

Seagrasses of the Great Barrier Reef

JANET LANYON



Illustrations Geoff Kelly



Great Barrier Reef Marine Park Authority
Special Publication Series (3)

Guide to the Identification of Seagrasses in the Great Barrier Reef Region

JANET LANYON

**Illustrations
Geoff Kelly**



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Janet Lanyon
November 1985

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INTRODUCTION

Seagrasses occur in many areas along the coast of northern Australia and are significant components of the flora of the Great Barrier Reef region. Recent field studies aimed at mapping seagrass beds in northern Australia (van R. Claasen et al., 1984; Coles et al., in press) have revealed that seagrasses occur along the length of the Great Barrier Reef lagoon to Torres Strait. In recent surveys conducted by the Commonwealth Scientific and Industrial Research Organisation (CSIRO), Division of Fisheries, seagrasses have been found in reef, inter-reef and offshore island situations throughout Torres Strait. Although reefs within the Great Barrier Reef Marine Park have not been comprehensively surveyed for seagrasses, preliminary studies (e.g., Zell, 1983) indicate that they may also commonly occur on many of these reefs, in habitats extending from intertidal to completely subtidal situations.

Little research has been carried out on the ecological role of tropical seagrasses, particularly in a reef environment. Factors such as local topography, substrate type and stability, tidal exposure, water clarity and salinity may be important in determining species distribution, however the influence of these is poorly understood. For instance, it is widely thought that the photosynthetic nature of seagrasses restricts them to shallow water (less than 35 metres), however some specimens have been recovered from depths of up to 68 metres within the Great Barrier Reef region (P. Arnold, pers comm., 1985). The discovery of a new species of seagrass within the Great Barrier Reef region as recently as 1979 is indicative of the present poor state of knowledge.

Seagrass meadows support a rich and diverse fauna and flora, providing sheltered, nutrient-rich habitat. In northern Australia, seagrass meadows are generally considered to be of major importance as nursery grounds for commercial prawn species (Penaeidae) (Coles et al., 1985). They also serve as sheltered refuges and perhaps feeding areas for a number of juvenile pelagic and reef fish. In some coastal areas, it is possible that entire fisheries may depend either directly or indirectly on the tropical seagrass ecosystem (McRoy and Helfferich, 1977).

Seagrass meadows constitute a major food source in detrital-based food chains in coastal waters, as well as providing a direct food source for a number of grazing animals (Phillips and McRoy, 1980). Within the Great Barrier Reef region, two large vertebrates are

included in the group of animals which graze on seagrasses - the dugong, *Dugong dugon*, and the green turtle, *Chelonia mydas*. While the relationships between faunal communities and their seagrass habitat need further investigation, it is already obvious that protection of seagrass meadows is vital to ensure the long term survival of a number of commercial and non-commercial species.

At present, there are no proven immediate large-scale threats to seagrass beds within the Great Barrier Reef region, but an awareness of potential causes of seagrass depletion is critical if this is to be prevented. Larkum and West (1982) suggest a number of man-induced threats. The effects of dredging and commercial fishermen using bottom trawls are perhaps the most relevant and important of these in this region.

Clearly there is a need for broad-scale mapping and ecological studies of seagrasses within the Great Barrier Reef Marine Park, with subsequent effort to encompass, monitor and conserve important seagrass areas within a management context. The purpose of this publication is to make available a means of quickly and easily identifying the seagrass species likely to be encountered within the Great Barrier Reef region. The most comprehensive work on seagrass identification and taxonomy is undoubtedly that of den Hartog (1970), although even since that publication, some of the nomenclature has changed and a new species has been discovered within the Great Barrier Reef region. Since den Hartog's monograph was never widely available and is often difficult for the novice, I have attempted to put together a guide which is at once adequate for the seagrass ecologist, yet simple enough for the layman. Within the guide, I have concentrated on the most obvious morphological features of adult plants of each species. The descriptions are based on den Hartog's work and other relevant literature plus my own experience. The seagrass species are described in alphabetical order irrespective of family.

This document was initially prepared as part of a seagrass workshop (supported by Fishing Industry Research Trust Account funds), which was held at the Northern Fisheries Research Centre, Queensland Department of Primary Industries, Cairns on 3-5 December 1984.

SEAGRASS STRUCTURE

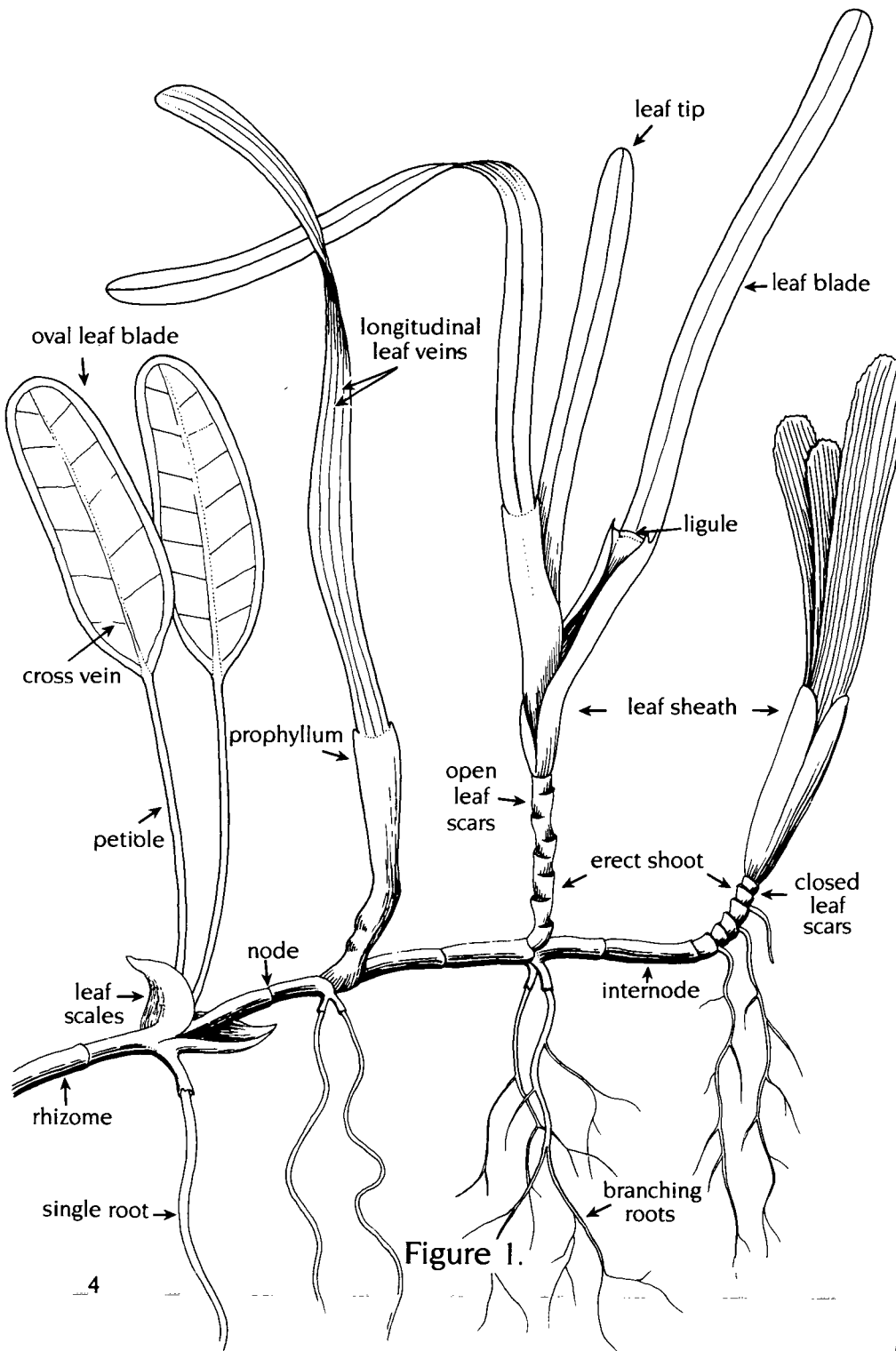


Figure 1.

GENERAL MORPHOLOGY

Seagrasses belong to the subclass Monocotyledoneae within the class Angiospermae, or flowering plants. As true vascular plants, seagrasses are structurally and functionally broadly similar to terrestrial grasses, and as such, are differentiated into discrete morphological entities- the leaves, stems, roots and reproductive structures (flowers and fruit). Since they are submerged for either part or all of their life cycle, they have mostly adopted means of underwater pollination.

A diagrammatic representation of a 'typical' seagrass is shown on the facing page (Figure 1). It should be noted that this is a composite diagram to illustrate structural features and does not mirror a particular species.

All seagrasses are rhizomatous in habit, which means that they possess rhizomes and are dependent upon the growth and branching of these for vegetative propagation. A **rhizome** is a horizontal underground stem. Scars from old leaves (**nodes**) divide the rhizome into **internodes**, i.e., the areas between successive leaf scars, of varying length. Although the rhizome mainly runs horizontally, some lateral branches are more or less erect and bear leaves. These are referred to as erect **shoots**, and may vary in length from a millimetre or less, to over half a metre.

The **roots** serve some of the same functions as those of terrestrial plants, i.e., to anchor the plants and absorb nutrients. Since seagrasses inhabit an aquatic environment, the roots do not play a significant role in water uptake (compared to terrestrial grasses), and nutrients are also absorbed directly from the water column through the leaves. However, being submerged does present a problem in terms of oxygen acquisition and seagrasses have subsequently developed air channels in the leaves and stems. On the other hand, the aquatic medium has eliminated the need for a fibrous support system.

The growing tips, or meristems, which continuously produce new plant tissue, are located at the apices of the rhizome and its branches. The leaf base or **sheath** encloses the growing tip of the rhizome and protects young leaves. The **leaf blades** are long and grass-like in many seagrass species (with the notable exception of the genus *Halophila*) and fulfil photosynthetic and vascular functions. In the case of a few *Halophila* species, the leaf is divided

into a distinct stalk or **petiole** plus the blade. Other *Halophila* species have compound leaves, each leaf being made up of a number of leaflets arranged around a common stalk. A **prophyllum** is a single leaf arising immediately from the horizontal rhizome instead of from an erect shoot. This feature is unique to the genus *Zostera*.

The **ligule** is a short membranous flap on the upper, inner side at the junction of the leaf blade and the sheath, and is present in some species only. In fact, this single character is sufficient to divide seagrass species into one or other of the two recognized families (see Taxonomy).

SEAGRASS VERSUS SEAWEED

There are over 500 described species of algae (seaweed) in Great Barrier Reef waters, compared with only 14 known species of seagrass. The possibility of confusing these two groups of aquatic plants is, for the most part, unlikely, nevertheless it must be regarded as a potential problem for the botanical novice. I know of at least two species of green algae which could be mistaken for the 'fern-like' seagrass, *Halophila spinulosa*, but only when viewed from a distance. There are a number of obvious morphological differences between seagrasses and seaweeds upon closer inspection.

