Regional Assessment of the Seagrass *Ruppia maritima* L. in the Tropical Atlantic Seagrass Bioregion (Bioregion 2) for the IUCN Red List [1]

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PLANTAE - TRACHEOPHYTA - LILIOPSIDA - ALISMATALES - RUPPIACEAE - *Ruppia - maritima*

Common Names: Beaked Tasselweed (English), Ditch-grass (English), Ditchgrass (English), Erba da Chiozzi Comune (Italian), Rupelle Maritime (French), Ruppia maritime (French), Species code: Rm (English), Widgeongrass (English)

Synonyms: *Ruppia brachypus J. Gay; Ruppia maritma L. ssp. rostellata (Koch) Asch.; Ruppia maritima* subsp. *rostrata* (C.Agardh) Piper & Beattie*; Ruppia rostellata Koch in Rchb.*

Taxonomic Note:
The taxonomy of *Ruppia* remains problematic and is undergoing revision (den Hartog & Triest, 2020). *Ruppia maritima* has traditionally been considered cosmopolitan (F. T. Short et al., 2001) but recent molecular studies demonstrated that it is a complex of multiple species, including polyploids and recent and ancient hybrid lineages (Ito et al., 2010, 2013, 2015; Triest et al., 2018). *Ruppia maritima* sensu stricto (i.e. the diploid species in this complex that retains the original name, den Hartog & Triest, 2020) was described from northern Europe (Linnaeus, 1753), and has a wide but patchy distribution throughout Europe and the Mediterranean Basin (Triest & Sierens, 2014, 2015), as well as Cabo Verde (Martínez-Garrido et al., 2017). In other parts of the world, several populations previously treated as *R. maritima* have been described as distinct species (den Hartog et al., 2016; Novelo, 1991; Yu & den Hartog, 2014), and further species have been identified but await formal description (Ito et al., 2010, 2015; Martinez-Garrido et al. 2016; Triest et al., 2018). Morphologically, considerable diversity has been reported in the bioregion (Fernald & Wiegand, 1914; Koch & Seeliger, 1988; Oliveira Filho et al., 1983), but the taxonomy and distribution of these cryptic species

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remain insufficiently studied. Most records lack sufficient information to be assigned to the distinct species and therefore they are collectively considered under *R. maritima* in the present assessment, pending further studies. *R. mexicana* and *R. didyma* are considered distinct species following morphological, cytological, and molecular evidence (den Hartog et al., 2016; Novelo, 1991; Triest et al., 2018), and are not included in the current assessment.

Red List Status
LC - Least Concern, (IUCN version 3.1)
Extent of Occurrence (EOO) in Bioregion 2= 43,064,197 km²
Area of occupancy (AOO) in Bioregion 2= >2,240 km²

Red List Assessment

Assessment Information

Assessor(s): Duarte G. Frade, Joel C. Creed, Bradley T, Furman, Jimena Samper-Villarreal, Ester A. Serrão, Brigitta I. van Tussenbroek

Publication date: 2nd June 2025

Time period assessed: 2007-2020

Assessment Rationale

The current assessment considers the conservation status of *Ruppia maritima* in the Tropical Atlantic seagrass bioregion, which includes the Pacific coast of Central America (F. Short et al., 2007). *R. maritima* is a colonizing seagrass that tolerates a wide range of environmental conditions, is capable of fast growth and reproduction, and has a wide distribution. The general population trend in the bioregion is stable or increasing, with *Ruppia* showing resilience to large disturbance events (hurricanes, oil spills), and occasionally replacing other seagrasses in the northern Gulf of Mexico following disturbance. Population declines have also been reported, particularly in the Everglades-Florida Bay ecotone, USA. The species is threatened locally by extreme weather events, increasingly unstable salinities caused by freshwater usage, and wetland degradation. Nonetheless, restoration and monitoring programs are in place in several parts of the Tropical Atlantic. Although parts of the region (West Africa and the Caribbean) remain poorly studied, the species is tolerant of disturbance, and is still widely distributed and locally common in the bioregion, and it is therefore listed as Least Concern (LC) in the Tropical Atlantic bioregion. Nonetheless, there is evidence that the present assessment includes multiple species – some of which incompletely described (see Taxonomic Notes), and further studies are needed to characterize the distribution and species-specific trajectories of each of these *Ruppia* species for future reassessments.

