UNIVERSITI MALAYSIA SABAH

Strive to Excel

Community and Education-based monitoring of seagrass in Sabah, Malaysia

A workshop organized by

Borneo Marine Research Institute, University of Malaysia, Sabah.

in collaboration with the

Marine Plant Ecology Group, Northern Fisheries Centre, Department of Primary Industries, Queensland, Australia.

Community and education-based monitoring of seagrass in Sabah, Malaysia

Workshop background

The Indo-Pacific region is the area of the world that has the highest concentration of seagrass species, extensive and diverse seagrass habitats and a myriad of industrial and non-industrial impacts threatening seagrass growth and survival. The combination of these factors provides a complex set of circumstances that challenges our scientific ability to monitor seagrass habitat and test the diversity of habitat impacts, an ideal area for a pilot monitoring initiative. Additionally, the Indo-Pacific region includes countries that have extensive seagrass habitat intricately linked to important economic features such as fishing, tourism, SCUBA diving. For these reasons, the development of a community and education-based monitoring protocol that is capable of assessing the condition of seagrass habitats will provide the focus of the workshop.

Seagrass-Watch is a community-based monitoring program developed by the Marine Plant Ecology Group (MPEG) four years ago in Queensland (Australia), in collaboration with community (citizen) groups. With support from Prof. Fred Short and the University of New Hampshire, who negotiated funding from The David and Lucile Packard Foundation, Seagrass-Watch is being extended across the Western Pacific. The project provides training opportunities for local scientists, schools or community members so that in future the seagrass can be sampled, measured and processed with the expertise of local co-ordinators and advice from us by email or phone.

This program will be similar to Queensland Seagrass-Watch program where local communities and schools are involved with scientists in the assessment of seagrass habitats. Local co-ordinators are trained to maintain the program. Other sites have been established in Kosrae, Pohnepei, Palau, The Philippines, Indonesia, Papua New Guinea, and Fiji. This is part of a longer term plan to establish monitoring sites for seagrass around the world and to eventually provide a Global Report Card on seagrasses.

Dr Stuart Campbell and Mr Len Mckenzie from the Marine Plant Ecology Group (MPEG), Department of Primary Industries, Queensland, Australia will be invited as Resource Persons to facilitate the workshop.

Workshop dates

15-16 August 2002

Objectives

The aims of Seagrass-Watch are:

- To raise awareness and provide educational opportunities on the importance of marine habitats with a focus on seagrass ecosystems.
- To introduce methods to collect information on changes in seagrass meadows and associated fauna and possible human impacts for coastal management purposes.
- To integrate existing education and scientific programs for the benefit of people and organisations who participate.

Workshop Schedule

Day 1

Presentation of Seagrass-Watch monitoring in the Western Pacific region
Seagrass species identification
Demonstration of monitoring protocols and methodologies
Discussion of how community/education based seagrass monitoring can be implemented in Sabah.

Day 2

The workshop will train students and other interested people in scientific methods to:

- Measure seagrass abundance and species composition to make an assessment of the habitat condition
- Measure abundance of invertebrate animals living in seagrass meadows.
- Develop rapid techniques for assessment of fish populations living in seagrass meadows.

The techniques will involve non-destructive methods employing transects and quadrats to sub-sample areas and count and measure marine plants and animals in seagrass habitats.

Location of Field Site

The practical part of the workshop will be conducted in Ambong Bay which is approximately 1 hour drive from Kota Kinabalu. We aim to work with local communities in developing ways of gaining local knowledge of the ecology of nearshore seagrass ecosystems. This will involve working closely with students and staff from the University of Malaysia, Sabah towards the establishment of a local Seagrass-Watch network.

WORKSHOP ON "COMMUNITY AND EDUCATION BASED MONITORING OF SEAGRASS MEADOWS IN SABAH, MALAYSIA" 15-16 August, 2002.

Tentative program

Thursday, 15 August 2002

8.30 A.M.	:	Arrival of Guests and Speakers
9.00A.M.	:	Preliminary Introductions- By Prof. Dr. Ridzwan Abdul Rahman
9.30 A.M.	:	Presentation of Seagrass-Watch monitoring in the Western Pacific region - by Dr. Stuart Campbell
10.30 A.M.	:	Tea Break
11.00 A.M.	:	Demonstration of Monitoring protocol and methodologies - by Mr. Len McKenzie
1.00 P.M.	:	Lunch
2.00 P.M.	:	Discussion of how community/education-based seagrass monitoring can be implemented in Sabah.
4.00 P.M.	:	End of Session - Tea

Friday, 16 August, 2002

8.30 A.M.	:	Departure to field site
10.00 A.M.	:	The participants will be taught how to : 1) Measure seagrass abundance and species composition to make an assessment of the habitat condition. 2) Measure abundance of invertebrate animals living in seagrass. 3) Develop rapid techniques for assessment of fish populations living in seagrass.