Seagrasses have a prostrate stem (rhizome) which is typically buried in the sandy or muddy substrate; the rhizome system may be very extensive. Leaves are produced on erect branches and usually only the leafy part of the plant emerges from the substrate; the leaves are generally green. The stems, roots and leaves of seagrasses contain lignified conducting tissue (veins) and air channels. Seagrasses are flowering plants and as such produce flowers, seeds and fruit, though these do not necessarily resemble their terrestrial counterparts.

Only occasionally do algae become large and complex with differentiation into organs that resemble leaves, stems and roots. If an alga does possess a prostrate axis, it is rarely extensive and almost always lies above the substrate. Leaflike organs, if present, never have lignified conducting tissue or air channels, though gas-filled floats may be produced. Algae vary greatly in colour; some are green but many are brown or reddish; the colour may be uniform across the entire algal body (thallus). Algae never form flowers, seeds or fruits.

TAXONOMY

Out of a total of 12 genera of seagrasses known worldwide, eight are represented in the Great Barrier Reef region. These fall into two families, Potamogetonaceae and Hydrocharitaceae. The following 14 seagrass species are likely to be encountered in tropical Queensland waters.

Family **Potamogetonaceae**: leaves possess a ligule

Cymodocea rotundata Ehrenb. et Hempr. ex Aschers.

Cymodocea serrulata (R. Br.) Aschers. and Magnus

Halodule pinifolia (Miki) den Hartog

Halodule uninervis (Forsk.) Aschers. in Boissier

Syringodium isoetifolium (Aschers.) Dandy

Thalassodendron ciliatum (Forsk.) den Hartog

Zostera capricorni Aschers.

Family **Hydrocharitaceae**: leaves lack a ligule

Enhalus acoroides (L.F.) Royle

Halophila decipiens Ostenfeld

Halophila ovalis (R.Br.) Hook. F.

Halophila ovata Gaud. in Freycin

Halophila spinulosa (R.Br.) Aschers.

Halophila tricostata Greenway

Thalassia hemprichii (Ehrenb.) Aschers.

SPECIES DESCRIPTIONS

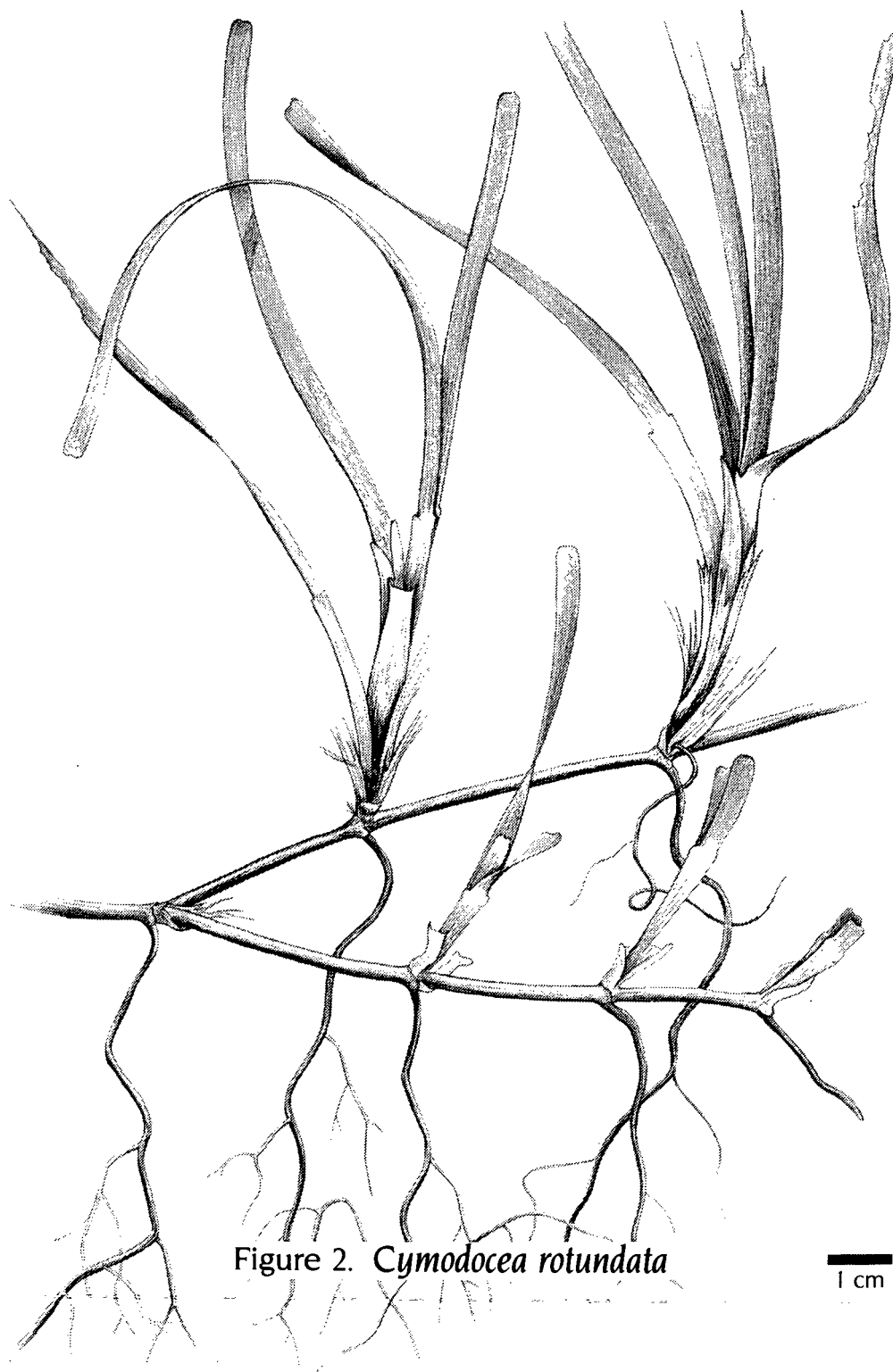


Figure 2. *Cymodocea rotundata*

1 cm

GENUS CYMODOCEA

FAMILY: Potamogetonaceae

SPECIES: *Cymodocea rotundata*
Cymodocea serrulata

CYMODOCEA SPP

Morphology

The two *Cymodocea* species are rather robust seagrasses with ribbon-like curved leaves, smooth herbaceous rhizomes and well developed leaf sheaths. There are a number of features which easily separate the two species.

Diagnostic features

Smooth rhizome with no scars between successive shoots. Linear strap-like leaves.

Cymodocea rotundata

Morphology

C. rotundata has a smooth, herbaceous rhizome with a short erect lateral shoot at each node, bearing 2-7 leaves (Figure 2). The leaf sheath is well developed (1.5-5.5 cm long), often pale purple in colour and is not shed along with the blade. When the leaf sheaths are shed, they leave closed circular scars on the shoot. A ligule is present. The leaves are linear to somewhat curved, flat and strap-shaped, 7-15 cm long and 2-4 mm wide. There are 7-15 longitudinal veins in the leaves, and often numerous tannin cells in circular-shaped aggregations. The leaf tip is bluntly rounded (or obtuse) and sometimes appears slightly heart-shaped to the naked eye, often with very faint serrations (Plate 1a). Little phenotypic variation has been recorded in this species.

Diagnostic features

Leaf sheath scars form a continuous ring around the shoot — annular appearance. Well developed leaf sheath. Rounded leaf tip, 7-15 veins.

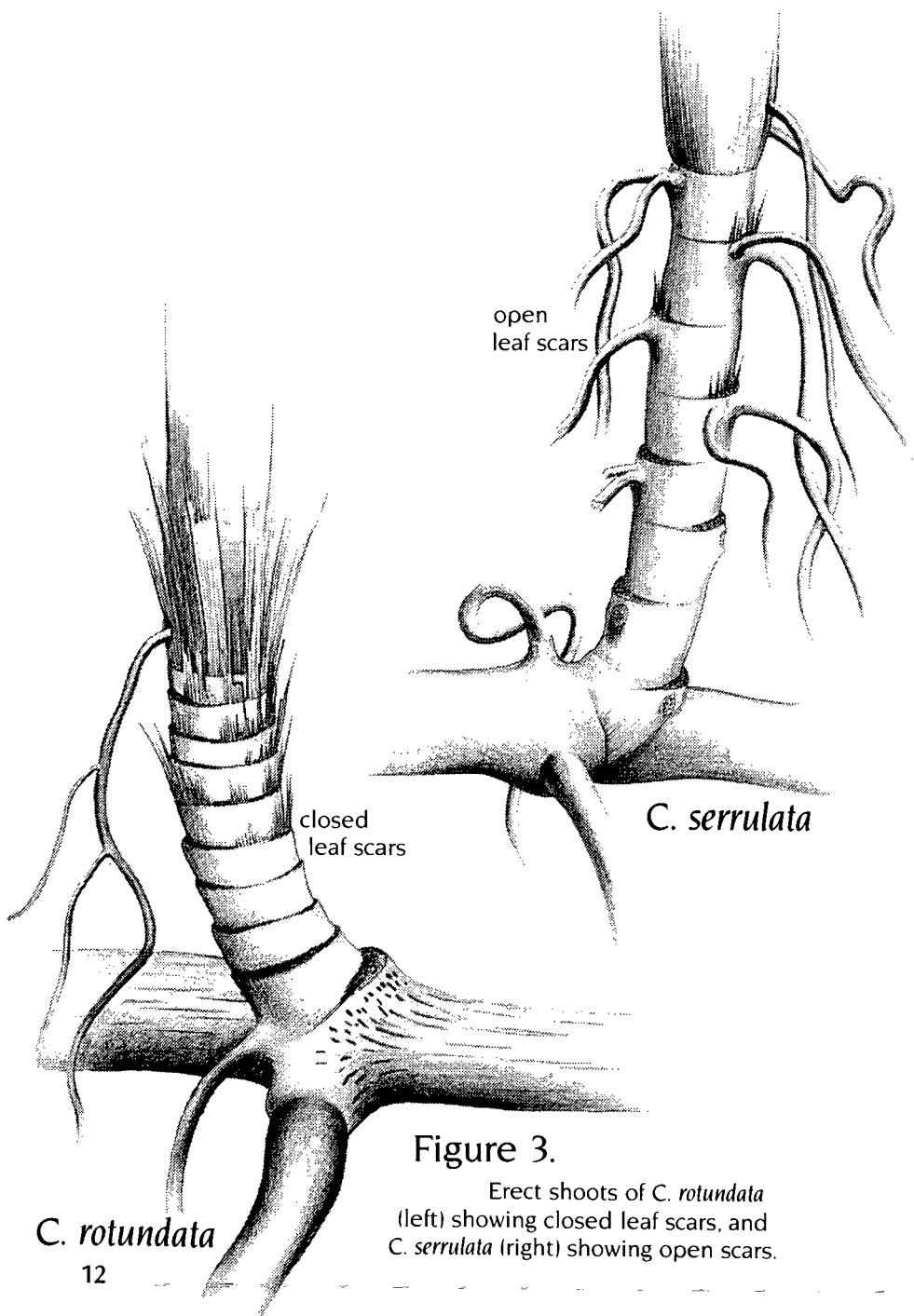


Figure 3.

Erect shoots of *C. rotundata* (left) showing closed leaf scars, and *C. serrulata* (right) showing open scars.

