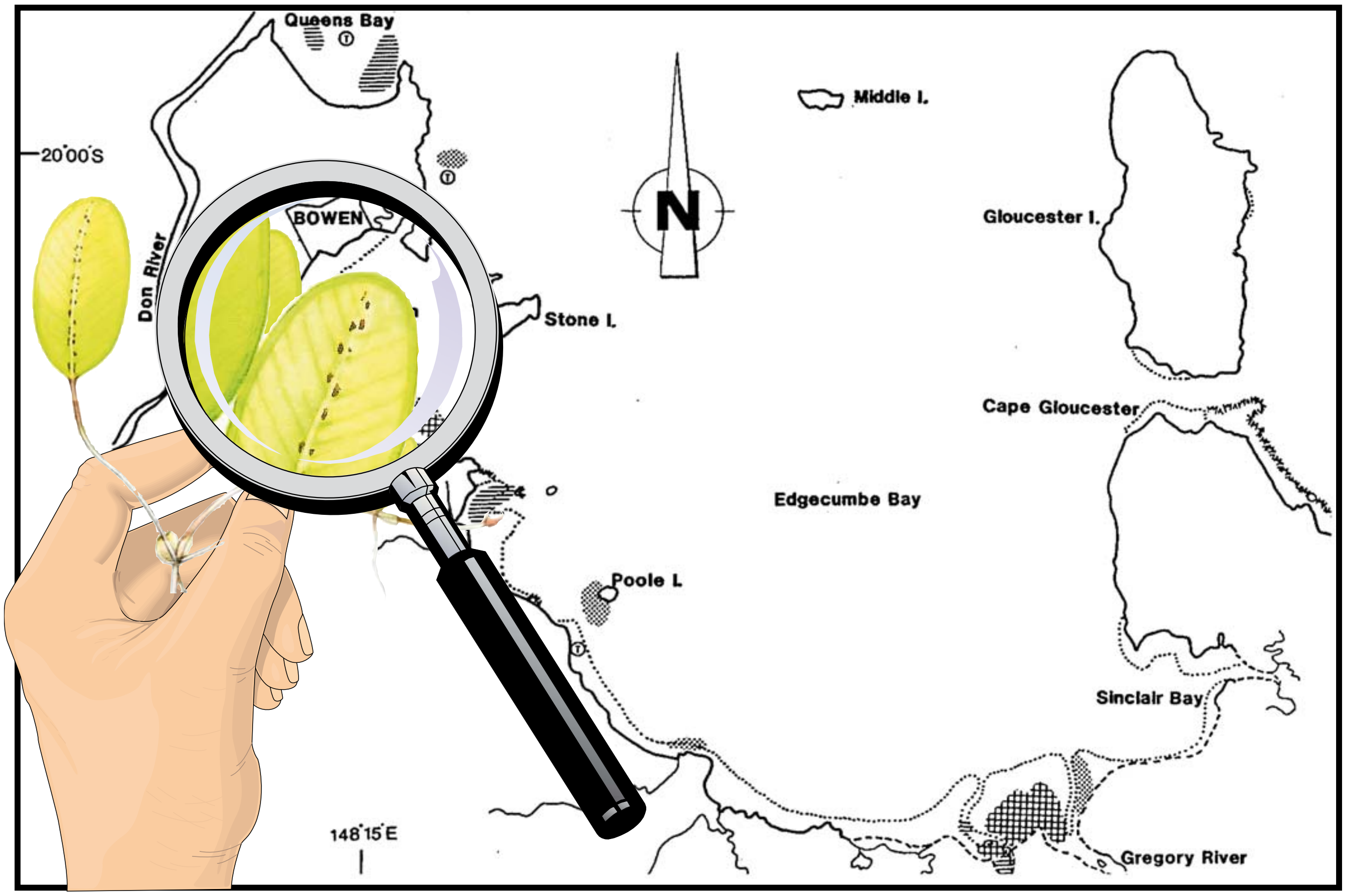
Seagrass-Watch

Proceedings of a Workshop for Monitoring Seagrass Habitats in the Bowen Region



Wongabeena Guide Hut, Bowen
17th May 2008

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Seagrass-Watch HQ
Department of Primary Industries & Fisheries, Queensland

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Disclaimer

Information contained in this publication is provided as general advice only. For application to specific circumstances, professional advice should be sought.

Seagrass-Watch HQ has taken all reasonable steps to ensure the information contained in this publication is accurate at the time of the survey. Readers should ensure that they make appropriate enquires to determine whether new information is available on the particular subject matter.

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Overview

Seagrass-Watch is a global scientific, non-destructive, seagrass assessment and monitoring program.

Often governments are unable to protect and conserve seagrass meadows without the assistance of local stakeholders (e.g., local residents, schools, tertiary institutions, non-government organisations). Seagrass-Watch is a monitoring program that brings citizens and governments together for seagrass conservation. It identifies areas important for seagrass species diversity and conservation. The information collected can be used to assist the management of coastal environments and to prevent significant areas and species being lost.

Monitoring seagrass resources is important for two reasons: it is a valuable tool for improving management practices; and it allows us to know whether resource status and condition is stable, improving or declining. Successful management of coastal environments (including seagrass resources) requires regular monitoring of the status and condition of natural resources.

Early detection of change allows coastal management agencies to adjust their management practices and/or take remedial action sooner for more successful results. Monitoring is important in improving our understanding of seagrass resources and to coastal management agencies for:

- *Exposing coastal environmental problems before they become intractable,*
- *Developing benchmarks against which performance and effectiveness can be measured,*
- *Identifying and prioritising future requirements and initiatives,*
- *Determining the effectiveness of management practices being applied,*
- *Maintaining consistent records so that comparisons can be made over time,*
- *Developing within the community a better understanding of coastal issues,*
- *Developing a better understanding of cause and effect in land/catchment management practices,*
- *Assisting education and training, and helping to develop links between local communities, schools and government agencies, and*
- *Assessing new management practices*

Seagrass-Watch monitoring efforts are vital to assist with tracking global patterns in seagrass health, and assess the human impacts on seagrass meadows, which have the potential to destroy or degrade these coastal ecosystems and decrease their yield of natural resources. Responsive management based on adequate information will help to prevent any further significant areas and species being lost. To protect the valuable seagrass meadows along our coasts, everyone must work together.

