1

Survey sites and transect features. Note: Headings are in reference to the magnetic north, as they are read in the field and not true North or grid North. Sites 1-15 are on the West coast, sites 16 and 17 are on the North coast. Maximum depth of U-transect refers to the “upward” transect

Site Name	Coordinates of Starting Point	Transect Heading	Transect Length (m)	Maximum Depth of U-Transect (m)
1 Toucari	15°36'89" N 61°27'50" W	270 °	190	15
2 Espagnol Bay	15°31'52" N 61°28'31" W	240°	335	16
3 Dublanc	15°30'59" N 61°28'12" W	270°	200	18
4 Bioche	15°30'29" N 61°28'01" W	290°	190	15
5 Anse Mulâtre	15°30'13" N 61°28'03" W	310°	180	18
6 Anse à Liane	15°29'20" N 61°27'56" W	270°	160	18
7 Colihaut (Anse Cola)	15°28'50" N 61°27'39" W	280°	150	18
8 Geule Leon	15°27'44" N 61°27'15" W	239°	130	18
9 Salisbury Bay	15°25'57" N 61°26'10" W	230°	150	18
10 Mero (North)	15°25'08" N 61°25'48" W	270°	290	15
11 Layou (North)	15°24'06" N 61°25'38" W	240°	290	15
12 Jimmit	15°22'38" N 61°24'27" W	255°	150	15
13 Mahaut	15°21'50" N 61°24'02" W	220°	200	18
14 Canefield	15°20'04" N 61°23'37" W	135°	110	16
15 Pointe Michel	15°15'35" N 61°22'39" W	250°	220	18
16 Calibishie	15°35'39" N 61°20'44" W	0°	100	1
17 Anse Soldat	15°35'48" N 61°22'58" W	337°	70	1

margins (intact or eroded, species composition, height and benthic cover of leaf shoots) and the central parts (species composition, height and benthic cover of shoots, signs of endofauna, epiphytes, sessile and vagile fauna) were recorded. Seagrasses observed beyond the deep end of each transect were also noted and their benthic cover was estimated. At Espagnol Bay the deep margin of the *S. filiforme* bed was further than 335m from shore and was not reached during the survey. Each “upward” transect included quantitative assessments of “plots” consisting of three 1m² quadrats, aligned perpendicular to shore and 1m apart from each other, first at a distance of 5m from the deep margin of the seagrass bed or at the deepest point of the “downward” transect if a seagrass bed margin was not reached, and repeated at 20m intervals towards shore. Intervals were measured with a 20m transect line extended in the opposite direction of the compass heading used during the “downward” transect. At Toucari and Espagnol Bay a 40m interval was used to allow for the completion of the survey during a single dive. Within each quadrat, seagrass species composition, benthic cover and height of leaf shoots were assessed and the presence of macroalgae, epiphytes, sedentary and vagile epifauna was noted. The benthic cover of leaf shoots was visually estimated using 1m² quadrats subdivided into four 0.25m² squares. Each estimate was derived from the consensus of at least two surveyors and was based on eight hours of consistency training in the field and with the aid of projected images, to ensure that surveyors estimated the percent cover congruently. Shoots closest to five pre-marked spots along the quadrat were selected for *in situ* height measurements to the closest centimeter. Quantitative data of the three quadrats constituting each of the plots were pooled and the means used for the comparison within and between seagrass beds and depth. Species identification in the field was based on Littler & Littler (2000). Voucher specimens were stored at the Institute for Tropical Marine Ecology.

Outer wind bands of Hurricane Omar caused strong swells along Dominica’s West

coast during the night of October 15 and through most of the day on October 16, 2008. Field surveys were suspended due to poor visibility caused by the storm and resumed on October 23, 2008. Storm impacts in the form of erosion and burial of seagrasses in varying degrees, were evident in many seagrass beds. The width of seagrass beds and the species presence were subsequently reassessed.

