

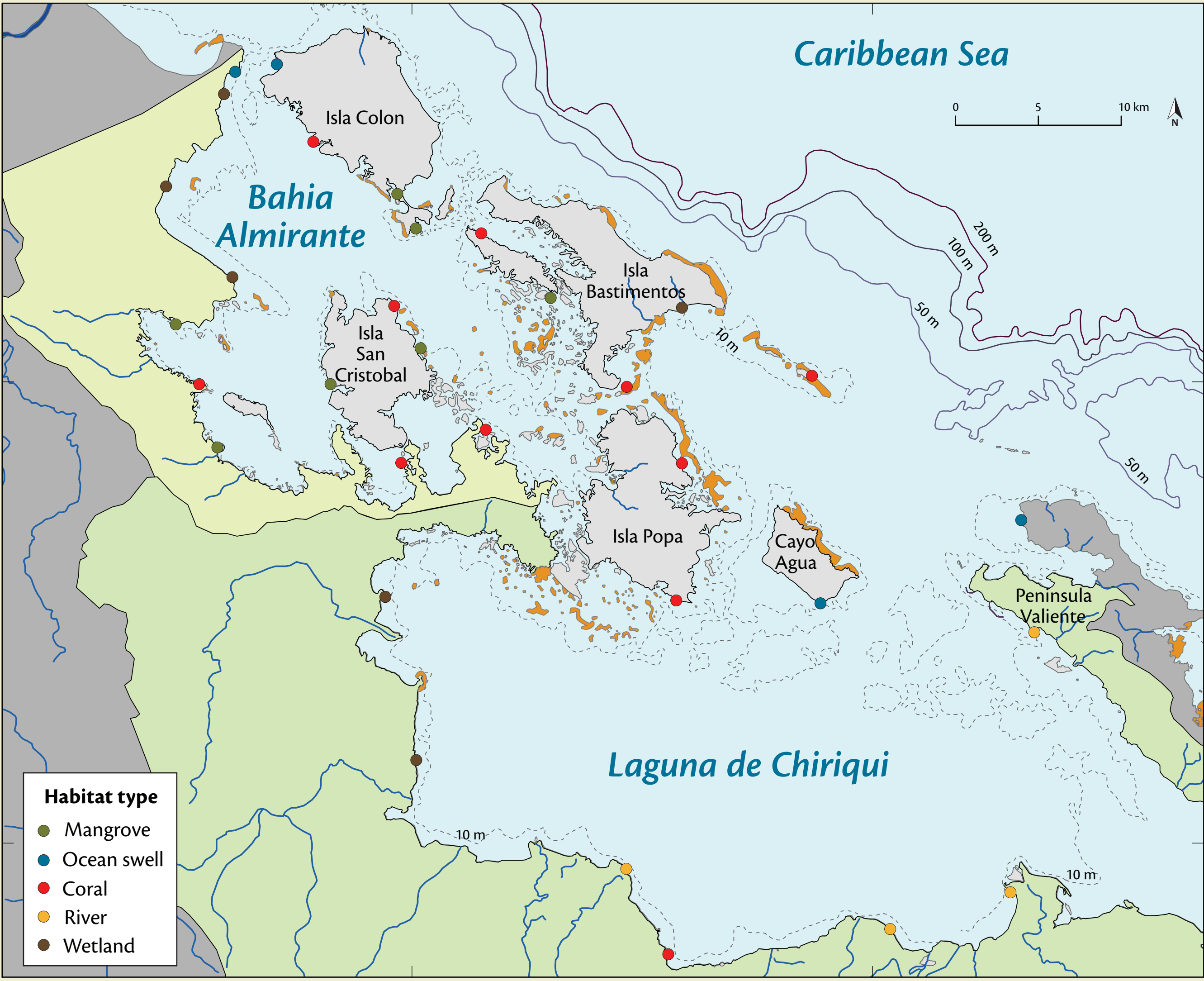
Seagrass habitats of Bocas del Toro, Panama

A balance between river, mangrove and coral influences

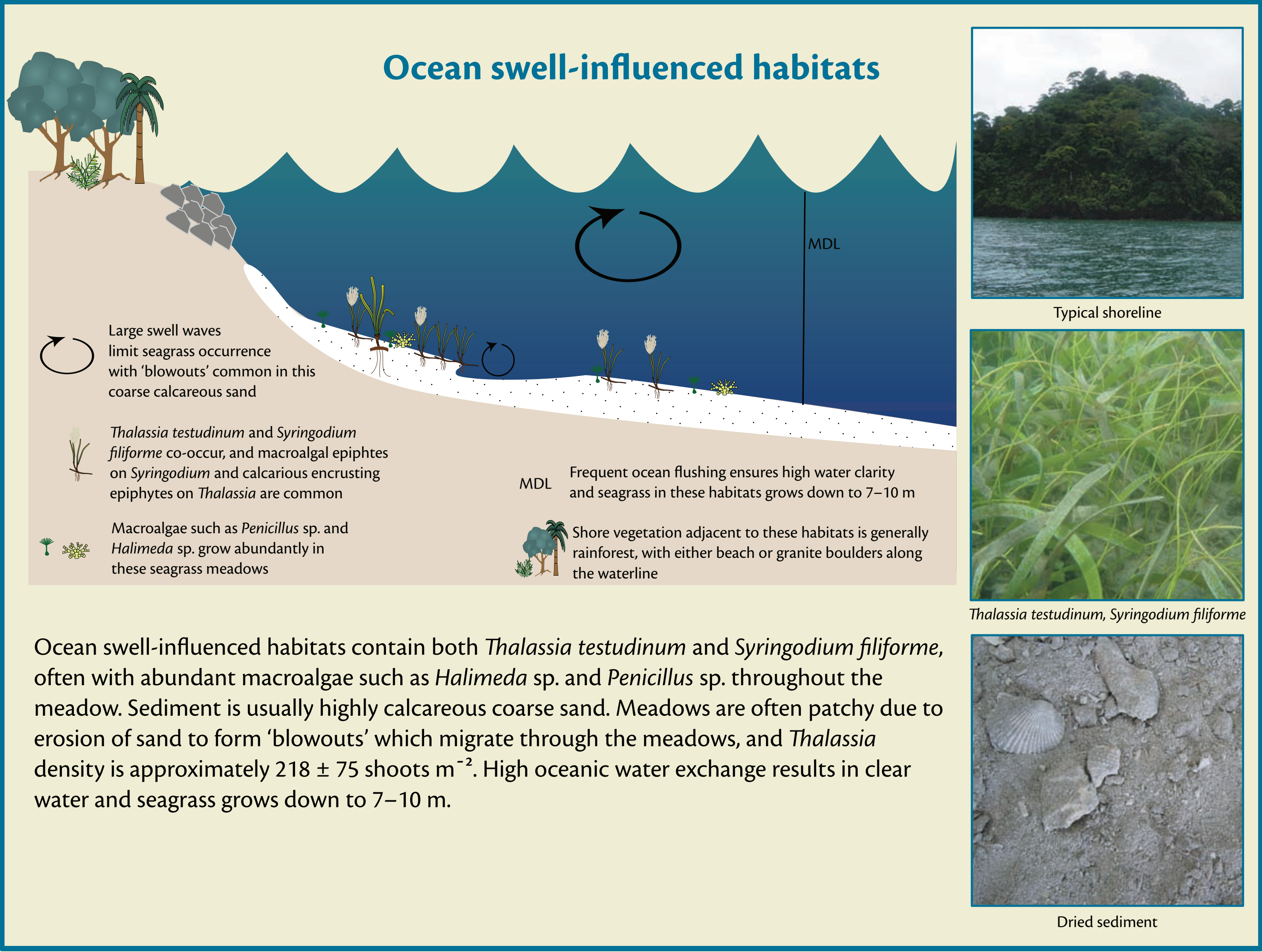
Smithsonian Tropical Research Institute
Bocas del Toro Research Station



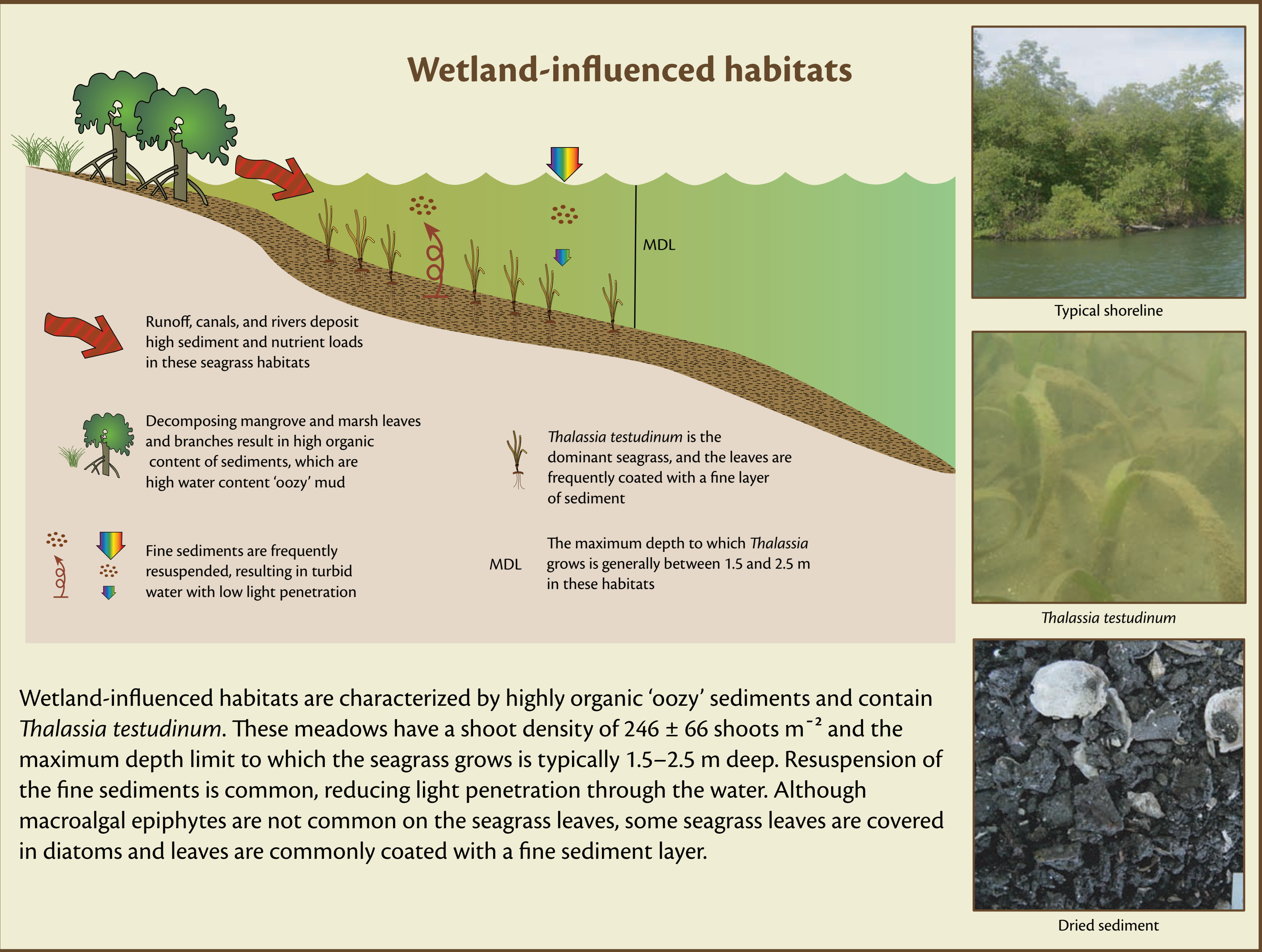
Seagrass meadows within the Bocas del Toro archipelago, Panama, are strongly influenced by their proximity to coral reefs, mangrove forests, and coastal rivers. Reef, mangrove, and river inputs influence sediment composition and water clarity, two of the most important factors responsible for the occurrence and abundance of seagrass meadows. Large volumes of silicoclastic sediment (silica sand) are deposited by the large rivers, high organic matter comes from the mangrove forests as well as associated wetlands, and eroding coral produces coarse carbonate sediment. An important modifier of these habitats and determinant of the type of seagrass that will survive is the amount of protection from water motion. The resulting seagrass communities within the Bocas del Toro archipelago can be divided into the following five categories, each linked to a dominant influence: wetland, river, mangrove, coral, and ocean swell.



