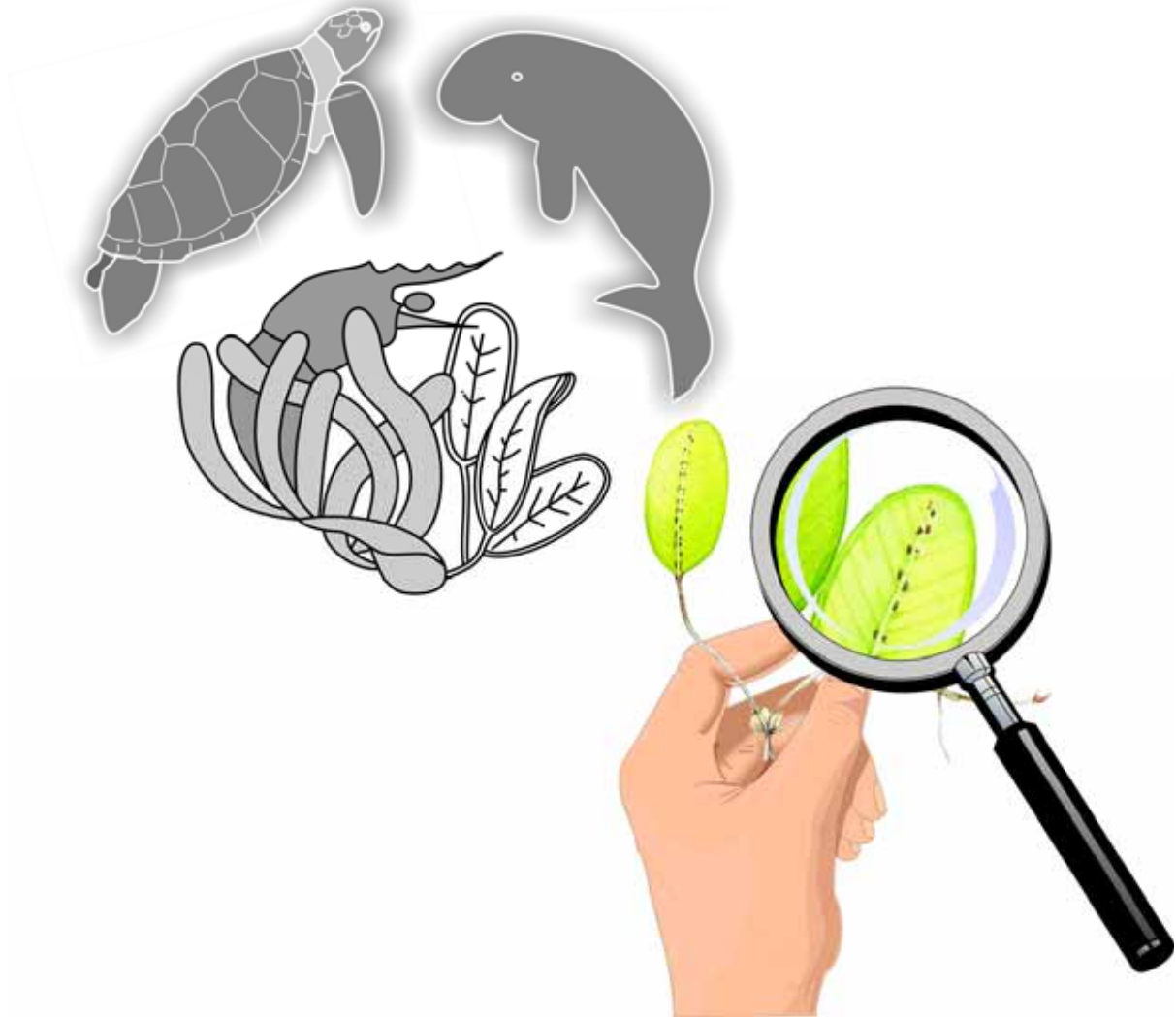


Seagrass-Watch

Guidelines for Monitoring Seagrass Habitats in
the Burdekin Dry Tropics Region



Arcadian Junior Surf Life Saving Club, Townsville

18th March 2007

Len McKenzie and Jane Mellors

Department of Primary Industries & Fisheries, Queensland



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The Department of Primary Industries & Fisheries have 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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Produced by Seagrass-Watch HQ

Northern Fisheries Centre, Cairns, 2005.

