Field Guide to

Seagrasses of the Red Sea

By Amgad El Shaffai

Edited by:
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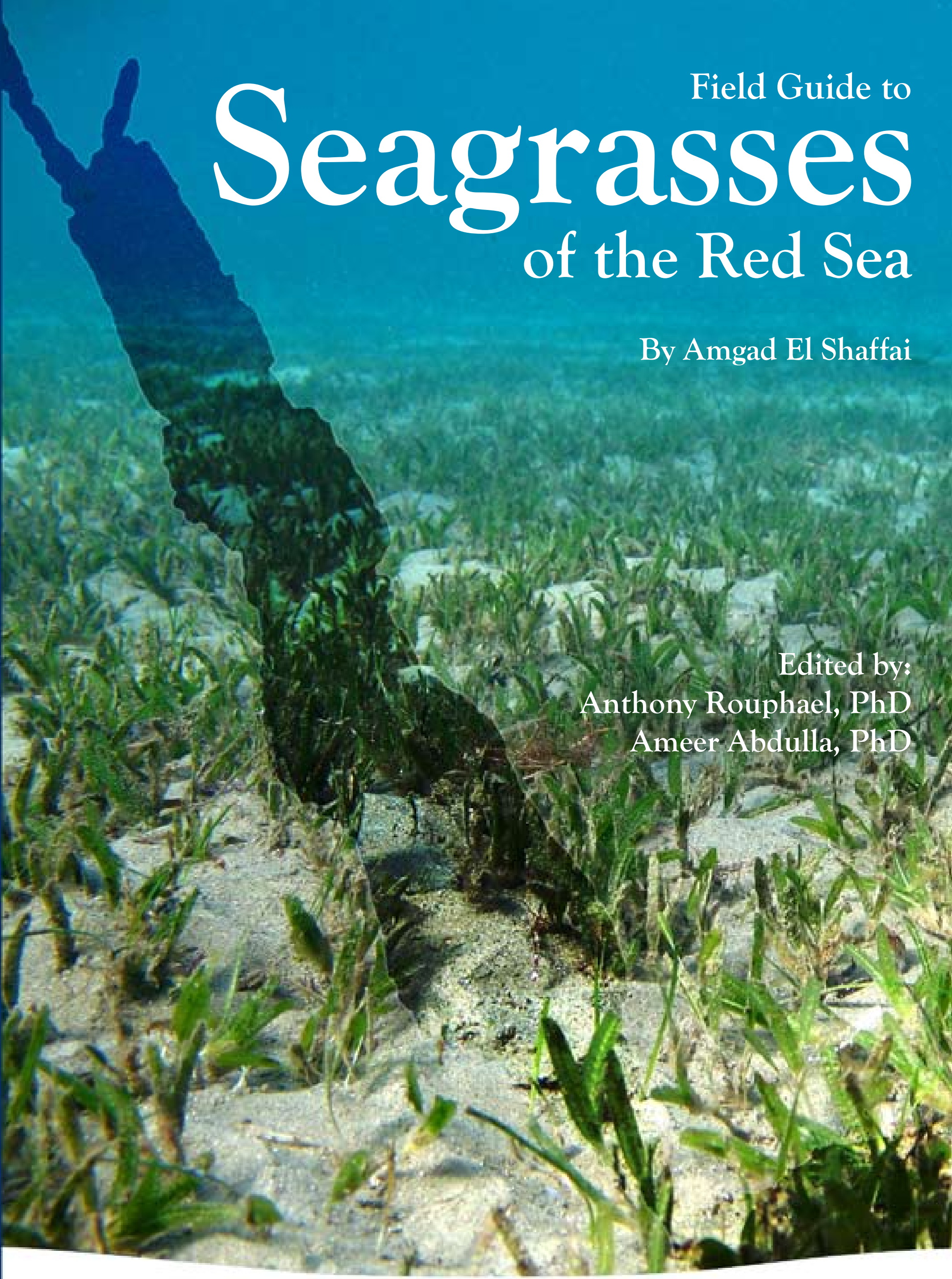

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of the Red Sea

Text and Photographs by
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Foreword

The role of taxonomy in understanding and managing marine ecosystems is pivotal. Taxonomy provides basic and fundamental understanding of ecosystem components and units (biodiversity) that are important in its functioning, its maintenance and sustainable use. Without this understanding it is very difficult to conserve species through targeted management intervention. The loss of global marine biodiversity at an alarming rate means that difficult but important decisions have to be made now to protect species and their habitats. Seagrass populations are declining globally as a result of habitat destruction and marine pollution. Unfortunately, conservation and management planning is impeded by a lack of clarity on seagrass taxonomy or people with the skills and tools to identify species accurately. Accurate species identification in the field would allow more people to understand and appreciate seagrasses. This is especially true for the Red Sea where people are taking a stronger interest in its unique natural values. This Guide is a fundamental step forward in understanding and managing seagrass species and habitats. It has been developed by the IUCN Global Marine Program and supported by the Total Foundation for Biodiversity to be an easy-to-use yet comprehensive field guide to the seagrasses of the Red Sea. It has been a great pleasure working with Amgad El Shaffai on this publication and we hope his efforts will encourage more people to take an interest in seagrasses and marine habitats in general.

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Introduction

Background

Seagrasses are unique amongst flowering plants in that they have adapted to live immersed in seawater. They flower, pollinate and produce seeds completely underwater. Seagrasses rank with coral reefs and mangroves as some of the world's most productive and ecologically significant marine ecosystems. Seagrasses are food for sea turtles, fishes and dugongs, and also support complex food webs because of their physical structure and primary productivity. Unfortunately, human destruction of seagrass communities is occurring on a worldwide scale. Seagrasses are lost at an alarming rate due to anchoring, pollution, mining, dredging and modifications to water movement. More recently, climate change has been recognized as a significant global threat as it may alter local and regional environmental conditions needed for seagrasses to thrive.

There are about 60 species of seagrasses worldwide, with most restricted to sand habitats in coastal waters where they sometimes form large meadows composed of one or more species. Thirteen species of seagrasses are known from the western Indian Ocean (Gullstrom, et al., 2002) with 12 species extending into the Red Sea (Lipkin & Zakai, 2003; El Shaffai, 2011).

The distribution of seagrass in the Red Sea is not well known. This is due to the Sea´s large size (≈2200 km in length), the remoteness and inaccessibility of much of its coastline and the lack of guide books to assist people in recognizing and identifying these plants. Ironically, the taxonomy of seagrasses in the Red Sea has a long and distinguished history. Peter Forsskål, a Swedish scientist and student of the famous taxonomist Carl Linnaeus, described *Halodule uninervis* and *Thalassodendron ciliatum* from the Red Sea in the 1700s. Much later, den Hartog (1970) prepared an extensive monograph of the seagrasses of the world. He summarized seagrass knowledge to provide a comprehensive guide to all seagrasses described at that time. More recent guides to seagrasses were prepared by Lanyon (1986) for the Great Barrier Reef, Waycott, et al., (2004) for the Indo-Pacific region, and Green and Short (2003) globally. None of these authors discuss the characteristics of the Red Sea species in particular detail.

Purpose and structure of this guide

The purpose of this publication is to provide naturalists, resource managers and scientists with a simple guide to identify all species of seagrasses in the Red Sea. Each species is described in detail using photographs of key and diagnostic features. Key features are those that distinguish a particular species from most other species, whereas diagnostic features belong only to that species.

The guide begins with a description of habitats in the Red Sea that support seagrasses, followed by an introduction to the features of seagrasses used for identification. Each seagrass species is then described individually. These species are grouped into two families: Cymodoceaceae and Hydrocharitaceae. Within each family, species are listed alphabetically.

Family Cymodoceaceae	Family Hydrocharitaceae
Cymodocea rotundata	*Enhalus acoroides*
Cymodocea serrulata	*Halophila decipiens*
Halodule pinifolia	*Halophila ovalis*
Halodule uninervis	*Halophila ovata*
Syringodium isoetifolium	*Halophila stipulacea*
Thalassodendron ciliatum	*Thalassia hemprichii*

Taxonomic notes

In this guide, seagrass taxonomy follows den Hartog (1970) and Lanyon (1986) because *Halodule pinifolia* is distinguished from *Halodule uninervis*, and *Halophila ovata* is distinguished from *Halophila ovalis*. Although Waycott, et al., (2004) noted genetic similarities between these related species, morphological variations of an organism are ecologically important and warrant identification and protection.

At the beginning of each species section, the surname of the scientist who first described it is presented immediately to the right of the species name. If two surnames are given, the one in the parentheses is the person who originally described it, while the second name is the scientist who modified the original name, typically by placing it in a different genus.

Only scientific (or Latin) names are given in this guide. A scientific name includes the genus (e.g. *Halodule*) and species (e.g. *uninervis*). With a little practice it is easy to pronounce these words. Most seagrass species do not have common names, and those that do are not used consistently amongst regions. For these reasons, common names are not used in this guide.

Species Diversity in the Red Sea

Seagrasses diversity is uneven in the Red Sea (Figure 1). Seven species are known from the Gulf of Aqaba and five in the Gulf of Suez (Green & Short, 2003). The northern part of the Red Sea proper (north of 25° and south of the Gulfs) has up to eight species. The central Red Sea (18°-25° N) has the highest seagrass diversity (Jones, et al., 1987), possibly due to greater diversity of habitats and environmental conditions. The southern Red Sea has less species than the central Red Sea, possibly due to limited sampling in remote areas of Yemen, Eritrea and Djibouti. All species in the Red Sea originated from the Indian Ocean, and at least one species, *Halophila stipulacea*, has entered the Mediterranean Sea via the Suez Canal.