Distribution

Geographic Range

Ruppia maritima has been reported from all continents except Antarctica, from subpolar to tropical latitudes (F. Short et al., 2007), although many records are misidentifications of other *Ruppia* species (den Hartog et al., 2016; den Hartog & Triest, 2020; Triest et al., 2018; Yu & den Hartog, 2014) and the presence of the species in many countries is only known from historical collections. In the Tropical Atlantic seagrass bioregion (F. Short et al., 2007), *R. maritima* has been reported from most bordering countries, and the presence of *R. maritima* s.s. in Cape Verde has been confirmed using DNA sequences (Martínez-Garrido et al., 2017). Nonetheless, molecular evidence suggests that *Ruppia* populations from the African mainland (Democratic Republic of the Congo and South Africa) are more closely related to the Asian *Ruppia brevipedunculata* than to European *R. maritima* (Triest et al., 2018). Some populations from the Yucatan Peninsula and nearby parts of Mexico were recently reassigned to *Ruppia mexicana* (den Hartog et al., 2016; Triest et al., 2018), a tetraploid species that may occur more widely in the American continent (den Hartog et al., 2016).

In the West Atlantic, *R. maritima* has been reported from most countries in the northern Gulf of Mexico (Cho et al., 2009), Central America (Cortés, 2001; Grijalva, 2002; Muenschek, 1945; Nelson, 1978; Woodson et al., 1975), the Caribbean (Acevedo-Rodríguez & Strong, 2005; Baksh-Comeau et al., 2016; Guimarais Bermejo et al., 2011; Loveless, 1960; Stehlé, 1969, 1970; Urquiola Cruz & Cabrera Rivas, 1998), and South America (M. S. Copertino et al., 2016; Funk et al., 2007; Oliveira Filho et al., 1983). In Brazil, *R. maritima* has been reported from lagoons along the entire tropical coast (Amaral et al., 2018; Barros et al., 2013; Canalli & Bove, 2020; M. S. Copertino et al., 2016; Queiroz Matias et al., 2017).

The distribution in West Africa is poorly known. In Angola, *R. maritima* was last collected in 1857 at Salinas do Dungo (Rendle, 1899). The species has also been reported from inland saline wetlands in Mwashya, Democratic Republic of the Congo (Malaisse, 1988), as well as from coastal lagoons in Ghana (Lamptey & Armah, 2008; Ntiamoa-Baidu et al., 1998), Senegal (Adam, 1958), and Cape Verde (Gomes et al., 1995; Martínez-Garrido et al., 2017). The species is reportedly common in brackish pools along the Namibian coast (Clarke & Klaassen, 2001), although Namibia was not included in any of the bioregions recognized by (F. Short et al., 2007). There are also inland records from Chad (Meise Botanical Garden, specimen BR0000021553073).

Elevation / Depth / Depth Zones

Depth Lower Limit (in metres below sea level): 1
Depth Upper Limit (in metres below sea level): 0
Depth Zone: Shallow photic (0-50m)

Map Status

Map Status	How the map was created, including data sources/methods used:	Please state reason for map not available:	Data Sensitive?	Justification	Geographic range this applies to:	Date restriction imposed:
Done	The maps are based on HydroBASIN polygons (largely level 6), following IUCN recommendations for	-	-	-	Tropical Atlantic Seagrass	-

	species from inland waters (including coastal lagoons). We used HydroBASIN polygons that overlapped with *R. maritima* records.				Bioregion (Bioregion 2)	