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Overview

Often governments are unable to protect and conserve seagrass meadows without the assistance of local communities (e.g., local residents, schools, non-government organisations). Seagrass-Watch is a community based 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*

It is also important to realise that the reasons for monitoring will also influence the monitoring plan and the methods used. A rapid method for monitoring seagrass resources is used in the Seagrass-Watch program. The Seagrass-Watch program originated from

- *Community concerns about seagrass loss and habitat integrity*
- *Community interest in science, and*
- *Government objectives in long-term monitoring of critical fisheries habitats.*

The goals of the Seagrass-Watch program are:

- *Partnerships between Government and non-government organisations,*
- *Community participation and ownership of marine resources,*
- *Long-term & broad-scale monitoring of habitat, seasonal patterns, condition and trend data,*
- *An early warning system of coastal environment changes,*
- *Community education on the importance of seagrass resources, and*
- *Community awareness of coastal management issues.*
- *To provide training to build the capacity of local communities to collect information useful for the ongoing management and protection of important marine resources.*
- *Integrate with existing education, government, non-government and scientific programs to raise community awareness and preserve these important marine ecosystems for the benefit of the community.*



This workshop is hosted by the Townsville & Thuringowa Seagrass-Watch group, local coordination by Posa Skelton and Sue Mulvaney, and supported by the Australian Government's Marine and Tropical Sciences Research Facility (Department of the Environment and Water Resources) represented in North Queensland by the Reef and Rainforest Research Centre, the Great Barrier Reef Marine Park Authority (GBRMPA), the Queensland Department of Primary Industries & Fisheries and the Burdekin Dry Tropics NRM. 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 community based Seagrass- Watch monitoring activities. For further information, please do not hesitate to contact us at

Seagrass-Watch HQ

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Queensland Department of Primary Industries & Fisheries
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or visit