Seagrass-Watch in the Indo-western Pacific

Often governments are unable to protect and conserve seagrass meadows without the assistance of local communities (eg. local residents, schools, non government organizations). 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 manage 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 seagrass meadows are improving or declining. Successful management of coastal environments (including seagrass resources) requires regular monitoring of the status and condition of natural resources.

Monitoring is important in improving our understanding of seagrass resources for:

- Identifying coastal environmental problems
- Determining the effectiveness of management practices
- 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 of watershed management practices on marine environments
- Assisting education and training, and helping to develop links between local communities, schools and government agencies
- Assessing new management practices
- Identifying and prioritising future management requirements and initiatives.

Seagrass-Watch Western Pacific is a component of the Global Seagrass Monitoring Network, a scientific global seagrass monitoring program that investigates and documents the status of seagrass resources worldwide and the threats to this important ecosystem. Seagrass-Watch in the Western Pacific are supported through the University of New Hampshire (USA) by funding from the David and Lucile Packard Foundation.

Seagrass Habitat picture courtesy of QDPI ©

The Seagrass-Watch Western Pacific Monitoring Program is modelled using techniques developed for the Australian based Seagrass-Watch program. This program originated from:

- Community concerns about seagrass loss and the value of habitats
- Community interest in marine science, and
- Scientific and community interest in long term monitoring of critical fisheries habitats

Seagrass-Watch Western Pacific monitoring program Goals & objectives

The goals of the Seagrass-Watch Western Pacific Monitoring Program are to develop:

- 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

The objectives of the Seagrass-Watch Western Pacific Community Monitoring Program include:

- To provide training to build the capacity of local communities in the use of the seagrass and associated fauna monitoring protocols.
- To provide training to allow communities to collect information useful for their ongoing management and protection of important marine resources.

If you would like to be involved in the program or would like more information, contact

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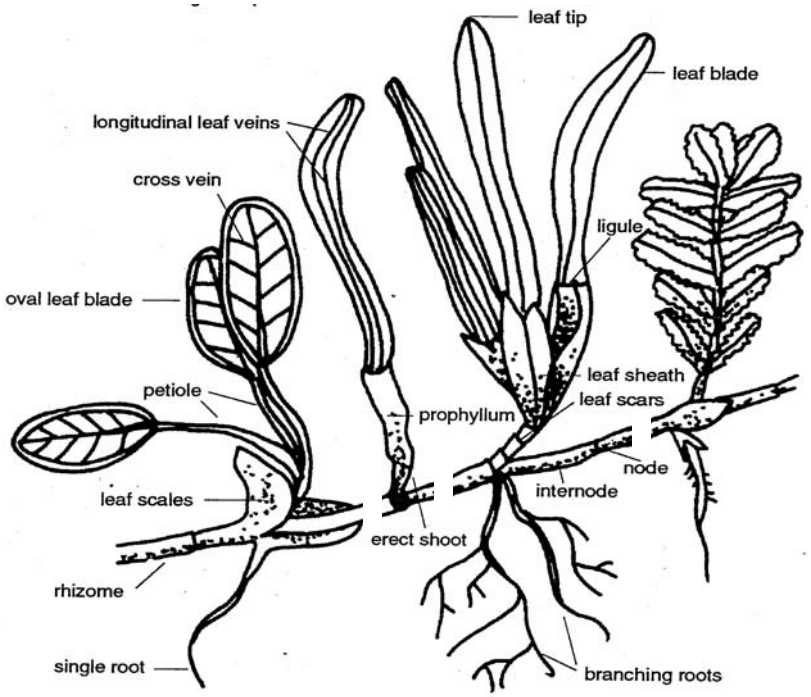
Western Pacific Seagrasses

Seagrasses are angiosperms (flowering plants) more closely related to terrestrial lilies and gingers than to true grasses. Seagrasses are a group of marine flowering plants living entirely submersed in marine waters. They grow in sediment on the sea floor and have:

1) erect leaves that need light to photosynthesize
2) buried root-like structure (rhizomes) that hold the plants in the sediments
3) roots that take up nutrients from sediments for growth.