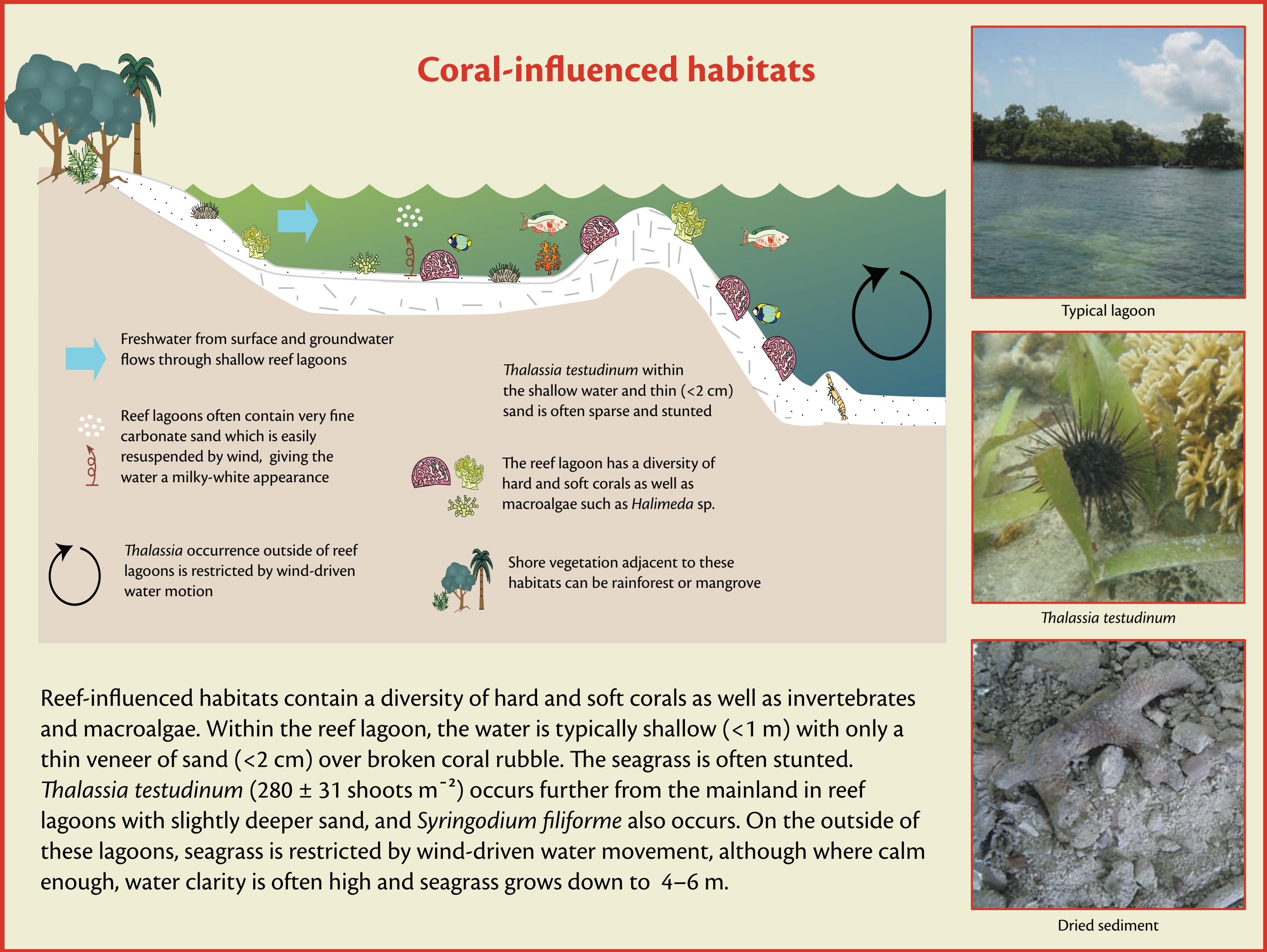
Locations of the five seagrass habitats throughout the Bocas del Toro archipelago. The watersheds are indicated in yellow and green, and coral reefs in golden brown.



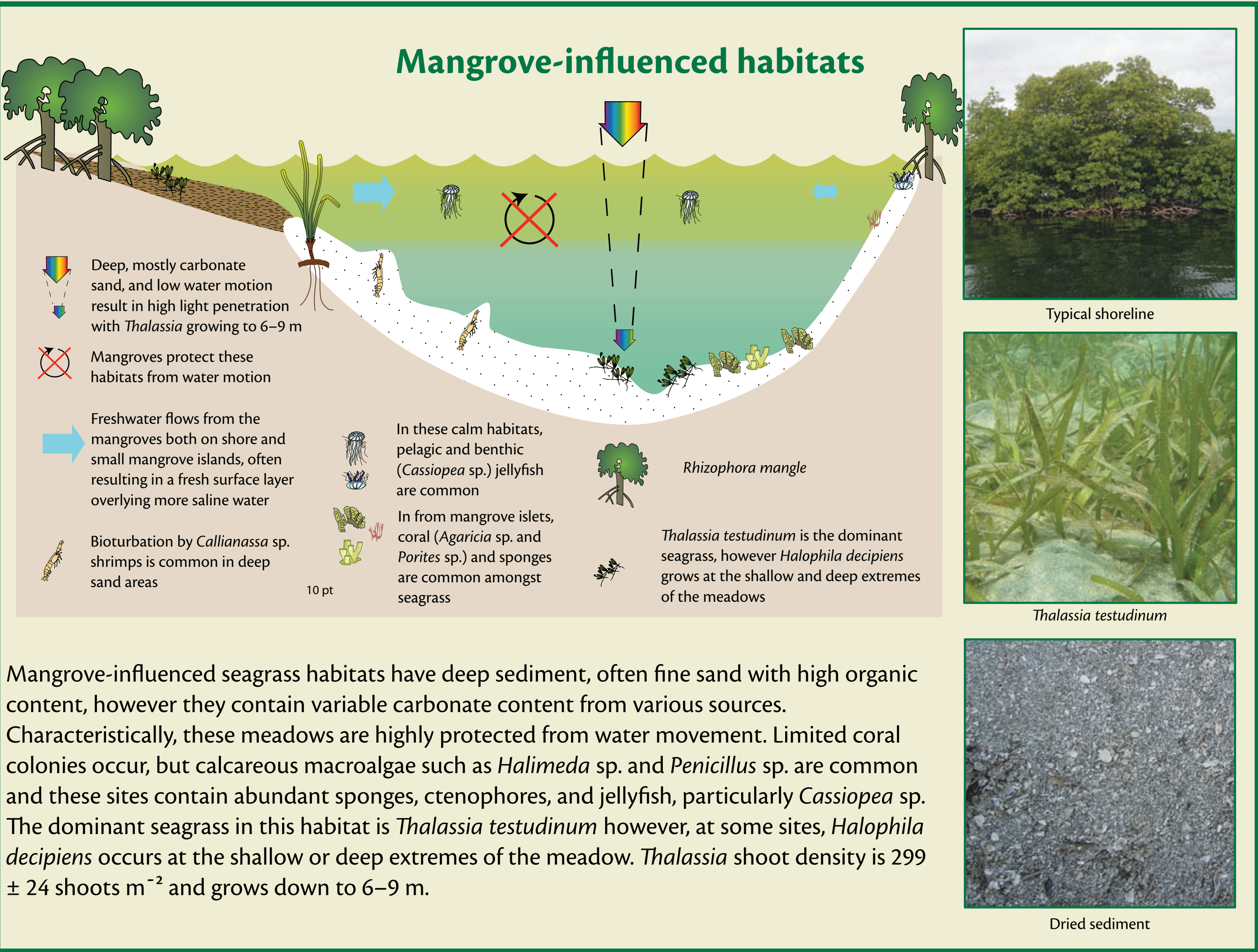
Ocean swell-influenced habitats contain both *Thalassia testudinum* and *Syringodium filiforme*, often with abundant macroalgae such as *Halimeda* sp. and *Penicillus* sp. throughout the meadow. Sediment is usually highly calcareous coarse sand. Meadows are often patchy due to erosion of sand to form 'blowouts' which migrate through the meadows, and *Thalassia* density is approximately 218 ± 75 shoots m^{-2} . High oceanic water exchange results in clear water and seagrass grows down to 7–10 m.



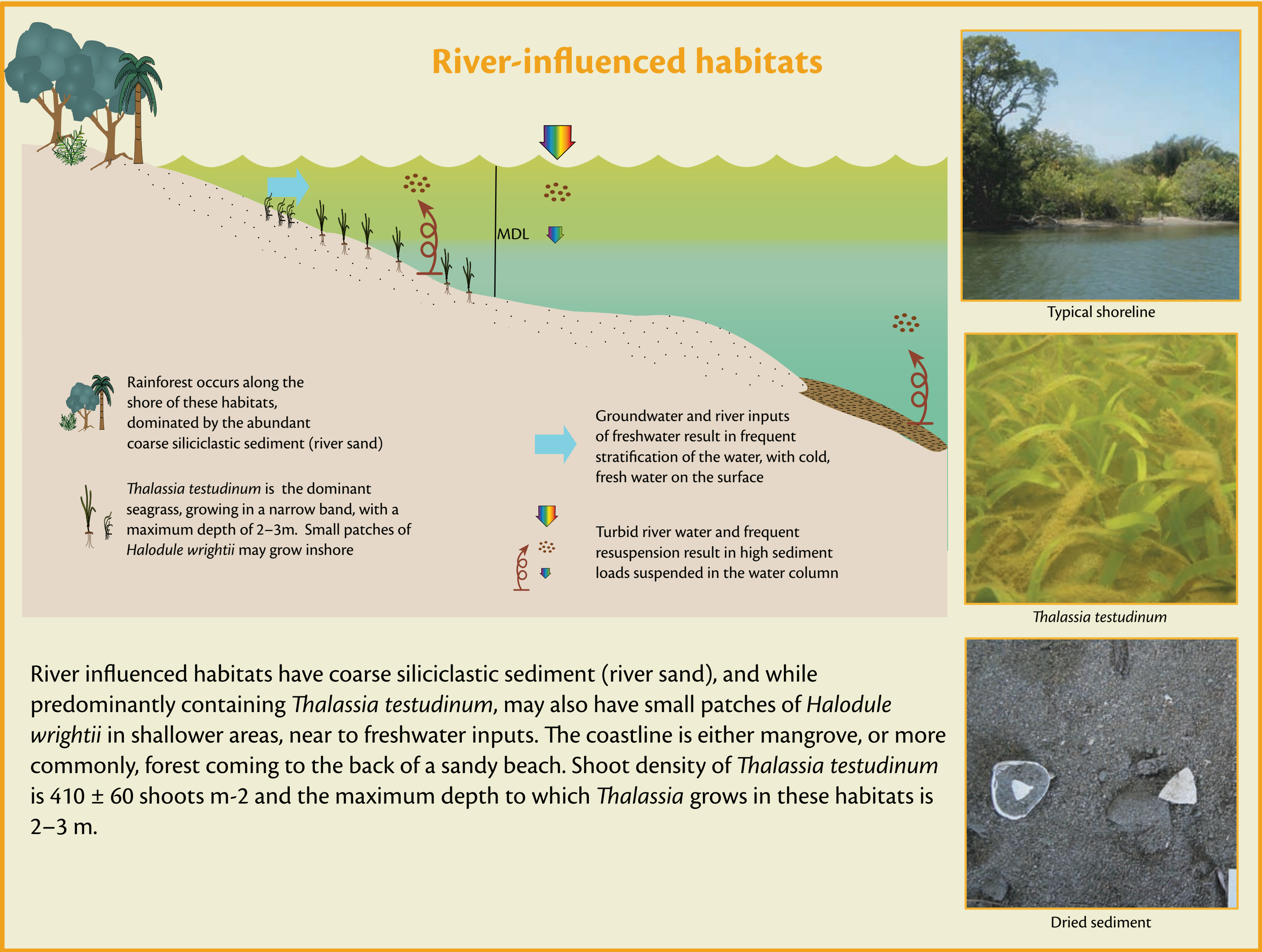