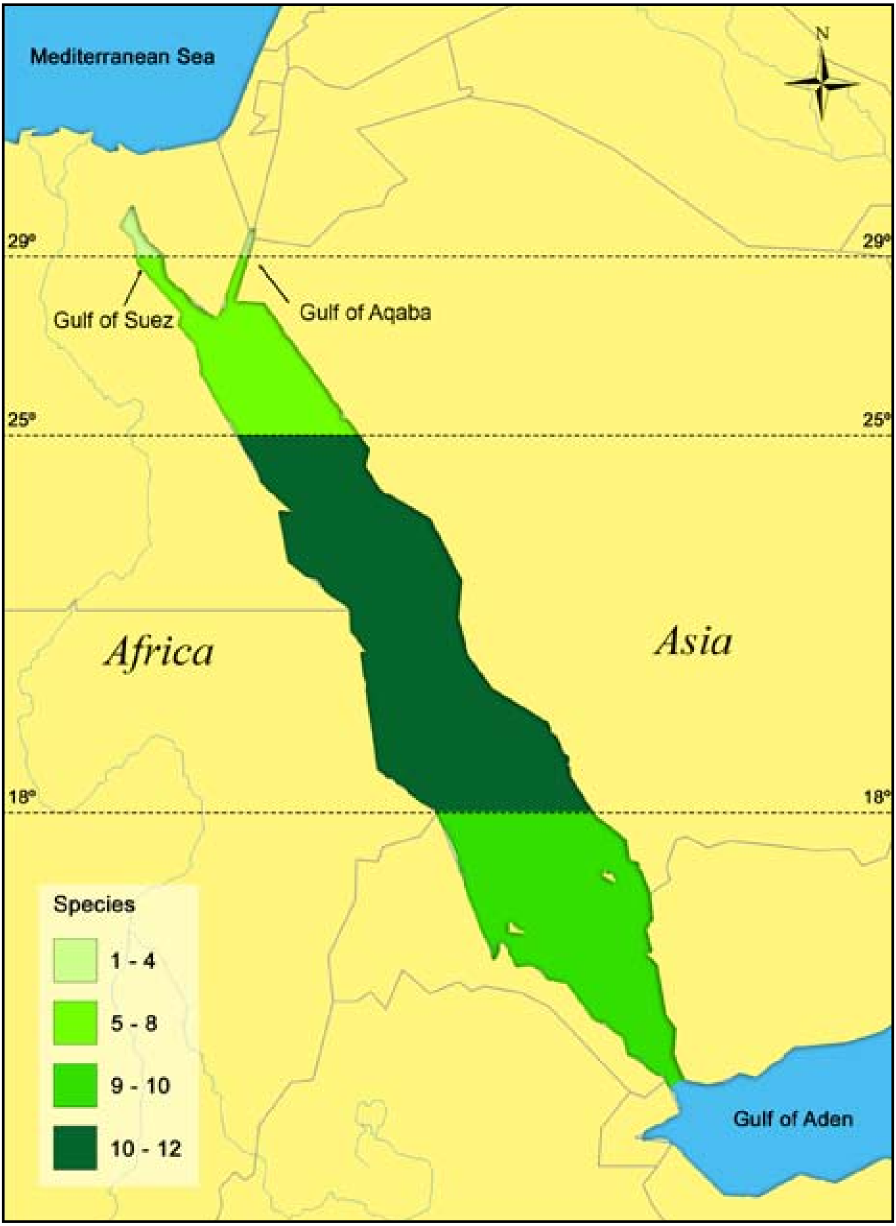
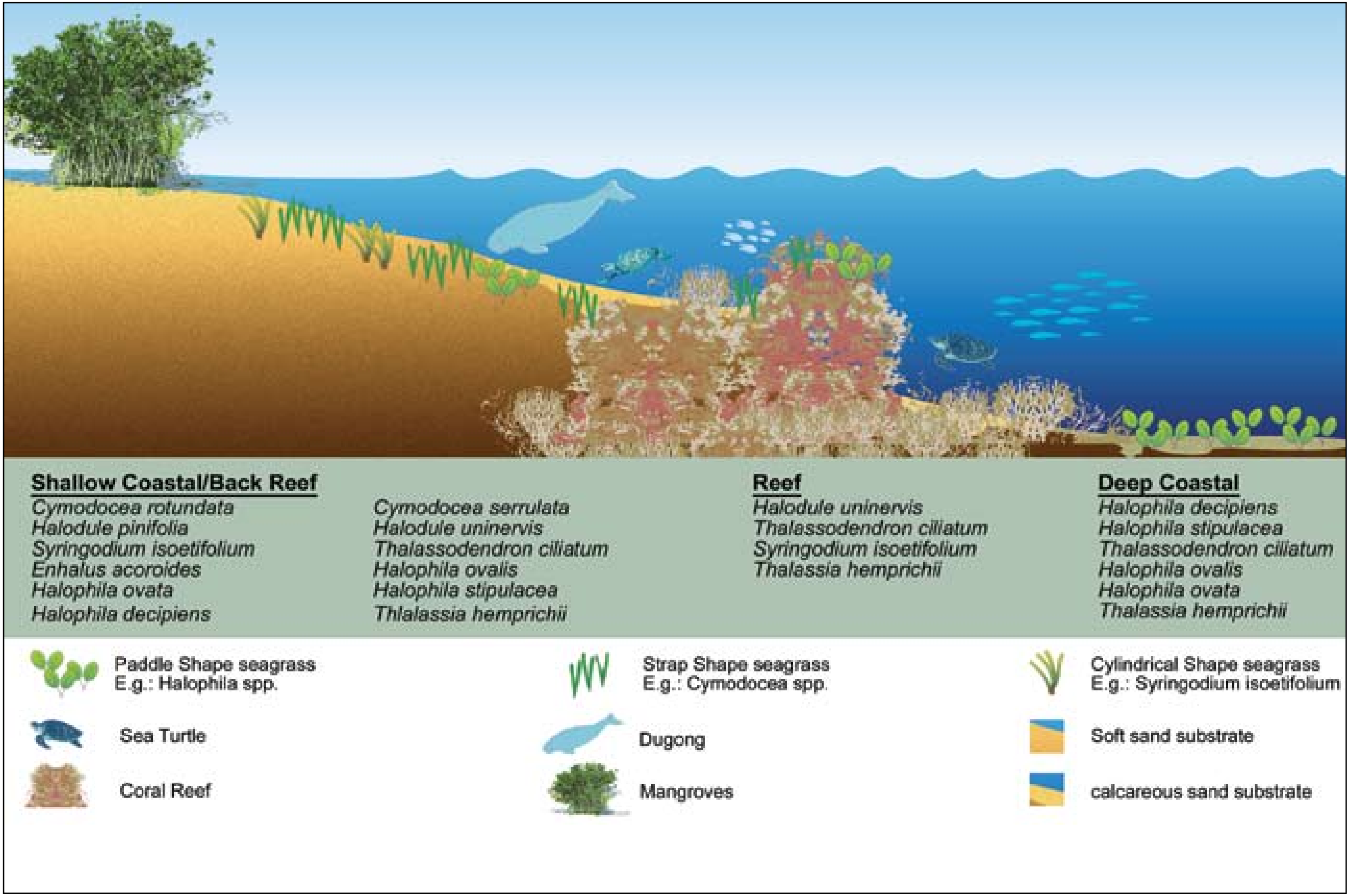


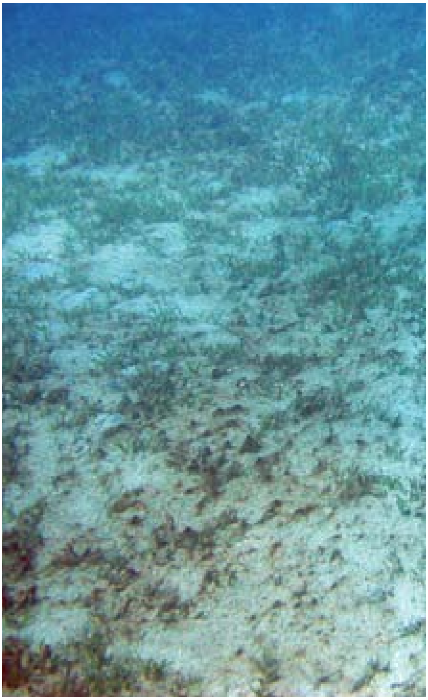
Figure 1. Schematic map represents the seagrass species diversity in the Red Sea based on published literature (Jones, et al., 1987; Price, et al., 1988; Green & Short, 2003; Fishazion, et al., 2007 and El Shaffai, 2011).

Habitats

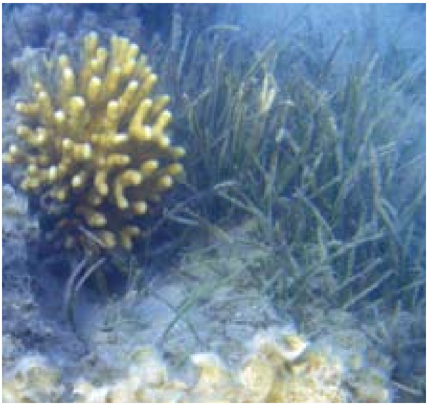
The Red Sea contains examples of all the major tropical marine habitats except estuaries. For the purpose of this guide, three main seagrass habitats are identified: i) shallow coastal; (ii) reef; and (iii) deep coastal (refer to illustration and photographs on pages 6 and 7). These three broad habitat types differ in terms of water depth and seafloor type (sand versus rock). Water depth has a major influence on light levels reaching seagrasses and light is critical for photosynthesis. Seafloor type is important because most species can only grow in sand, but a few species can be found on reef. The shallow coastal habitat, also referred to as a back reef environment, is characterized by depths shallower than 10 m and a seafloor dominated by sand. The deepwater coastal habitat relates to waters ranging from 10 to 70 m in depth, the latter being the maximum depth in which seagrasses are known to persist in the Red Sea. This habitat is also characterized by sand on the seafloor. The reef habitat is characterized by calcium carbonate rock mainly formed by coral. Very shallow water habitats are periodically exposed to air at low tide (the intertidal zone). Exposure to air in the intertidal zone and extreme levels of light can greatly limit seagrass growth and diversity.


Shallow Coastal/Back Reef
Cymodocea rotundata
Halodule pinifolia
Syringodium isoetifolium
Enhalus acoroides
Halophila ovata
Halophila decipiens
Cymodocea serrulata
Halodule uninervis
Thalassodendron ciliatum
Halophila ovalis
Halophila stipulacea
Thlalassia hemprichii
Reef
Halodule uninervis
Thalassodendron ciliatum
Syringodium isoetifolium
Thalassia hemprichii
Deep Coastal
Halophila decipiens
Halophila stipulacea
Thalassodendron ciliatum
Halophila ovalis
Halophila ovata
Thalassia hemprichii
Paddle Shape seagrass
E.g.: Halophila spp.
Strap Shape seagrass
E.g.: Cymodocea spp.
Cylindrical Shape seagrass
E.g.: Syringodium isoetifolium
Sea Turtle
Dugong
Soft sand substrate
Coral Reef
Mangroves
calcareous sand substrate

Shallow coastal habitat
Seagrass meadows can be found in very shallow water near beaches and mangroves.



Deep coastal habitat
Seagrass in the Red Sea can be found close to the beach or in depths of up to 70 m.



Reef habitat
Some seagrass species can attach to coral reefs, but most are found in sand.

Intertidal
Some seagrass meadows are periodically exposed to air partially or completely depending on the tide.

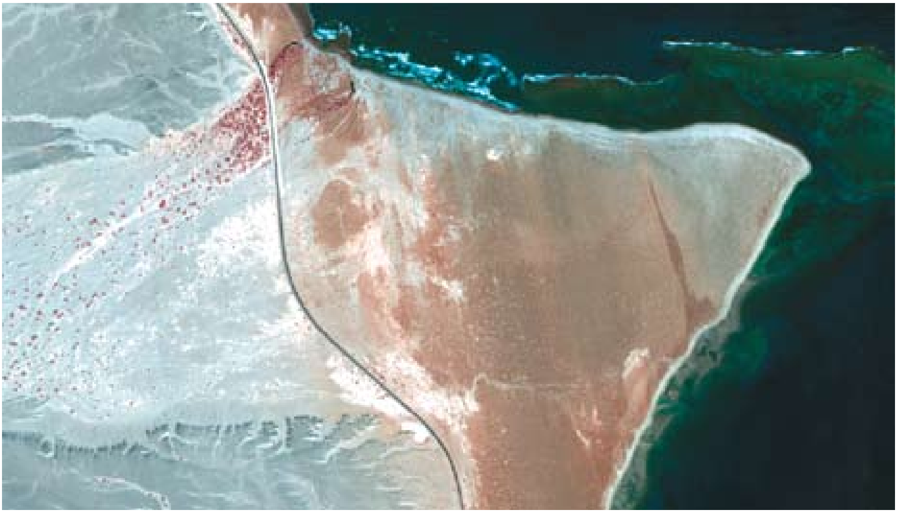
Subtidal
In the subtidal zone, seagrass meadows are covered completely by water even at the lowest tide.

The abundance and distribution of seagrasses are influenced by wave action. Strong wave action can erode seagrass meadows or inhibit colonization of unoccupied habitat. Therefore, seagrass meadows in the sheltered side of a headland and in bays (refer to photographs below) often differ in abundance and diversity to meadows found in locations exposed to stronger wave action.

Animals can also influence the abundance and distribution of seagrasses. Snorkeling on corals reefs fringing the Red Sea coastline will reveal a 'halo' of bare sand between the reef and seagrass meadows. This area of sand remains free of seagrasses due to sea urchins and other animals that leave the reef to feed on these plants at night. Dugongs and stingrays can disturb seagrass meadows while feeding. Burrowing shrimps can also effect meadows by depositing sediment on top of seagrasses located adjacent to their burrows.

Bay (or Sharm)

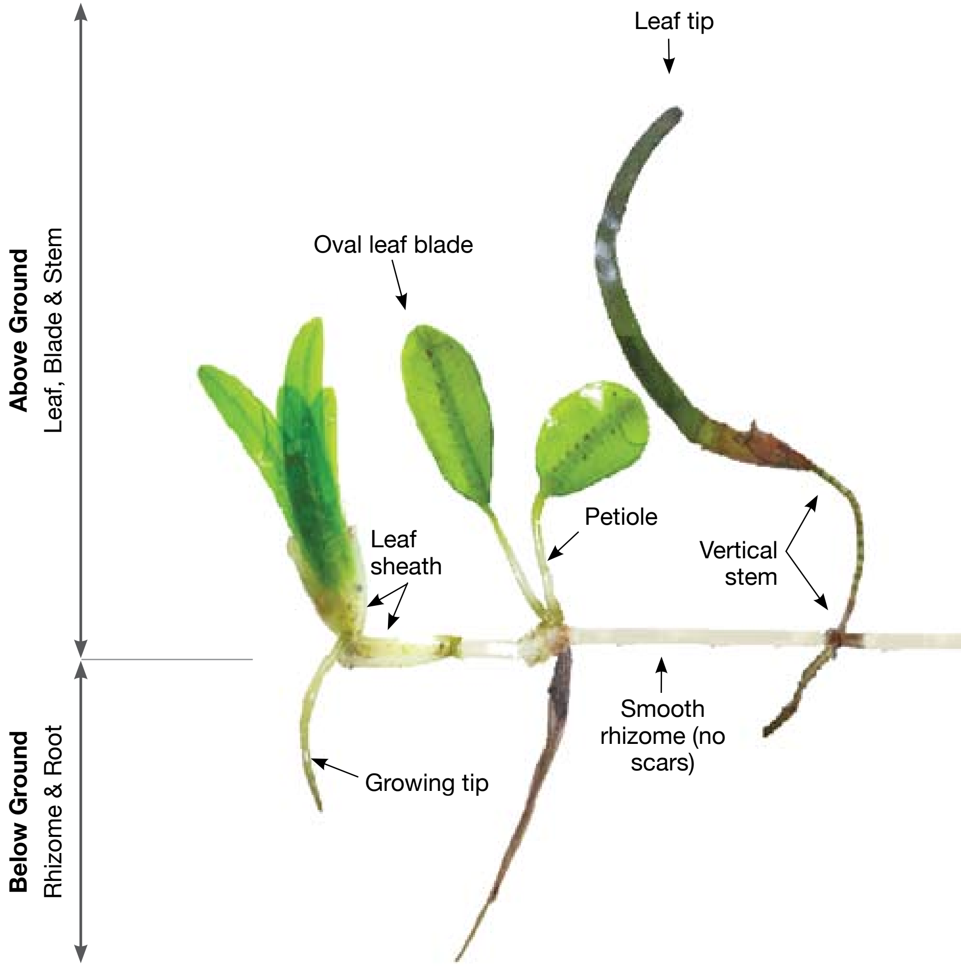
A Sharm is the Arabic name for sheltered lagoons and small bays. Seagrass meadows in bays are often very different from those in habitats exposed to strong water movement.