www.seagrasswatch.org





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

Sunday 18th March 2007

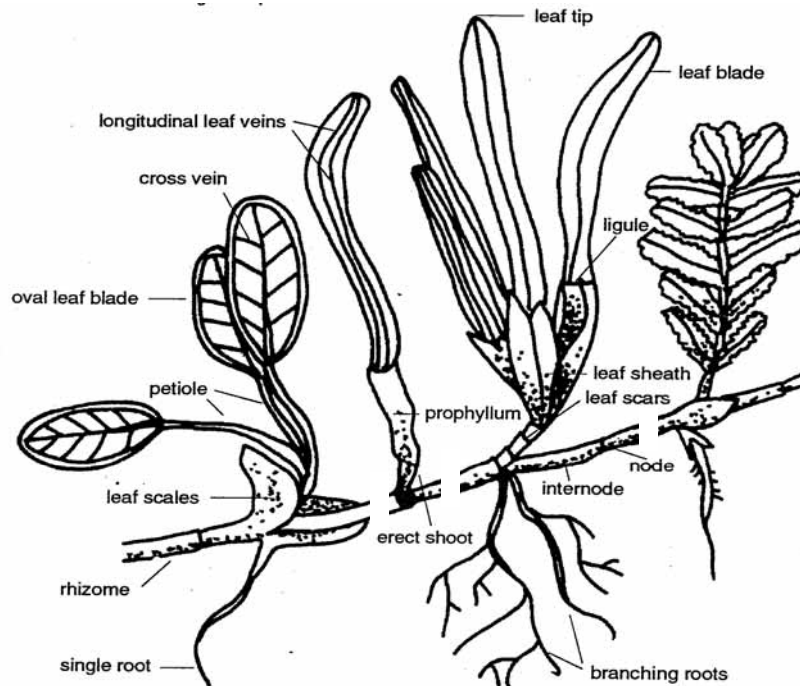
Morning	0830 - 0845	Welcome – <i>Posa Skelton & Jane Mellors</i>
	0845 – 0920	Seagrass Biology and Identification – <i>Naomi Smith</i>
	0920 – 0945	Laboratory exercise: Seagrass Identification & how to prepare a seagrass press specimen – <i>Naomi Smith & Jane Mellors</i>
		Morning Tea
	1015 - 1045	Seagrass Ecology and Threats – <i>Jane Mellors</i>
	1045 – 1100	Seagrass monitoring – <i>Jane Mellors</i>
	1100-1200	Seagrass-Watch - <i>Jane Mellors & Naomi Smith</i>
	1200 – 1215	Safety briefing & risk assessment – <i>Naomi Smith</i>
Afternoon	1215 – 13:15	Lunch
	1330 - 1645	Field exercise: Seagrass-Watch – <i>Jane Mellors, Naomi Smith, Posa Skelton, Lux Foot, Catherine Walsh,</i> <i>Where:</i> At Rowes Bay, meet in park opposite caravan park <i>When:</i> 1330 start (finishing at approximately 4:30pm probably earlier) <i>What to bring:</i> <ul style="list-style-type: none"> • <i>hat, sunscreen (Slip! Slop! Slap!)</i> • <i>dive booties or old shoes that can get wet</i> • <i>drink/refreshments</i> • <i>Polaroid sunglasses (not essential)</i> • <i>enthusiasm</i> <i>We welcome your children, but please keep them under close supervision.</i> <i>You will be walking across a seagrass meadow exposed with the tide, through shallow water. It may be wet and muddy!</i> <i>Please remember, seagrass meadows are an important resource and are protected by law. We ask that you use discretion when working/walking on them.</i>

- *Low tide: 0.6m at 1454*



Background

Seagrasses are specialized marine flowering plants that have adapted to the nearshore environment of most of the world's continents. Most 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 just 13 Genera and 5 Families.



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

from Lanyon (1986)

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 seagrass is time consuming and expensive and it is likely that areas of deepwater seagrass are still to be located.

A number of general parameters are critical to whether seagrass will occur along any stretch of coastline. These include physical parameters that regulate the physiological activity of seagrasses (temperature, salinity, waves, currents, depth, substrate and day length), natural phenomena that limit the photosynthetic activity of the plants (light, nutrients, epiphytes and diseases), and anthropogenic inputs that inhibit the access to available plant resources (nutrient and sediment loading). Various combinations of these parameters will permit, encourage or eliminate seagrass from a specific location.

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. Thermal 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 determine 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.

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, 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.

Further reading:

- Short, FT, RG Coles, C Pergent-Martini. 2001. Global seagrass distribution. Chapter 1, pp. 5-30. *In: FT Short, RG Coles (eds.) Global Seagrass Research Methods.* Elsevier Science B.V., Amsterdam.
- Creed, JC, Phillips, RC, and Van Tussenbroek, BI. 2003 Seagrasses of the Caribbean. pp. 234 - 242. *In: Green, E.P. and Short, F.T. (eds.). World Atlas of Seagrasses.* University of California Press, Berkeley, USA.
- Kuo, J, C Den Hartog. 2001. Seagrass taxonomy and identification Key. Chapter 2. pp. 31-58. *In: FT Short, RG Coles (eds.) Global Seagrass Research Methods.* Elsevier Science B.V., Amsterdam.



Notes:

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Townsville Seagrasses

Seagrass meadows in the Townsville region play a vital role in supporting coastal marine communities and in maintaining diverse flora and fauna. They are an important component of coastal fisheries productivity, which includes being nursery grounds for many commercially important species. They play an important role in maintaining coastal water quality and clarity. They are also used by dugong and are important to this endangered species. The loss of seagrass habitat due to anthropogenic effects would further reduce the viability of dugong surviving in the long term in the Townsville Region.