C. rotundata

Likely to be confused with

Cymodocea serrulata

C.rotundata has narrower leaves than *C.serrulata* and the leaf sheaths are not so conspicuously flattened and triangular. The shoot of *C.serrulata* has open leaf sheath scars, whereas the shoot of *C.rotundata* has closed scars (they are continuous around the shoot) (Figure 3). *C.rotundata* may also be distinguished from *C.serrulata* by the morphology of the leaf tip. To the naked eye, *C.rotundata* has an almost smoothly rounded tip whereas the leaf tip of *C.serrulata* is distinctly serrated.

Thalassia hemprichii

Thalassia hemprichii has a thicker rhizome than *C.rotundata* and the rhizome is marked by several scars between successive erect shoots. In contrast, the rhizome of *C.rotundata* is smooth between shoots. *T.hemprichii* lacks a ligule, a feature possessed by *C.rotundata*. *C.rotundata* can also be distinguished by the shape of tannin cell aggregations. In *C.rotundata* these are circular, whereas in *T.hemprichii* they are markedly rodshaped.

Thalassodendron ciliatum

T.ciliatum has generally wider (6-10 mm compared to *C.rotundata*'s 2-4 mm), and more strongly curved leaves than *C.rotundata*. The leaves of *T.ciliatum* originate from an elongate erect shoot (10-65 cm long), in contrast to the shoot of *C.rotundata* which is relatively short (up to 1-2 cm long).

***Halodule* species**

C.rotundata is easily distinguished from species of *Halodule* by the number of longitudinal veins in the leaves; 9-15 in *C.rotundata* and characteristically three in *Halodule*. The form of the leaf tip is another good distinguishing character, since the rounded, sometimes slightly serrated leaf tip of *C.rotundata* differs conspicuously from the narrower, irregularly serrated tip of *H.pinifolia* and the three-pointed tip of *H.uninervis*.

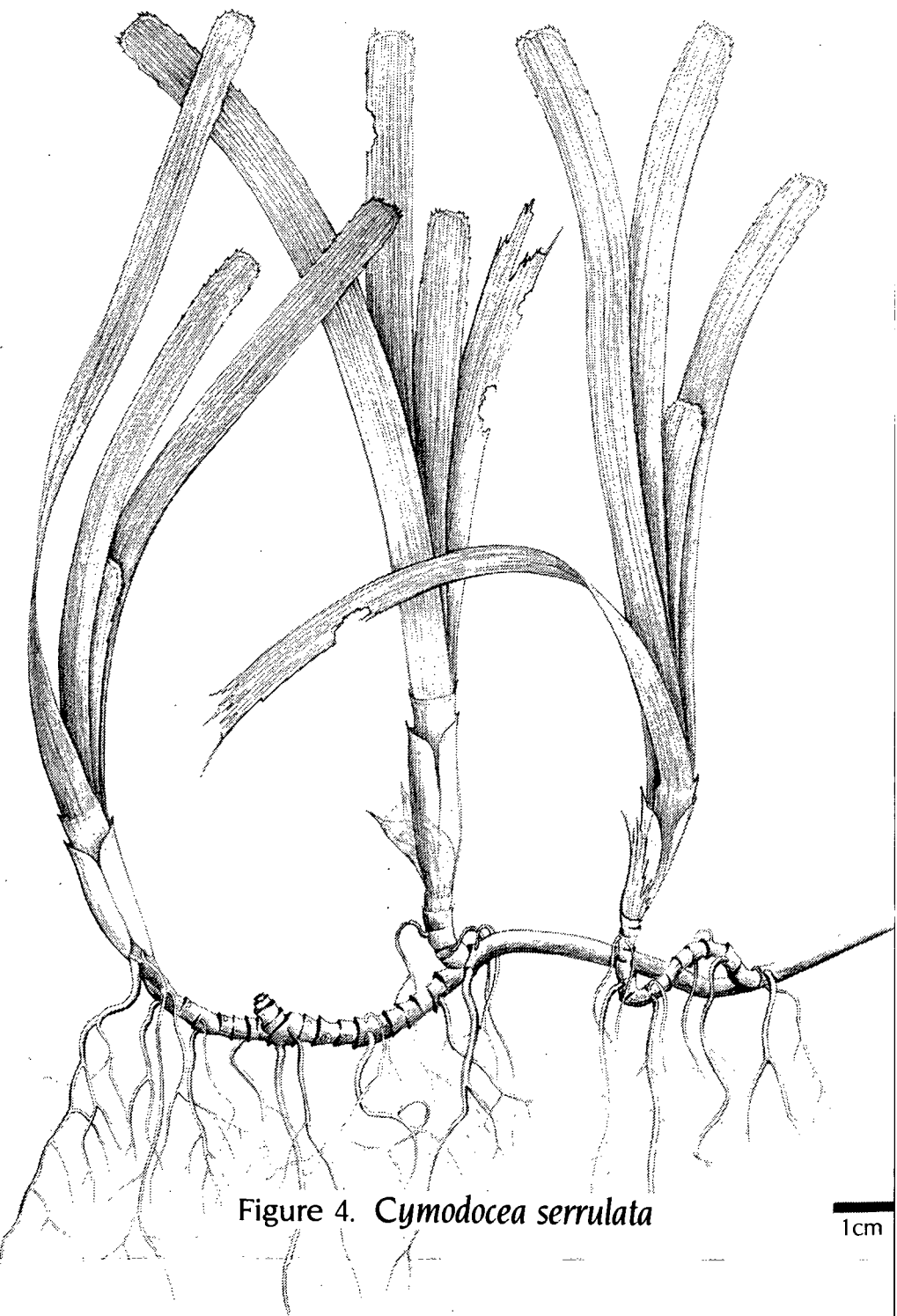


Figure 4. *Cymodocea serrulata*

1cm

Cymodocea serrulata

Morphology

C. serrulata has, like *C. rotundata*, a smooth, herbaceous (if a little more robust) rhizome system, which produces short, erect shoots often with fibrous rootlets at each node, each shoot bearing 2-5 leaves (Figure 4). Unlike *C. rotundata*, the leaf sheath of *C. serrulata* is broadly triangular and narrowed at the base. It is often a purple colour in the living plant. When shed, the sheaths leave open circular scars on the shoot. A ligule is present. The leaf blade is linear to somewhat curved, 6-15 cm long and 4-9 mm wide, with 13-17 longitudinal veins. The leaf is narrowed at the base and the leaf tip is bluntly rounded and distinctly serrated. (Plate 1b). Tannin cells are present in circular-shaped groups. Phenotypic variation is generally minimal.

Diagnostic features

Shoot with distinctive open leaf scars, i.e., scars are not continuous around the shoot. Triangular, flat leaf sheath. Fibrous roots on shoot. Serrated leaf tip. 13-17 longitudinal leaf veins.

Likely to be confused with

Cymodocea rotundata

C. serrulata may be distinguished on the basis of leaf tip morphology and differences in shoot and leaf sheath form (Figure 3).

Thalassia hemprichii

C. serrulata is commonly confused with this species, however it may be distinguished by differences in the shape of the tannin cell aggregations — round in *C. serrulata*, rod-shaped in *T. hemprichii*. More conspicuous are the rhizome differences. *T. hemprichii* has a rhizome with scars between successive erect shoots while the rhizome of *C. serrulata* is smooth between shoots.

Thalassodendron ciliatum

C. serrulata has short erect shoots, compared to the elongate 10-65 cm shoots of *T. ciliatum*; also an herbaceous rhizome, compared to *T. ciliatum*'s tough 'woody' rhizome. *T. ciliatum* has scars on the rhizome between successive erect shoots; *C. serrulata* lacks these.



Figure 5. *Enhalus acoroides*

1 cm

GENUS ENHALUS

FAMILY: Hydrocharitaceae

SPECIES: *Enhalus acoroides*

Enhalus acoroides

Morphology

E.acoroides is a very distinctive seagrass unlikely to be confused with any other species. Besides being the most massive of the northern Australian seagrasses, both the above and belowground structures are quite characteristic (Figure 5).

The leaves are very long and ribbon-like (30-150 cm long, approx. 1.25-1.75 cm wide), with many parallel veins, generally dark green in colour and thick and tough (hard to tear). Contributing to this apparent 'toughness' are the raised margins along the sides of the leaves, caused by inrolling and thickening of the lateral edges.

E.acoroides is the only seagrass to show this feature. Perhaps an even more striking characteristic is the thick rhizome (at least 1 cm thick) and the long, black fibrous bristles it supports. These fibres are actually remnants of a leaf sheath. The roots are cordlike (approximately 3-5 mm thick) and numerous. There is no ligule. The leaf tips are rounded or blunt and often asymmetrical (Plate 1c); slight serrations are visible on young leaves. The leaf tips are often damaged by grazing herbivores or rough weather. Leaf tips, therefore, are not a consistently useful character in *E.acoroides*. Variation in leaf length may be considerable.

Diagnostic features

Thick rhizome with long black bristles and cord-like roots. Very long ribbon-like leaves; inrolled leaf margins. The 'largest' of the seagrasses.

Likely to be confused with

E.acoroides is unlikely to be confused with any other species. However in a field situation and when viewed from a distance, it may be confused with other straplike genera such as *Cymodocea* or *Thalassia*. Closer observation should reveal the unmistakable *Enhalus* characters.



Figure 6. *Halodule uninervis*

1 cm

GENUS HALODULE

FAMILY: Potamogetonaceae

SPECIES: *Halodule pinifolia*
Halodule uninervis

HALODULE SPP

Morphology

Fine, rather delicate seagrasses, *Halodule* species possess a thin, herbaceous rhizome system with a short erect shoot at each node, and fine thin roots (Figure 6). The leaf sheath is well developed and remains in place long after the blade has been shed. The leaf blade is linear and flat. It always has three veins, the midvein being most conspicuous — a good distinguishing character of this genus. A ligule is present. Phenotypic variation is quite high, particularly in *H.uninervis* and the leaves may be of variable width (falling between 0.25 and 5.00 mm), and of variable length, commonly 5 cm or longer. Species are usually distinguished on the basis of leaf tip morphology and to a lesser extent, leaf width. As there is some overlap with respect to leaf widths of the two species, this is often a poor character to use when dividing *Halodule* into its constituent species. In rare instances, leaf tip morphology may also be unreliable and in such cases it is safer to consign specimens to generic level only. Likewise, if leaf tips are unavailable, e.g. in dugong or turtle digesta samples, it is often impossible to key seagrass fragments out to a species level.

Diagnostic features

Thin, herbaceous rhizome, often with numerous leaf scars. Thin linear leaf blades with three longitudinal veins.

Halodule pinifolia

Morphology

The smaller of the *Halodule* species, *H. pinifolia* has leaf widths ranging from 0.25 mm to a maximum width of approximately 1.20 mm. Leaf lengths are generally less than 20 cm. The simplest feature to use in identification is the undamaged leaf tip as the black central vein usually splits into two at the tip. In those cases where the vein is not obviously split, the shape of the leaf tip must be examined. *H. pinifolia* always has a more or less rounded, somewhat irregularly serrated leaf tip (Plate 1d), and this consistently distinguishes it from *H. uninervis*, the leaf apex of which has three distinct points. However, because of the variation in leaf tip morphology, it is advisable to examine several tips.