Headland (or Ras)

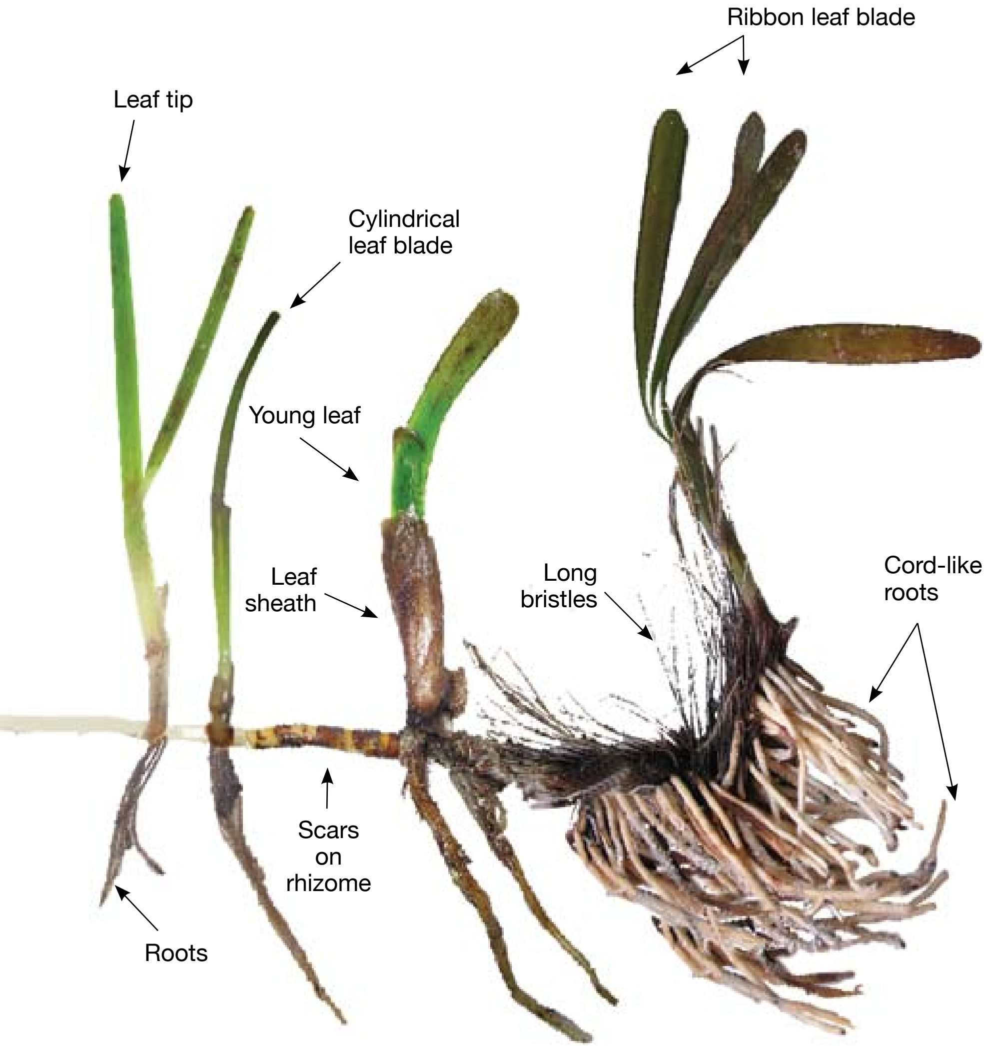
A headland in some areas of the Red Sea is called a Ras. Seagrass meadows on the windward side differ from those in the leeward or sheltered side.

General structure of seagrass plants



An individual seagrass plant consist of leaves, stem, rhizome and reproductive parts, such as flowers and fruits. A diagrammatic representation of a 'stylized' seagrass is shown in Figure 2. Note that this is a composite diagram of many species used to illustrate variation in the same structural features among different species. These features are described in detail under the species descriptions.

Figure 2: A diagrammatic and stylized representation of a seagrass structure which is a merge of the three major morphological forms of seagrass found in the Red Sea. This does not represent a single species, but illustrates the characteristics of many species.



Family Cymodoceaceae

Cymodocea rotundata

Ehrenberg & Hemprich ex Ascherson

Cymodocea rotundata (Plate 1) is a common seagrass in shallow coastal water. In the Red Sea it is often found in meadows consisting of two or more species. This species is widespread throughout the southern and central regions of the Red Sea, however it has not been found in the Gulfs of Suez and Aqaba (Lipkin, 1977; Jacobs & Dicks, 1985).

Morphology

Leaf
The leaf blade of this species is 7-15 cm long and 0.2-0.4 cm wide, linear and flat. The leaf sheath is well developed and ranges from 1.5-5.5 cm in length. The leaf sheath may be pale purple in color and is not shed along with the blade. When a leaf sheath sheds, closed circular scars are left on the stem. There are 9-15 longitudinal leaf veins. The leaf margin may have small serrations. The leaf tip sometimes appears slightly heart-shaped to the naked eye. Note that the dark color of the upper section of the leaf in Plate 1 is due to dead or old tissue. A healthy leaf is green all over.

Stem
This species has a short erect lateral stem at each node, bearing 2-7 leaves.

Rhizome
The rhizome is smooth, with 1-3 irregularly branched roots at each node.

Microscopic Leaf Anatomy

Cells are round to angular. Tannin (black colored) cells can be seen in round to rectangular groups (Plate 2).

Similar Species

- *Cymodocea serrulata* has open leaf scars.
- *Thalassia hemprichii* has a rhizome with scars between successive erect shoots.
- *Thalassodendron ciliatum* has erect stem 10-65 cm in length.

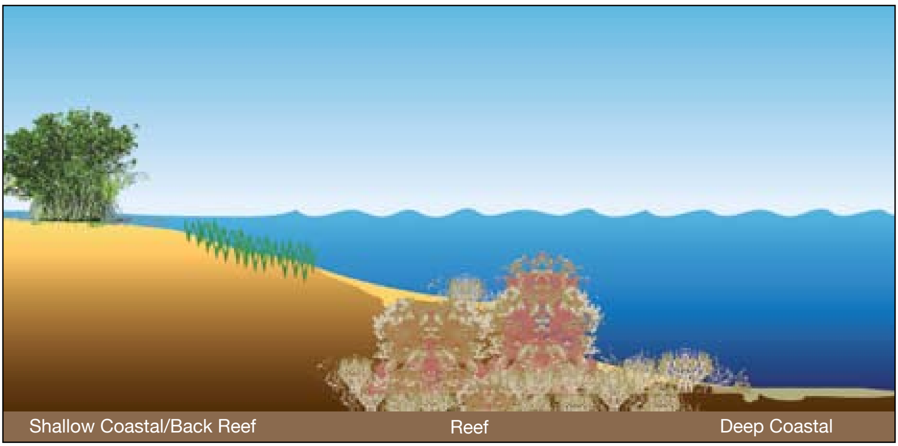
Key Features

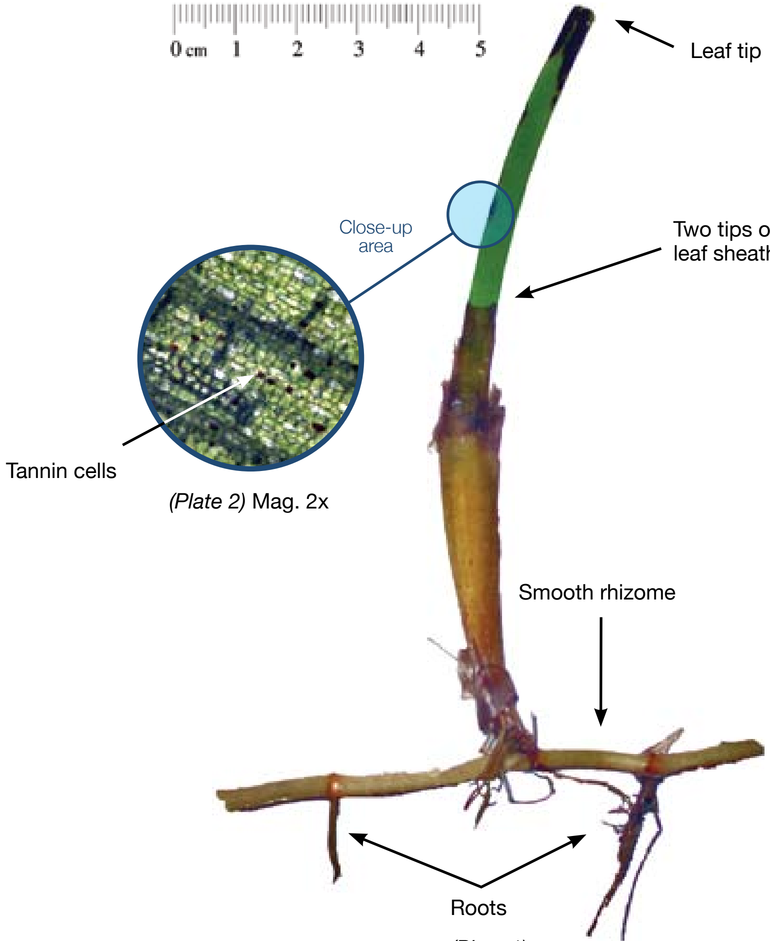
- Rhizome is smooth without scars between stems (Plate 3).
- Leaf sheath ends with two tips at the upper side (Plate 4).
- Leaf tip is bluntly rounded and appears slightly heart-shaped (Plate 5).

Diagnostic Features

- Leaf sheath scars fully encircle vertical stem 'closed leaf scars' (Plate 6).

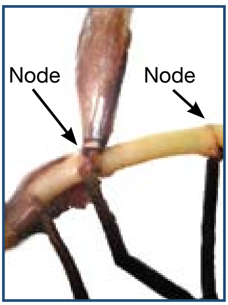
Habitat



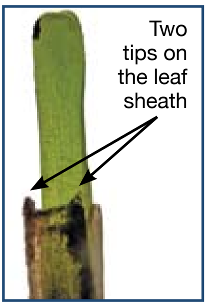


(Plate 2) Mag. 2x

(Plate 1)



(Plate 3)



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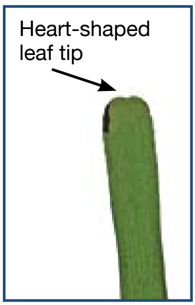

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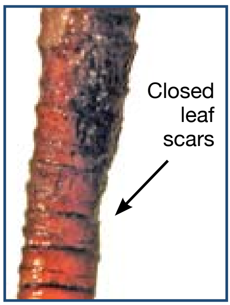


(Plate 6)

Cymodocea serrulata

(R. Brown) Ascherson and Magnus

Cymodocea serrulata (Plate 1) is widespread throughout the southern and central regions of the Red Sea. On the eastern side of the Red Sea, the abundance of this species increases southward (Aleem, 1979; Price, et al., 1988). It is uncommon along Egypt's central and northern Red Sea coast (El Shaffai, 2011) and has not been found in the Gulfs of Suez and Aqaba (Lipkin, 1977; Jacobs & Dicks, 1985).

Morphology

Leaf

The leaf blade is up to 15 cm long, 0.4-0.9 cm wide and can be linear or slightly curved. The leaf sheath is purple, broadly triangular, and narrows at the base. When the leaf sheaths are shed, they leave open, semi-circular scars on the stem. There are 13-17 longitudinal leaf veins and the leaf margin is serrated with obvious tooth-like projections. The leaf tip is bluntly rounded and also serrated.

Stem

This species has a short erect vertical stem often with fibrous roots at each node.

Rhizome

The rhizome is smooth. The color can be yellow, green or brown depending on its health and exposure to light.

Microscopic Leaf Anatomy

Cells are generally angular in shape (Plate 2).

Similar Species

- *Cymodocea rotundata* has closed leaf scars.
- *Thalassia hemprichii* has a rhizome with node scars with small leaves between successive erect shoots.
- *Thalassodendron ciliatum* has 10-65 cm long erect stems. Also the rhizome is woody with scars between successive erect stems.