The importance of seagrass in the Townsville to commercial and recreational fisheries production, and threatened species such as dugong and turtle populations is widely recognised. The value of seagrass areas in the Townsville region is recognised with the Cleveland Bay area being declared a Dugong Protection Area. The loss of seagrass habitat due to anthropogenic effects would further reduce the viability of dugong surviving in the long term in this part of the Great Barrier Reef region.

There are extensive and diverse seagrass meadows in the Townsville Region. Intertidal and shallow subtidal seagrasses predominate and tend to form multi-specific meadows that are arranged in mono-specific bands across a depth gradient. True reefal seagrasses are also rare in this region, but most fringing reefs associated with continental islands support moderately dense mixed species meadows. Area of seagrass in the region is estimated at 130 km², of mostly moderate (11-49%) and light (1-10%) cover.

In the Townsville region, there are significant seagrass meadows along Cape Cleveland (8394 ± 323 ha), the Strand, Cape Pallarenda, and around Magnetic Island (4404 ± 331 ha for Townsville & Magnetic Island). The main seagrass species in shallow waters near Townsville are *Halophila ovalis*, *Halodule uninervis*, *Zostera capricorni*, and *Cymodocea serrulata*. *Halophila spinulosa* that has been washed up from deeper waters can sometimes be found. Despite the variable inter-annual rainfall that occurs along this coastline, cyclones frequent (~15 cyclones/decade). In April 2000, intertidal seagrass meadows in the Townsville region were decimated by a cyclone but they are now recovering.

The distribution of seagrasses along this coastline is predominately influenced by seasonal (April-November) south-easterly trade winds. 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 large tidal runs (in the south) creates significant coastal turbidity. Consequently seagrasses that inhabit this area are 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.

The greatest threat to seagrass throughout this region is agricultural land clearing (both grazing and cropping) and its inherent problems of soil erosion and associated loads of nutrients and pesticides.

Townsville Regional report card - Feb05

- Healthy seagrass meadows throughout the Townsville region support significant fisheries, turtle and dugong populations
- Seagrass meadows in the Townsville region are in a **fairly-good** condition.
- Seagrass cover at some sites is good and showing seasonal trends (significant increases each spring), while the remaining sites appear to be recovering/improving. Although Sandfly Creek sites are rated as Poor, there are significant seagrass meadows in the near vicinity.
- Seagrass species composition at most sites across region has remained stable.
- Temperature records show high intertidal temperatures within the seagrass canopy in December 2003 and January 2004 at Shelley Beach. Highest temperature recorded was 41°C at SB2 on 18 January 2003, on the low tide at 3:00pm. Latest research indicates that short term (less than 3 hours) exposure to elevated temperatures over 40°C can cause seagrass leaf/chlorophyll death. Also, high (>30°C) mean sea-surface temperatures have been acknowledged as the main cause of coral bleaching.
- Seagrass-Watch data provides understanding of seasonal trends and effects of climatic patterns on seagrass meadows



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



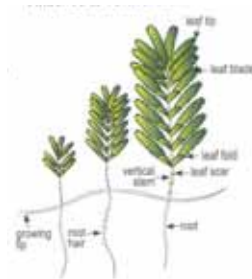
Syringodium isoetifolium

- 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

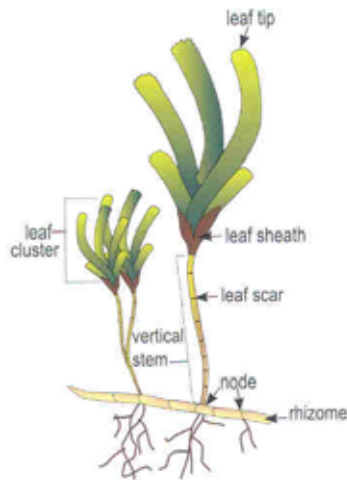
- leaf margins serrated
- fine hairs on one side of leaf blade
- separate male & female plants