Composite illustration demonstrating morphological features used to distinguish main seagrass taxonomic groups.
from Lanyon, . (1986)

There are 60 described species of seagrasses worldwide, within 12 genera. The Indo-Pacific has the largest number of seagrass species worldwide, with vast meadows of mixed species stands. There are 23 species (Short *et al.* 2001) of seagrasses found throughout the tropical Indo-Pacific (Region IX, in Short and Coles 2001). These include the genera of *Cymodocea, Enhalus, Halodule, Halophila, Syringodium, Thalassia, Zostera* and *Thalassodendron*. Seagrasses provide a sheltered, nutrient-rich habitat for a diverse range of flora and fauna. The Philippines is believed to be the area where seagrasses originally evolved, and has a high concentration of seagrass species. In the western Pacific there are 16 species recorded from the Philippines, 13 from Papua New Guinea, (Fortes 1998), and 15 from northern Australia (Lee Long *et al.* 2000) and 10 from Micronesia.

Seagrasses are unique amongst flowering plants, in that all but one genus can live entirely immersed in seawater. *Enhalus* plants are the exception, as they must emerge to the surface to reproduce; all others can flower and be pollinated under water. Adaptation to a marine environment imposes major constraints on morphology and structure. The restriction of seagrasses to seawater has obviously influenced their geographic distribution and speciation.

Seagrasses grow in waters where there is sufficient light and nutrients that are required for growth. Sediment runoff and over supply of nutrients from watersheds can reduce the amount of light needed for seagrasses to photosynthesise and grow. Too many nutrients from agricultural fertilizers and sewage inputs can cause seaweeds to grow and smother seagrass meadows. The causes of loss can also be natural such as cyclones and floods, or due to human influences such as dredging, agricultural runoff, industrial runoff or oil spills. Other factors that regulate the growth of seagrasses include temperature, salinity, waves, currents, depth, substrate and day length.

Tropical seagrasses occupy a variety of coastal habitats. Tropical seagrass meadows typically occur in most shallow, sheltered soft-bottomed marine coastlines and estuaries. 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. Tropical seagrasses are also important in their interactions with mangroves and coral reefs. 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. All these systems exert a stabilizing effect on the environment, resulting in important physical and biological support for the other communities.

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. 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. Human impacts on seagrass meadows are continuing 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.

References & Further reading:

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Focus Groups

Aim: To contribute information/ideas for developing a

strategy to implement the Seagrass-Watch program in

Sabah, Borneo Malaysia.

Focus groups were asked to provide responses to the following questions:

- How can Seagrass-Watch integrate with existing programs?
- How can Seagrass-Watch involve schools, communities, conservation groups, *etc*?
- How can Seagrass-Watch results be communicated effectively?
- How can Seagrass-Watch fit into existing strategies?
- How can Seagrass-Watch be improved/tailored to local needs?
- How can Seagrass-Watch activities be coordinated on-ground?

Focus Group 1.

Education opportunities

Issue ***• Comment/Solution***

Schools often very interested but require support from Education ministry

Marine Club at Borneo Research Institute potential co-ordinators for Seagrass-Watch

- Seagrass-Watch could be used as a basis for developing student projects.
- Linking Borneo Research Institute Marine Club with NGO's could develop interest in seagrass monitoring

Production of video to educate broader community on the value of fisheries habitats

Focus Group 2.

Government agencies:

Issue ***• Comment/Solution***

Difficult to get interest in on-ground monitoring of fisheries habitat from government agencies as they are already stretched with resources, require support from management within government

Education of government scientists and mangers required on the importance of seagrass ecosystems and the threats to their survival

Marine Parks interested in monitoring but only within marine park boundaries, difficult to develop networks with communities

Focus Group 3.

Non-government agencies:

Issue ***• Comment/Solution***

Collaborative networks between NGO's to develop monitoring network, this was identified as a mechanism to develop Seagrass-Watch in Sabah

Development of education centre on Palau Banggi opportunity for development of education approaches on seagrass ecosystems and seagrass monitoring

Palau Banggi identified as an area where possibly community interaction could be achieved