Occurrence

Countries of Occurrence

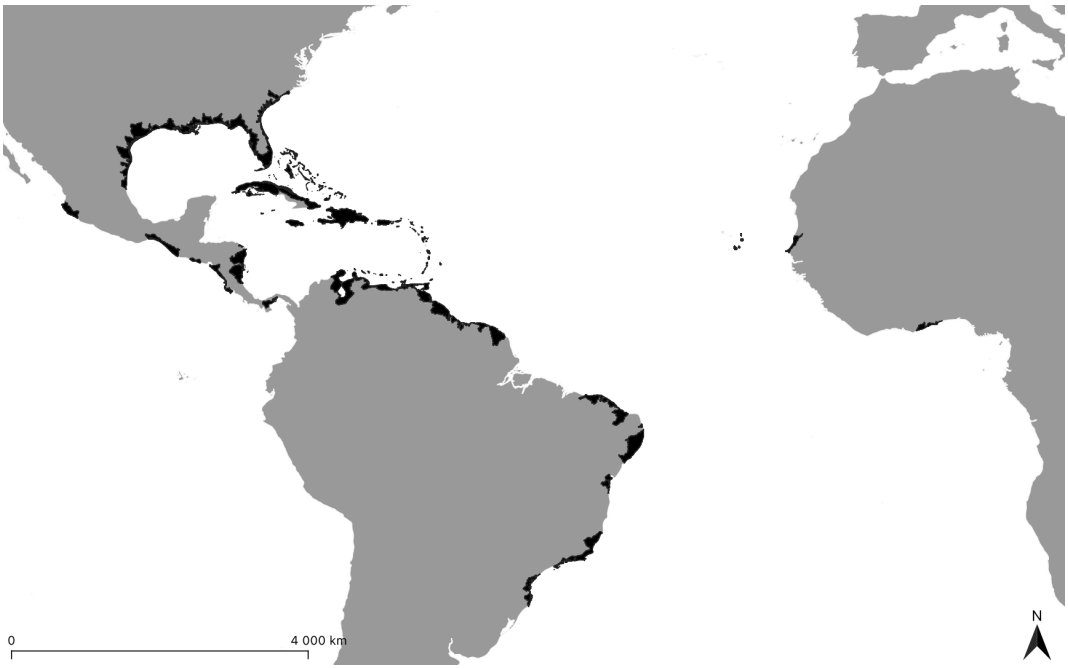
Country	Presence	Origin	Formerly Bred	Seasonality
Anguilla	Extant	Native	-	Resident
Angola	Extant	Native	-	Resident
Antigua and Barbuda	Extant	Native	-	Resident
Aruba	Extant	Native	-	Resident
Bahamas	Extant	Native	-	Resident
Barbados	Extant	Native	-	Resident
Belize	Extant	Native	-	Resident
Bermuda	Extant	Native	-	Resident
Bonaire, Sint Eustatius and Saba	Extant	Native	-	Resident
Brazil	Extant	Native	-	Resident
Cabo Verde	Extant	Native	-	Resident
Cayman Islands	Extant	Native	-	Resident
Colombia	Extant	Native	-	Resident
Congo, The Democratic Republic of the	Extant	Native	-	Resident
Costa Rica	Extant	Native	-	Resident
Cuba	Extant	Native	-	Resident
Curaçao	Extant	Native	-	Resident
El Salvador	Extant	Native	-	Resident
Equatorial Guinea	Extant	Native	-	Resident
French Guiana	Extant	Native	-	Resident
Gabon	Extant	Native	-	Resident
Ghana	Extant	Native	-	Resident
Guadeloupe	Extant	Native	-	Resident
Guatemala	Extant	Native	-	Resident
Guyana	Extant	Native	-	Resident
Haiti	Extant	Native	-	Resident
Honduras	Extant	Native	-	Resident
Jamaica	Extant	Native	-	Resident
Mexico	Extant	Native	-	Resident
Namibia	Extant	Native	-	Resident
Nicaragua	Extant	Native	-	Resident

Panama	Extant	Native	-	Resident
Puerto Rico	Extant	Native	-	Resident
Saint Barthélemy	Extant	Native	-	Resident
Senegal	Extant	Native	-	Resident
Surinam	Extant	Native	-	Resident
Trinidad and Tobago	Extant	Native	-	Resident
Turks and Caicos Islands	Extant	Native	-	Resident
United States	Extant	Native	-	Resident
Venezuela, Bolivarian Republic of	Extant	Native	-	Resident
Virgin Islands, British	Extant	Native	-	Resident
Virgin Islands, U.S.	Extant	Native	-	Resident
Anguilla	Extant	Native	-	Resident
Angola	Extant	Native	-	Resident

FAO Area Occurrence

	Presence	Origin	Formerly Bred	Seasonality
31. Atlantic - western central	Extant	Native	-	Resident
34. Atlantic - eastern central	Extant	Native	-	Resident
41. Atlantic - southwest	Extant	Native	-	Resident
47. Atlantic - southeast	Extant	Native	-	Resident
31. Atlantic - western central	Extant	Native	-	Resident
34. Atlantic - eastern central	Extant	Native	-	Resident