Diagnostic features

Small, delicate appearance, thin linear leaves, more or less rounded leaf tip, often with the central vein splitting into two at the apex.

Likely to be confused with

Halodule uninervis

H. pinifolia can generally be distinguished from *H. uninervis* on the basis of leaf tip morphology as described above and to a lesser degree on leaf width. This species is unlikely to be confused with any other.

Halodule uninervis

Morphology

H.uninervis exhibits quite variable growth forms (in terms of leaf length and width) but is usually larger than *H.pinifolia*. Some workers have divided *H.uninervis* into two or even three forms, generally on the basis of leaf width, which may range from 0.25-5.00 mm. Although structurally similar to *H.pinifolia*, *H.uninervis* differs markedly in the leaf tip region, where the leaf always ends in three distinct points or teeth (Plate 1e). The lateral teeth are well developed whereas the middle tooth is blunt. Unlike *H.pinifolia*, the black central vein does not usually split into two at the leaf tip.

Diagnostic features

Leaf tip with three distinct points. Black central vein does not usually split into two at leaf tip.

Likely to be confused with

Halodule pinifolia

H.uninervis can usually be distinguished on the basis of leaf tip morphological differences, as described above.

Zostera capricorni

There is a possibility that *H.uninervis* (wide-leaved form) could be confused with *Z.capricorni* as the leaf size and shape of the two species are similar. However, the leaves of *Z.capricorni* tend to be thinner and more translucent than *H.uninervis*, often with distinct cross veins running perpendicular to the five longitudinal veins. In comparison, *H.uninervis* characteristically has three longitudinal veins, and lacks cross veins. *H.uninervis* lacks a prophyllum at each node, a feature limited to the genus *Zostera*.

Cymodocea rotundata

Amongst other characters, *H.uninervis* may be distinguished from *C.rotundata* by the number of longitudinal leaf veins (three in *H.uninervis*, compared to 9-15 in *C.rotundata*). Leaf tip morphology can also be used since *H.uninervis* has three distinct points at the leaf apex compared to *C.rotundata*'s more rounded tip.

Thalassia hemprichii

There is only a remote possibility of confusing *T.hemprichii* with *H.uninervis*. *T.hemprichii* has 10-17 longitudinal leaf veins whereas *H.uninervis* has a characteristic three. *T.hemprichii* also has a thicker rhizome, larger leaves and distinct bars of tannin cells in the leaf blades, which *H.uninervis* lacks.

GENUS HALOPHILA

FAMILY: Hydrocharitaceae

SPECIES: *Halophila decipiens*

Halophila ovalis

Halophila ovata

Halophila spinulosa

Halophila tricostata

HALOPHILA SPP

Morphology

The genus *Halophila* is readily distinguishable from other seagrasses on the basis of leaf form. The leaves are variably oval, elliptical to oblong in shape, as distinct from the strapshaped or curvilinear leaves of other seagrass genera. Leaves may be compound (made up of a number of leaflets), or differentiated into a petiole and blade (petiolate). No ligule is present. Five species are frequently encountered in north Queensland coastal and Barrier Reef waters.

Diagnostic features

Simple, oval-oblong leaf blade, often with distinct petiole; or a compound leaf.

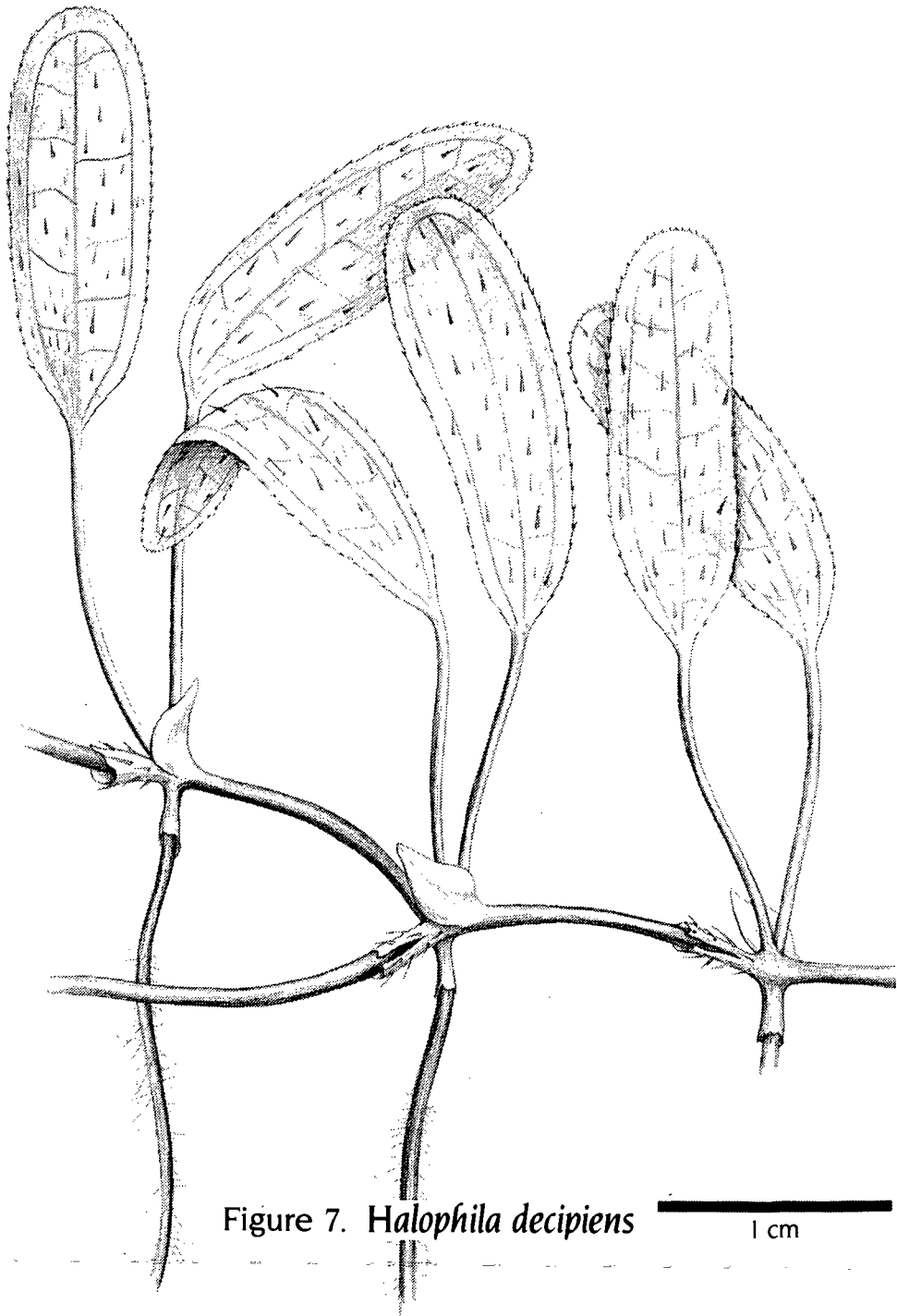


Figure 7. *Halophila decipiens*

1 cm

Halophila decipiens

Morphology

The leaves of *H. decipiens* occur in pairs and consist of a distinct blade and petiole (Figure 7). The leaf blades are typically oval/elliptical in shape, 5 mm wide or narrower and approximately 1.0-2.5 cm in length. The leaf blade is hairy and translucent with prominent marginal and mid veins, the mid vein being most conspicuous. There are 6-9 pairs of cross veins. The margin of the leaf blade is finely serrated along its length; this feature is best observed with a hand lens or low power microscope. The rhizome scales are hairy. *Halophila decipiens* often has a 'dirty' appearance due to sediment entangled in the hairs of the leaves.

Diagnostic features

Translucent, hairy, oval leaves with serrated margin. Prominent venation. Hairy rhizome scales.

Likely to be confused with

Other *Halophila* species, particularly *H. ovalis* and *H. ovata*.

The leaves of *H. decipiens* are generally three times longer than broad, whereas the leaves of *H. ovalis* and *H. ovata* are less elongate, i.e. up to 2.5 times longer than broad. A more obvious feature is the margin of the leaf blade, which is smooth in *H. ovalis* and *H. ovata*, but finely serrate in *H. decipiens*.

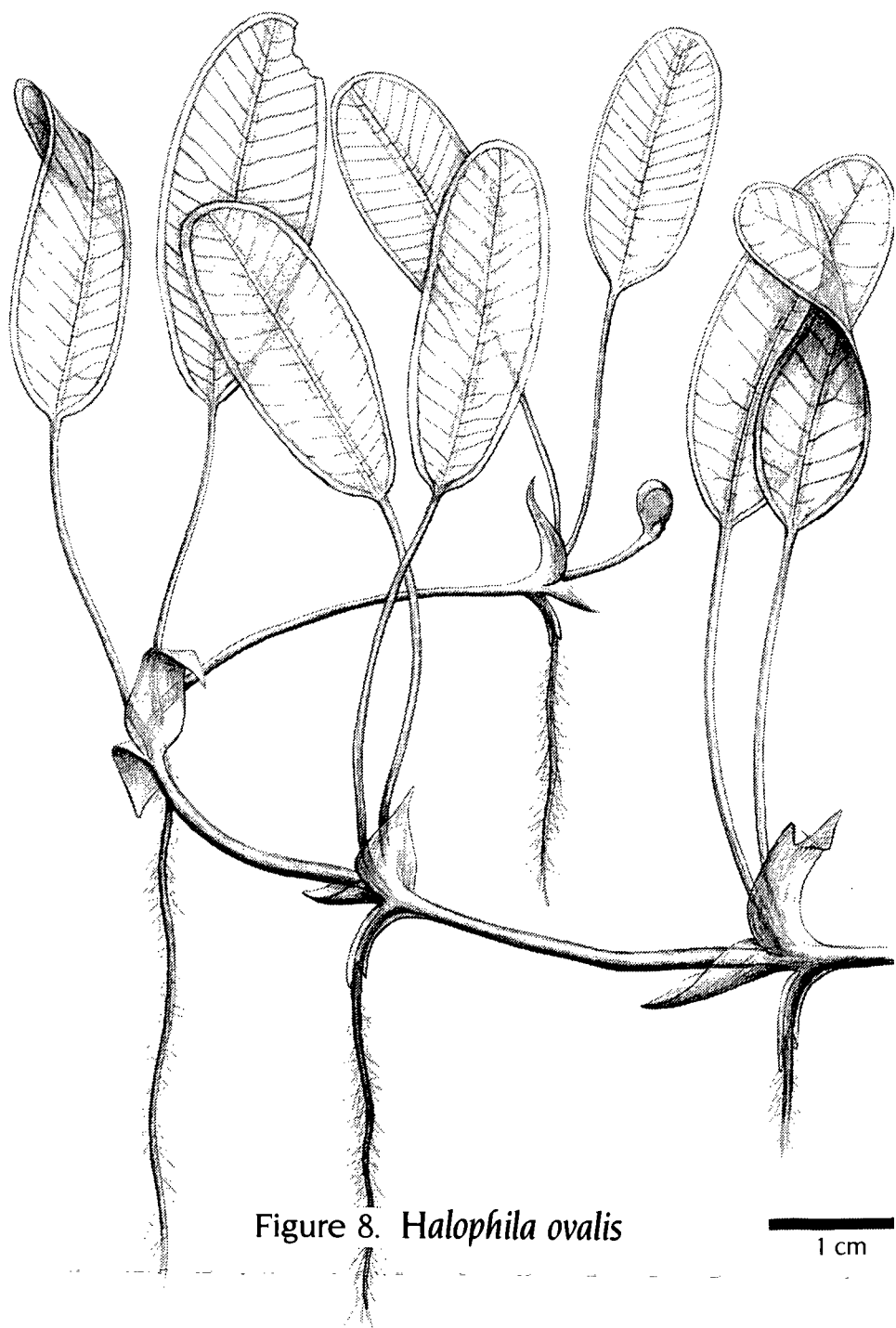


Figure 8. *Halophila ovalis*

1 cm

Halophila ovalis

Morphology

Halophila ovalis could be described as a delicate 'cloverlike' seagrass. Leaves have petioles, occur in pairs and can be morphologically very variable, with leaf blades oval to elliptical in shape, and ranging from 1-4 cm in length; the leaf blade is 0.5-2.0 cm wide (Figure 8). Leaves have 10-25 pairs of cross veins ascending at 45-60 degrees to the mid vein. Intramarginal veins are present and the leaf margin is smooth (Plate 1f). The rhizomes are thin, pale and smooth, and although the leaves often appear to arise directly off the rhizome, there is in fact a very short lateral shoot enclosed in two membranous scales. Fine roots originate at the base of each shoot.