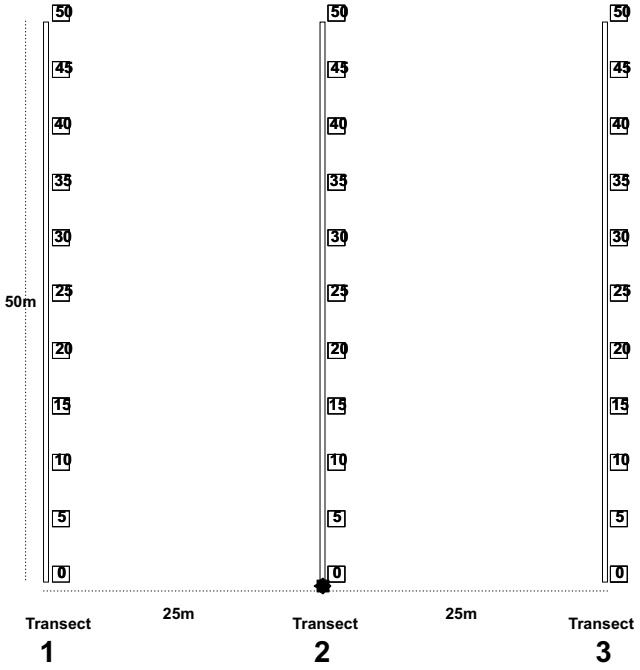
Need for emphasis on importance of seagrass ecosystems to local fisheries, local marine park management and protection of marine biodiversity

Appendix

Seagrass-Watch Monitoring Methods: Summary

Extract from: McKenzie, L.J. & Campbell, S.J. (2002) Seagrass-Watch: Manual for Community (citizen) monitoring of seagrass habitat - western Pacific edition. (QFS, NFC, Cairns) 43pp

Site layout



Quadrat code = site + transect+quadrat
e.g., NN1225 = Nadroga Navosa site 1, transect 2, 25m

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 participants involved in advance so they can make their arrangements to get to the site on time. List on this timetable what the participants 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 if available
- Keep your site clean, remove any rubbish

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 50m 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 taken at the 5m, 25m and 45m quadrats along each transect, and in quadrats of particular interest. First place the photo quadrat labeller beside the quadrat with the correct code.

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. Tick 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 total cover. 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. 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 9. Take a voucher seagrass specimen if seagrass ID uncertain

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 <u>completely</u> filled in.

Ensure that your name, the date and site/quadrat details are clearly recorded on the datasheet. Also record the number of other observers assisting and your 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.

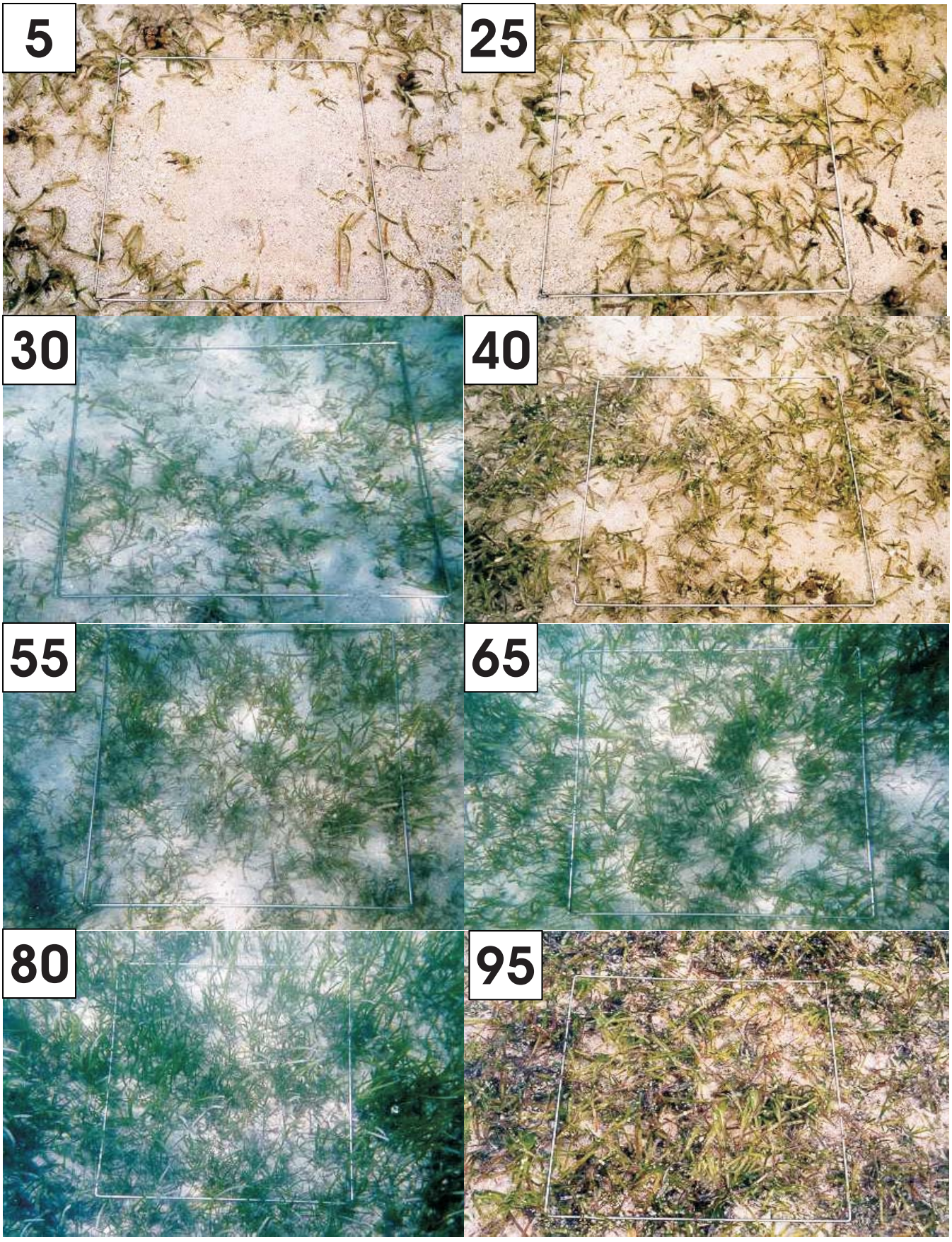
Allow to dry in a dry/warm/dark place for a minimum of two weeks. For best results, replace the newspaper after 2-3 days. Send dry specimens to Seagrass-Watch Coordinator.