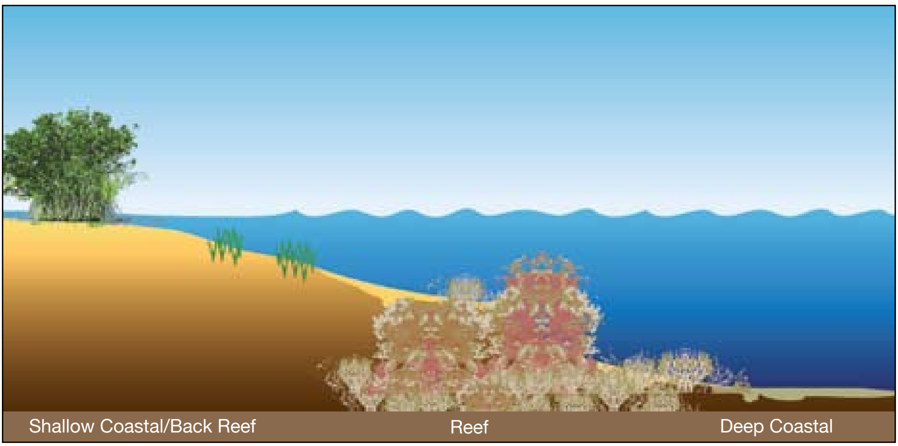
Key Features

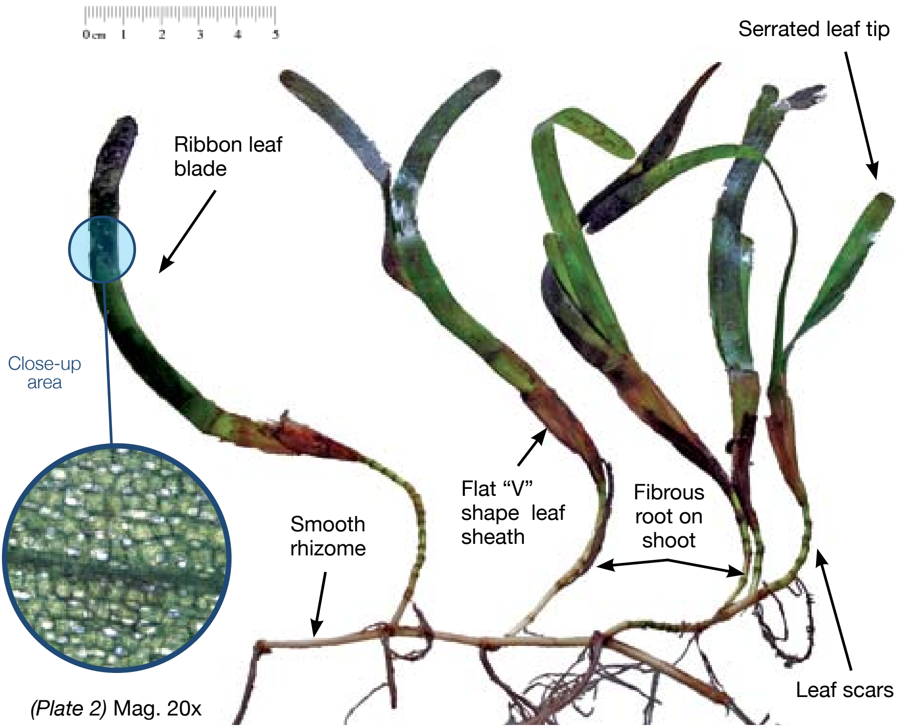
- Fibrous roots on shoot (Plate 3).
- Leaf sheath compressed and forming a "V" shape on one side (Plate 4).
- Leaf tip is serrated and there are 13-17 longitudinal leaf veins (Plate 5).

Diagnostic Features

- Leaf sheath scars do not fully encircle vertical stem 'open leaf scars' (Plate 6).

Habitat





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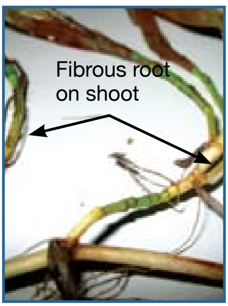
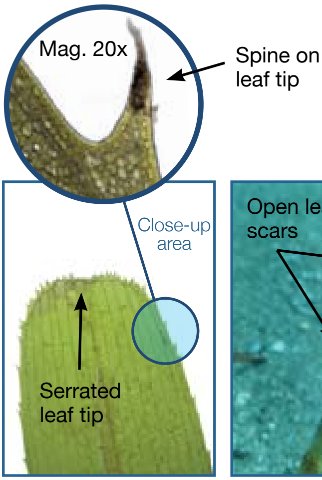
(Plate 1)

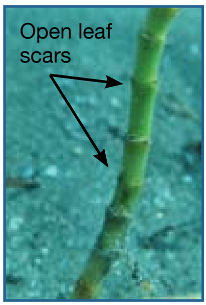


(Plate 3)

(Plate 4)



(Plate 5) Mag. 2x



(Plate 6)

Halodule pinifolia

(Miki) den Hartog

Halodule pinifolia (Plate 1) is known from the southern Egyptian coast (El Shaffai, 2011), but is probably more widespread in suitable habitat. As *Halodule pinifolia* is morphologically very similar to *Halodule uninervis*, it has probably been reported as the latter in many places. It is not always easy to differentiate between the two species. Indeed Waycott, et al., (2004) reported that *Halodule pinifolia* is genetically identical to *Halodule uninervis*.

Morphology

Leaf

The leaf blade is less than 20 cm long and 0.02-0.1 cm wide, linear and flat. The leaf sheath is well developed and there are three longitudinal leaf veins. Leaf margin is mostly smooth but finely serrated at the tip. The most distinctive feature is the black central vein at the leaf tip, which splits into two at the apex.

Stem

The stem of this species is short, erect, vertical and bearing 1-2 leaves. It is often covered by dense leaflets and looks like leaves develop directly from rhizome.

Rhizome

The rhizome is thin and often covered by leaf scars.

Microscopic Leaf Anatomy

Cells are small, regular and rectangular in shape (Plate 2).

Similar Species

- *Halodule uninervis* has three distinct points or "teeth" at the leaf tip with the mid "tooth" not showing any splitting.

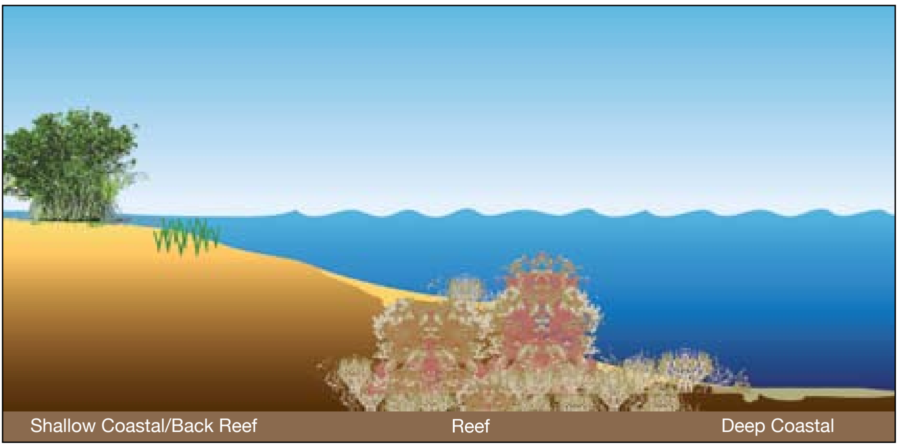
Key Features

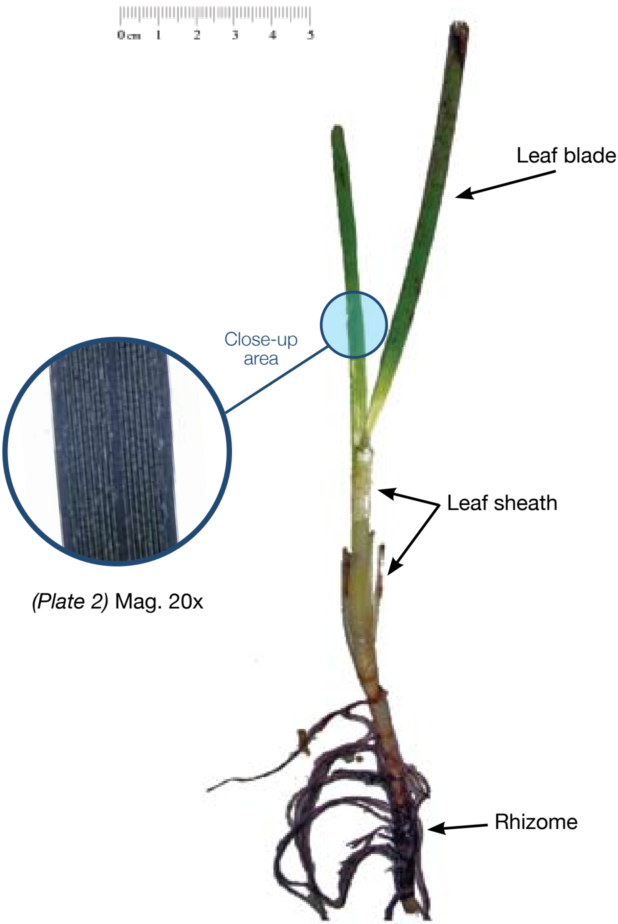
- Short erect stem often with numerous leaf scars (Plate 3).
- Very narrow leaf blade.
- Bluntly rounded leaf tip with serration (Plate 4).

Diagnostic Features

- The black central leaf vein split into two at the leaf tip (Plate 4).

Habitat

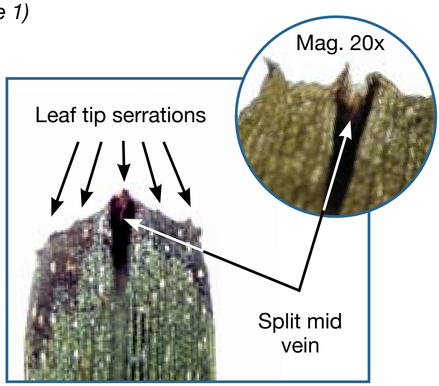




(Plate 2) Mag. 20x

(Plate 1)

(Plate 3) Mag. 2x



(Plate 4)

Halodule uninervis

(Forsskål) Ascherson

Halodule uninervis (Plate 1) is one of the most widespread seagrass species in the Red Sea. This species is found from the southern Red Sea to the northern tips of the Gulfs of Suez and Aqaba (Green & Short, 2003). On the eastern side of the Red Sea, the abundance of this species increases towards the southern Red Sea (Price, et al., 1988). Two forms may be present; plants with broad or narrow leaves. The occurrence of these two forms is influenced by environmental conditions such as water depth and turbidity, both of which influence light availability.

Morphology

Leaf

Leaf dimensions of this species are highly variable. The leaf blade is up to 15 cm long, but typically much shorter. The leaf width ranges from 0.05-0.5 cm, and has a linear shape and is flat. The leaf sheath is well developed and remains long after the blade is shed. The leaf has three longitudinal veins, the mid vein being the most obvious and easiest to identify. The leaf margin is smooth and the leaf tip has three distinct points (called "teeth"), one in the middle and one on each side (see Plate 5).

Stem

The stems are short, erect and vertical at each node and can bear 1-4 leaves.

Rhizome

The rhizome is typically smooth.

Microscopic Leaf Anatomy

Cells are regular and rectangular in shape (Plate 2).

Similar Species

- *Halodule pinifolia* has a rounded leaf tip with a split mid vein and numerous faint serrations.

