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SHORT COMMUNICATION

CONTINUED SPREAD OF THE SEAGRASS *HALOPHILA STIPULACEA* IN THE CARIBBEAN: DOCUMENTATION IN PUERTO RICO AND THE BRITISH VIRGIN ISLANDS

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INTRODUCTION

The spread of *Halophila stipulacea* (Forssk.) Asch. from the Red Sea to the eastern Mediterranean probably occurred in the late 19th century (Fritsch 1895 and further reported by Den Hartog 1972 and Lipkin 1975a,b) following construction of the Suez Canal. Its subsequent incremental westward spread within the Mediterranean has been well documented (e.g., Lanfranco 1970; Van der Velte and den Hartog 1989; Cancemi et al. 1994; Bianchi and Morri 2004; Gambi et al. 2009; Sghaier et al. 2011). Until recently, the only other documented transoceanic migrations or introductions of a seagrass was limited to the transPacific spread of *Zostera japonica* Asch. & Graebn to western North America (Harrison and Bigley, 1982) and *Heterozostera tasmanica* (Martens ex Ascherson) den Hartog (=*Zostera tasmanica* Martens ex Ascherson) to Chile (Phillips et al. 1983). Ruiz and Ballantine (2004) reported the only known transAtlantic spread of a seagrass, *H. stipulacea*. They speculated that it was transported from the Mediterranean to Grenada (in the southeast of the Lesser Antilles arc) by a pleasure yacht and that its potential as an invasive was high due to broad physiological tolerances. Ruiz and Ballantine (2004) originally found floating portions of the seagrass in Grenada, West Indies in 2001 and subsequently located a small monospecific stand a year later. The originally discovered *H. stipulacea* bed covered an area of about 300 m^2 at a depth of 3.6 m (although larger undiscovered stands may certainly have existed).

Subsequently, Willette and Ambrose (2009) and Steiner and Willette (2015) have documented the spread of *H. stipulacea* northward to multiple locations in Dominica and St. Lucia. Willette and Ambrose (2012) demonstrated rapid expansion of transplanted *H. stipulacea* and documented experimental replacement of a native seagrass species, *Syringodium filiforme* Kützing. They noted that *H. stipulacea* readily formed fragments that disperse over short distances and possessed the ability to re—establish itself. Evidence of further range expansion to Martinique was provided by Maréchal et al. (2013). Willette et al. (2014) also reported expansion of the *H. stipulacea* range to the north in St. Vincent and the Grenadines, St. Eustatius, St. John (U.S. Virgin Islands), and St. Martin, and to the west to Aruba and Curaçao. Debrot et al. (2014) documented establishment of *H. stipulacea* in St. Eustatius. The large size and distinctive morphology make recognition of *H. stipulacea* and its discrimination from other Caribbean species of seagrasses easy for marine biologists.

Halophila stipulacea stands have for the most part been monoclultures or in proximity to *S. filiforme*, although it has also been observed in mixed seagrasss beds with *Thalassia testudinum* König, *S. filiforme, Halodule wrightii* Ascherson and *Halophila decipiens* Ostenfeld (Willette et al. 2014). Aside from the report of seagrass species displacement above (Willette and Ambrose 2012), ecological impacts of the alien *H. stipulacea* are essentially unknown (Rogers et al. 2014).

The purpose of this report is the further documentation of the invasive seagrass species' spread to include the northernmost Caribbean Sea and Atlantic Ocean.

MATERIALS AND METHODS

Seagrasses were collected by snorkeling or scuba diving in waters around Culebra Island, Humacao, and Vieques, Puerto Rico and at Road Harbour Bay, Tortola, British Virgin Islands; specimens were fixed in 10% formalin in seawater. The northern Puerto Rican collections were based on transect studies conducted under the auspices of the National Oceanographic and Atmospheric Administration's National Coral Reef Monitoring Program. A voucher specimen has been deposited in the Herbarium of the U.S. Natural History Museum (accession no. U.S. 3620465).

RESULTS AND DISCUSSION

We document here the further spread of *H. stipulacea* to 2 sites in Puerto Rico. The seagrass was found growing attached at Culebra Island in a mixed stand with dense *T. testudinum* (Figure 1) at 11 m depth [Coll. J.S.; 18°19.292'N; 65° 19.652'W; vii.2016] and also found at 22 m depth at a site between Humacao and Vieques [Coll. J.S.; 18°06.672'N; 65°38.635'W; 19.vii.2016]. Another collection was made at

FIGURE 1. *Invasive* Halophila stipulacea *(arrows) in established* Thalassia testudinum *bed. Specimen was at 11 m depth, Culebra Island, Puerto Rico (lower left inset:* Halophila stipulacea *leaves).*

Road Harbour Bay, Tortola, British Virgin Islands of floating material [H.R.; 18°24.825'N 64°30.857'W; 12.ix.2016].