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

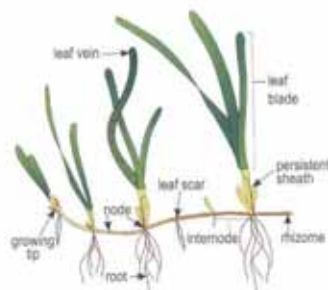
Halodule pinifolia

- 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 18 countries. Monitoring is currently occurring at over 165 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 and preserve these important marine ecosystems 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 is also a component of the Global Seagrass Monitoring Network.

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, the community, government and researchers have to work together.

THE GOALS OF THE PROGRAM ARE:

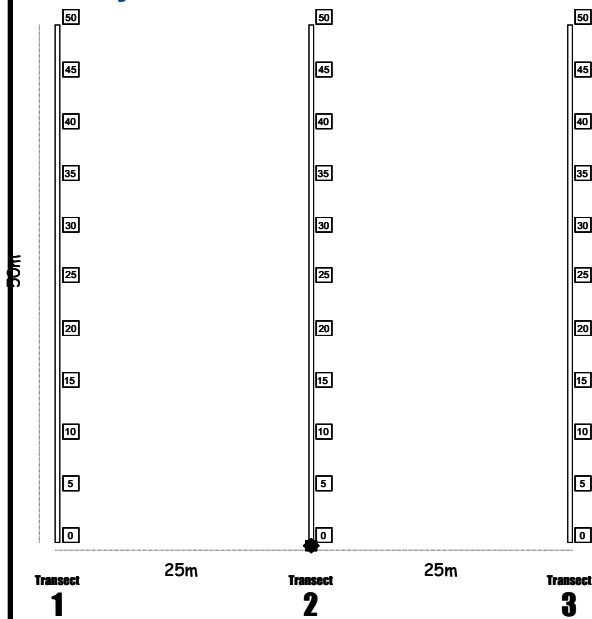
- To educate the wider community on the importance of seagrass resources
- To raise community awareness of coastal management issues
- To develop community participation and ownership
- To build the capacity of local communities in the use of standardised scientific methodologies
- To conduct long-term & broad-scale monitoring of seagrass & coastal habitats, and
- To provide an early warning system of coastal environment changes for management.



Seagrass-Watch Monitoring Summary

Source: McKenzie, L.J., Campbell, S.J. & Roder, C.A. (2003) *Seagrass-Watch: Manual for Mapping & Monitoring Seagrass Resources by Community (citizen) volunteers*. (DPI&F, NFC, Cairns) 100pp

Site layout



Quadrat code = site + transect+quadrat

e.g., RB1225 = Rows Bay 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 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. Try to avoid having any shadows or patches of reflection off any water in the field of view. Check the photo taken box on the datasheet for that quadrat.

Step 2. Describe sediment composition

- To assess the sediment, 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. Estimate seagrass percent cover

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

Step 4. Estimate seagrass species composition

- Identify the species of seagrass within the quadrat and determine the percent contribution of each species to the cover (must total 100%). Use seagrass species identification keys provided.

Step 5. Measure canopy height

- Measure canopy height of the seagrass ignoring the tallest 20% of leaves. Measure from the sediment to the leaf tip of at least 5 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”.

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%).

Step 9. 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).

Step 10. 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 number of other observers assisting.