Wetland-influenced habitats are characterized by highly organic 'oozy' sediments and contain *Thalassia testudinum*. These meadows have a shoot density of 246 ± 66 shoots m^{-2} and the maximum depth limit to which the seagrass grows is typically 1.5–2.5 m deep. Resuspension of the fine sediments is common, reducing light penetration through the water. Although macroalgal epiphytes are not common on the seagrass leaves, some seagrass leaves are covered in diatoms and leaves are commonly coated with a fine sediment layer.



Reef-influenced habitats contain a diversity of hard and soft corals as well as invertebrates and macroalgae. Within the reef lagoon, the water is typically shallow (<1 m) with only a thin veneer of sand (<2 cm) over broken coral rubble. The seagrass is often stunted. *Thalassia testudinum* (280 ± 31 shoots m^{-2}) occurs further from the mainland in reef lagoons with slightly deeper sand, and *Syringodium filiforme* also occurs. On the outside of these lagoons, seagrass is restricted by wind-driven water movement, although where calm enough, water clarity is often high and seagrass grows down to 4–6 m.



Mangrove-influenced seagrass habitats have deep sediment, often fine sand with high organic content, however they contain variable carbonate content from various sources. Characteristically, these meadows are highly protected from water movement. Limited coral colonies occur, but calcareous macroalgae such as *Halimeda* sp. and *Penicillus* sp. are common and these sites contain abundant sponges, ctenophores, and jellyfish, particularly *Cassiopea* sp. The dominant seagrass in this habitat is *Thalassia testudinum* however, at some sites, *Halophila decipiens* occurs at the shallow or deep extremes of the meadow. *Thalassia* shoot density is 299 ± 24 shoots m^{-2} and grows down to 6–9 m.



River influenced habitats have coarse siliciclastic sediment (river sand), and while predominantly containing *Thalassia testudinum*, may also have small patches of *Halodule wrightii* in shallower areas, near to freshwater inputs. The coastline is either mangrove, or more commonly, forest coming to the back of a sandy beach. Shoot density of *Thalassia testudinum* is 410 ± 60 shoots m^{-2} and the maximum depth to which *Thalassia* grows in these habitats is 2–3 m.