Regional Assessment Map



Population

R. maritima is reported to be widely distributed and locally common in parts of the Tropical Atlantic seagrass bioregion, particularly in the northern Gulf of Mexico, where it is increasingly abundant (Cho et al., 2009), and coastal lagoons in southeastern Brazil (M. S. Copertino et al., 2016). A positive population trend has been reported for the northern Gulf of Mexico (Cho et al., 2009), with *Ruppia* resisting or even becoming more abundant following large disturbance events, including hurricane seasons (Anton et al., 2009; Byron & Heck, 2006; Cho et al., 2017; Cho & May, 2008) and the 2010 Deepwater Horizon oil spill (Byron & Heck, 2006; Cho et al., 2017; Cho & May, 2008). In some locations of the northern Gulf of Mexico, *R. maritima* is reported to have replaced fully marine seagrasses following disturbance, including *Thalassia testudinum, Syringodium filiforme,* and *Halodule wrightii* (Cho et al., 2009; Steward et al., 2006).

Ruppia populations are subject to strong fluctuations in abundance, biomass, and distribution, both at seasonal and interannual levels. In the Tropical Atlantic bioregion, particularly large variations in abundance have been reported during and after the 1997-2001 El Niño Southern Oscillation shift (Cho & Poirrier, 2005a; Morris & Virnstein, 2004). In Lake Pontchartrain, Louisiana, *R. maritima* increased its distribution and abundance during 1999-2002, following increases in salinity and water clarity, though it subsequently declined after 2003 (Cho & Poirrier, 2005a).

Population declines and local extinctions have also been reported at smaller scales. Historically the dominant macrophyte in the Everglades-Florida Bay ecotone, *R. maritima* meadows have become more patchily distributed and ephemeral in recent decades, following increasingly variable salinity levels caused by freshwater diversion (Strazisar et al., 2015; Strazisar, Koch, Dutra, et al., 2013; Strazisar, Koch, Madden, et al., 2013). In Cuba, field surveys in 2009 failed to find the species in most locations where it had been reported in 2000 (Guimarais Bermejo et al., 2011). In Cape Verde, a population on Boa Vista Island was recently lost following the construction of a bridge over its habitat (Samir Martins, personal communication). A meadow on the Pacific coast of Costa Rica disappeared after a storm in 1996

without reported recovery to date (Cortés, 2001; Samper-Villarreal & Cortés, 2020). Subpopulations in West Africa and most Caribbean countries are known from too few records to determine population trends.

Population Information

Continuing decline in mature individuals?	Qualifier	Justification
-	-	-

Continuing decline in number of subpopulations	Qualifier	Justification
-	-	-

Habitats and Ecology

R. maritima occupies a wide range of aquatic environments, including coastal lagoons, estuaries, salt pans, small saline ponds, and mudflats, typically in coastal areas but sometimes also further inland. The species requires habitats with low hydrodynamics as most of the biomass is distributed on shoots rather than on roots and rhizomes (Cho & Poirrier, 2005b), and roots and rhizomes are shallow (usually less than 10 cm deep, Kantrud, 1991) and easily dislodged. *Ruppia* is highly tolerant of salinities ranging from near freshwater to highly hypersaline (reviewed in Kantrud, 1991), and is often associated with habitats with low salinity average but high salinity variations (Strazisar et al., 2021). *R. maritima* has high light requirements and is restricted to shallow waters, typically less than 1 meter deep (reviewed in Kantrud, 1991).

R. maritima can form single-species beds (Kanouse et al., 2006), or co-occur with either marine (*Halodule wrightii* and occasionally other seagrasses, Cho et al., 2009; Lirman et al., 2008) or freshwater plants (e.g. *Vallisneria americana, Najas guadelupensis, Zannichellia palustris*, Cho et al., 2010). *Ruppia* beds provide food and habitat for a wide range of organisms, including waterbirds (Bortolus et al., 1998; Charalambidou et al., 2003; Figuerola et al., 2002; Hartke et al., 2009; Ntiamoa-Baidu et al., 1998), manatees (Allen et al., 2018; Campbell & Irvine, 1977), capybaras (Creed, 2004), and a wide range of fish and invertebrates (Agami & Waisel, 1988; Bonis et al., 1993; Garcia et al., 1996; Garcia & Vieira, 1997; Kanouse et al., 2006; Olivera Espinosa & Guimarais Bermejo, 2012). Herbivores likely contribute to seed dispersal as some seeds remain viable after passing through the guts of waterbirds and herbivorous fish (Agami & Waisel, 1988; Charalambidou et al., 2003; Rodríguez-Pérez & Green, 2006).