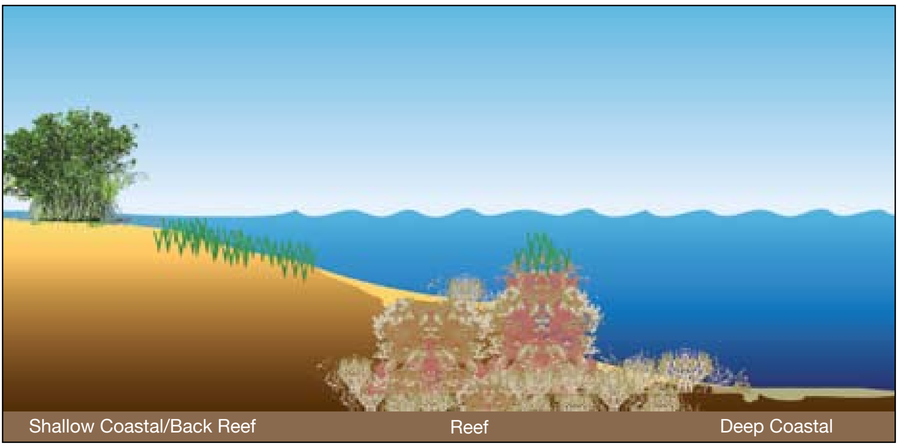
Key Features

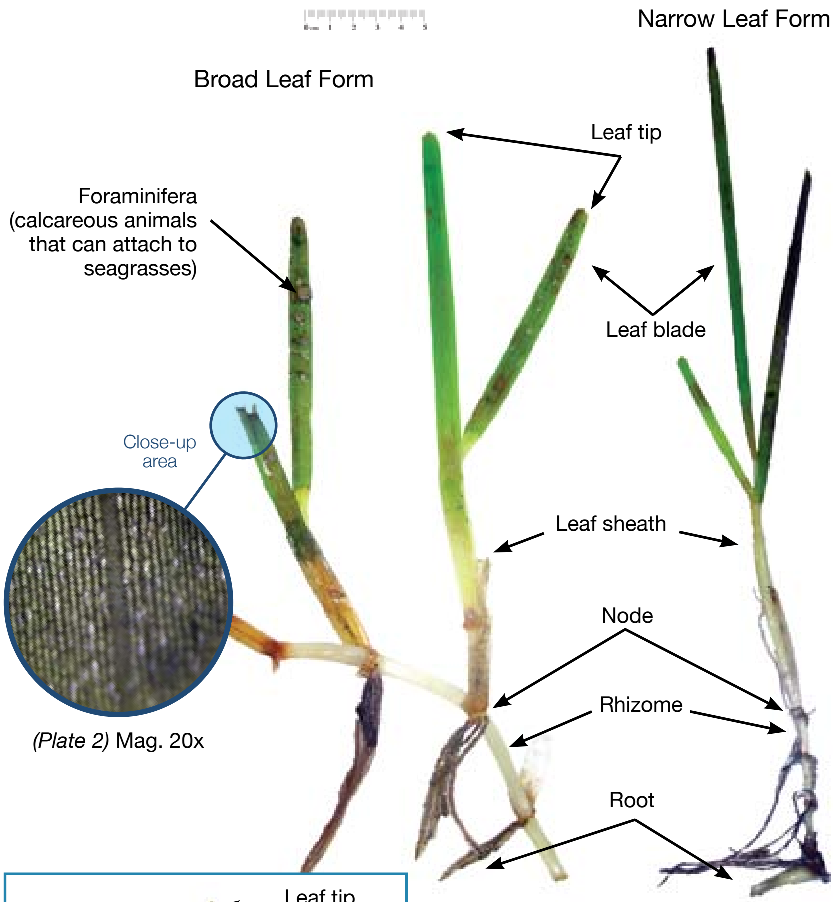
- Blade with three longitudinal veins.
- Vertical short erect stem at each node (Plate 3).

Diagnostic Features

- Three leaf tips with a blunt central "tooth" (Plate 4).

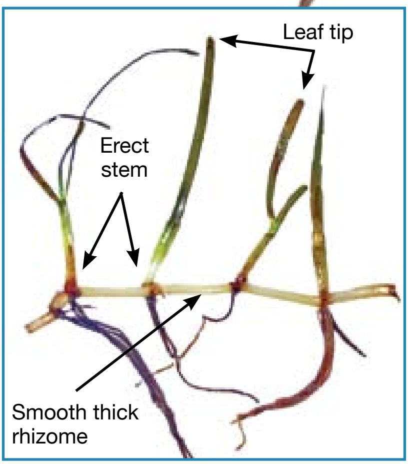
Habitat



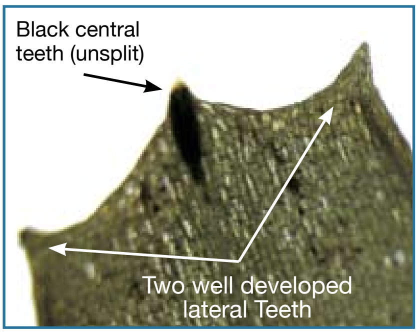


(Plate 2) Mag. 20x

(Plate 1)



(Plate 3)



(Plate 4) Mag. 4x

Syringodium isoetifolium

(Ascherson) Dandy

Syringodium isoetifolium (Plate 1) is the only species with a cylindrical leaf structure and thus is one of the easiest to identify. On the eastern coast of the Red Sea this species increases in abundance northward (Price, et al., 1988). Although this species is common in many areas of the Red Sea, it appears to be absent in the Gulf of Suez (Jacobs & Dicks, 1985).

Morphology

Leaf

The leaf blade is up to 30 cm long and 0.1-0.2 cm wide. The leaf sheath ranges from 1.5-4.0 cm in length. There are no obvious leaf veins. The leaf margin is smooth and the leaf tip tapers off to a point (Plate 1).

Stem

This species has an erect stem at each node bearing 2-3 leaves.

Rhizome

The rhizome is smooth and has 1-3 small branched roots.

Microscopic Leaf Anatomy

Cells are hexagonal in shape and are closely packed (Plate 2).

Similar Species

- *Syringodium isoetifolium* is easily distinguished from other species because of its cylindrical shaped leaves.

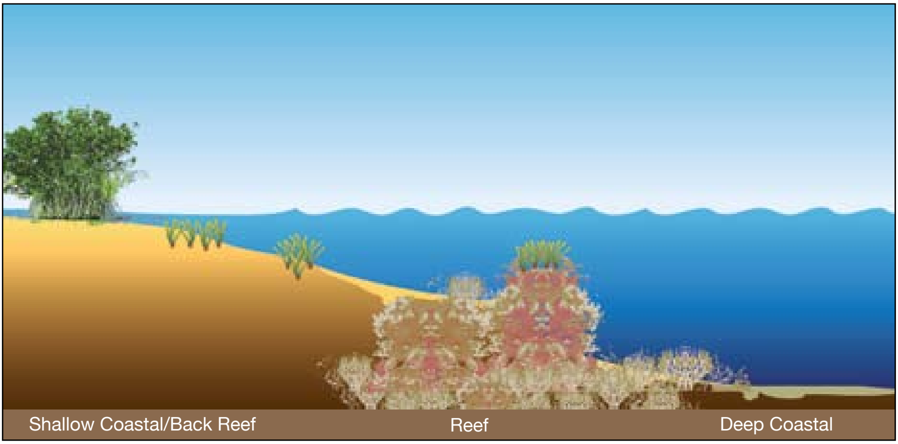
Key Features

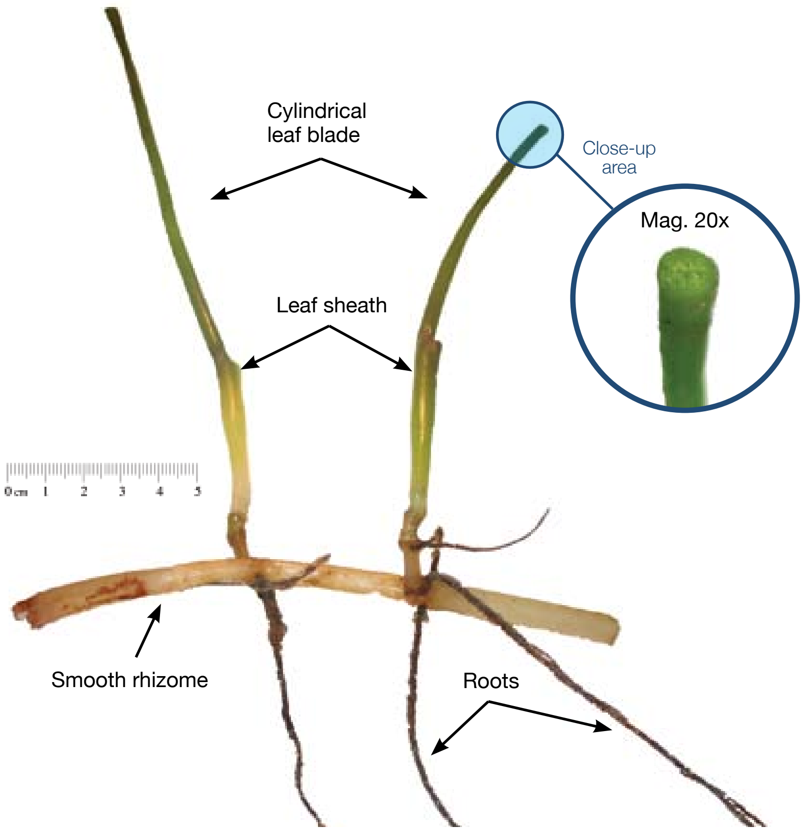
- Erect stem, sometimes branched (Plate 3).

Diagnostic Features

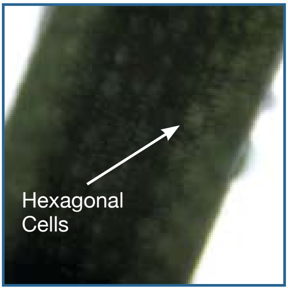
- Leaf blade is cylindrical and a cross-section of the blade reveals air cavities (Plate 4).

Habitat

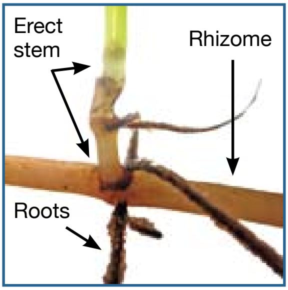




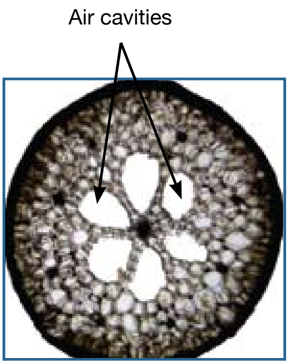
(Plate 1)



(Plate 2) Mag. 20x



(Plate 3) Mag. 2x



(Plate 4) Mag. 20x

Thalassodendron ciliatum

(Forsskål) den Hartog

Thalassodendron ciliatum (Plate 1) is typically found only in single species meadows and is one of the few species that can be found attached to reef. It is widespread throughout the Red Sea. On the eastern side of the Red Sea, the abundance of this species increases northward (Price, et al., 1988). This species has been recorded in the Gulfs of Suez and Aqaba (Green & Short, 2003), and has been reported from shallow to 40 m of water depth.

Morphology

Leaf

The leaf blade is up to 15 cm long and 0.5-1.5 cm wide, and linear in shape. The leaf sheath is wide (1.5-3.0 cm), flat and often purple in color, and curved at the base of the leaves. Leaves have between 17-27 longitudinal veins. The margin of the leaf has irregular serration and the leaf tip is rounded, with obvious numerous teeth.

Stem

This species has a long erect and wiry stem that can be up to 65 cm (but usually much shorter) with numerous leaf scars along its length. The stem bears a cluster of leaves (called crown leaves).

Rhizome

The rhizome of this species is woody and tough, up to 0.5 cm thick and covered by scars along the length of rhizome. The roots are generally well attached to the seafloor.

Microscopic Leaf Anatomy

Cells are square to angular and are placed in well-spaced rows (Plate 2).

Similar Species

- *Cymodocea serrulata* has linear leaves. Also, the rhizome of *Cymodocea serrulata* is smooth and thin without scars between the erect shoots.
- *Thalassia hemprichii* has a shorter stem, tannin cells and has no leaf clusters.