RESULTS

Syringodium filiforme was the principal component of all seagrass beds examined. It occurred at all sites (Table 2) and grew at depths between 0.2 and 18m (Fig. 2). Its mean benthic cover ranged between 0.9 and 10% among the west coast sites and gradually decreased from the shallow seagrass bed margins in depths ≥ 2 m towards the deep margins. The mean blade height of *S. filiforme* ranged from 14.3 to 33cm (n=205) and the highest mean values (24.7cm, n=180) consistently occurred within the deeper half of the seagrass beds at 14-15m depth. A single blade of 56cm was measured at Anse Mulâtre at a depth of 11m, outside of the quadrats. The deep margins of *S. filiforme* beds were all abrupt and intact, linear rather than undulating and without exposed rhizome layers. In contrast, its shallow margins were undulating, marked by a distinct drop in the terrain (ranging from 20 to 35cm) exposing rhizome layers. The widest and best-developed *S. filiforme* bed of the West coast, in terms of its benthic cover of shoots and blade heights, was at Espagnol Bay. Along the North coast *S. filiforme* grew between 0.2 and 1m depth, on reef flats, with a mean benthic cover of 34.3% (n=18), a mean blade height of 17.3cm (n=60), and always intermixed with *T. testudinum*. Across beds, mean benthic cover and blade height increased from the off-shore margins (31% n=6, 15.5cm, n=30) towards the central portions (48.9%, n=6, 21.8cm, n=30) of the seagrass beds, from where they decreased towards the near-shore margins (22.5%, n=6, 14.7cm, n=30). Its off-shore distribution limits at were gradual transitions to areas of coral

TABLE 2
Distribution of seagrass species across sites

Site Name	Width BS (m)	Width AS (m)	SFIL	HWRI	HDEC	HSTI	TTES
1 Toucari	150	150	●	■	○+	○+	-
2 Espagnol Bay	160 *	160 *	●	-	-	○	-
3 Dublanc	95	95	●	-	■+	■+	-
4 Bioche	95	95	●	-	○+	■+	-
5 Anse Mulâtre	125	85	●	-	-	○	-
6 Anse à Liane	85	85	●	■	○+	○+	-
7 Colihaut (Anse Cola)	115	115	●	-	■	■	-
8 Geule Leon	90	90	●	-	■+	■+	-
9 Salisbury Bay	75	15	● → □	-	○+ → □	-	-
10 Mero	170	0	● → □	■	-	-	-
11 Layou	70	70	■	■	○+	■+	-
12 Jimmit	145	85	●	■	○	-	-
13 Mahaut	75	50	● → ■	■	○	-	-
14 Canefield	85	60	● → □	-	○ → ■	○ → ■	-
15 Pointe Michel	75	0	● → □	-	■+	-	-
16 Calibishie	105	105	●	■	-	-	●
17 Anse Soldat	70	70	●	■	-	-	●

Seagrass bed widths (excluding isolated patches in shallow waters) before (BS) and up to 7 weeks after (AS) storm impact. At Pointe Ronde, the seagrass bed width (*) could not be determined and was greater than 160 m. Species *S. filiforme* (SFIL), *H. wrightii* (HWRI), *H. decipiens* (HDEC), *H. stipulacea* (HSTI) and *T. testudinum* (TTES) ranked as primary (● dominant in benthic cover when compared to other seagrass species), secondary (○ non-dominant with a minimum benthic cover of 1%), marginal (■ cover less than 1% of the benthos), occasional (□ previously recorded but absent during study due to disturbances) or absent (-). Changes from one to another rank during the study's timeframe are indicated by →. Where HDEC and HSTI were marginal within the surveyed areas but primary or secondary in deeper areas outside of the survey is indicated with +.

rubble where *T. testudinum* grew monospecifically. Its near-shore distribution limit at Calibishie were also smooth and marked by a gradual transition into monospecific areas of *T. testudinum*, however in sandy substrates. At Anse Soldat the near shore distribution limit of *S. filiforme* co-occurred with that of *T. testudinum* less than a meter from shore.