IUCN Habitats Classification Scheme

Habitat	Season	Suitability	Major Importance?
9.4. Marine Neritic -> Marine Neritic - Subtidal Sandy	-	Suitable	-
9.5. Marine Neritic -> Marine Neritic - Subtidal Sandy-Mud	-	Suitable	-
9.6. Marine Neritic -> Marine Neritic - Subtidal Muddy	-	Suitable	-
9.8.2. Marine Neritic -> Marine Neritic - Coral Reef -> Back Slope	-	Suitable	-
9.8.4. Marine Neritic -> Marine Neritic - Coral Reef -> Lagoon	-	Suitable	-

9.8.5. Marine Neritic -> Marine Neritic - Coral Reef -> Inter-Reef Soft Substrate	-	Suitable	-
9.9. Marine Neritic -> Marine Neritic - Seagrass (Submerged)	-	Suitable	-
9.10. Marine Neritic -> Marine Neritic - Estuaries	-	Suitable	-
12.2. Marine Intertidal -> Marine Intertidal - Sandy Shoreline and/or Beaches, Sand Bars, Spits, Etc	-	Suitable	-
12.4. Marine Intertidal -> Marine Intertidal - Mud Flats and Salt Flats	-	Suitable	-
12.6. Marine Intertidal -> Marine Intertidal - Tidepools	-	Suitable	-
12.7. Marine Intertidal -> Marine Intertidal - Mangrove Submerged Roots	-	Suitable	-

Life History

Plants are capable of fast growth and reproduction through both seeds and clonal propagation, and can produce large amounts of seeds (Cho et al., 2009), although the relative importance of sexual and asexual reproduction varies considerably between different locations (Cho et al., 2009; Strazisar et al., 2021). Inflorescences of *R. maritima* contain two flowers, both with male and female parts. Most inflorescences release their pollen inside air bubbles underwater, and the plant typically self-pollinates (Verhoeven, 1979), resulting in high levels of sexual reproduction, but low genetic variability due to inbreeding (Triest & Sierens, 2015). Cross-pollination can also occur, particularly under fluctuating water levels (Lacroix & Kemp, 1997; Taylor et al., 2020).

Generation length (time from germination until seed set, F. T. Short et al., 2011) is less than a year, as seedlings can reach sexual maturity within months. Seed germination is triggered by osmotic shifts from high to low salinity (Koch & Seeliger, 1988; Seeliger et al., 1984; Strazisar, Koch, Madden, et al., 2013), but seedlings can subsequently tolerate salinities as high as 50 psu if allowed to acclimate (Strazisar, Koch, Madden, et al., 2013). Seeds have no intrinsic dormancy and can germinate after being produced (Cho & Sanders, 2009; Strazisar, Koch, Dutra, et al., 2013). However, desiccation can induce an environmental dormancy (Cho & Sanders, 2009), allowing the species to survive in habitats that are seasonally dry (Koch & Seeliger, 1988). Both annual and perennial life cycles have been reported for *R. maritima* (Koch & Seeliger, 1988; Malea et al., 2004), although annual populations can perennate if there is sufficient water level (Koch & Seeliger, 1988).

Seedbanks can reach thousands of seeds per square meter (e.g. 4,110 seeds m-2 in McMillan, 1985), but recurrent events of high seed production are required to sustain viable seedbanks because seeds often have high germination rates and do not remain dormant in the seedbank for long periods of time (Strazisar et al., 2016; Strazisar, Koch, Dutra, et al., 2013). Germination of seeds in the sediment can also be reduced by burial, even under 1-3 cm of sediment (Ailstock et al., 2010). Seeds are negatively buoyant and sink rapidly in the water column, but seedlings are easily dislodged and dispersed (Koch et al., 2010). Seedling removal can prevent recruitment from seeds in hydrodynamic conditions, particularly in the absence of established rhizome networks (M. Copertino & Seeliger, 2010). Dispersal through specialized clonal propagules (turions), formed in shoot nodes and rhizomes, has also been reported in Lake Pontchartrain, USA (Cho & Poirrier, 2005b).

Generation Length	Justification	Data Quality
1	-	-

Systems

System: Freshwater (=Inland waters), Marine

Use and Trade

General Use and Trade Information

Ruppia maritima meadows provide habitat for commercially importante fisheries (Kanouse et al., 2006).