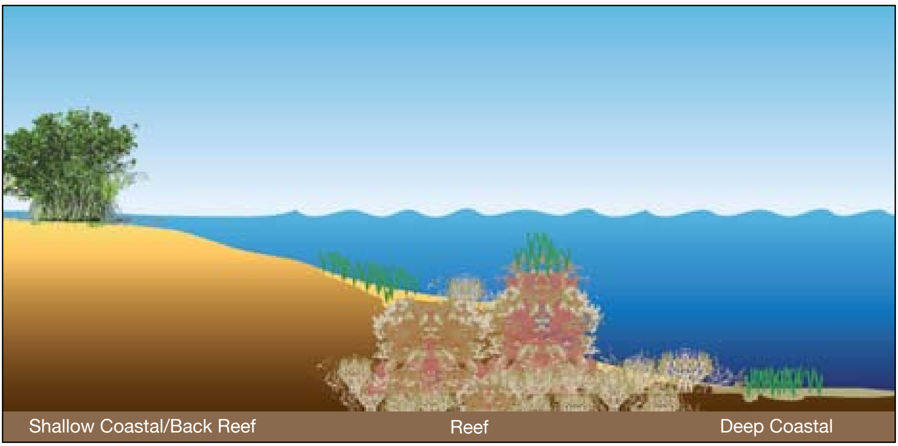
Key Features

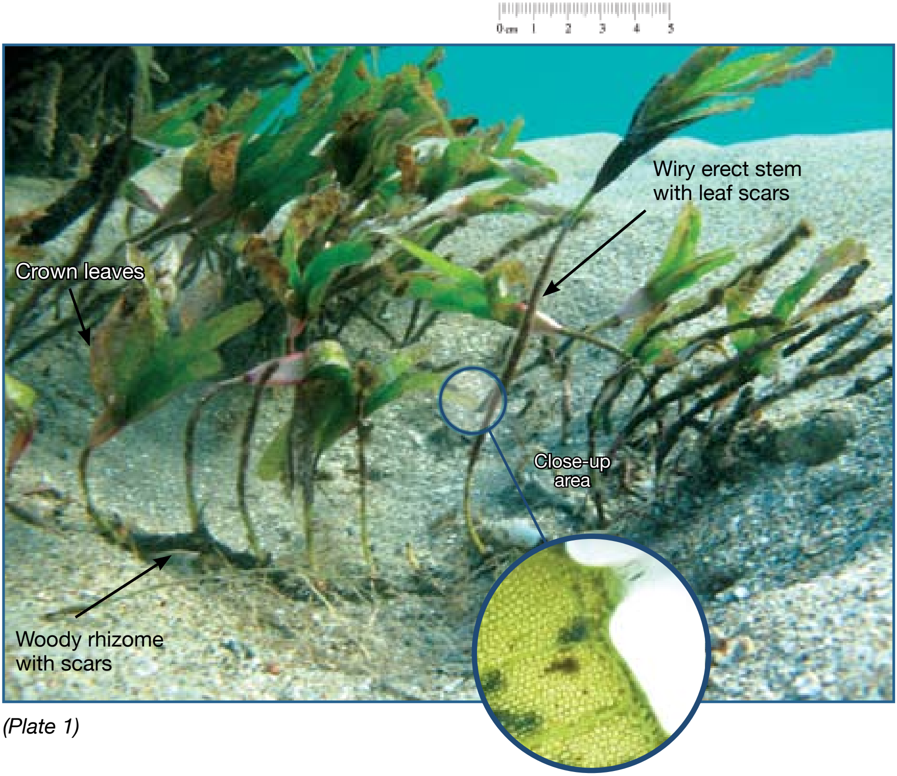
- Woody rhizome with scars between successive erect stem (Plate 3).
- Long wiry erect stem with leaf scars along its length (Plate 4).
- Leaf tip is finely toothed or notched, with 17-27 longitudinal veins (Plate 5).

Diagnostic Features

- A cluster of sickle-shaped leaves (crown leaves) with a wide and flat leaf sheath (Plate 1).

Habitat

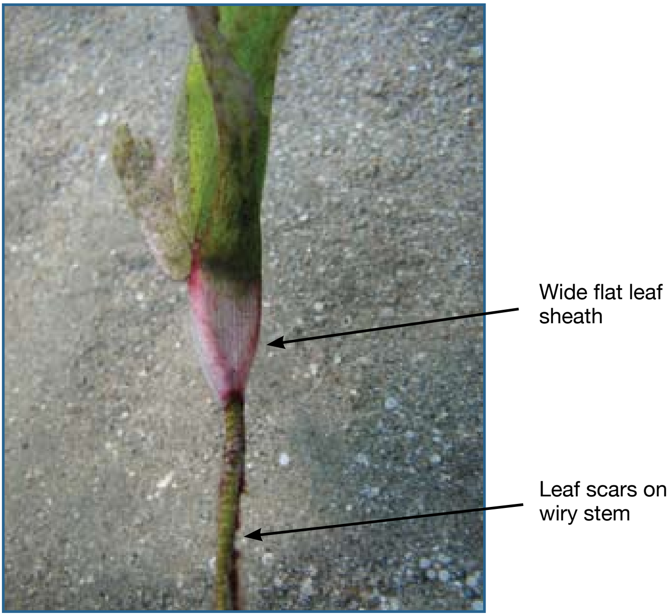




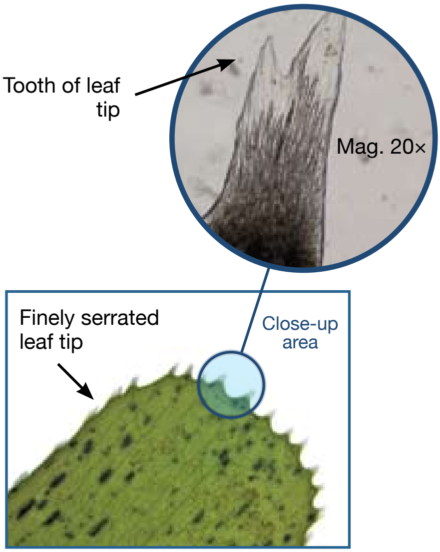
(Plate 1)

(Plate 2) Mag. 20x

(Plate 3)



(Plate 4)



(Plate 5) Mag. 2x

Family Hydrocharitaceae

Enhalus acoroides

(L.f.) Royle

Enhalus acoroides (Plate 1) is the least abundant of the seagrass species in the Red Sea. On the eastern side of the Red Sea it is locally abundant off the southern coast of Saudi Arabia (Price, et al., 1988) and in Yemen (Barratt, et al., 1987). It is rare along the northwest coast of the Red Sea, with one observation recorded by the Author in southern Egypt. It is also known from Eritrea (Fishazion, et al., 2007) and Sudan (Somaya Kidir, pers. comm. June 2009). It has not been recorded in the Gulfs of Suez and Aqaba (Lipkin, 1977; Jacobs & Dicks, 1985).

Morphology

Leaf
The blade of the leaf is ribbon-like, and can be 200 cm long and nearly 2 cm wide. The remnants of the leaf sheath form long black fibrous bristles. There are up to 30 longitudinal parallel leaf veins. The leaf margins are thick and inrolled. Young leaves have slight serrations with a rounded and smooth leaf tip.

Stem
The leaves develop directly from the rhizome.

Rhizome
The rhizome is thick (up to 1 cm in diameter). The roots are cordlike, 0.3-0.5 cm thick.

Microscopic Leaf Anatomy

Cells are mostly brick-shaped, usually two to three times longer than they are broad (Plate 2).

Similar Species

- The leaf and rhizome of *Enhalus acoroides* are easily distinguished from other species because of their unique appearance.

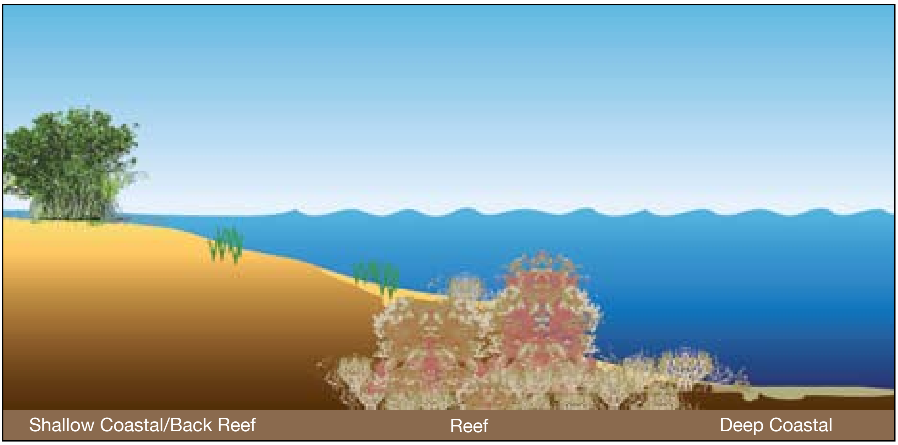
Key Features

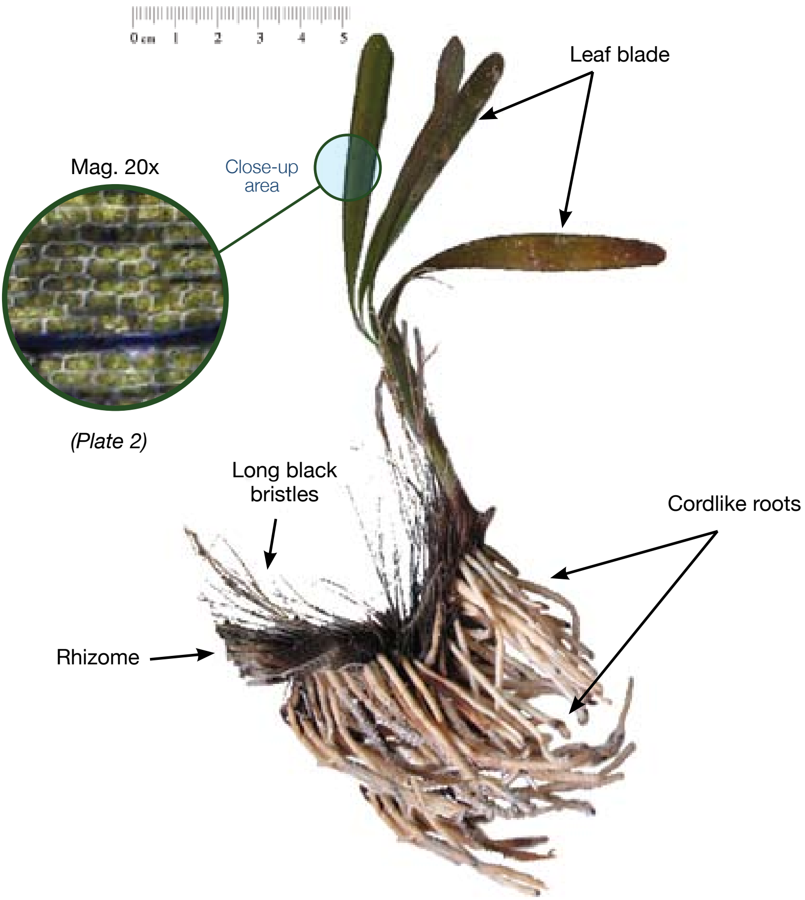
- The rhizome is thick and covered with stiff long black fibrous bristles (Plate 3).
- Roots are cord-like (Plate 4).
- Large plant with long ribbon like leaves.

Diagnostic Features

- Leaf margins are inrolled (Plate 5).

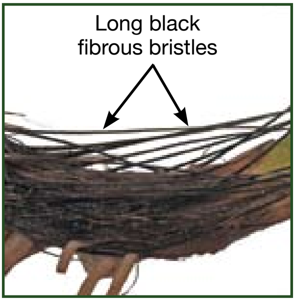
Habitat



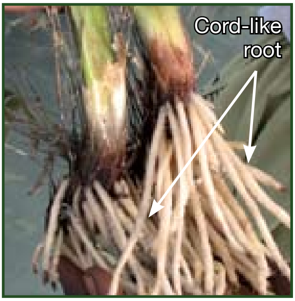


(Plate 2)

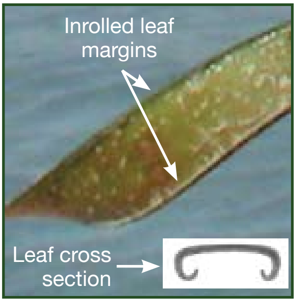
(Plate 1)



(Plate 3)



(Plate 4)



(Plate 5)

Halophila decipiens

Ostenfeld

Halophila decipiens (Plate 1) is currently known from only two locations in the Red Sea. Jacobs and Dicks (1985) recorded it in the Gulf of Suez at 30 m depth and the Author recorded it in 7 m and 42 m of water off the southern Egyptian coast. The distribution of this species in the Red Sea is otherwise unknown, but likely to be found throughout in suitable habitat.

Morphology

Leaf
The leaf blade is up to 2.5 cm long, 0.5 cm wide and paddle-shaped. It has hairs on both side of the leaf blade. There are 6-9 unbranched cross leaf veins. The margin of the leaf is finely serrated and the leaf tip is rounded.

Stem
The petioles are 3-15 mm long, each bearing pairs of leaves. Petioles develop directly from the rhizome.

Rhizome
The rhizome is smooth, thin and elongated.

Microscopic Leaf Anatomy

Cells angular to hexagonal in shape (Plate 2).

Similar Species

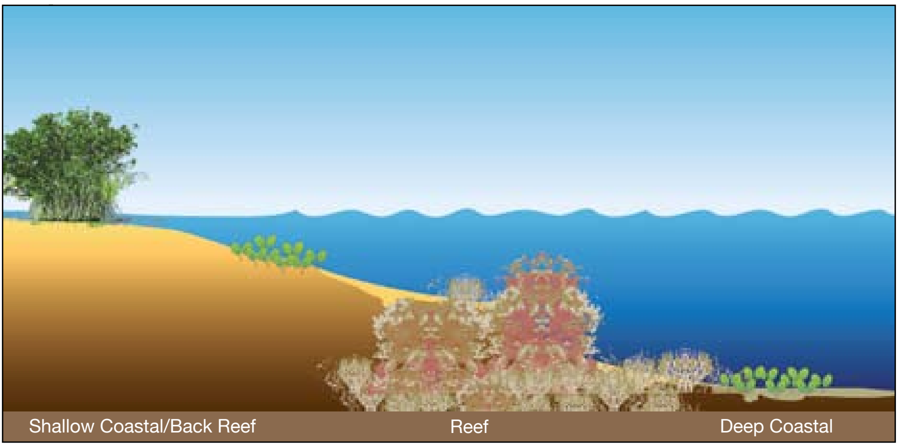
- *Halophila ovalis* and *Halophila ovata* have less elongated and broader leaf blade and do not have hairs on the leaf blades.
- *Halophila stipulacea* has a lopsided sheath structure on each leaf pair.