Diagnostic features

Oval-elliptical leaf blade on petiole. 10-25 pairs of cross veins.

Likely to be confused with

Halophila ovata

Generally the leaves of *H.ovalis* are more elongate /elliptical (approximately 2.0-2.5 times longer than broad) than the smaller, more oval leaves of *H.ovata* (approximately 1-2 times longer than broad). These species also differ in the number and angle of cross veins relative to the mid vein. Various authors have questioned the legitimacy of separating *H.ovata* and *H.ovalis*. Although these species are typically distinguished on the basis of leaf length and width, ranges of leaf lengths and widths can show quite a degree of overlap, and it is therefore often difficult to classify intermediate forms. Similarly, the number of cross veins is variable. For these reasons, many workers tend to group these two forms together under the species *H.ovalis*, or classify to generic level only.

Halophila decipiens

The leaf of *H.ovalis* is readily distinguishable from *H.decipiens* by its smooth or entire margin, compared to the finely serrated margin of *H.decipiens*, and perhaps less reliably, on the basis of the length to width ratio. *H.ovalis* leaves are 2.0-2.5 times longer than broad, compared to the leaves of *H.decipiens* which are 2.75-3.25 times longer than broad. In addition, the leaf blade of *H.decipiens* is hairy rather than smooth, and the marginal and mid veins are prominent compared with *H.ovalis*.

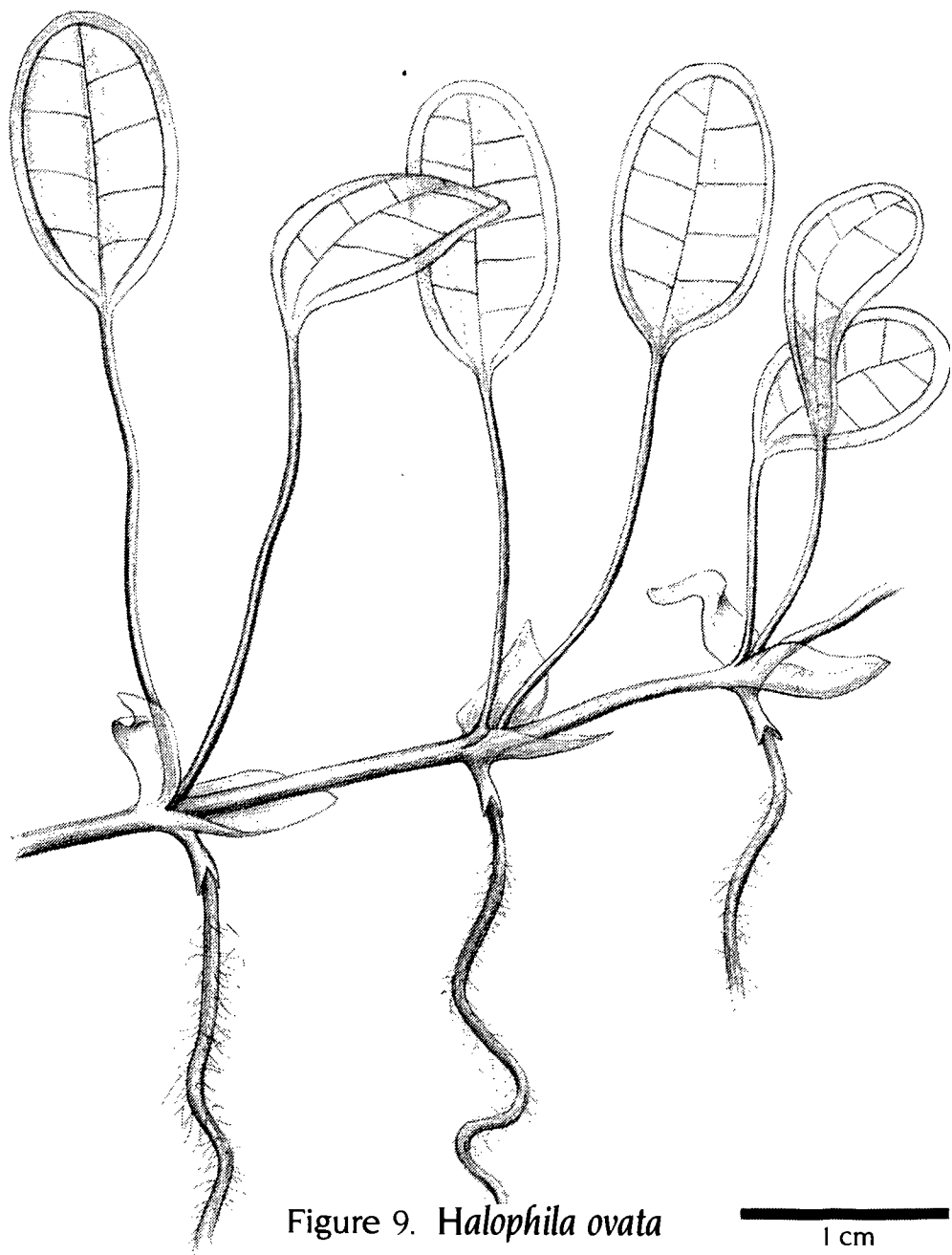


Figure 9. *Halophila ovata*

1 cm

Halophila ovata

Morphology

Within the Great Barrier Reef region, *H.ovata* is a relatively rare seagrass compared to the more commonly encountered *H.ovalis*. Structurally it is very similar to *H.ovalis*, i.e. petiolate leaves and a smooth rhizome, however it is generally smaller all over. The leaf blade is oval, 0.5-1.5 cm long and less than 5 mm wide, possessing 3-10 pairs of cross veins ascending at 70-90 degrees to the mid vein (Figure 9).

Diagnostic features

Small, oval leaf blades on petioles. Generally less than 10 pairs of cross veins.

Likely to be confused with

H.ovalis

See *H.ovalis* 'Likely to be confused with' section.

H.decipiens

H.ovata has a small, oval leaf blade with a smooth margin. This in direct contrast to the leaf of *H.decipiens* which is usually larger and oval - elliptical, with fine serrations along its margin.

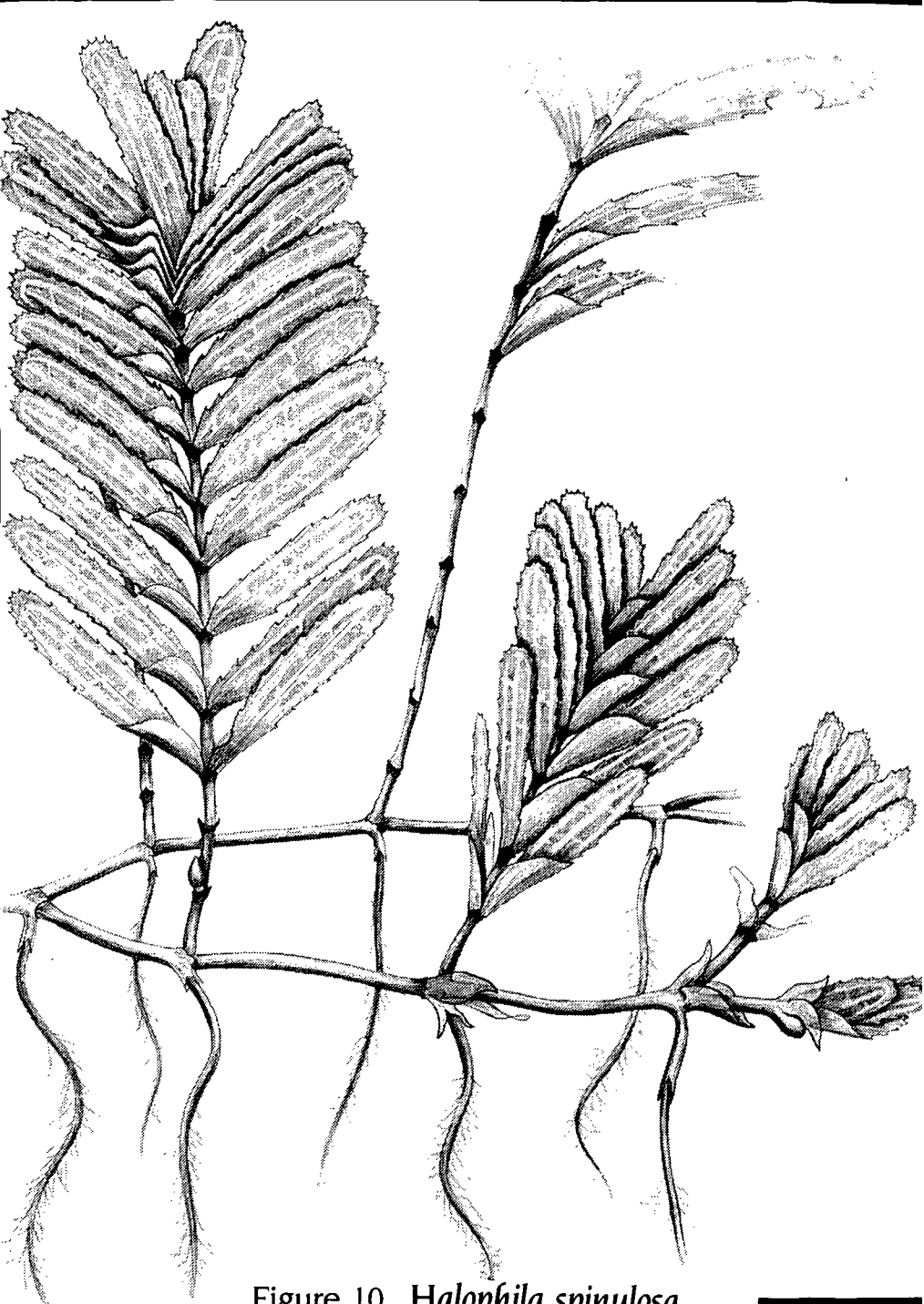


Figure 10. *Halophila spinulosa*

1 cm

Halophila spinulosa

Morphology

The rhizome of *H. spinulosa* gives rise to erect lateral shoots, up to 15 cm long, bearing compound leaves. Each compound leaf is made up of 10-20 pairs of opposite leaflets, lying in a single plane and obliquely arranged around the common stalk (Figure 10). The leaflets are oblong-linear, 1.5-2.5 cm long and 3-5 mm wide, with a serrated edge distinctly visible to the naked eye (Plate 2a). The appearance of *H. spinulosa* could be described as 'fern-like' since the pinnate nature of the leaves bears some resemblance to fern fronds. The rhizomes are thin, sometimes 'woody', and have prominent shoot scars.