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

- Mail original datasheets, photos and herbarium sheets

Seagrass-Watch
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Managing seagrass resources

Threats to seagrass habitats

Destruction or loss of seagrasses have 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 reclamation and changes in land use. Increases in dredge and fill, construction on the shoreline, damage associated with 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 seagrass functions and values, 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*) are listed as threatened or vulnerable to extinction in the IUCN Red List (IUCN 2000). 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 that 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

- 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, McKenzie LJ and Campbell SJ. (2003). The seagrasses of eastern Australia. Chapter 11 In: World Atlas of Seagrasses. (EP Green and FT Short eds) Prepared by the UNEP World Conservation Monitoring Centre. (University of California Press, Berkeley. USA). Pp 119-133.
- Fitzpatrick, J., Kwan, D., and Smyth (2006). Towards the development of cultural indicators for marine resource management in Torres Strait. Report to Torres Strait CRC, August 2006. 71 pp.
- 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.
- Long B, Skewes, T, Thomas, M, Isdale, P, Pitcher, R, and Poiner I, (1997). Torres Strait Seagrass Dieback. Final report to TSFSAC 26. CSIRO Division of Marine Research, Cleveland, Brisbane, Australia. 24pp.
- Long B.G and Poiner I.R (1997). The Seagrass Communities of Torres Strait, Northern Australia.. Final report to TSFSAC 26. CSIRO Division of Marine Research, Cleveland, Brisbane, Australia. 49pp.
- McKenzie LJ, Campbell SJ, Roder CA (2001). Seagrass-Watch: Manual for Mapping & Monitoring Seagrass Resources by Community (citizen) volunteers. (QFS, NFC, Cairns) 94pp.
- 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.
- McKenzie LJ. (1994). Seasonal changes in biomass and shoot characteristics of a *Zostera capricorni* Aschers. dominant meadow in Cairns harbour, northern Queensland. *Australian Journal of Marine and Freshwater Research* 45: 1337-52.
- Middlebrook, R., Williamson, J.E., 2006. Social attitudes towards marine resource management in two Fijian villages. *Ecological Management & Restoration* 7 (2), 144-147.
- 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.
- Thomas, R. and Rasheed, M.A. (2004). Port of Thursday Island long-term seagrass monitoring - March 2004. QDPI&F Information Series QI04082. (Queensland Department of Primary Industries and Fisheries, Northern Fisheries Centre, Cairns), 22 pp.
- Torres Strait Regional Authority (TSRA), 2006. Welcome to the TSRA. <http://www.tsra.gov.au/>
- Turnbull, C and Mellors J (1990). Settlement of juvenile *Penaeus esculentus* (Haswell 1978) on nursery grounds in the Torres Strait. In Torres Strait prawn project: A Review of Research 1986-88, J.E Mellors ed, Queensland Department of Primary Industries QI90018 29 – 38.



- Turnbull, J., 2004. Explaining complexities of environmental management in developing countries: lessons from the Fiji Islands. *The Geographical Journal*, 170 (1), 64–77.
- 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:

- Bridges K.W, Phillips R.C, Young P.C (1982). Patterns of some seagrass distributions in the Torres Strait, Queensland. *Marine and Freshwater Research* 33: 273-283.
- 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.
- Coles, R.G. (1998) Proposed Pontoon at Engineer's Wharf, Thursday Island - Review of Environmental Factors (seagrasses and other benthic habitats). Report to Queensland Department of Main Roads. (QDPI, NFC, Cairns) 8pp.
- 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.
- 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.
- 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. Larkum, A-J. McComb and S.A.Shepherd (Eds). Elsevier, Amsterdam, New York; 841 pp.
- Rasheed, M.A, Thomas, R, Roelofs, A, and Neil K, (2003). Seagrass, benthic habitats and targeted introduced species of the Ports of Thursday Island: March 2002. DPI Information Series QI03019 (DPI Cairns) 28pp.
- Short, FT and Coles, RG. (Eds.) Global Seagrass Research Methods. Elsevier Science B.V., Amsterdam. 473pp.
- Thomas M, Long B, and Taranto T, (1997). Mapping Shallow Water Seagrass with Landsat TM Satellite Data in Torres Strait. Final report to TSFSAC 26. CSIRO Division of Marine Research, Cleveland, Brisbane, Australia. 13pp.



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