The goals of the Seagrass-Watch program are:

- *To educate the wider community on the importance of seagrass resources*
- *To raise awareness of coastal management issues*
- *To build the capacity of local stakeholders in the use of standardised scientific methodologies*
- *To conduct long-term monitoring of seagrass & coastal habitat condition*
- *To provide an early warning system of coastal environment changes for management*
- *To support conservation measures which ensure the long-term resilience of seagrass ecosystems.*

This workshop is hosted by the Bowen Scout Group, Seagrass-Watch HQ, DPI&F, and supported by Reef and Rainforest Research Centre implementing the Marine and Tropical Sciences Research Facility in North Queensland. The seagrass-watch monitoring kit was kindly donated by the BDTNRM.

As part of this workshop we will

- *learn seagrass taxonomy*
- *discuss the present knowledge of seagrass ecology,*
- *discuss the threats to seagrasses*
- *learn techniques for monitoring seagrass resources*
- *provide examples of how Seagrass-Watch assists with the management of impacts to seagrass resources and provides an understanding of their status and condition.*

The following information is provided as a training guide and a reference for future Seagrass- Watch monitoring activities. For further information, please do not hesitate to contact us at

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or visit
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Workshop leaders

Jane Mellors

Jane is a Fisheries Biologist with the Queensland Department of Primary Industries & Fisheries. Jane has over 20 years experience in seagrass related research and monitoring. She is the project Leader for the Torres Strait, Education opportunities for indigenous involvement in marine ecosystem monitoring project. Jane is a specialist in tropical seagrass eco-physiology, seagrass taxonomy, geochemistry of marine sediments and marine invertebrate taxonomy pertaining to seagrass meadow communities. In 2003, Jane completed her Doctorate (Dept TESAG, James Cook University) on sediment and nutrient dynamics in coastal intertidal seagrass meadows of north eastern Australia of North Queensland

Current Projects

- Seagrass-Watch community seagrass monitoring
- NHT & Queensland ED: Education opportunities for indigenous involvement in marine ecosystem monitoring
- Co-author of a guide to tropical seagrasses of the Indo-west Pacific
- Investigations on the effects of nutrients on tropical seagrasses
- Water Quality and Ecosystem Monitoring Programs – Reef Water Quality Protection Plan

Naomi Smith

Naomi graduated with a Bachelor of Science, majoring in Marine Biology and Zoology, from James Cook University in 2003. Naomi has been employed with the Department of Primary Industries & Fisheries as a Fisheries Technician for the past 18 months, working on the Reef Water Quality Protection Plan project. The main task for this project is to collect and prepare the seagrass and sediment samples for further nutrient analysis. Naomi has also participated and co-ordinated in numerous Seagrass-Watch activities including public displays and community monitoring days. Naomi is confident in tropical seagrass taxonomy and the Seagrass-Watch methodology.

Current Projects

- Seagrass-Watch community seagrass monitoring
- Water Quality and Ecosystem Monitoring Programs – Reef Water Quality Protection Plan

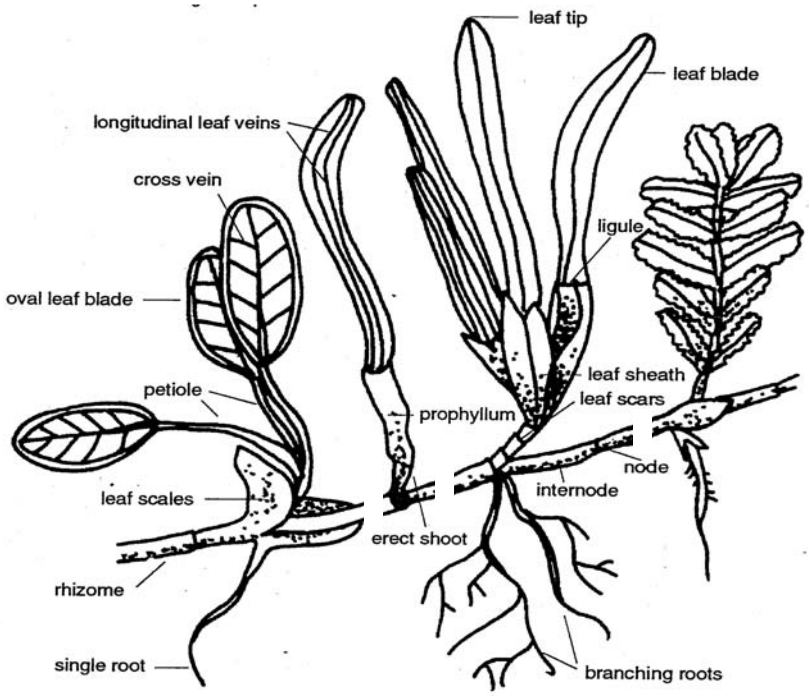
Agenda

Morning	0830 – 0840 *(10min)*	Welcome – *Jane Mellors and Lesley Bullemor*
	0840 – 0900 *(20min)*	Seagrass Biology and Identification – *Jane Mellors*
	0900 – 0945 *(45min)*	Laboratory exercise: Seagrass Identification & how to prepare a seagrass press specimen – *Jane Mellors and Naomi Smith*
	0945 - 1000 *(15min)*	*Morning Tea*
	1000 – 1100 *(60min)*	Seagrass Ecology and Threats – *Jane Mellors*
	1100 – 1115 *(15min)*	Seagrass monitoring – *Jane Mellors*
	1115 - 1230 *(75min)*	Seagrass-Watch – *Jane Mellors*
	1230 – 1235 (5mins)	Safety briefing & risk assessment – *Jane Mellors*
	1235 – 1310 *(35min)*	*Lunch*
Afternoon	1315 – 1530 *(135min)*	**Field exercise** Seagrass-Watch monitoring – *Jane Mellors, Naomi Smith and Iony Woolaghan* *Where*: *Front Beach, Port Denison, Bowen* *What to bring:* • *hat, sunscreen (Slip! Slop! Slap!)* • *dive booties or old shoes that can get wet* • *drink/refreshments* • *Polaroid sunglasses (not essential)* • *enthusiasm* *You will be walking across a seagrass meadow exposed with the tide, through shallow water. It may be wet and muddy!* *Please remember, seagrass meadows are an important resource and are protected by law. We ask that you use discretion when working/walking on them.*
	1530 - 1600 *(30min)*	Wrap up *(on foreshore)* • Wash gear • Feedback

- *Low tide: 0.6m 14:29*

Background

Seagrasses are specialised marine flowering plants that have adapted to the nearshore environment of most of the world's continents. The majority are entirely marine although some species cannot reproduce unless emergent at low tide. Some seagrasses can survive in a range of conditions encompassing fresh water, estuarine, marine, or hypersaline. There are relatively few species globally (about 60) and these are grouped into 13 Genera and 5 Families.