Diagnostic features

Compound leaf with serrated leaflets. 10-20 pairs of leaflets per shoot. 'Fern-like'.

Likely to be confused with

Halophila tricostata

Confusion may arise between *H. spinulosa* and *H. tricostata* because both have compound leaves i.e. leaves with a number of leaflets, but *H. spinulosa* has them arranged in definite opposite pairs whereas *H. tricostata* has 2-3 leaflets per node in a whorled arrangement.

Other *Halophila* species

The whole intact plant is unlikely to be confused with any other seagrass, except perhaps *H. tricostata* (see above). However, if examined in isolation, individual leaves may superficially resemble other *Halophila* species. The very serrated margin and oblong-linear shape of *H. spinulosa*'s leaves should distinguish them from leaves of other species.

Green algae

In the field, there is a real possibility of confusing *H. spinulosa* with two species of green algae, *Caulerpa sertularioides* and *C. mexicana*, but the similarity is largely superficial since the algae lack true leaves, roots and a creeping, underground rhizome system. See 'Seagrass versus seaweed' chapter.



Figure 11. *Halophila tricostata*

1 cm

Halophila tricostata

Morphology

A recently discovered species, *H. tricostata* has been found at several locations within the Great Barrier Reef region. As with the other *Halophila* species, the rhizome is thin (approx. 1 mm diameter) and herbaceous, with internodes of 2-3 cm (Figure 11). One root originates from each node. Erect shoots (8-18 cm long) bear the compound leaves, the first shoot node sometimes giving rise to a lateral branch. Each node gives rise to 2-3 leaflets and there are generally 6-18 nodes per shoot. The leaflets are linear-oblong, 1.2-2.0 cm long and 2-4 mm wide. There are no cross veins, however the mid vein and intramarginal veins are conspicuous and ribbed, and the three of these join up just below the apex. Leaf margins are sparsely serrulate; in mature leaves there may be 40-55 spines along the margin. The leaf has a symmetrical wedge-shaped sheath and the leaf tip is obtuse (Plate 2b).

Diagnostic features

Compound leaf with leaflets in whorls of 2-3 at each shoot node; 6-18 nodes per shoot. Wedge-shaped leaf sheath. Three conspicuous ribbed veins in a linear-oblong leaf.

Likely to be confused with

Halophila decipiens

H. decipiens has a distinctive hairy leaf blade and 6-9 pairs of cross veins; *H. tricostata* lacks these characteristics. Whereas the leaves of *H. tricostata* are compound (with leaflets), the leaves of *H. decipiens* are petiolate and occur in pairs.

Halophila ovalis* and *Halophila ovata

Leaves of *H. ovalis* and *H. ovata* are petiolate, occur in pairs at each rhizome node and have numerous pairs of cross veins. The growth form of *H. tricostata* differs in that it lacks distinct petioles, is compound (hence has more than one pair of leaflets per leaf originating from each shoot), and lacks cross veins.

Halophila spinulosa

The leaves of *H. spinulosa* consist of leaflets arranged in definite opposite pairs in the one plane. In *H. tricostata*, the leaflets are found in whorls of 2-3 around the common stalk (rachis). The rhizome of *H. spinulosa* differs from that of *H. tricostata* in that it has obvious shoot scars which the latter lacks.

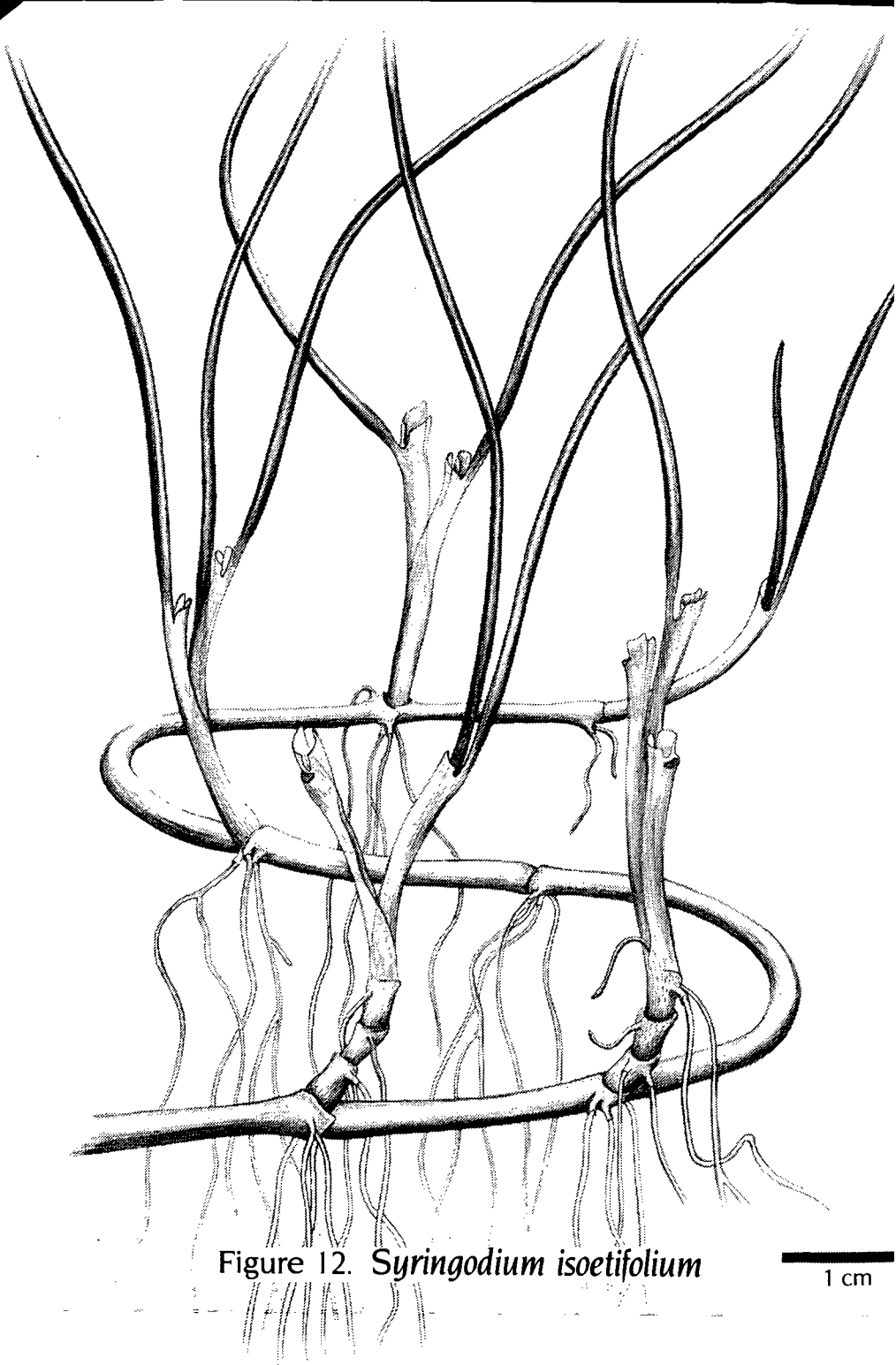


Figure 12. *Syringodium isoetifolium*

1 cm

GENUS SYRINGODIUM

FAMILY: Potamogetonaceae

SPECIES: *Syringodium isoetifolium*

Syringodium isoetifolium

Morphology

S. isoetifolium is the only north Queensland seagrass whose leaves are round in cross-section and thus it is easily recognized (Figure 12). The leaves of *S. isoetifolium* are quite thin (1-2 mm diameter), narrowed at the base and gradually taper off to a point at the leaf tip (Plate 2c). Leaves typically range in length from 7-30 cm. The rhizomes are thin and herbaceous, and at each node is a short erect shoot bearing 2-3 leaves. The leaf sheath is 1.5-4.0 cm long. A ligule is present.

Diagnostic features

Leaf narrow and round in cross-section, gradually tapering to a point.

Likely to be confused with

In a field situation, thin-leaved forms of *Halodule* species, *Z. capricorni*, *C. rotundata* or *T. hemprichii* may superficially resemble *S. isoetifolium*. However, upon closer examination, the cylindrical nature of *S. isoetifolium* leaves facilitates accurate identification.



Figure 13. *Thalassia hemprichii*

GENUS THALASSIA

FAMILY: Hydrocharitaceae

SPECIES: *Thalassia hemprichii*

Thalassia hemprichii

Morphology

T. hemprichii exhibits some variation in leaf width and length and as a result workers sometimes attempt to describe several growth forms. However the basic structure remains the same (Figure 13). The rhizome is thick (up to 5 mm thick), and distinctive, since the nodes, where the old shoots joined the leaf-bearing branch, are plainly visible with a prominent scale at each. The pale basal leaf sheath is 3-7 cm long and well developed. Leaves are generally 10-40 cm long, ribbon-like and often slightly curved laterally. Leaf width is generally in the range of 0.4-1.0 cm. There are 10-17 longitudinal leaf veins. The leaves have numerous large tannin cells grouped in short black bars running parallel to the long axis of the leaf. These 'bars' are clearly visible to the naked eye and are one of the diagnostic features of this species. The leaf tip is rounded and sometimes slightly serrated (Plate 2d). No ligule is present.

Diagnostic features

Short black bars of tannin cells on leaf blade. Thick rhizome with conspicuous scars between successive erect shoots.

Likely to be confused with

Cymodocea species

T. hemprichii is commonly mistaken for one or other of the *Cymodocea* species, particularly *C. serrulata*. The most obvious difference lies in the structure of the rhizome. In *T. hemprichii* there are a number of shoot scars on the rhizome between successive erect shoots. In contrast, the rhizome of *Cymodocea* is smooth between shoots. *T. hemprichii* lacks a ligule, which the *Cymodocea* species possess.