The original documentation of *H. stipulacea* in the Caribbean from Grenada predated by some 5 years reports of its occurrence from other Caribbean islands. While date of first appearance doesn't necessarily equate with first introduction, it is not unreasonable to consider that Grenada could represent the site of first introduction. The general current flow in the Caribbean is to the north and west, with most transport passing through a narrow point between Yucatan, Mexico and western Cuba (Gordon, 1967; Gyory et al. 2013). Thus, if one assumes a single introduction, Grenada's location in the southeast Caribbean is a logical point from which this could have occurred. No seeds have been observed for Caribbean *H. stipulacea* (Willette et al. 2014), and further spreading through fragmentation and current drift, in addition to boating activities is likely. Weatherall et al. (2016) provides a detailed discussion of seagrass fragment dispersal and dispersal potential. *Halophila stipulacea* is currently likely to be found along the entire lesser Antilles arc. In upcoming years, we predict that *H. stipulacea* will be encountered in the Gulf of Mexico and shores of the continental U.S. as well.

The degree to which spread of an alien seagrass species represents a potential danger to native seagrass systems is presently only speculative and interactions with other species, including associated fauna and infauna are for the most, unknown. However, Williams (2007, p. 97) has postulated that the introduced *Halophila decipiens* Ostenfeld is "potentially a concern for the endemic seagrass." *Halophila stipulacea* was originally found in monospecific stands and later in established seagrass beds. As *Thalassia* meadows are considered to be climax communities (Gallegos et al. 1994), it speaks to its invasive potential that *H. stipulacea* could successfully establish in these communities. Unlike its Pacific North American counterpart, *Z. japonica*, that does not overlap in habitat distribution with the native species, *Zostera marina* L., *H. stipulacea* does share habitats with Caribbean seagrasses. The introduction of *Z. japonica* occurred over a century ago (Harrison and Bigley 1982, Posey 1988). Perhaps abetted by multiple introductions, *H. japonica* is now known to exist from the Strait of Georgia, British Columbia to Humbolt Bay, California (a north/south distance of about 970 km). Since its first report in the Caribbean (Ruiz and Ballantine 2004), in a substantially shorter period of time, *H. stipulacea* has increased its present north/south range in the Caribbean to about 850 km.

Eradication efforts, if undertaken, would probably not be effective. Given the likelihood of continued northward colonization by *H. stipulacea*, the opportunity for further research is present. That includes, in part, evaluation and comparison of growth rates with native seagrass species, competitive interactions with native species, and controlled experimentation on associated species and faunal associations.

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Literature Cited

Bianchi C.N. and C. Morri. 2004. Climate change and biological response in Mediterranean Sea ecosystems — a need for broad—scale and long—term research. Ocean Challenge 13:32–36.

Cancemi G., A. Terlizzi, M.B. Scipione, and L. Mazzella. 1994. Il prato ad *Halophila stipulacea* (Forssk.) Aschers. di Giardini Naxos (Sicilia): caratteristiche della pianta e del popolamento a fauna vagile. Biologia Marina Mediterranea 1:401–402.

Debrot, A.O., E. Houtepen, E.H. Meesters, I. van Beek, T. Timmer, E. Boman, M. de Graaf, E.R. Hunting, and D.L. Ballantine. 2014. Habitat diversity and biodiversity of the benthic seascapes of St. Eustatius. IMARES Wageningen UR, The Netherlands, 43 p.

den Hartog, C. 1972. Range extension of *Halophila stipulacea* (Hydrocharitaceae) in the Mediterranean. Blumea 20:154. http://www.repository.naturalis.nl/document/565436

Fritsch, C. 1895. Über die Auffindung einer marinen Hydrocharidae im Mittelmeer. Verhandlungen Zoologisch—botanischen Vereins Wien 45:104–106. https://www.zobodat.at/pdf/VZBG_45_0104—0106.pdf

Gallegos, M.E., M. Merino, A. Rodriguez, N. Marbà, and C.M. Duarte. 1994. Growth patterns and demography of pioneer Caribbean seagrasses *Halodule wrightii* and *Syringodium filiforme*. Marine Ecology Progress Series 109:99—104.

Gambi, M.C., F. Barbieri, and C.N. Bianchi. 2009. New record of the alien seagrass *Halophila stipulaceae* (Hydrocharitaceae) in the western Mediterranean: a further clue to changing Mediterranean Sea biogeography. Marine Biodiversity Records 2:1—7. https://doi.org/10.1017/S175526720900058X

Gordon, A.L. 1967. Circulation of the Caribbean Sea. Journal of Geophysical Research 72:6207—6223. http//doi.org/10.1029/JZ072i024p06207

Gyory, J., E. Rowe, A.J. Mariano, and E.H. Ryan. 2013. The Florida Current. Ocean Surface Currents. http://oceancurrents.rsmas.miami.edu/caribbean/florida.html, (viewed on 3/17/2017).