Composite illustration demonstrating morphological features used to distinguish main seagrass taxonomic groups.

from Lanyon (1986)

Various common names are applied to seagrass species, such as turtle grass, eelgrass, tape grass, spoon grass and shoal grass. These names are not consistently applied among countries. Coastal communities would almost certainly recognise the term "turtle grass" as referring to the shallow subtidal and intertidal seagrasses that turtles are associated with.

There is now a broad understanding of the range of species and seagrass habitats. Areas less well known include the southeast Pacific reefs and islands, South America, the southern Atlantic, the Indian Ocean islands, the west African coast, and Antarctica. Shallow sub-tidal and intertidal species distributions are better recorded than seagrasses in water greater than 10 m below MSL. Surveying deeper water (>15m) seagrass is time consuming and expensive and it is likely that areas of deepwater seagrass are still to be located.

Tropical seagrasses occupy a variety of coastal habitats. Tropical seagrass meadows typically occur in most shallow, sheltered soft-bottomed marine coastlines and estuaries. These meadows may be monospecific or may consist of multispecies communities, sometimes with up to 12 species present within one location. The stresses and limitations to seagrasses in the tropics are generally different than in temperate or subarctic regions. Temperature related impacts most often result from high water temperatures or overexposure to warm air; osmotic impacts result from hypersalinity due to evaporation; radiation impacts result from high irradiance and UV exposure.

The depth range of seagrass is most likely to be controlled at its deepest edge by the availability of light for photosynthesis. Exposure at low tide, wave action and associated turbidity and low salinity from fresh water inflow determines seagrass species survival at the shallow edge. Seagrasses survive in the intertidal zone especially in sites sheltered from wave action or where there is entrapment of water at low tide, (e.g., reef platforms and tide pools), protecting the seagrasses from exposure (to heat, drying or freezing) at low tide.

Tropical seagrasses are important in their interactions with mangroves and coral reefs. All these systems exert a stabilizing effect on the environment, resulting in important physical and biological support for the other communities (Amesbury and Francis 1988).

Barrier reefs protect coastlines, and the lagoon formed between the reef and the mainland is protected from waves, allowing mangrove and seagrass communities to develop. Seagrasses trap sediment and slow water movement, causing suspended sediment to fall out. This trapping of sediment benefits coral by reducing sediment loads in the water.

Mangroves trap sediment from the land, reducing the chance of seagrasses and corals being smothered. Sediment banks accumulated by seagrasses may eventually form substrate that can be colonized by mangroves. All three communities trap and hold nutrients from being dispersed and lost into the surrounding oceanic waters.

The habitat complexity within seagrass meadows enhances the diversity and abundance of animals. Seagrasses on reef flats and near estuaries are also nutrient sinks, buffering or filtering nutrient and chemical inputs to the marine environment. The high primary production rates of seagrasses are closely linked to the high production rates of associated fisheries. These plants support numerous herbivore- and detritivore-based food chains, and are considered as very productive pastures of the sea. The associated economic values of seagrass meadows are very large, although not always easy to quantify. Seagrass meadows are rated the 3rd most valuable ecosystem globally (on a per hectare basis), only preceded by estuaries and wetlands. The average global value of seagrasses for their nutrient cycling services and the raw product they provide has been estimated at ^{1994}US$ 19,004 ha^{-1} yr^{-1} (Costanza *et al*. 1997).

Tropical seagrass meadows vary seasonally and between years, and the potential for widespread seagrass loss has been well documented (Short and Wyllie-Echeverria 1996). The causes of loss can be natural such as cyclones and floods, or due to human influences such as dredging, agricultural runoff, urban runoff and industrial runoff or oil spills.

Loss of seagrasses has been reported from most parts of the world, sometimes from natural causes, e.g., high energy storms, or "wasting disease". More commonly, loss has resulted from human activities, e.g., as a consequence of eutrophication or land reclamation and changes in land use. Anthropogenic impacts on seagrass meadows are continuing to destroy or degrade these coastal ecosystems and decrease their yield of natural resources.

It is important to document seagrass species diversity and distribution and identify areas requiring conservation measures before significant areas and species are lost. Determining the extent of seagrass areas and the ecosystem values of seagrasses is now possible on a local scale for use by coastal zone managers to aid planning and development decisions. Knowledge of regional and global seagrass distributions are still too limited and general for broad scale protection and management. Such information is needed to minimize future impacts on seagrass habitat worldwide. With global electronic communication it is now possible to begin the process of assembling both formally published and unpublished notes on the distribution of the world's seagrasses with the eventual aim of providing a global "report card" on the distribution and status of seagrass.

With well-recorded events of seagrass loss from many coastal environments it is important to map and record the distribution of not only the location of existing seagrass but also areas of potential seagrass habitat. Such areas are generally shallow, sheltered coastal waters with suitable bottom type and other environmental conditions for seagrass growth. Potential habitat may include areas where seagrass was known to grow at some time in the past but from which it has recently been eliminated.

Spatial and temporal changes in seagrass abundance and species composition must be measured and interpreted with respect to prevailing environmental conditions. These may need to be measured seasonally, monthly, or weekly, depending on the nature of their variability, and the aims of the study. Physical parameters important to seagrass growth and survival include light (turbidity, depth), sediment type and chemistry, and nutrient levels. Detailed studies of changes in community structure of seagrass communities are essential to understand the role of these communities and the effects of disturbance on their composition, structure and rate of recovery.