Halodule wrightii grew in depths between 1 and 14m (Fig. 2), in areas of recent (generally in shallow waters) and chronic disturbances (e.g. Layou river mouth), at western and northern sites, but did not occur in any of the 141 quantitatively examined quadrats. Its delicate morphology and sparse benthic cover (<0.1%) did not constitute seagrass beds that shape

their substrate. *H. decipiens* grew along the deep, shallow and lateral margins of the west coast *S. filiforme* beds and monospecifically in depths between 3 and 24m, however it did not occur in any of the quantitatively assessed quadrats. It was most commonly found along the deep margins of *S. filiforme* beds forming mono-specific beds with a benthic cover of shoots of up to 30% or in variegated or mixed assemblages with *H. stipulacea*. The latter was also widespread (Table 2) along 45km of the West coast between Canefield and Toucari and occurred in depths from 5 to 24m, predominantly along the deep margins of *S. filiforme* beds and with benthic covers of up to 80%. Only at Canefield did *H. stipulacea* occur

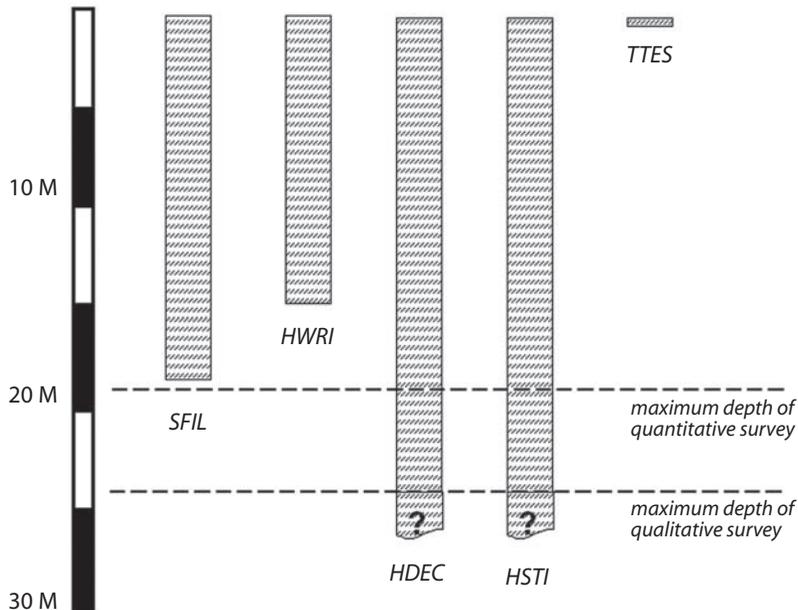


Fig. 2. Depth range of seagrass species *S. filiforme* (SFIL) and *H. wrightii* (HWRI) occurring at western and northern sites, *H. decipiens* (HDEC) and *H. stipulacea* occurring exclusively at western sites (HSTI) and *T. testudinum* (TTES) occurring exclusively at northern sites. The deep distribution limit for *H. decipiens* (HDEC), *H. stipulacea* (HSTI) was not determined.

within the quantitatively surveyed quadrats, where its mean benthic cover of shoots was 21.4% (n=12) with a mean blade height of 6cm (n=60). Both *Halophila* species formed extensive beds at depths beyond the survey limit of this study at 24m (Fig. 2) where *H. decipiens* still covered a greater portion of the seafloor than *H. stipulacea*.

Thalassia testudinum was confined to North coast where it occurred on sheltered reef flats at depths of 1m or less (Fig. 2), with a mean benthic cover ranging from 2 to 76% (n=18). It grew monospecifically in the most turbulent locations (coral rubble sediments behind the reef crest) and the calmest locations (along the shore), yet intermixed with *S. filiforme* in areas of moderate turbulence (central portions of the seagrass bed). At Calibishie the mean benthic cover and blade height within the seagrass beds increased steadily from the off-shore margin (most turbulent) to the near-shore

margin (calmest) where they peaked at 76.6% (n=3) and 22.8cm (n=15) respectively. The same pattern was observed in the mean blade heights across the narrower seagrass bed at Anse Soldat, which increased steadily from the off-shore margin (11.1cm, n=15) towards shore (22.8cm, n=15). However, the mean benthic cover had a sinusoid distribution with a mean benthic cover of 7% (n=3) at the off shore and near shore margins and peaking at 19% (n=3) in the central portions of the seagrass bed.