Harrison, P.G. and R.E. Bigley. 1982. The recent introduction of the seagrass *Zostera japonica* Aschers. and Graebn. to the Pacific coast of North America. Canadian Journal of Fisheries and Aquatic Science 39:1642—1648. https://doi.org/10.1139/f82—221

Lanfranco, E. 1970. The occurrence of *Halophila stipulacea* (Forskål) Ascherson at the Maltese waters. The Maltese Naturalist 1:16—17.

Lipkin, Y. 1975a. *Halophila stipulacea*. A review of a successful immigration. Aquatic Botany 1:203–215. http://doi.org/10.1016/0304—3770(75)90023—6

Lipkin, Y. 1975b. *Halophila stipulacea* in Cyprus and Rhodes, 1967—1970. Aquatic Botany 1:309–320. http://doi.org/10.1016/0304—3770(75)90029—7

Maréchal, J.—P., E.H. Meesters, F. Vedie, and C. Hellio. 2013. Occurrence of the alien seagrass *Halophila stipulacea* in Martinique (French West Indies). Marine Biodiversity Records 6:1—5. http://doi.org/10.1017/S1755267213000961

Phillips, R.C., B. Santileces and C.P. McRoy. 1983. *Heterozostera tasmanica* (Martens ex Aschers.) den Hartog in Chile. Aquatic Botany 15:195–200. http://doi.org/10.1016/0304—3770(83)90029—3

Posey, M.H. 1988. Community changes associated with the spread of an introduced seagrass, *Zostera japonica*. Ecology 69(4):974—983. http://doi.org/10.2307/1941252

Rogers, C.S., D.A. Willette, and J. Miller. 2014. Rapidly spreading seagrass invades the Caribbean with unknown ecological consequences. Frontiers in Ecology and the Environment 12:546—547. http://doi.org/10.1890/14.WB.016

Ruiz, H. and D.L. Ballantine. 2004. Occurrence of the seagrass *Halophila stipulacea* in the tropical west Atlantic. Bulletin of Marine Science 75:131—135.

Sghaier, Y.R., R. Zakhama—Sraieb, I. Benamer, and F. Charfi–Cheikhrouha. 2011. Occurrence of the seagrass *Halophila stipulacea* (Hydrocharitaceae) in the southern Mediterranean Sea. Botanica Marina 54:575—582. http://doi.org/10.1515/BOT.2011.061

Steiner, S.C.C. and D.A. Willette. 2015. The expansion of *Halophila stipulacea* (Hydrocharitaceae, Angiospermae) is changing the seagrass landscape in the Commonwealth of Dominica, Lesser Antilles. Caribbean Naturalist 22:1—19

Van der Velte, C. and C. den Hartog. 1989. Continuing range extension of *Halophila stipulacea* (Forssk.) Aschers. (Hydrocharitaceae) in the Mediterranean — now found in Kefallonia and Ithaki (Ionian Sea). Acta Botanica Neerlandica 41:345–348.

Weatherall, E.J., E.L. Jackson, R.A. Hendry, and M.L. Campbell. 2016. Quantifying the disperal potential of seagrass vegetative fragments: A comparison of multiple subtropical species. Estuarine, Coastal and Shelf Science 169:207—215. http://dx.doi.org/10.1016/j.ecss.2015.11.026

Willette, D.A. and R.F. Ambrose. 2009. The distribution and expansion of the invasive seagrass *Halophila stipulacea* in Dominica, West Indies, with a preliminary report from St. Lucia. Aquatic Botany 91:137—142. http://doi.org/10.1016/j.aquabot.2009.04.001

Willette, D.A. and R.F. Ambrose. 2012. The effects of the invasive seagrass *Halophila stipulacea* on the native seagrass *Syringodium filiforme*, and associated fish and epibiota communities in the eastern Caribbean. Aquatic Botany 103:74—82. http://doi.org/10.1016/j.aquabot.2012.06.007

Willette, D.A., J. Chalifour, A.O. Dolfi Debrot, M. Sabine Engel, J. Miller, H.A. Oxenford, F.T. Short, S.C.C. Steiner, and F. Védie. 2014. Continued expansion of the trans—Atlantic invasive marine angiosperm *Halophila stipulacea* in the eastern Caribbean. Aquatic Botany 112:98—102. http://doi.org/10.1016/j.aquabot.2013.10.001

Williams, S.L. 2007. Introduced species in seagrass ecosystems: status and concerns. Journal of Experimental Marine Biology and Ecology 350:89–110. http://doi.org/10.1016/j.jembe.2007.05.032