SEAGRASS-WATCH
GLOBAL SEAGRASS OBSERVING NETWORK

SENTINEL SITES PERMANENT TRANSECTS

GUIDE

Quick guide to monitoring
Seagrass resources

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Disclaimer

Information contained in this manual is provided as general advice only. For application to specific circumstances, please contact Seagrass-Watch HQ.

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

This manual is designed to offer information on how to monitor seagrass resources to stakeholders and participants of the Global Seagrass Observing Network, for seagrass conservation.

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ABOUT SEAGRASS-WATCH

Seagrass-Watch is a not for profit, which established the Global Seagrass Observing Network in 1998. The network is currently working across 26 countries, monitoring the status and trends in seagrass condition.

Seagrass-Watch is one of the largest long-term seagrass observing programs globally and is highly recognised for its scientific rigour.

Participants are from a wide variety of backgrounds. All share a common interest in marine conservation and

Participants are associated with universities & research institutions, government (local & state) or non-government organisations.

Research

Seagrass-Watch has a strong scientific underpinning with an emphasis on consistent data collection, recording and reporting. Scientific, statistical, data management, data interpretation and logistic support underpins all monitoring efforts.

Aims

Seagrass-Watch raises awareness on seagrass ecosystems globally. The Program involves collaboration/partnerships between scientists, community and data users (environment management agencies).

Participants

Seagrass-Watch partners scientists with citizens, as people involved in the program develop a deep sense of custodianship and understanding of their local marine environments that reaches throughout the wider community.

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GOALS
GLOBAL NETWORK

- 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 ecosystem

MONITORING

What is monitoring?

Monitoring is the repeated observation of a system, usually to detect change.

The level of change and accuracy of the detection will vary according to the methodology.

Environmental monitoring programs should ideally be designed to:

- quantify the causes of change;
- examine and assess acceptable ranges of change for the particular site; and
- to measure levels of impacts.

Why monitor?

Common drivers (reasons) for monitoring include: community interest; government policies such as Coastal Strategies and Plans, Oceans Policy, State of the Environment Reporting (SoE), Water Quality guidelines or Best Practice Guidelines; and Government Legislation (e.g., Fish Habitat Protection).

Users of the monitoring program information/results are diverse, including for example: the general public, environmental regulators - legislators, resource managers and scientists.

Monitoring seagrass

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. Seagrass make good bioindicators of environmental health because they are:

- are widely distributed;
- have an important ecological role;
- are sessile plants which show measurable and timely responses to external stressors/impacts (rather than relocating to a less stressful environment)
- are integrative of environmental conditions.

Seagrass-Watch & Monitoring

A method for monitoring seagrass resources is used in the Seagrass-Watch program. This method uses globally standardised measurements taken from sites established within representative meadows to monitor seagrass condition. The number and position of sites can be used to investigate natural and anthropogenic impacts.

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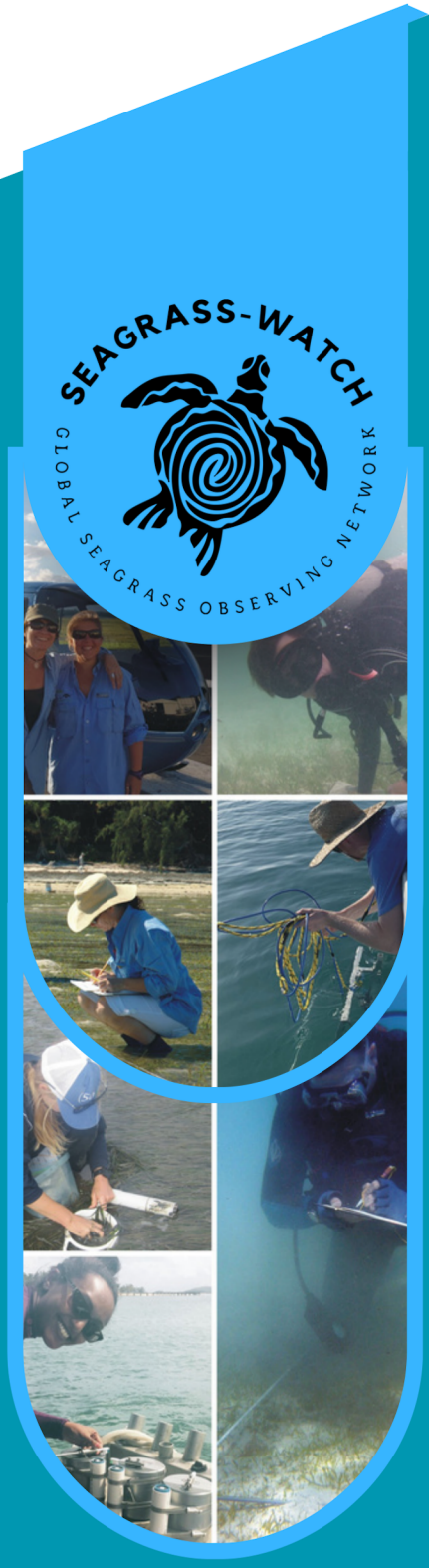
STRATEGIES



Different habitat, different strategy

Seagrass-Watch has several seagrass monitoring strategies depending on the type and location of seagrass meadows.