Step 5. Submit all original datasheets to Seagrass-Watch HQ

(keep a copy for your own records)

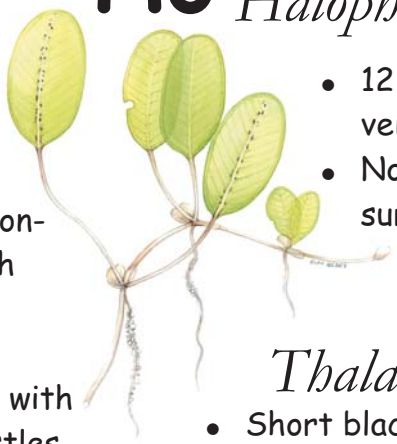
Seagrass-Watch
Northern Fisheries Centre
PO Box 5396
Cairns Qld 4870
AUSTRALIA
Email: seagrass@dpi.qld.gov.au

Seagrass Percentage Cover



SEAGRASS SPECIES CODES

Ho *Halophila ovalis*



- 12 or more cross veins
- No hairs on leaf surface

Ea *Enhalus acoroides*

- Very long ribbon-like leaves with inrolled leaf margins
- Thick rhizome with long black bristles and cord-like roots
- Leaves 30-150 cm long

Th *Thalassia hemprichii*

- Short black bars of tannin cells on leaf
- Thick rhizome with scars between shoots
- "Sickle" shaped leaves
- Leaves 10-40 cm long

Hu *Halodule uninervis*

- trident leaf tip
- 1 central vein
- Usually pale rhizome, with clean black leaf scars

Hp *Halodule pinifolia*

- rounded leaf tip
- 1 central vein
- Usually pale rhizome, with clean black leaf scars

Cr *Cymodocea rotundata*

- Rounded leaf tip
- Narrow leaf blade (2-4mm wide)
- Leaves 7-15 cm long
- 9-15 longitudinal veins
- Well developed leaf sheath

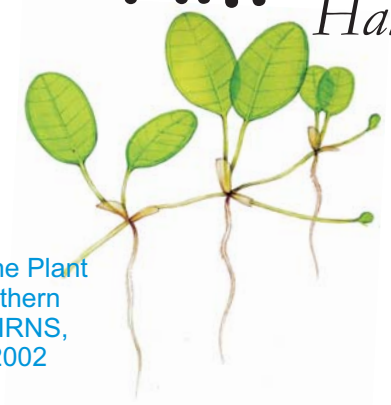
Cs *Cymodocea serrulata*

- Serrated leaf tip
- Wide leaf blade (5-9mm wide)
- Leaves 6-15cm long
- 13-17 longitudinal veins

Si *Syringodium isoetifolium*

- Cylindrical in cross section
- Leaf tip tapers to a point
- Leaves 7-30cm long

Hm *Halophila minor*



- Less than 12 pairs of cross veins
- Small oval leaf blade

Compiled by the Marine Plant Ecology Group, Northern Fisheries Centre CAIRNS, AUSTRALIA July 2002

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