Notes:

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Bowen

Once occupied by the Girudala people, the first European to set eyes upon the present site of Bowen was Captain James Cook who named Cape Gloucester and Edgecumbe Bay in 1770. Bowen has a varied history being the oldest town in North Queensland. Its establishment really dates back to 1859 when Captain Henry Daniel Sinclair sailed in search of a suitable port north of Rockhampton. He found a good harbour which he named Port Denison. In March 1861 the Queensland government declared Port Denison an official port of entry, allowing for the future development of the region and the township of Bowen was established. During World War II Bowen became home to two squadrons of Catilinas, when it was deemed that the operational base in Port Moresby was no longer safe from Japanese attack. Many of these historical events are depicted in the numerous murals that can be found scattered through the town. Bowen's industries include beef cattle, a salt works, coke production, a tomato-processing plant and fish processing plants. Abbot Point is situated 19 km north of Bowen. It is Australia's most northerly coal-shipping port and will eventually be able to handle over 24 million tonnes of coal each year. Officers from the QDPI&F Northern Fisheries Centre will be monitoring the impacts of the port expansion on the marine benthic habitats in proximity to Abbot Point.

Bowen is within the Don catchment which covers an area of approximately 3900km2. It is drained by the Don River, which flows intermittently depending on seasonal and variable monsoon rain events. Average rainfall is around 1013,mm per year (Ludescher 1997). Winds are predominantly south-easterly trades, strongest during winter, weaker and with a north-easterly element during the summer months (Scheltinga and Heydon 2005).). The coast is protected against oceanic swells by the complex reefs and shoals of the Great Barrier Reef system. Tides in this region are semi-diurnal and tidal amplitude is around 3.3 m.

Bowen Seagrasses

Whilst episodic riverine delivery of freshwater nutrients and sediment is a medium time scale factor in structuring coastal seagrass meadows in this region, the distribution of seagrasses along this coastline is predominately influenced by seasonal (April-November) south-easterly trade winds.(Coles et al 2007). Seagrass meadows generally establish in places that offer protection from these winds, such as the large north opening bays and the leeward sides of continental islands. The combination of seasonal terrestrial run-off, frequent cyclones, strong south-easterly trade winds and tidal runs create significant natural coastal turbidity. Seagrasses that inhabit this area are therefore, subjected to low light regimes, and high influxes of freshwater and sediment. To survive this regime seagrasses need to exhibit high vegetative growth rates and prolific seed banks. This has probably led to the predominance of opportunistic species, such as Halodule and Halophila within this region.

Between Cape Upstart and Edgecumbe Bay, seagrass meadows have a discontinuous inshore distribution (Zeller, 1998). They are found both subtidally and intertidally, and are a significant food resource for dugongs and green turtles. (Coles et al 2007). They also represent significant nursery grounds for fisheries. Edgecumbe Bay in particular has meadows that support large populations of juvenile brown tiger king and endeavour prawns – species of high commercial value (Coles et al 1992). Within Edgecumbe Bay, six species of seagrass have been recorded – *Halodule uninervis, Halophila ovalis*, *Syringodium isoetofolium*, *Cymodocea serrulata*, *Halophila decipiens* (Coles et al 1992) and *Zostera muelleri/capricornia* (Seagrass-Watch 2007).

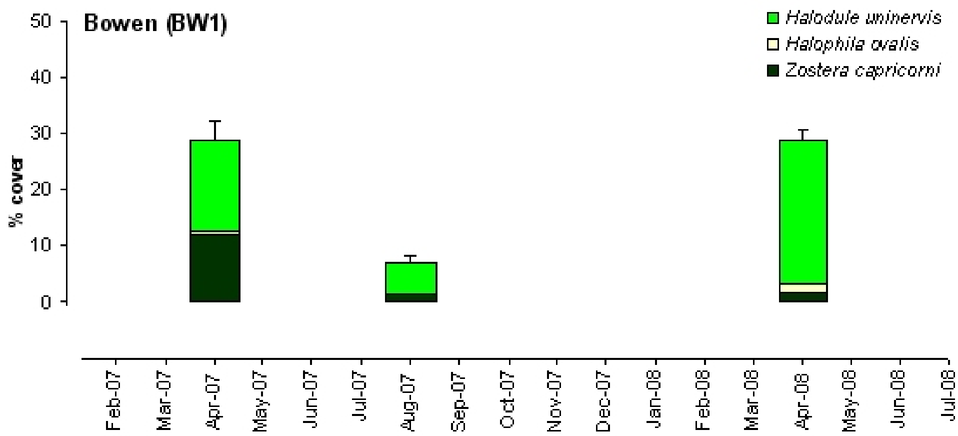
This is just under half of the species recognized within Queensland waters. This combined with other habitat values and fisheries values made Edgecumbe Bay a standout candidate for declaration as a Fish Habitat Area which occurred in 2005 (www.dpi.qld.gov.au/fisheries/habitat)

The greatest threat to seagrasses throughout this region is land clearing with respect to agricultural - grazing and cropping and coastal/urban development. Land clearing with its inherent problems of soil erosion and associated loads of nutrients and pesticides are problematic for the long term survival of seagrasses that are already stressed by natural events.

Bowen – Seagrass-Watch report card

A Seagrass-Watch site has been established by the Bowen State School in Port Denison in April 2007. As the site has only been monitored three times it is difficult to determine the condition of the seagrass meadow as Seagrass-Watch relies on long term monitoring to provide an understanding of seasonal trends and effects of climatic patterns on seagrass meadows.

- Cover has remained at 30 % between years with a seasonal decrease observed in August.
- Three species of seagrass were recorded from this site.
- Species composition has changed with *Zostera* being less prolific and *Halodule uninervis* increasing in dominance.



A guide to the identification of western Pacific Seagrasses

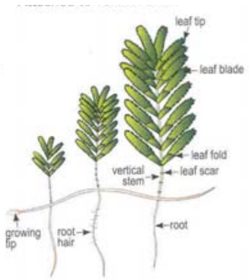
Adapted from Waycott, M, McMahon, K, Mellors, J., Calladine, A., and Kleine, D (2004) A guide to tropical seagrasses in the Indo-West Pacific. (James Cook University Townsville) 72pp.