Methods and sampling designs will continue to be modified and improved and the approach described here is not intended as a standard suitable for all situations. We recognise that sampling designs are largely influenced by logistics, safety issues and resource limitations.

There is still a great need to test the precision and efficiency of various sampling methods. Priority should be placed on selecting appropriate parameters for study, so that the study results and subsequent environmental assessments are ecologically meaningful.

Some examples of our monitoring designs include intertidal Permanent Transect site, intertidal fixed point site, subtidal fixed single transect, subtidal spots in defined area, depth transects across a meadow. This section also considers how often to monitor, pre-monitoring preparation and safety issues to consider.

Issues to consider

There are a number of issues to consider when implementing a monitoring program, including:

- ensure the protocols used have explicit objectives; clearly identified responsibilities of the partners (e.g. Gov agencies, consultants, community groups);
- a clear and defensible rationale for using the parameters that are measures (e.g. physico/chemico, biological indicators);
- to have a baseline (first) assessment / measure against which subsequent changes can be measured/compared;
- knowledge of spatial and temporal variation prior to designing the program (i.e. pilot study);
- clearly defined field protocols;
- data management procedures, ensure the level of change and accuracy of the detection is appropriate (as will vary according to the methodology);
- selection of statistical tools; and a mechanism to reduce and manage errors (i.e. QA/QC program).

Intertidal monitoring

In this manual, we describe the most popular method of monitoring in the Global Seagrass Observing Network, Permanent Transects.

IF you do not think the method is suitable for your seagrass meadows (for example, the seagrass meadow is subtidal or not of a size able to contain a 50m by 50m site), alternative strategies are available by contacting Seagrass-Watch HQ for advice. We should be able to assist you with your design and site layout.

PERMANENT TRANSECTS

What is a permanent Transect?

The use of Permanent Transects for monitoring, is a strategy developed by Seagrass-Watch and is commonly used in representative intertidal meadows larger than 50m x 50m (e.g. 5.5 hectares). This method uses globally standardised measurements taken from sites established within representative meadows to monitor seagrass condition. The number and position of sites can be used to investigate natural and anthropogenic impacts.

A sentinel site (Permanent Transect site) is 50m x 50m area within a homogeneous section of meadow. At each site, three parallel 50m transects (each 25m apart) are established. We advocate, "permanently" marking the site using a GPS to record points at the start and end of each transect. If you must physically mark the site, generally only the middle transect is permanently pegged/marked. PLEASE check with local authorities before permanently marking a site.

Factors to consider when selecting a site

Choosing a location to establish a site for monitoring should be done with care. The following factors should be considered for intertidal seagrass meadows.

- Select a homogeneous area (not patchy), with uniform coverage of seagrass
- Make sure the site not topographically mixed with high sand or mud ridges and troughs
- Ensure seagrass is the dominant habitat at the site
- The seagrass community should be representative of that locality
- The seagrass presence should be similar in coverage across the site.
- The site should be logistically (e.g., weather, access, safety) feasible.
- Walk over the 50m by 50m area you would like to establish a site, ensuring that its selection meets these requirements.

Using all available information collected when the status of seagrass meadows was determined, locations for monitoring and positions for sites can be chosen.

STEPS TO FOLLOW

Pre-monitoring

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 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 don't feel safe, do not put yourself or others at risk.
- Wear appropriate clothing and footwear.Be sun-smart.
- Be aware of dangerous marine animals.
- Have a first aid kit on site or nearby
- Take a mobile phone or marine radio

Essential Equipment

Ensure you have the correct field kit to conduct your monitoring:

- 3 x 50 metre fibreglass measuring tapes
- 6x plastic pegs
- 3x standard quadrat (50x50cm)
- 1x photoquadrat labeller
- Compass
- Handheld GPS
- Digital Camera with geotagging
- Seagrass identification sheets
- Percent cover standard sheets
- Monitoring datasheets
- Clipboards
- Pencils
- Rulers
- First aid kit
- Seed Corer
- Sieve (1mm mesh)

SITE SETUP

Monitoring

A sentinel site (Permanent Transect site) is 50m x 50m area within a homogeneous section of meadow. At each site, three parallel 50m transects (each 25m apart) are established.