Subsistence:	Rationale:	Local Commercial:	Further detail including information on economic value if available:
Yes	-	-	-

National Commercial Value: No

International Commercial Value: No

End Use	Subsistence	National	International	Other (please specify)
2. Food - animal	true	-	-	-

Threats

R. maritima inhabits naturally dynamic habitats, and can often colonize habitats quickly through its fast development and high clonal and sexual reproduction (Cho et al., 2009). Sexually reproducing populations are highly resilient to environmental changes and generally capable of fast regeneration from seed or even increasing in abundance after disturbance, e.g. hurricanes (Anton et al., 2009; Byron & Heck, 2006; Chabreck & Palmisano, 1973; Cho et al., 2009; Steward et al., 2006) or boat propeller scarring (Orth et al., 2017). *R. maritima* can also benefit from eutrophic conditions (Burkholder et al., 1994, 2007). However, the high reliance on sexual reproduction makes the species susceptible to variation in recruitment. Seeds loose viability quickly in the sediment, and seedbanks can be lost if they are not replenished by recurrent events of high seed production (Strazisar et al., 2016, 2021; Strazisar, Koch, Dutra, et al., 2013). Burial of seedbanks may also reduce recruitment from seed as germination is inhibited even under few centimeters of sediment (Ailstock et al., 2010).

The shallow structure of the rooting system makes the species susceptible to physical disturbance, particularly during extreme weather events, i.e., severe storms or periods of high rainfall. During these periods, *Ruppia* meadows are vulnerable to the combined effects of erosion, high turbidity and hydrodynamics, and the burial or displacement of existing meadows and seedbanks (Cortés, 2001). Once the original meadows are lost or damaged, recovery can be slow or inexistent if seedbanks are lost or no recruitment is possible, i.e. a meadow on the Pacific coast of Costa Rica has not recovered 25 years after being lost in a storm (Cortés, 2001; Samper-Villarreal & Cortés, 2020). Seedlings are positively

buoyant and easily detached from the sediment (Koch et al., 2010), and can experience high mortality in the absence of structures to anchor them to the substrate, e.g. if established roots and rhizomes are lost (M. Copertino & Seeliger, 2010).

R. maritima has high light and nutrient requirements, particularly during the seedling stage, and growth and seedling survival are low if these are limiting (Strazisar et al., 2021). Competition with other macrophytes (e.g. *Chara hornemannii* or *H. wrightii*) for light and nutrients can also inhibit the development of *R. maritima*, although the presence *of H. wrightii* has been suggested to facilitate the establishment of *R. maritima* seedlings by protecting them from physical disturbance (Strazisar et al., 2021).

Reduced freshwater flow into marine environments can also be a threat to *R. maritima* due to the transitional habitats it occupies. Lower inputs of freshwater can alter salinity levels by causing greater fluctuations and extremes, which in turn can inhibit sexual reproduction and seedling recruitment. These reproductive bottlenecks have been proposed as the main cause of the decline of the species in the Everglades-Florida Bay ecotone (Strazisar et al., 2021). The coastal wetlands where the species lives are also susceptible to coastal development or land reclamation.

R. maritima was resilient to the effects of the 2010 Deepwater Horizon oil spill (Cho et al., 2017), and is able to maintain growth and reproduce in a range of different oil concentrations (Martin et al., 2015). Nonetheless, high oil concentration may lead to shallower roots and rhizomes and lower sediment cohesion, making *R. maritima* more susceptible to being uprooted (Martin et al., 2015). Flowering and fruiting are also reportedly lower under high oil concentrations (Martin et al., 2015), and oil-contaminated plants are preferred by herbivores (Martin & Swenson, 2018), which may increase the vulnerability of oil-exposed plants to other threats.

The genetic diversity of the species in the Tropical Atlantic bioregion has not been studied to date, but high levels of inbreeding have been reported for *R. maritima* in Europe, as sexual reproduction in the species often happens through self-pollination (Triest & Sierens, 2015).

Conservation

Ruppia maritima occurs in several protected areas throughout the Tropical Atlantic bioregion. The species has been the target of long-term monitoring schemes in the northern Gulf of Mexico. In the Everglades-Florida Bay ecotones, the species is considered a restoration target, and an indicator in the management of freshwater flows (Strazisar et al., 2021). Propagation and transplanting techniques have been developed for the species (Cho et al., 2009; Cho & Biber, 2010; Durako et al., 1993; Koch & Durako, 1991).

Further studies are needed to clarify the distribution and define species-specific conservation plans for *R. maritima* and other cryptic species within the genus.

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