Leaves cylindrical

Syringodium isoetifolium
- Leaf tip pointed
- Leaves contain air cavities
- Inflorescence a “cyme”

Leaves oval to oblong

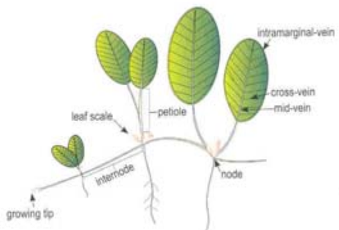
obvious vertical stem with more than 2 leaves



Halophila spinulosa
- leaves arranged opposite in pairs
- leaf margin serrated

Halophila tricostata
- leaves arranged in clusters of 3, at a node on vertical stem
- leaf margin serrated
- leaf clusters do not lie flat

leaves with petioles, in pairs



Halophila ovalis
- cross veins more than 10 pairs
- leaf margins smooth
- no leaf hairs
- separate male & female plants

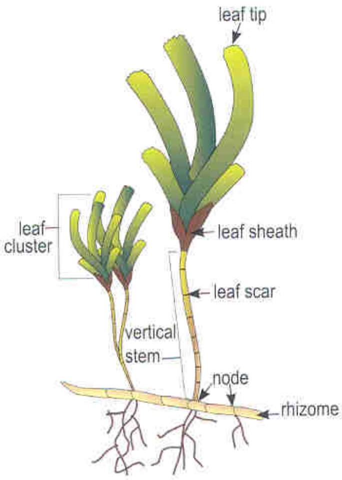
Halophila decipiens
- leaf margins serrated
- fine hairs on both sides of leaf blade
- male & female flowers on same plant

Halophila minor
- Leaf less than 5mm wide
- cross veins up to 10 pairs
- leaf margins smooth
- no leaf hairs
- separate male & female plants

Halophila capricorni
- leaf margins serrated
- fine hairs on one side of leaf blade
- separate male & female plants

Leaves strap-like

Leaves can arise from vertical stem



Thalassia hemprichii

- Leaf with obvious red flecks, 1-2mm long
- Leaf tip rounded may be slightly serrated
- Leaf often distinctly curved
- Distant scars on rhizome

Cymodocea serrulata

- Leaf tip rounded with serrated edge
- Leaf sheath broadly flat and triangular, not fibrous
- Leaf sheath scars not continuous around upright stem

Cymodocea rotundata

- Leaf tip rounded with smooth edge
- Leaf sheath not obviously flattened
- Leaf sheath scars continuous around upright stem

Halodule uninervis

- Leaf tip tri-dentate or pointed, not rounded
- Leaf with 3 distinct parallel- veins, sheaths fibrous
- Rhizome usually white with small black fibres at the nodes

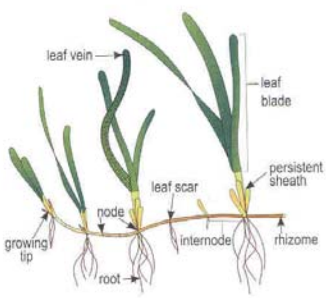
Halodule pinifolia

- Leaf tip rounded
- Leaf with 3 distinct parallel- veins, sheaths fibrous
- Rhizome usually white with small black fibres at the nodes

Thalassodendron ciliatum

- distinct upright stem
- clusters of curved leaves (>5 mm wide), margins serrated
- stem and rhizome woody

Leaves always arise directly from rhizome



Enhalus acoroides

- large plant, leaves >30 cm long, >1 cm wide
- inrolled edges of leaves
- long, black bristles protruding from thick rhizome

Zostera capricorni

- leaf with 3-5 parallel-veins
- cross-veins form boxes
- leaf tip smooth and rounded, may be dark point at tip
- rhizome usually brown or yellow in younger parts

Monitoring a seagrass meadow

Environment monitoring programs provide coastal managers with information and assist them to make decisions with greater confidence. Seagrasses are often at the downstream end of catchments, receiving runoff from a range of agricultural, urban and industrial land-uses.

Seagrass communities are generally susceptible to changes in water quality and environmental quality that make them a useful indicator of environmental health. Several factors are important for the persistence of healthy seagrass meadows, these include: sediment quality and depth; water quality (temperature, salinity, clarity); current and hydrodynamic processes; and species interactions (e.g., epiphytes and grazers). Seagrass generally respond in a typical manner that allows them to be measured and monitored. In reporting on the health of seagrasses it is important to consider the type of factors that can effect growth and survival. Factors include:

- increased turbidity reduces light penetration through the water, interfering with photosynthesis and limiting the depth range of seagrass;
- increased nutrient loads encourages algal blooms and epiphytic algae to grow to a point where it smothers or shade seagrasses, thereby reducing photosynthetic capacity;
- increased sedimentation can smother seagrass or interferes with photosynthesis;
- herbicides can kill seagrass and some chemicals (e.g., pesticides) can kill associated macrofauna;
- boating activity (propellers, mooring, anchors) can physically damage seagrass meadows, from shredding leaves to complete removal;
- storms, floods and wave action can rip out patches of seagrasses.

Seagrass-Watch

A simple method for monitoring seagrass resources is used in the Seagrass-Watch program. This method uses 50m by 50m sites established within representative intertidal meadows to monitor seagrass condition. The number and position of sites can be used to investigate natural and anthropogenic impacts.

Seagrass-Watch is one of the largest seagrass monitoring programs in the world. Since it's genesis in 1998 in Australia, Seagrass-Watch has now expanded internationally to 20 countries. Monitoring is currently occurring at over 200 sites. To learn more about the program, visit www.seagrasswatch.org .

Seagrass-Watch aims to raise awareness on the condition and trend of nearshore seagrass ecosystems and provide an early warning of major coastal environment changes. Participants of Seagrass-Watch are generally community/citizen volunteers from a wide variety of backgrounds who all share the common interest in marine conservation. Most participants are associated with established local community groups, schools, universities & research institutions, government (local & state) or non-government organisations.

Seagrass-Watch integrates with existing education, government, non-government and scientific programs to raise community awareness to protect this important marine habitat for the benefit of the community. The program has a strong scientific underpinning with an emphasis on consistent data collection, recording and reporting. Seagrass-Watch identifies areas important for seagrass species diversity and conservation and the information collected is used to assist the management of coastal environments and to prevent significant areas and species being lost.