The growth of epiphytic invertebrates (primarily hydroids) and algae (primarily phaeophytes and rhodophytes) was most pronounced on the deep half of western seagrass beds, while northern seagrass beds were characterized by dense epibenthic macroalgal communities in the space not covered by seagrasses. Epipsammic macro-invertebrates were uncommon throughout all sites except Bioche, which was characterized by the common occurrence

of the gastropod *Strombus costatus* and the asteroid *Oreaster reticulatus*.

Strong surge along the West coast (October 15 and 16, 2008) associated with Hurricane Omar caused uprooting and burial of seagrass beds in varying degrees, in particular along the shallow margins between 2 and 10m depth, leading to a decrease in the width of seagrass beds and the number of species at several locations (Table 2). The complete or close-to-complete removal and burial of entire seagrass beds occurred at Salisbury Bay, Mero and Pt. Michel. *H. wrightii* was the only species that reappeared in disturbed areas and within the survey time frame and as early as two weeks after the storm. North coast beds were not affected by this event.

DISCUSSION

Dominica's west coast (leeward) and east coast (windward) seagrass beds differed in seagrass species composition, depth range, and associated species. West coast beds were dominated by *S. filiforme*, and were typically found between 2 and 18m, in otherwise sandy regions. The narrow and steep shelf of the West coast, lacking wave energy dissipating structures such as shallow fringing reef systems, limits the space suitable for light dependent seagrasses. Near-shore turbulence creates unstable conditions for seagrasses and therefore Dominica's west coast communities start growing in no less 2m and extend towards their physiological light limits, which in Dominica was at 18m for *S. filiforme*. Although *T. testudinum* is known to have lower minimum light requirements than *S. filiforme* (Lee *et al.* 2007), self-shading by *T. testudinum* with blade-like leaves may be a disadvantage in these depths, possibly explaining its absence along the West coast. In contrast, windward beds were characterized by *T. testudinum* growing in depths of 0-1m in back reef areas or behind other sheltering features like islands. *T. testudinum* has the deepest live rhizome mats of the five species (Duarte 1991, den Hartog 1970), and unbranched roots with substantial root-hairs that are adapted for

a range of sediment types (Kuo & den Hartog 2006). These attributes provide the necessary stability in the coral rubble substrates behind the reef crests of Anse Soldat and Calibishie. Close to shore, in calm waters where seagrasses lay submerged but flat during low tides, shading by the blade-like leaves of *T. testudinum* may be among the limiting factors for *S. filiforme* at these sites.

H. wrightii displayed the sparsest yet most "opportunistic" distribution in that it occurred in areas of disturbance lining or within mixed and mono-specific seagrass beds, and patches of *S. filiforme* and *T. testudinum*. Furthermore, it was the first species to reappear at sites disturbed by Hurricane Omar. This is in accordance with their status as pioneer species and described by Mariani & Alcoverro (1999).

Both *H. decipiens* and *H. stipulacea* were only found along the West coast. *H. decipiens* is known to grow at depths of up to 40 m (Williams & Dennison 1990). *H. stipulacea* generally grows at depths of up to 50m (Beer & Waisel 1981), but as deep as 85 m near the Great Barrier Reef and Cargolos (den Hartog 1970). The deep distribution limit for these species in Dominica has not yet been determined, as this survey did not go beyond 24m depth. However, based on their wide distribution, in particular along the deep distribution limits of the west coast *S. filiforme* beds, first examined during this study, *Halophila* spp. must be considered to have the largest benthic cover after *S. filiforme* and to contribute to a total benthic cover of seagrasses in Dominica certainly greater than the 265ha previously surveyed by Steiner & Willette (2010). Although the native *H. decipiens* is still more widespread than the invasive *H. stipulacea*, the rapid mean lateral expansion rates of 0.5cm d⁻¹ (maximum rates >6 cm d⁻¹) of the latter, observed in Dominica by Willette & Ambrose (2009), may lead to a reversal of this situation over time. *H. stipulacea* also has the ability to displace the native *S. filiforme* as demonstrated in experiments by Willette (unpublished), posing a potential threat to Dominica's largest seagrass beds (West coast) and the associated fauna and flora.