Figure 14. *Thalassodendron ciliatum*

1 cm

GENUS THALASSODENDRON

FAMILY: Potamogetonaceae

SPECIES: *Thalassodendron ciliatum*

Thalassodendron ciliatum

Morphology

T.ciliatum is often found attached to a rocky or coral substrate and in some instances is difficult to remove. The rhizomes are very tough and 'woody' and once removed are a good identifying character (Figure 14). The rhizome is up to 5 mm thick and there are scars on the rhizome between successive erect shoots. The erect shoots are elongate (10-65 cm long) and give rise to a cluster of ribbon-like, falcate (sickle-shaped) leaves, which are slightly narrowed at the base. The leaves are usually 10-15 cm long and 0.5-1.4 cm wide, and have 17-27 longitudinal veins. Very coiled and often branched roots originate from the internode preceding the shoot. The leaf tip is rounded and forked with numerous 'teeth' (denticulate) (Plate 2e). The leaf sheath is wide, compressed and often purple in the living plant. The leaf base is shed with the leaf. A ligule is present.

Diagnostic features

'Woody' rhizome. Cluster of ribbon-like, curved leaves at the end of a very elongate shoot.

Likely to be confused with

Thalassia hemprichii

T.ciliatum is easily distinguished from *T.hemprichii* by the elongate shoot (10-65 cm long), compared to *T.hemprichii*'s short shoot (only a few centimetres long). *T.ciliatum* lacks the black rod-shaped tannin cell aggregations found in *T.hemprichii*, but does possess a ligule, a feature *T.hemprichii* lacks.

Cymodocea serrulata

T.ciliatum is often mistaken for robust *C.serrulata*, however *T.ciliatum*'s falcate, almost 'fan' arrangement of leaves at the apex of a very elongate shoot differs from the more linear leaf cluster and short shoot of *C.serrulata*. Scarring on the rhizome between erect shoots is a feature present in *T.ciliatum* but lacking in *C.serrulata*.



Figure 15. *Zostera capricorni*

1 cm

GENUS ZOSTERA

FAMILY: Potamogetonaceae

SPECIES: *Zostera capricorni*

Zostera capricorni

Morphology

Z. capricorni has an herbaceous rhizome system with a short lateral shoot at each node, each of which bears up to six leaves (Figure 15). The rhizome has elongate internodes with 1-2 or more groups of long, thin roots at each node. The linear leaf blade is thin and translucent. There is a total of five main longitudinal veins, however three very distinct dark green intramarginal veins are especially visible when held against the light. Cross veins, if present, run at right angles to the longitudinal veins. Leaves are 2-5 mm wide and vary in length from several centimetres to over half a metre. The leaf tip is blunt and the leaf margin generally smooth, but rarely slightly denticulate (with 'teeth') (Plate 2f). A ligule is present.

Z. capricorni is characterised by the presence of a prophyllum, i.e. a single leaf originating from the rhizome instead of from the vertical, leafbearing shoot. This is the only seagrass to exhibit this feature.

Diagnostic features

Prophyllum present. Thin, translucent leaf blade with five main longitudinal veins.

Likely to be confused with

Halodule uninervis

Z. capricorni is superficially quite similar to *H. uninervis* but can always be distinguished by the possession of the prophyllum. The three-toothed leaf tip of *H. uninervis* is similarly unmistakable.

H. uninervis characteristically has three longitudinal veins and lacks distinct cross veins. *Z. capricorni*, on the other hand, has five main veins, although three are more conspicuous than the other two, and cross veins, if present, run at right angles to the longitudinal veins.

Cymodocea rotundata

Z. capricorni may be distinguished from thin-leaved *C. rotundata* by its possession of a prophyllum, and thin translucent leaf blades, which *C. rotundata* lacks. There are between 9 and 15 longitudinal veins in *C. rotundata*, but only five in *Z. capricorni*.

SEAGRASS KEYS

INTRODUCTION TO TAXONOMIC KEYS

The following taxonomic keys have been developed to facilitate identification of seagrass species found in the Great Barrier Reef region. They are based on the best aspects of several keys developed by other authors, and incorporate my own improvements. Only characters that consistently and readily divide seagrasses into generic and specific groupings have been chosen. The use of complex botanical terminology and diagnostic characters involving anatomical and chemical features has been avoided. Since vegetative features of the morphology of adult plants can be recognised and determined in the field, these have been preferred.

The first key (morphological characters of the whole plant) is based primarily on leaf characters because they are most obvious. Differences in the above-ground portions of the seagrass plant are often more conspicuous than variations in rhizome and root structure. More importantly, the below-ground parts of the plant may be difficult to remove from the substrate, e.g. in the case of *T.ciliatum* anchored in coral, or simply not available, e.g. pieces of seagrass floating on the water surface, or washed up in windrows along the shore. Additional characters including rhizome, leaf sheath and root structure have been described where appropriate.

A second key is provided based on cellular features of the leaf surface, and undamaged leaf tip morphology. This method may prove valuable in refining and confirming identification based on the morphological key, and is also applicable when the specimen consists of damaged leaves or fragments. This key is adapted from Channells and Morrissey (1981).

Floral and other reproductive structures (e.g. fruit) have not been used as key characters since their presence is sporadic and even rare in some species. These structures are also often fairly inconspicuous and not always obvious to the untrained eye.

KEY BASED ON GROSS MORPHOLOGY

1. Leaf thin, elongate, round in cross-section, 1-2 mm diameter, tapering to a point. No leaf venation obvious.
Syringodium isoetifolium
1. Leaf flattened; either strap-shaped, oval-elliptical, oblong, compound or otherwise. ----- 2
2. Leaf compound. i.e. each node of the rhizome has an erect lateral shoot bearing a number of linear-oblong leaflets ----- 3
2. Leaf simple ----- 4
3. Erect, lateral shoot bearing 10-20 pairs of opposite leaflets. Leaflets 1.5-2.5 cm long and 3-5 mm wide, with a serrated edge (visible with the naked eye), intramarginal and mid veins. 'Fern-like' appearance.
Halophila spinulosa
3. Leaflets borne on erect shoot 8-18 cm long, with 2-3 leaflets per node and 6-18 nodes per shoot. Leaflets 1.2-2.0 cm long and 2-4 mm wide, sparsely serrated edge (best seen with a hand lens), prominent marginal and mid veins. No cross veins.
Halophila tricostata
4. Leaf blade oval to elliptical to oblong; distinct petiole. ----- 5
4. Linear, strap-shaped leaves; no petiole. ----- 7
5. Leaf blade oval to elliptical; wider than 5 mm, 1-4 cm long with 10-25 pairs of cross veins ascending at 45-60 degrees.
Halophila ovalis
5. Leaf blade oval to oblong, less than 5 mm wide. ----- 6
6. Leaf blade with smooth margin, 0.5-1.5 cm long. 3-10 pairs of cross veins ascending at 70-90 degrees. No hairs.
Halophila ovata
6. Leaf blade with serrated margin (best seen with hand lens), 1.0-2.5 cm long. Prominent marginal and mid veins, 6-9 pairs of cross veins. Hairy, translucent leaf blade.
Halophila decipiens
7. Leaf blade with thickened, inrolled margin. Leaf long, 30-150 cm or longer, ribbon-like, 1.25-1.75 cm wide, thick (hard to tear). Rhizome at least 1 cm thick and bristly, i.e. sheath persisting as long black fibrous strands. Roots cordlike. No ligule.
Enhalus acoroides

7. Leaf linear to curvi-linear, no raised margins. Rhizomes without bristles. ----- 8
8. Ligule absent. Numerous large tannin cells in the form of short black bars running parallel to the long axis of the leaf (these are clearly visible to the naked eye). Thick rhizome, up to 5 mm thick, with lateral shoots bearing ribbon-like leaves. Nodes on rhizome between successive shoots are clearly visible with a scale at each. ***Thalassia hemprichii***
8. Ligule present. Tannin cells in blade not obviously organised into distinct black bars. ----- 9
9. Leaf 2 mm wide or less. Leaf with three veins ----- 10
9. Leaf greater than 2 mm wide ----- 11
10. Leaf 0.25-2.00 mm wide. Leaf tip with three points. Lateral points (or 'teeth') well developed and middle point obtuse (blunt). Black central vein, at tip, not splitting into two. Leaves of variable length. ***Halodule uninervis***
(narrow leaf form)
10. Leaf 0.25-1.20 mm wide. Leaf tip rounded with a more or less serrated edge, lateral 'teeth' faint or absent. Black central vein, at tip, splitting into two (visible under hand lens or dissecting microscope). ***Halodule pinifolia***
11. Leaf tip with three distinct points. Leaf 2-5 mm wide. Leaf with three veins. ***Halodule uninervis***
(wide leaf form)
11. Leaf tip otherwise. ----- 12
12. 3-5 distinct veins in leaf (clearly visible when held up to the light). Cross veins, if present, at right angles to main veins. Translucent, thin leaf blade, 2-5 mm wide. Prophyllum present at each node (i.e. a single leaf produced from the horizontal rhizome instead of from the vertical leaf-bearing side branch). Leaf tip obtuse. No obvious tannin cells. ***Zostera capricorni***
12. 7-27 veins in leaf 13
13. 'Woody' rhizome. Scars on the rhizome between successive erect shoots. Elongate, erect shoots (10-65 cm long). From erect shoot, a cluster of sickle-shaped leaves. Rounded leaf tip. Leaf blade shed with sheath. 17-27 longitudinal veins. ***Thalassodendron ciliatum***

13. Herbaceous rhizome lacking scars between successive erect shoots. Short lateral shoots. Curvilinear, ribbon-shaped leaves. Leaf sheath not shed along with the blade. 7-17 longitudinal veins. ----- 14
14. Distinctly serrated leaf tip. Leaf sheath broad and triangular. Erect shoot with leaf scars discontinuous around the shoot.
Cymodocea serrulata
14. Rounded, often faintly heart-shaped leaf tip (sometimes faint serrations). Short, erect shoot with leaf scars continuous around shoot.
Cymodocea rotundata

KEY BASED ON MICROSCOPIC LEAF ANATOMY

PREPARATION OF SEAGRASS SPECIMEN

To examine epidermal cell features and leaf tip morphology, place a piece of seagrass on a clean microscope slide, cover with a few drops of seawater and a coverslip, and examine under a low-power microscope.