Seagrass-Watch monitoring efforts are vital to assist with tracking global patterns in seagrass health, and assessing human impacts on seagrass meadows, which have the potential to destroy or degrade these coastal ecosystems and decrease their value as a natural resource. Responsive management based on adequate information will help to prevent any further significant areas and species being lost. To protect the valuable seagrass meadows along our coasts, the community, government and researchers have to work together.

THE GOALS OF THE PROGRAM ARE:

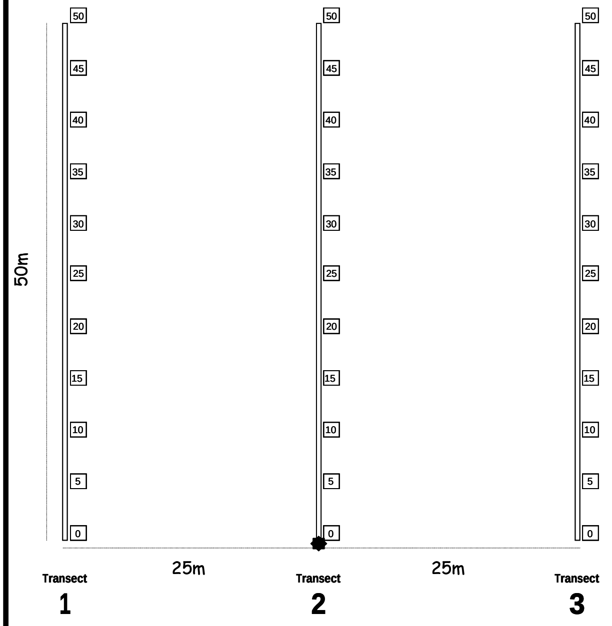
- *To educate the wider community on the importance of seagrass resources*
- *To raise awareness of coastal management issues*
- *To build the capacity of local stakeholders in the use of standardised scientific methodologies*
- *To conduct long-term monitoring of seagrass & coastal habitat condition*
- *To provide an early warning system of coastal environment changes for management*
- *To support conservation measures which ensure the long-term resilience of seagrass ecosystems.*

Lesley assisting BSS with Seagrass-Watch monitoring

Seagrass-Watch Protocols

Source: McKenzie, L.J., Campbell, S.J., Vidler, K.E. & Mellors, J.E. (2007) Seagrass-Watch: Manual for Mapping & Monitoring Seagrass Resources. (Seagrass-Watch HQ, Cairns) 114pp (www.seagrasswatch.org/manuals.html)

Site layout



Quadrat code = site + transect+quadrat

e.g., PI1225 = Pigeon Is. site 1, transect 2, 25m quadrat

Pre-monitoring preparation

Make a Timetable

Create a timetable of times of departure and arrival back, and what the objective of the day is and what is to be achieved on the day. Give a copy of this to all volunteers involved in advance so they can make their arrangements to get to the site on time. List on this timetable what the volunteers need to bring.

Have a Contact Person

Arrange to have a reliable contact person to raise the alert if you and the team are not back at a specified or reasonable time.

Safety

- Assess the risks before monitoring - check weather, tides, time of day, etc.
- Use your instincts - if you do not feel safe then abandon sampling.
- Do not put yourself or others at risk.
- Wear appropriate clothing and footwear.
- Be sun-smart.
- Adult supervision is required if children are involved
- Be aware of dangerous marine animals.
- Have a first aid kit on site or nearby
- Take a mobile phone or marine radio

Necessary equipment and materials

- ❑ *3x 50metre fibreglass measuring tapes*
- ❑ *6x 50cm plastic tent pegs*
- ❑ *Compass*
- ❑ *1x standard (50cm x 50cm) quadrat*
- ❑ *Magnifying glass*
- ❑ *3x Monitoring datasheets*
- ❑ *Clipboard, pencils & 30 cm ruler*
- ❑ *Camera & film*
- ❑ *Quadrat photo labeller*
- ❑ *Percent cover standard sheet*
- ❑ *Seagrass identification sheets*

Quarterly sampling

Within the 50m by 50m site, lay out the three 50 transects parallel to each other, 25m apart and perpendicular to shore (see site layout). Within each of the quadrats placed for sampling, complete the following steps:

Step 1. Take a Photograph of the quadrat

- Photographs are usually taken at the 5m, 25m and 45m quadrats along each transect, or of quadrats of particular interest. First place the photo quadrat labeller beside the quadrat and tape measure with the correct code on it.
- Take the photograph from an angle as **vertical** as possible, which includes the entire quadrat frame, quadrat label and tape measure. Avoid having any shadows or patches of reflection off any water in the field of view. Check the photo taken box on datasheet for quadrat.

Step 2. Describe sediment composition

- Dig your fingers into the top centimetre of the substrate and feel the texture. Describe the sediment by noting the grain size in order of dominance (e.g., Sand, Fine sand, Fine sand/Mud).

Step 3. Describe other features and ID/count of macrofauna

- Note and count any other features which may be of interest (eg. number of shellfish, sea cucumbers, sea urchins, evidence of turtle feeding) within the comments column.

Step 4. Estimate seagrass percent cover

- Estimate the total % cover of seagrass within the quadrat – use the percent cover photo standards as a guide.

Step 5. Estimate seagrass species composition

- Identify the species of seagrass within the quadrat and determine the percent contribution of each species to the cover. Use seagrass species identification keys provided.

Step 6. Measure canopy height

- Measure canopy height of the dominant strap-like seagrass species ignoring the tallest 20% of leaves. Measure from the sediment to the leaf tip of at least 3 shoots.

Step 7. Estimate algae percent cover

- Estimate % cover of algae in the quadrat. Algae are seaweeds that may cover or overlie the seagrass blades. Use "Algal percentage cover photo guide". Write within the comments section whether the algae is overlying the seagrass or is rooted within the quadrat.

Step 8. Estimate epiphyte percent cover

- Epiphytes are algae attached to seagrass blades and often give the blade a furry appearance. First estimate how much of the blade surface is covered, and then how many of the blades in the quadrat are covered (e.g., if 20% of the blades are each 50% covered by epiphytes, then quadrat epiphyte cover is 10%).
- Epibionts are sessile animals attached to seagrass blades – please record % cover in the comments or an unused/blank column – do not add to epiphyte cover.