Given their wide depth range, both *Halophila* species grow below the areas directly impacted by hurricanes and also have the potential of locally resettling shallower waters after storm disturbances. Although all west coast seagrasses beds were affected by Hurricane Omar, the level of destruction varied greatly between sites. This is an indication as to which seagrass beds are more resistant to such disturbances (Espagnol Bay, Dublanc, Bioche, Colihaut), which in turn is a key insight for establishing conservation measures tailored specifically to the local conditions.

This study has discerned the differences in the seagrass species distribution of the leeward and windward coasts of Dominica, where all sublittoral ecosystems cover comparatively small areas along the island's narrow shelf and close to coastal settlements. Dominica's seagrass beds also undergo dynamic fluctuations in their benthic cover, resulting from storms, as observed here. In such a scenario, marine conservation measures aimed at multiple rather than single habitats (e.g. coral reefs) seem more appropriate given Dominica's contiguous layout of seagrass beds and coral reefs described in Steiner & Willette (2010). To date, Dominica's marine habitat conservation measures and two marine protected areas (Scott's Head-Soufrière Marine Reserve, Cabrits National Park) focus on coral reefs and areas of coral assemblages. Although seagrasses are Dominica's largest organism-built habitat type, their investigation has only recently begun and non-anecdotal information is now available for the incorporation into broader marine conservation efforts.

ACKNOWLEDGMENTS

Logistic and financial support was provided by the Institute for Tropical Marine Ecology Inc. (ITME RPfa09). The research license for this project (RP-09/248-1) was granted and issued by the Fisheries Development Division, Government of Dominica.

RESUMEN

Pastos marinos son los ambientes más grandes constituidos por organismos en Dominica. Sin embargo, sólo se han examinado desde 2007. Entre el 10 de septiembre y 9 de diciembre 2008, se examinaron la composición de especies y la densidad de magnolofitas en profundidades de 0 a 24m. Los Cymodoceaceae: *Syringodium filiforme* y *Halodule wrightii*, tal como los Hydrocharitaceae: *Halophila decipiens*, *H. stipulacea* y *Thalassia testudinum*, mostraron una distribución regional y horizontal muy distinta. *Syringodium filiforme* fue la especie dominante en las costas del oeste y del norte de la isla. Se encontró en profundidades de 2 a 18m y con un promedio de cobertura béntica de 0.9-10% en la costa del oeste. En las costas del norte creció entre 0.2 y 1m de profundidad con un promedio de cobertura béntica de 48.9%. *Halodule wrightii* creció en las costas del norte y oeste, en profundidades de 1 a 14m en áreas de perturbaciones recientes o crónicas. Su morfología delicada y su baja cobertura béntica (<0.1%) no constituyeron pastos. *Halophila decipiens* creció en los márgenes profundos, llanos y laterales de pastos dominados por *S. filiforme*, pero también en forma mono-específica entre 3 y 24m. *Halophila stipulacea*, una especie invasora, se encontró comúnmente a lo largo de 45km de la costa del oeste en profundidades entre 5 y 24m. Ambas especies de *Halophila* formaron pastos extensos en profundidades mayores al límite de este estudio y pudieron ser importantes en la recolonización de áreas llanas después de tormentas destructivas. *H. decipiens* y *H. stipulacea* ahora son las especies más comunes después de *S. filiforme*, a pesar de su ausencia en la costa del norte. *T. testudinum*, sólo creció en la costa del norte, encima de áreas arrecifales con un promedio de cobertura béntica entre 2 y 76%, en aguas con 1m o menos de profundidad. Crecieron mono-específicamente en áreas de turbulencia máxima y mínima, pero entre *S. filiforme* en áreas de turbulencia moderada. Oleaje fuerte en la costa del oeste (octubre 16), asociado con el Huracán Omar, causó la erosión y el enterramiento variado de las márgenes llanas de pastos marinos, particularmente entre 2 y 10m de profundidad. Este evento demostró la dinámica en las márgenes llanas de pastos marinos de Dominica y el nivel de resistencia a perturbaciones de pastos individuales.