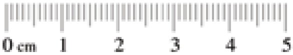
Key Features

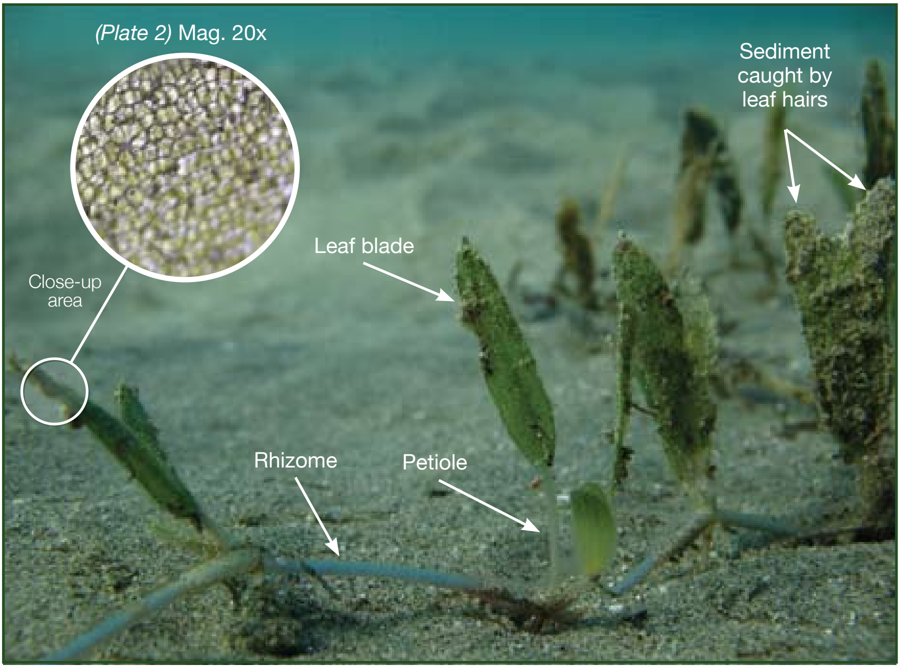
- Rhizome is thin (Plate 3).
- Paddle shaped leaves with fine serrations along margin but only visible clearly with a magnifying lens.
- Long petioles arising directly from the rhizome (Plate 3).

Diagnostic Features

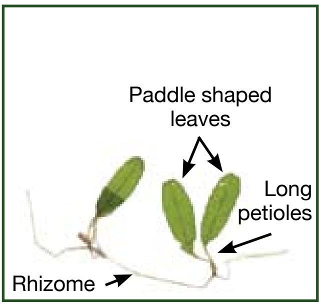
- Dense hairs on both sides of leaf blade but requires a magnifying lens to see clearly (Plate 4). Sometimes sediment will adhere to hairs on the leaf blade as shown in Plate 5.



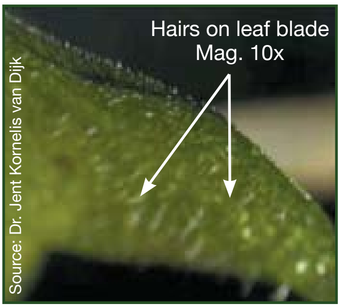




(Plate 1)



(Plate 3)



(Plate 4)

(Plate 5)

Halophila ovalis

(R. Brown) Hooker f.

Halophila ovalis (Plate 1) is widespread throughout the Red Sea, including the Gulfs of Suez and Aqaba (Green & Short, 2003). In the Red Sea, *Halophila ovalis* has been reported down to 23 m of water in the Gulf of Suez (Jacobs & Dicks, 1985), but is more common in shallower waters.

Morphology

Leaf
The leaf blade is 1-4 cm long and 0.5-2.0 cm wide, and is oval shaped. The leaf has no sheath, but two scales cover the base of the petiole. There are 10-28 branched cross veins and in some specimens there are small dark colored dots beside the mid vein (Plate 1). The leaf margin is smooth and there are no hairs on the leaf surface.

Stem
Petioles are 0.4-8.0 cm in length and arise directly from the rhizome. Each petiole supports leaf pairs.

Rhizome
Rhizome is smooth, thin and light colored.

Microscopic Leaf Anatomy

The cells are not in clear rows but irregular in arrangement and shape. Cells sometimes have a "jigsaw" like appearance (Plate 2).

Similar Species

- *Halophila ovata* has a smaller leaf blade and fewer cross veins.
- *Halophila decipiens* has hairs on the leaf blade and has a serrated leaf margin.

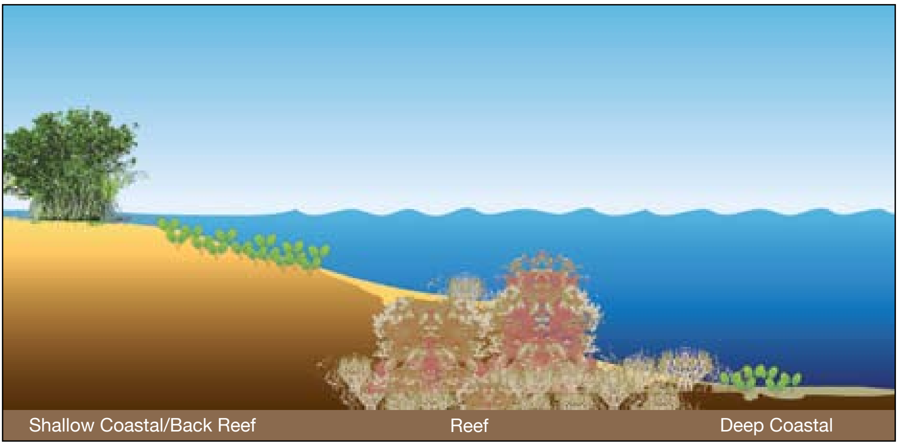
Key Features

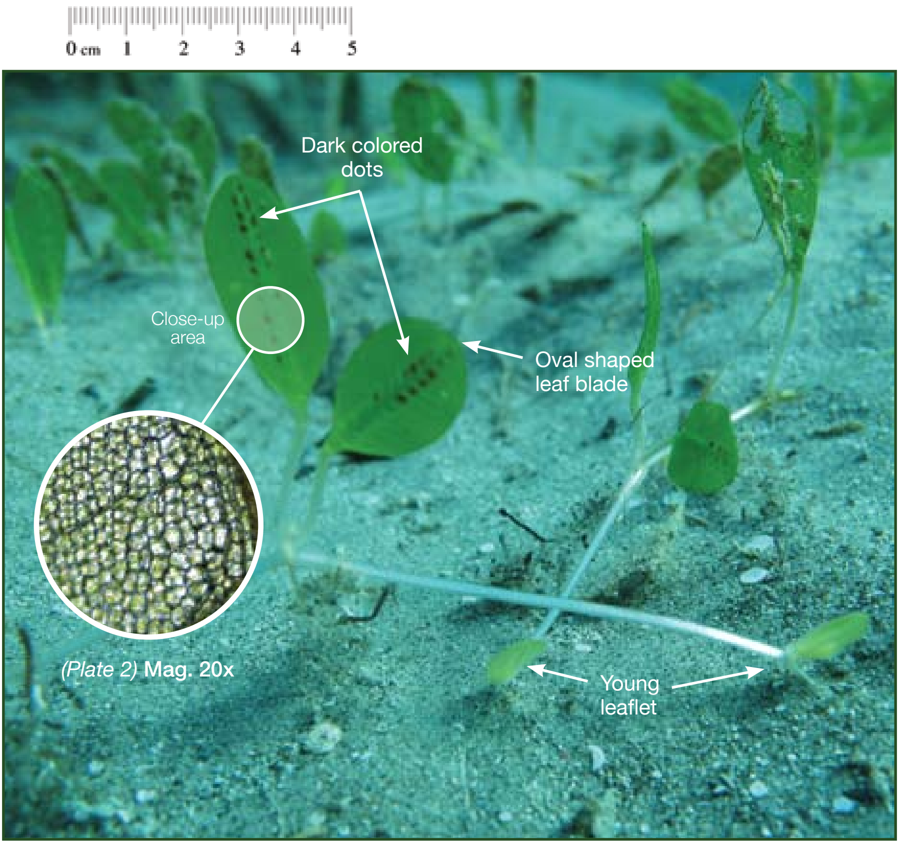
- Pairs of oval shaped leaves on petioles (Plate 3).
- No hairs on leaf surface and smooth leaf margin (Plate 4).

Diagnostic Features

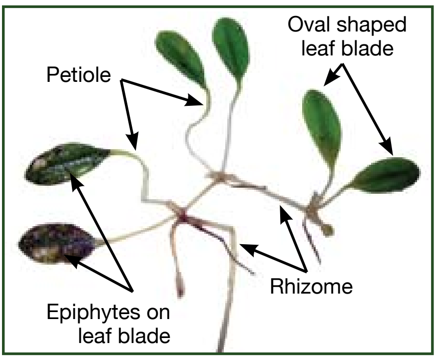
- Ten to twenty-eight branched cross veins ascending at 45-60 degrees on both sides of the mid vein (Plate 4).

Habitat

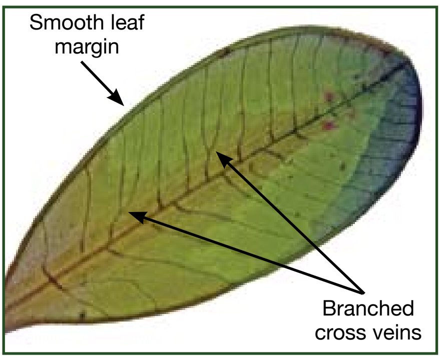




(Plate 1)



(Plate 3)



(Plate 4) Mag. 2x

Halophila ovata

Gaudichaud

Halophila ovata (Plate 1) is less common than *Halophila ovalis*, which is structurally similar. Published observations of this species in the Red Sea are from the Gulf of Suez (Jacobs & Dicks, 1985), from near Jeddah on the Saudi Arabian coastline (Aleem, 1979) and off the Yemeni coast (Barratt, et al., 1987). The Author has also collected this species from a range of sites in southern Egypt. *Halophila ovata* has been recorded in 20 m of water in the Gulf of Suez (Jacobs & Dicks, 1985), but it is probably more common in shallower waters (Jones, et al., 1987).

Morphology

Leaf

The leaf blade is oval shaped (Plate 2), and ranges between 0.8-1.3 cm in length and 0.4-0.8 cm in width. There is no leaf sheath, but two scales cover the petiole base. There are 4-10 leaf veins, with a wide space between the cross veins that are unbranched. The leaf margin has smooth edges with no hairs on the leaf surface.

Stem

The petioles arise directly from the rhizome.

Rhizome
The rhizome is smooth, thin and light-colored.

Microscopic Leaf Anatomy

Cells not in rows. Cells irregular in arrangement or have a "jigsaw" appearance.

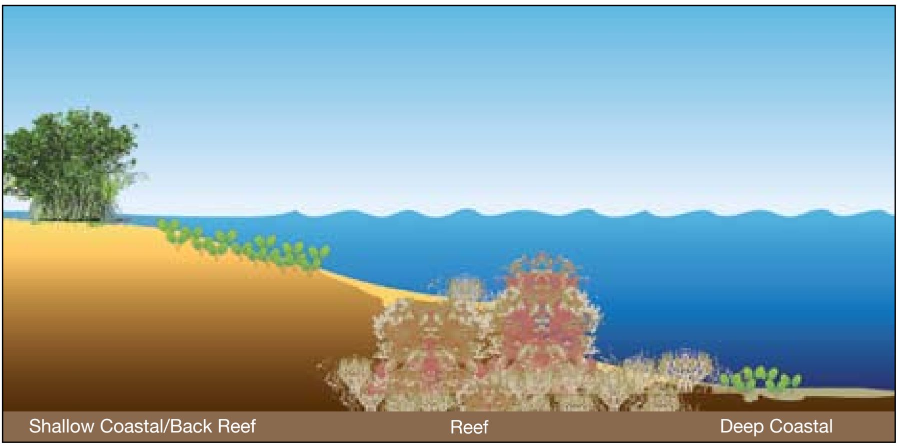
Similar Species

- *Halophila ovalis* has a more elongated leaf blade and more cross veins.
- *Halophila decipiens* has fine hairs on the leaf surface and the leaf blade is serrated.