Step 9. Take a voucher seagrass specimen if required

- Seagrass samples should be placed inside a labelled plastic bag with seawater and a waterproof label. Select a representative specimen of the species and ensure that you have all the plant part including the rhizomes and roots. Collect plants with fruits and flowers structures if possible.

At completion of monitoring

Step 1. Check data sheets are filled in fully.

- Ensure that your name, the date and site/quadrat details are clearly recorded on the datasheet. Also record the names or number of other observers and the start and finish times.

Step 2. Remove equipment from site

- Remove all tent pegs and roll up the tape measures. If the tape measures are covered in sand or mud, roll them back up in water.

Step 3. Wash & pack gear

- Rinse all tapes, pegs and quadrats with freshwater and let them dry.
- Review supplies for next quarterly sampling and request new materials
- Store gear for next quarterly sampling

Step 4. Press any voucher seagrass specimens if collected

- The voucher specimen should be pressed as soon as possible after collection. Do not refrigerate longer than 2 days, press the sample as soon as possible.
- Allow to dry in a dry/warm/dark place for a minimum of two weeks. For best results, replace the newspaper after 2-3 days.

Step 5. Submit all data

- Data can be entered into the MS-Excel file downloadable from www.seagrasswatch.org. Email completed files to hq@seagrasswatch.org
- Mail original datasheets, photos and herbarium sheets

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Managing seagrass resources

Threats to seagrass habitats

Destruction or loss of seagrasses has been reported from most parts of the world, often from natural causes, e.g., "wasting disease" or high energy storms. However, destruction commonly has resulted from human activities, e.g., as a consequence of eutrophication or land clamation and changes in land use. Increases in dredging and landfill, construction on the shoreline, commercial overexploitation of coastal resources, and recreational boating activities along with anthropogenic nutrient and sediment loading has dramatically reduced seagrass distribution in some parts of the world. Anthropogenic impacts on seagrass meadows continue to destroy or degrade coastal ecosystems and decrease the function and value of seagrass meadows including their contribution to fisheries. It is possible global climate change will have a major impact. Efforts are being made toward rehabilitation of seagrass habitat in some parts of the world: transplantation, improvement of water quality, restrictions on boating activity, fishing and aquaculture, and protection of existing habitat through law and environmental policy.

Management

Seagrasses do not exist in nature as a separate ecological component from other marine plants and are often closely linked to other community types. In the tropics the associations are likely to be complex interactions with mangrove communities and coral reef systems. In temperate waters, algae beds, salt marshes, bivalve reefs, and epiphytic plant communities are closely associated with areas of seagrass. Many management actions to protect seagrasses have their genesis in the protection of wider ecological systems or are designed to protect the overall biodiversity of the marine environment.

Seagrasses are also food for several marine mammal species and turtles, some of which (such as the dugong *Dugong dugon* and green turtle *Chelonia mydas*) are listed as threatened or vulnerable to extinction in the IUCN Red List (www.iucnredlist.org). Seagrasses are habitat for juvenile fish and crustaceans that in many parts of the world form the basis of economically valuable subsistence and/or commercial fisheries. The need to manage fisheries in a sustainable way has itself become a motivating factor for the protection of seagrasses.

Coastal management decision making is complex, and much of the information on approaches and methods exists only in policy and legal documents that are not readily available. There may also be local or regional Government authorities having control over smaller jurisdictions with other regulations and policies that may apply. Many parts of South East Asia and the Pacific Island nations have complex issues of land ownership and coastal sea rights. These are sometimes overlaid partially by arrangements put in place by colonising powers during and after World War II, leaving the nature and strength of protective arrangements open for debate.

Both Australia and the United States have developed historically as Federations of States with the result that coastal issues can fall under State or Federal legislation depending on the issue or its extent. In contrast, in Europe and much of South East Asia, central Governments are more involved. Intercountry agreements in these areas such as the UNEP Strategic Action Plan for the South China Sea and the Mediterranean Countries Barcelona Convention (http://www.unep.org/) are required to manage marine issues that encompass more than one country.

Approaches to protecting seagrass tend to be location specific or at least nation specific (there is no international legislation directly for seagrasses as such that we know of) and depend to a large extent on the tools available in law and in the cultural approach of the community. There is, however, a global acceptance through international conventions (RAMSAR Convention; the Convention on Migratory Species of Wild Animals; and the Convention on Biodiversity) of the need for a set of standardised data/information on the location and values of seagrasses on which to base arguments for universal and more consistent seagrass protection.

Indigenous concepts of management of the sea differ significantly from the introduced European view of the sea as common domain, open to all and managed by governments (Hardin 1968). Unlike contemporary European systems of management, indigenous systems do not include jurisdictional boundaries between land and sea. Indigenous systems have a form of customary ownership of maritime areas that has been operating in place for thousand of years to protect and manage places and species that are of importance to their societies.

Marine resource management these days should, therefore, attempt to achieve the following interrelated objectives: *a*) monitor the wellbeing (e.g. distribution, health and sustainability) of culturally significant species and environments (e.g. dugong, marine turtles, fish, molluscs, seagrass *etc*.); and *b*) monitor the cultural values associated with these culturally significant species and environments (Smyth *et al*. 2006).

To realize objective a) we believe the following also needs to be accomplished if the successful management of coastal seagrasses is to be achieved.

1. Important fish habitat is known and mapped
2. Habitat monitoring is occurring
3. Adjacent catchment/watershed impacts and other threats are managed
4. Some level of public goodwill/support is present
5. Legal powers exist hat are robust to challenge
6. There is effective enforcement and punishment if damage occurs

The key element is a knowledge base of the seagrass resource that needs to be protected and how stable/variable that resource is. It is also important to know if possible any areas that are of special value to the ecosystems that support coastal fisheries and inshore productivity. It is important as well that this information is readily available to decision makers in Governments in a form that can be easily understood.