Palabras clave: algas marinas, *Syringodium*, *Halodule*, *Halophila*, *Thalassia*, Dominica.

REFERENCES

- Agawin, N.S.R. & C.M. Duarte. 2002. Evidence of direct particle trapping by a tropical seagrass meadow. *Estuaries* 25: 1205-1209.

- Baelde, P. 1990. Differences in the structure of fish assemblages in *Thalassia testudinum* beds in Guadeloupe, French West Indies, and their ecological significance. *Mar. Biol.* 105: 163-173.
- Beck, M.W., K.L. Heck JR., K.W. Able, D.L. Childers, D.B. Eggleston, B.M. Gillanders, B. Halpern, C.G. Hays, K. Hoshino, T.J. Minello, R.J. Orth, P.F. Sheridan & M.P. Weinstein. 2001. The identification, conservation and management of estuarine and marine nurseries for fish and invertebrates. *Bioscience* 51: 633-641.
- Beer, S. & Y. Waisel. 1981. Effects of light and pressure on photosynthesis in two seagrasses. *Aquat. Bot.* 13: 331-337.
- Boström, C. & J. Mattila. 1999. The relative importance of food and shelter for seagrass-associated invertebrates: a latitudinal comparison of habitat choice by isopod grazers. *Oecology* 120: 162-170.
- Chen, S., L.P. Sanford, E.W. Koch, F. Shi & E. Worth. 2007. A nearshore model to investigate the effects of seagrass geometry and wave attenuation and suspended sediment transport. *Est. Coast.* 30: 296-310.
- Constanza, R., R. d'Arge, R. De Groot, S. Farber, M. Grasso, B. Hanon, K. Limburg, S. Naeem, R.V. O'Neill, J. Paruelo, R.G. Raskin, P. Sutton & M. van den Belt. 1998. The value of the world's ecosystem services and natural capital. *Ecol. Econ.* 25: 3-15.
- Danovaro, R. & C. Gambi. 2002. Biodiversity and trophic structure of nematode assemblages in seagrass systems: evidence for a coupling with changes in food availability. *Mar. Biol.* 141: 667-677.
- Den Hartog, C. 1970. *The Sea-Grasses of the World*. North-Holland, Amsterdam, Netherlands.
- Duarte C.M. 1991. Allometric scaling of seagrass form and productivity. *Mar. Ecol. Prog. Ser.* 77: 289-300.
- Duarte, C.M. 2002. The future of seagrass meadows. *Environ. Conser.* 29: 192-206.
- Duarte, C.M. & C.L. Chiscano. 1999. Seagrass biomass and production: a reassessment. *Aquat. Bot.* 65: 159-174.
- Fonseca, M.S. & J.A. Cahalan. 1992. A preliminary evaluation of wave attenuation by four species of seagrass. *Est. Coast. Shelf Sci.* 35: 565-576.
- Fonseca, M.S. & J.S. Fisher. 1986. A comparison of canopy friction and sediment movement between four species of seagrass with reference to their ecology and restoration. *Mar. Ecol. Prog. Ser.* 29: 15-22.
- Gacia, E., H. Kennedy, C.M. Duarte, J. Terrados, N. Marba, S. Papadimitriou & M. Fortes. 2005. Light-dependence of the metabolic balance of a highly productive Philippine seagrass community. *J. Exp. Mar. Biol. Ecol.* 316: 55-67.
- Grizzle, R.E., F.T. Short, C.R. Newell, H. Hoven & L. Kindblom. 1996. Hydrodynamically induced synchronous waving of seagrasses: "monamis" and its possible effects on larval mussel settlement. *J. Exp. Mar. Biol. Ecol.* 206: 165-177.
- Government of Dominica. 2005. *Dominica's Biodiversity Strategy Action Plan*. Government of Dominica, Roseau, Commonwealth of Dominica.
- Kuo, J. & C. den Hartog. 2006. Seagrass morphology, anatomy, and ultrastructure, p. x-x. *In* A.W.D. Larkum, R.J. Orth, C.M. Duarte (eds.). *Seagrasses: Biology, Ecology and Conservation*. Springer, Netherlands.
- Lee, K. & K.H. Dunton. 1999. Inorganic nitrogen acquisition in the seagrass *Thalassia testudinum*: Development of a whole-plant nitrogen budget. *Limnol. Oceanogr.* 44: 1204-1215.
- Lee, K.S., S.R. Park & Y.K. Kim. 2007. Effects of irradiance, temperature and nutrients on growth dynamics of seagrasses: A review. *J. Exp. Mar. Biol. Ecol.* 355: 144-175.
- Littler, D.S. & M.M. Littler. 2000. *Caribbean Reef Plants*. Offshore Graphics, Washington, U.S.A.
- Marbà, N., M. Holmer, E. Gacia & C. Barron. 2006. Seagrass beds and coastal biogeochemistry, p. x-x. *In* A.W.D. Larkum, R.J. Orth, C.M. Duarte (eds.). *Seagrasses: Biology, Ecology and Conservation*. Springer, Netherlands.
- Mariani, S. & T. Alcoverro. 1999. A multiple-choice feeding-preference experiment utilizing seagrasses with a natural population of herbivorous fishes. *Mar. Ecol. Prog. Ser.* 189: 295-299.
- Nagelkerken, I., G. van der Velde, M.W. Gorissen, G.J. Meijer, T. van't Hof & C. den Hartog. 2000. Importance of mangroves, seagrass beds and the shallow coral reef as a nursery for important coral reef fishes. Using a visual census technique. *Est. Coast. Shelf Sci.* 51: 31-44.
- Onuf, C.P., R.C. Phillips, C.A. Moncreiff, A. Raz-Guzman & J.A. Herrera-Silveira. 2003. The seagrasses of the Gulf of Mexico, p. 224-233. *In* E.P. Green & F.T. Short (eds.). *World Atlas of Seagrasses*. University of California, Berkeley, California, U.S.A.