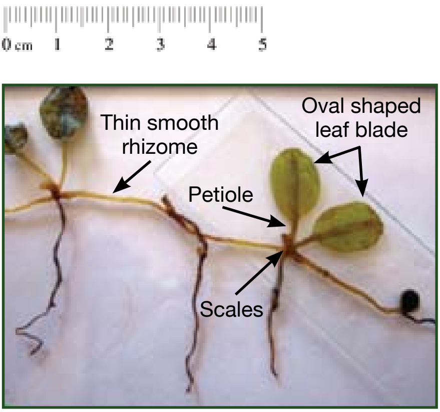
Key Features
- Smooth leaf margin and no hairs on the leaf blade (Plate 3).
- Oval shaped leaf blade, 0.8-1.3 cm long and 0.4-0.8 cm wide (Plate 3).

Diagnostic Features
- Four to ten unbranched cross veins and wide space between the cross veins (Plate 3).

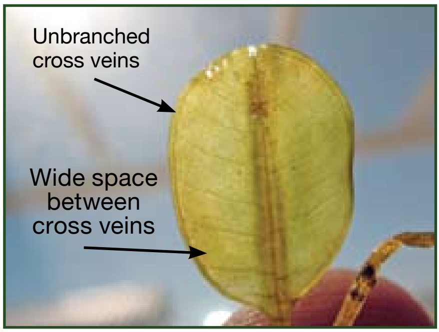
Habitat



(Plate 1)



(Plate 2)



(Plate 3)

Halophila stipulacea

(Forsskål) Ascherson

Halophila stipulacea (Plate 1) has been recorded from all countries bordering the Red Sea (Green & Short, 2003), and is one of the most common species. It is more abundant in the northern Red Sea compared with the central and southern Red Sea (Green & Short, 2003). This species has been recorded from shallow depths to 70 m of water (Lipkin, 1979). It entered the Mediterranean Sea after the Suez Canal was built, and is now found in many areas of the eastern Mediterranean as an introduced species. In the Egyptian Red Sea, this species commonly occurs in large single-species meadows in water depths exceeding 10 m. Specimens tend to be larger in deeper water (Lipkin, 1979), which may be an adaptation to lower levels of light at greater depths.

Morphology

Leaf

The leaf blade is up to 6 cm long and 0.8-1.0 cm wide, and is linear to oblong in shape. The leaf sheath is a large transparent scale covering a short petiole. Leaf veins consist of 10-40 branched cross veins with a clear and obvious mid vein (Plate 1). An unusual leaf structure observed in the Red Sea is called 'bullose', which is a bulging section on the leaf surface (Waycott, et al., 2004). The leaf margin is serrated and minute hairs may be present on one side of the leaf surface. The leaf tip is rounded, and distinctly serrated.

Stem

Two short stems, each carrying two leaves.

Rhizome

The rhizome is smooth with long internodes and the rhizome is always covered by leaf scars at the stem base.

Microscopic Leaf Anatomy

The leaf contains large cells that are angular to hexagonal in shape (Plate 2).

Similar Species

- *Halophila decipiens* has hairs on both side of the leaf blade.

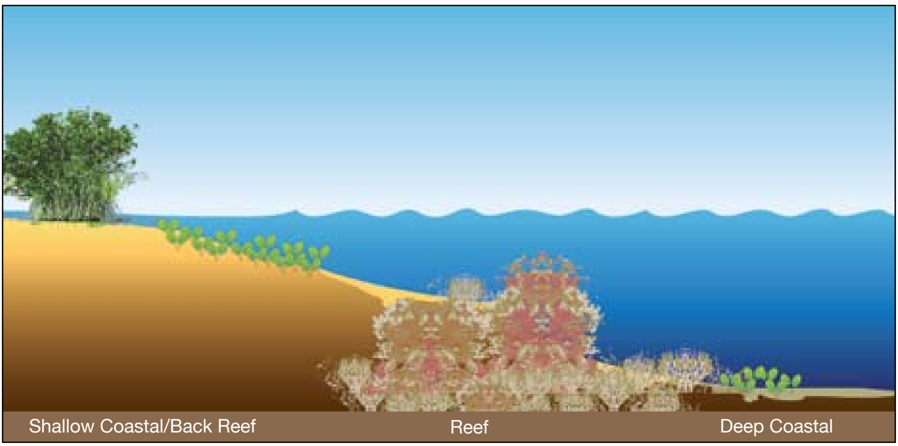
Key Features

- Length of leaves is long compared to the width and short stems (Plate 3).
- Leaf margin serrated (Plate 4).
- Clear obvious mid vein with branched cross veins (Plate 4).
- Bulging sections (bullose) between the veins on the leaves (Plate 5).

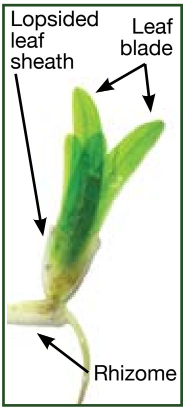
Diagnostic Features

- The leaf sheath is a large transparent scale covering the short stem to form a lopsided structure on each leaf pair (Plate 6).

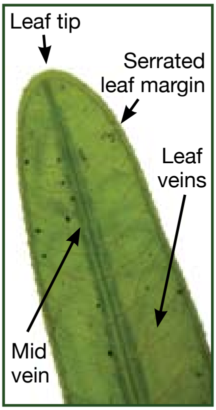
Habitat



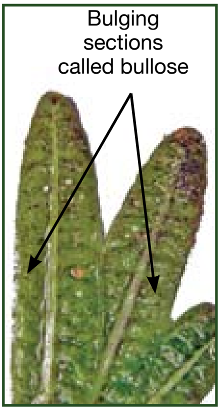
(Plate 1)



(Plate 3)



(Plate 4) Mag. 4x



(Plate 5) Mag. 2x

(Plate 6) Mag. 2x

Thalassia hemprichii

(Ehrenberg) Ascherson

Thalassia hemprichii (Plate 1) is a widespread species throughout the Red Sea, including the Gulf of Aqaba, but has not been reported in the Gulf of Suez. On the eastern side of the Red Sea, the abundance of this species increases southward (Price, et al., 1988).

Morphology

Leaf

The blade of the leaf is up to 40 cm long, but typically much shorter, and 0.4-1.0 cm wide. The leaf blade is ribbon-like and often slightly curved with obvious large cells grouped in red or black bars. The leaf sheath is well developed and there are 10-17 longitudinal leaf veins (Plate 1). The margin of the leaf is smooth except for the leaf tip, which has fine serrations and is rounded.

Stem

The stem is short and erect, bearing 2-6 leaves.

Rhizome

The rhizome is thick and covered with triangular shaped leaf scars.

Microscopic Leaf Anatomy

Cell shape can range from circular to rectangular with red or black colored cells arranged in regular bars (Plate 2).

Similar Species

- Both species of *Cymodocea* have a smooth rhizome without scars and lack obvious cells arranged in dark bars.

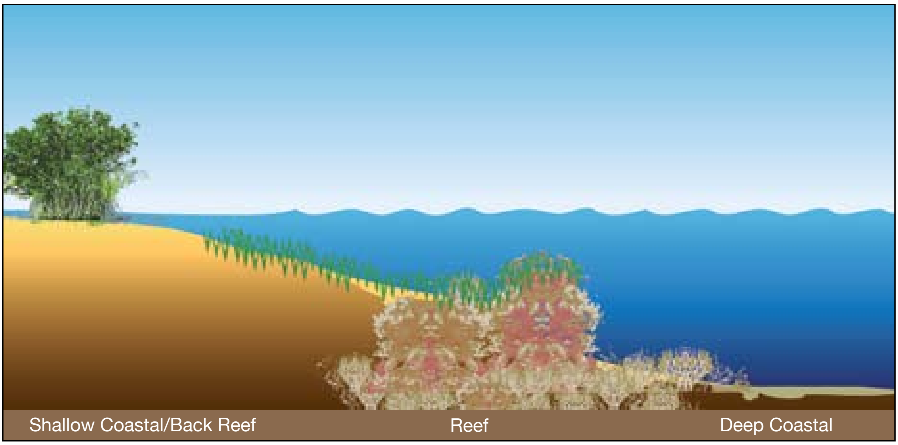
Key Features

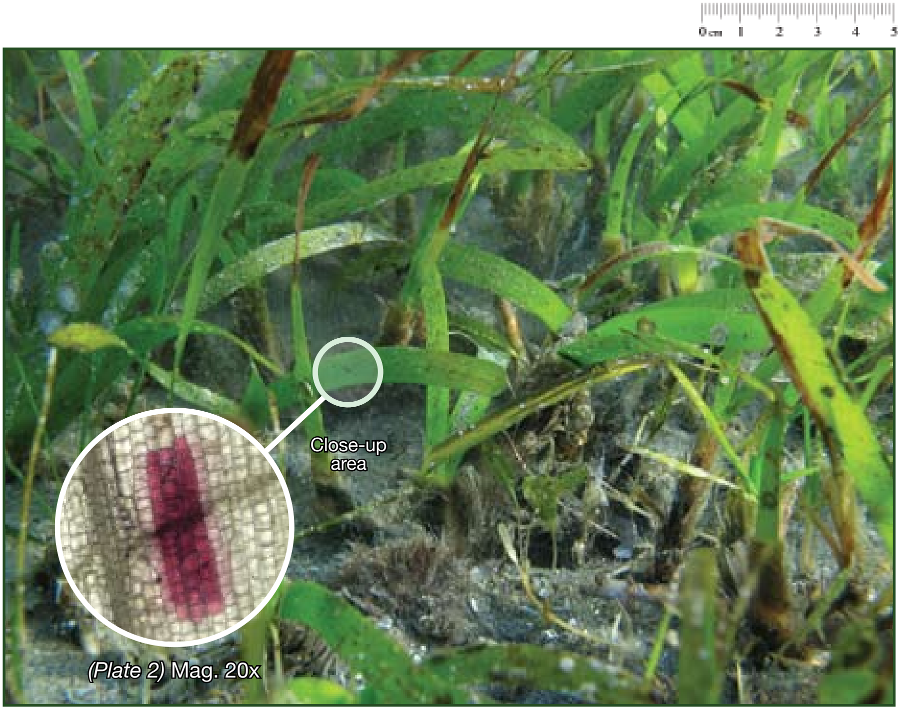
- Rhizome is thick and covered by obvious triangular leaf scars (Plate 3).
- Ribbon-like leaves arise from short erect stem with fully enclosed leaf sheath (Plate 3).

Diagnostic Features

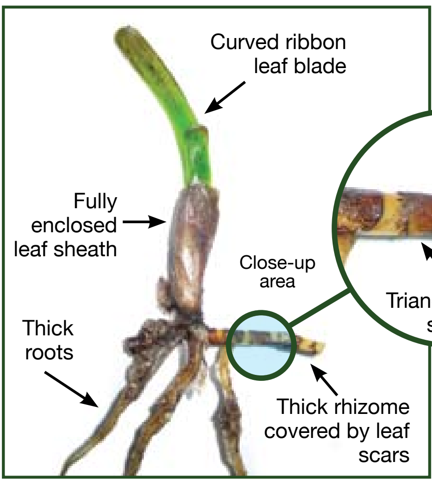
- Curved leaves with clearly visible red or black cells arranged in bars running along the blade (Plate 4).

Habitat

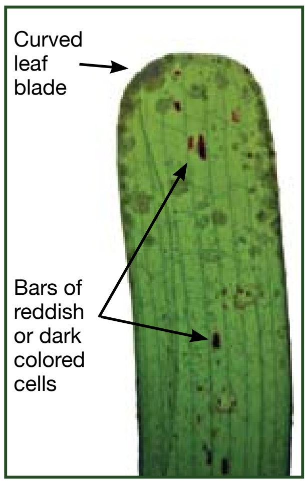




(Plate 1)



(Plate 3)



(Plate 4) Mag. 2x

Glossary

Bullose: bulb-shaped or bulging surface.

Diversity: variety, often expressed as a function of a number of species in a sample.

Epiphyte: plants growing on the surface of other plants.

Internodes: the part of the rhizome between two nodes.

Leaf scars: the marks remaining on the rhizome or stem of a plant after a leaf has died.

Leaf sheath: the protective cover for the young leaves, it encloses the growing tip of the rhizome.

Leaf scale: a modified leaf, often small and membranous.

Leeward: side protected from the wind.

Nodes: the point on a plant rhizome from which the leaves and lateral shoots grow.

Seagrass meadow: a large expanse of seagrass plants.

Sediment: matter that settles to the bottom of a water body.

Subtidal: beneath the low watermark.

Vein: the clearly defined vascular bundle in a leaf, usually seen as slightly darker lines forming the framework of a leaf.

Windward: side exposed to the wind.

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About the Guide

This guide answers many questions about seagrass identification, habitats, distribution and diversity in the Red Sea. It provides a useful resource for students, biologists, managers of marine resources and tourists who share an interest for these marine flowering plants.

This guide contains clear field photographs of the distinctive features of each species to facilitate accurate identification for beginners and experts alike.