1. Cells not in definite rows. Cells irregular in arrangement and/or shape. ----- 2
1. Cells arranged in definite rows, varying from circular to rectangular. ----- 4
2. 'Jigsaw' appearance (Plate 3f). Leaf tip smooth and rounded on oval-elliptical leaf (Plate 1f). ***Halophila ovalis/Halophila ovata***
2. Cells round to angular to hexagonal in shape ----- 3
3. Cells basically hexagonal in shape, small and closely packed. No leaf venation obvious (Plate 4c). Leaf tip bluntly rounded (Plate 2c). ***Syringodium isoetifolium***
3. Cells angular to hexagonal in shape, relatively large cells (Plate 4b). Marginal and mid veins strongly ribbed. Sparsely serrated edge on linear-oblong leaflets (Plate 2b) ***Halophila tricostata***
4. Cells large and brick-shaped (usually 2-3 times longer than broad); some triangular in appearance (Plate 3c). Leaf blade wide. Leaf tip blunt (Plate 1c). ***Enhalus acoroides***
4. Cells small, regular and very rectangular in shape (approx. 2-4 times longer than broad). Leaf blade narrow, three veins. ***Halodule species***
(Plates 3d and 3e).
Leaf tip with three distinct points (Plate 1e) ***Halodule uninervis***
Leaf tip bluntly rounded with irregular serrations. Mid vein usually split into two at apex (Plate 1d). ***Halodule pinifolia***
4. Cells square to circular; not as above ----- 5
5. Cells irregularly square to angular. Very close packed, often 'crowded' appearance (Plate 4a). Leaf tip and margin serrated (Plate 2a). ***Halophila spinulosa***

5. Cells square to angular, in well-spaced rows. Not 'crowded' (Plate 4e). Leaf tip rounded, bifurcate with well-developed teeth (Plate 2e). ***Thalassodendron ciliatum***
5. Cells not as above ----- 6
6. Cell shape irregularly oval with long cell axis at right angles to the long leaf axis (Plate 4f). No obvious tannin cells. 3-5 main veins; cross veins, if present, at right angles to the main veins. Blunt leaf tip (Plate 2f). ***Zostera capricorni***
6. Cells not as above. Tannin cells present. 7-17 longitudinal veins. ----- 7
7. Cells generally circular. Tannin cells arranged in regular blocks or 'bars' (Plate 4d). Leaf tip rounded, sometimes slightly serrated (Plate 2d). ***Thalassia hemprichii***
7. Cells generally angular (Plate 3b). Tannin cells arranged in rounded groups. Leaf tip distinctly serrated (Plate 1b). ***Cymodocea serrulata***
7. Cells round to angular. Tannin cells in round to rectangular groups (Plate 3a). Leaf tip more or less rounded with faint serrations; may appear slightly heart-shaped to the naked eye (Plate 1a). ***Cymodocea rotundata***

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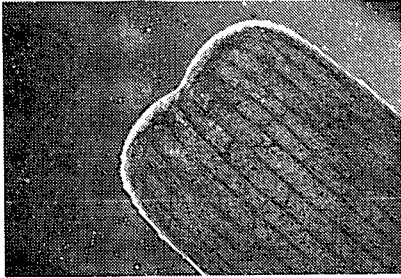
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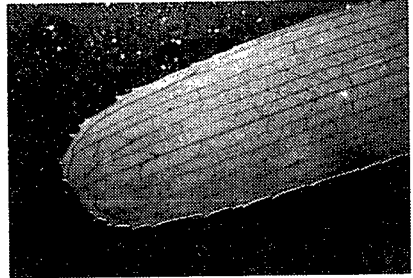


Plate 1. Photomicrographs of the leaf tips of seagrasses.

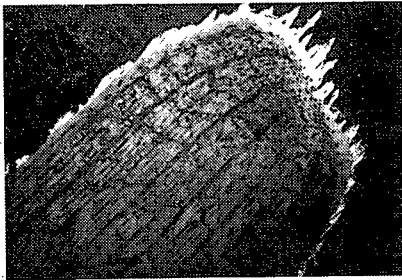
Magnification x 20



a. *Cymodocea rotundata*

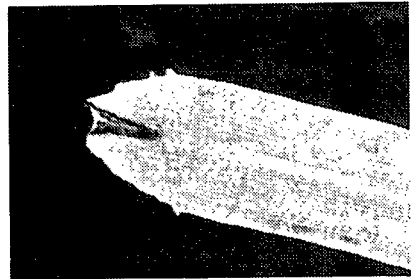


b. *Cymodocea serrulata*

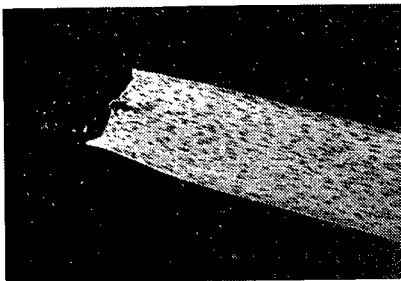


c. *Enhalus acoroides*

Note epiphytic algae around leaf tip



d. *Halodule pinifolia*



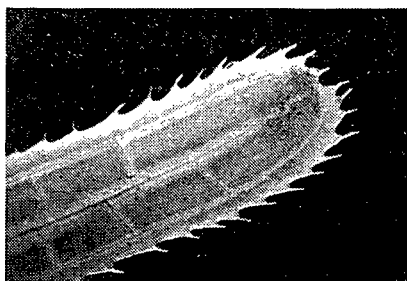
e. *Halodule uninervis*



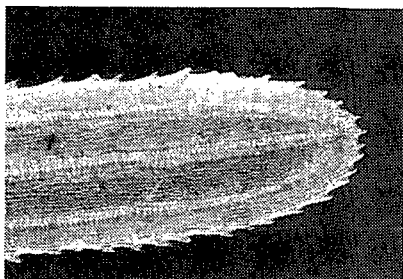
f. *Halophila ovalis*

Plate 2. Photomicrographs of the leaf tips of seagrasses.

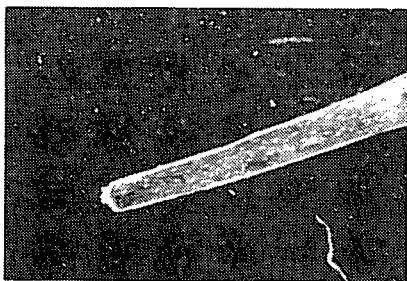
Magnification x 20



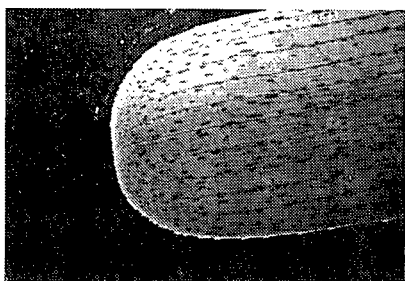
a. *Halophila spinulosa*



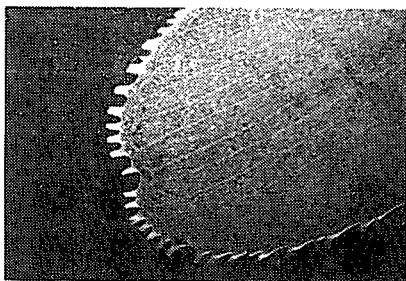
b. *Halophila tricostata*



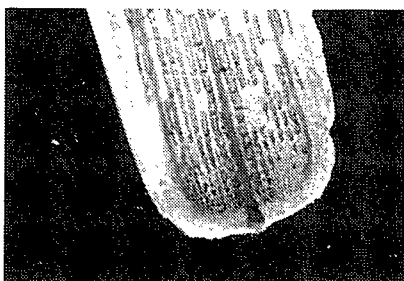
c. *Syringodium isoetifolium*



d. *Thalassia hemprichii*



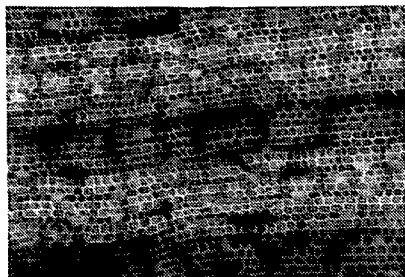
e. *Thalassodendron ciliatum*



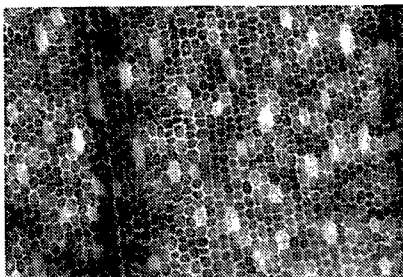
f. *Zostera capricorni*

Plate 3. Photomicrographs of the leaf surface of seagrass species.

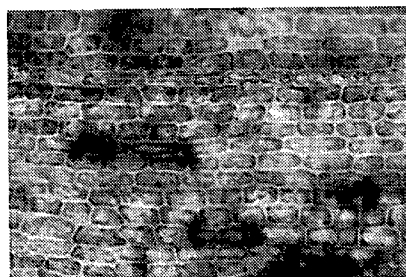
Magnification x 20



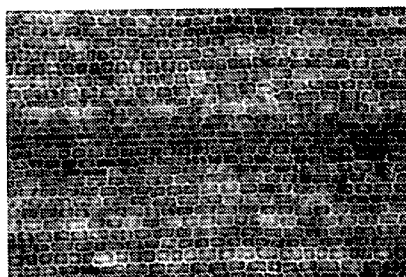
a. *Cymodocea rotundata*



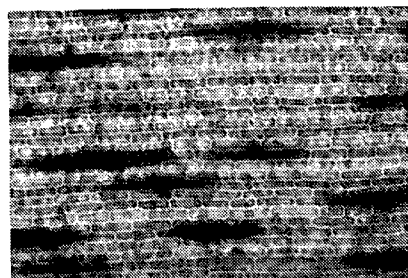
b. *Cymodocea serrulata*



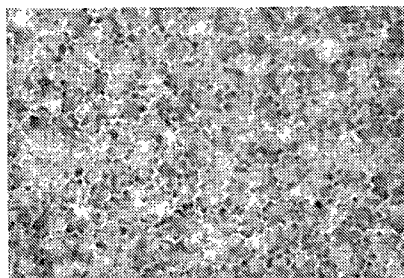
c. *Enhalus acoroides*



d. *Halodule pinifolia*



e. *Halodule uninervis*



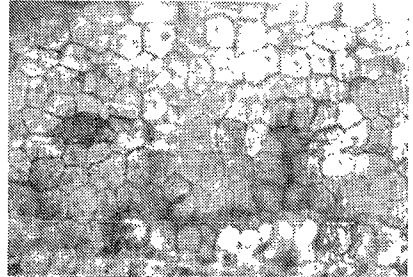
f. *Halophila ovalis*

Plate 4. Photomicrographs of the leaf surface of seagrass species.

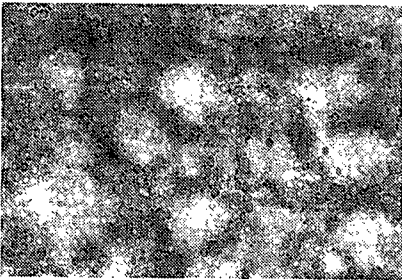
Magnification x 20



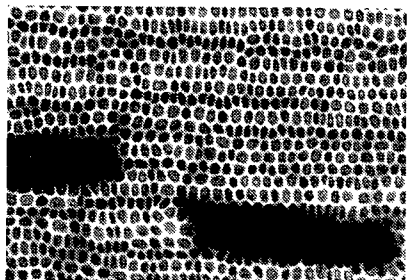
a. *Halophila spinulosa*



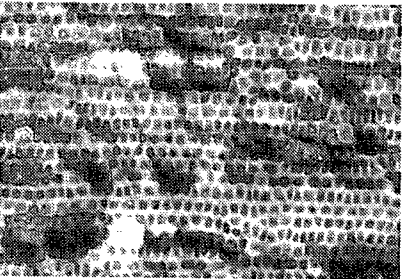
b. *Halophila tricostata*



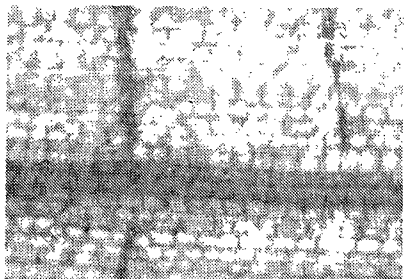
c. *Syringodium isoetifolium*



d. *Thalassia hemprichii*



e. *Thalassodendron ciliatum*



f. *Zostera capricorni*