- Peterson, B.J. & K.L. Heck. 2001. Positive interactions between suspension-feeding bivalves and seagrass – a facultative mutualism. *Mar. Ecol. Prog. Ser.* 213: 143-155.
- Randall, J.E. 1965. Grazing effect on sea grasses by herbivorous reef fishes in the West Indies. *Ecology* 46: 255-260.
- Steiner, S.C.C. & D.A. Willette. 2010. The distribution and size of benthic marine habitats in Dominica, Lesser Antilles. *Rev. Biol. Trop.* 58: 589-602.
- Suzuki, Y., M. Fuji, B.E. Casareto, A. Furuta & Y. Ishikawa. 2003. CO₂ sequestration and fate of organic matters within seagrass (*Zostera marina*) ecosystem. *J. Chem. Eng. Japan* 36: 417-427.
- UNEP-WCMC. 2007. (Downloaded: 21 December, 2009, www.stort.unep-wcmc.org/imaps/marine/seagrass/viewer.htm).
- Willette, D.A. & R. Ambrose. 2009. The distribution and expansion of the invasive seagrass *Halophila stipulacea* in Dominica, West Indies, with a preliminary report from St. Lucia. *Aquat. Bot.* 91: 137-142.
- Williams, S.L. & W.C. Dennison. 1990. Light availability and growth of a green macroalga (*Caulerpa cupressoides*) and a seagrass (*Halophila decipiens*). *Mar. Biol.* 106: 437-443.