Consequently a combination of modern *"western"* science and indigenous knowledge should be brought together within a co-management framework for the successful management of these resources. (Johannes 2002; Aswani & Weiant 2004; Turnbull 2004; Middlebrook and Williamson 2006; Gaskell 2003, George *et al.* 2004). This can only occur if the resource owners actively involve themselves in the management of their resources. Western science also needs to recognise that resource owners have practical and spiritual connections with the resources found within their environment. Once this is recognized then this approach will have the added benefit of empowering communities who own the knowledge to be the primary managers and leaders in decisions about their land and sea country.

References

Amesbury, S. S. and J. H. Francis (1988). The role of seagrass communities in the biology of coral reef fishes: experiments with artificial seagrass beds. *Sea Grant Quarterly* **10**(1): 1-6.

Aswani, S., Weiant, P. (2004). Scientific evaluation in women's participatory management: monitoring marine invertebrate refugia in the Solomon Islands. *Human Organisation* 63 (3), 301-319.

Coles RG, Lee Long WJ, Helmke SA, Bennett RE, Miller KJ and Derbyshire KJ (1992). Seagrass beds and juvenile prawn and fish nursery grounds – Cairns to Bowen. Queensland Department of Primary Industries Information Series QI92012 (Queensland Government: Brisbane) 64pp.

Coles, R. G., McKenzie, L. J., Rasheed, M. A., Mellors, J. E., Taylor, H., Dew, K. McKenna, S., Sankey. T. L., Carter A. B. and Grech A. (2007). Status and Trends of seagrass in the Great Barrier Reef World Heritage Area: Results of monitoring in MTSRF project 1.1.3 Marine and Tropical Sciences Research Facility, Cairns (108 pp).

Costanza R, d'Arge R, de Groot R, Farber S, Grasso M, Hannon B, Limburg K, Naeem S, O'Neil RV, Paruelo J, Raskin RG, Sutton P and van der Belt M. (1997). The Value of the world's ecosystem services and natural capital. *Nature* 387(15): 253-260.

Gaskell, J., 2003. Engaging science education within diverse cultures. *Curriculum Inquiry*. 33, 235-249.

George, M., Innes, J., Ross, H., 2004. Managing sea country together: key issues for developing co-operative management for the Great Barrier Reef World Heritage Area. CRC Reef Research Centre Technical Report No 50, CRC Reef Research Centre Ltd, Townsville.

Hardin, G., 1968. The tragedy of the commons. *Science, New Series.* 162 (3859), 1243-1248.

Johannes, R.E., 2002. The renaissance of community-based marine resource management in Oceania. *Annu. Rev. Ecol. Syst.* 33, 317-340.

Lanyon, J. (1986), Guide to the identification of seagrasses in the Great Barrier Reef Region. Townsville, Great Barrier Reef Marine Park Authority

Ludescher, CM. (1997) Fisheries Resources between Bowen and Tully – An Inventory (AFMA:Birsbane) 136pp ISBN0 72427011 6

McKenzie, L.J., Campbell, S.J., Vidler, K.E. & Mellors, J.E. (2007) Seagrass-Watch: Manual for Mapping & Monitoring Seagrass Resources. (Seagrass-Watch HQ, Cairns) 114pp (www.seagrasswatch.org/manuals.html) .

Middlebrook, R., Williamson, J.E., 2006. Social attitudes towards marine resource management in two Fijian villages. *Ecological Management & Restoration* 7 (2), 144-147.

Scheltinga DM and Heydon L (eds.) (2005). Report on the Condition of Estuarine, Coastal and Marine Resources of the Burdekin Dry Tropics Region. Commissioned by the Burdekin Dry Tropics Board. Cooperative Research Centre for Coastal Zone, Estuary and Waterway Management 230 pp.

Short, F. and Wyllie-Echeverria, S. (1996). Natural and human-induced disturbance of seagrasses. *Environmental Conservation* **23**(1): 17-27.

Smyth, D., Fitzpatrick, J., Kwan, D., 2006. Towards the development of cultural indicators for marine resource management in Torres Strait. CRC Torres Strait, Townsville. 61 pp.

Waycott, M, McMahon, K, Mellors, J., Calladine, A., and Kleine, D (2004) A guide to tropical seagrasses in the Indo-West Pacific. (James Cook University Townsville) 72pp.

Further reading:

Carruthers TJB, Dennison WC, Longstaff BJ, Waycott M, Abal EG, McKenzie LJ and Lee Long WJ. (2002). Seagrass habitats of northeast Australia: models of key processes and controls. *Bulletin of Marine Science* 71(3): 1153-1169.

den Hartog C. (1970). The seagrasses of the world. (North-Holland Publishing, Amsterdam). 293pp.

Green EP. and Short FT (Eds) (2003). World Atlas of Seagrasses. Prepared by the UNEP World Conservation Monitoring Centre. (University of California Press, Berkeley. USA). 298pp.

Kirkman H (1997). Seagrasses of Australia. Australia: State of the Environment .Technical Paper Series (Estuaries and the Sea), Department of the Environment, Canberra.

Lanyon JM, Limpus CJ and Marsh H. (1989). Dugongs and turtles: grazers in the seagrass system. In: Biology of Seagrasses: A treatise on the biology of seagrasses with special reference to the Australian region. (AWD Larkum, AJ McComb and SA Shepherd eds). (Elsevier: Amsterdam, New York). pp 610-34.

Lee Long, W. J., Coles, R. G. & McKenzie, L. J. (2000) Issues for seagrass conservation management in Queensland. *Pacific Conservation Biology* 5, 321-328.

McKenzie LJ, Finkbeiner MA and Kirkman H (2001b). Methods for mapping seagrass distribution. Chapter 5 pp. 101-122 In: Short FT and Coles RG (eds) 2001. Global Seagrass Research Methods. Elsevier Science B.V., Amsterdam. 473pp.

Phillips, R.C, E.G Menez. (1988). Seagrasses. Smithsonian Institution Press, Washington, D.C. 104 pp.

Poiner, I.R., Walker, D.I., and Coles, R.G. (1989). Regional Studies - Seagrass of Tropical Australia. In: Biology of Seagrasses. A.W.D. Larkurn, A-J. McComb and S.A.Shepherd (Eds). Elsevier, Amsterdam, New York; 841 pp.

Short, FT and Coles, RG. (Eds.) Global Seagrass Research Methods. Elsevier Science B.V., Amsterdam. 473pp.

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