Lay out and peg down the three 50 transects parallel to each other, 25m apart and orientated perpendicular to shore (heading out to sea or deeper water).

Laying out the site

Layout and peg down the three 50m transects, parallel to each other, 25m apart & orientated perpendicular to shore (heading out to sea or deeper water)

You first need to lay all tape measures (transects)

Start with Transect 2:

- Push a plastic tent peg into the substrate and attach one end of the 50m tape to the peg.
- Using your compass, you will need to take a bearing of the direction the transect will run. Typically this will be perpendicular to the shoreline, but might vary depending on the topography of the site.
- Record the bearing on your data sheet, e.g. 80°.
- Pick something on the horizon at the compass bearing. Keeping your eye on that point or object, hold the tape in your right hand and run the transect tape out for 50 metres along the compass bearing.

As sampling is always done to the right hand side of the tape, keeping to the left ensures that you won't leave foot holes or depressions where you will be sampling.

- At the end of the transect check your position back along the bearing to the start of the transect and push in another peg into the sediment.
- Ensure the tape is as straight as possible between the start and end pegs. Attach the end of the tape (50 m mark) to another peg pushed into the substrate.
- You have just marked out transect 2. Leave the tape in place and mark out transects 1 and 3.

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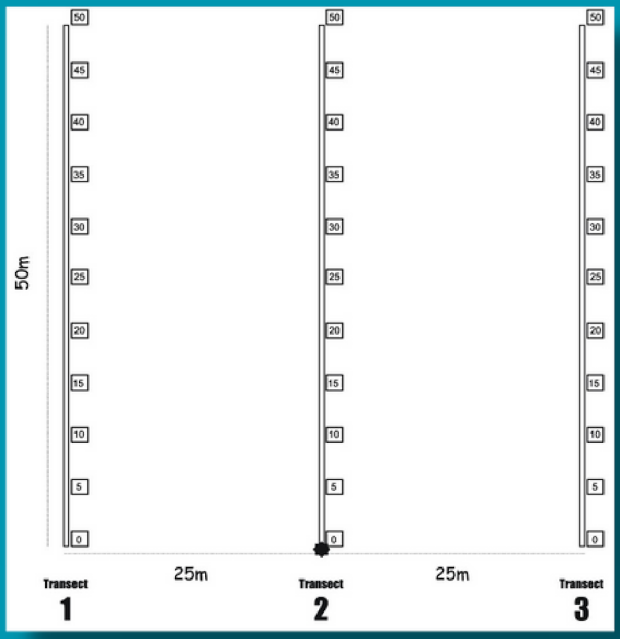
We advocate, "permanently" marking the site using a GPS to record points at the start and end of each transect. If you must physically mark the site, generally only the middle transect is permanently

Layout Transects 1 & 3:

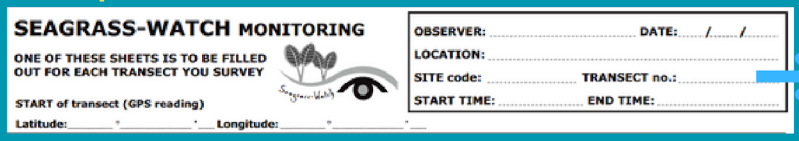
- Transects 1 and 3 always lie 25 metres to the left and 25 metres to the right of transect 2, respectively.
- Leave all three tapes in place, held down with the pegs, until all sampling is completed.



Start monitoring

Once all the transects have been laid out with tape measures in place (see diagram to right), you can start on your first quadrat.

Step 1: Details


SEAGRASS-WATCH MONITORING

ONE OF THESE SHEETS IS TO BE FILLED OUT FOR EACH TRANSECT YOU SURVEY

START of transect (GPS reading)

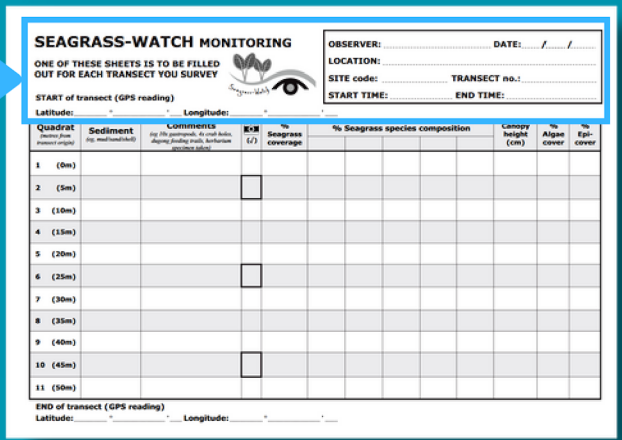
Latitude: ° ' Longitude: ° '

OBSERVER: DATE: / /

LOCATION:

SITE code: TRANSECT no.:

START TIME: END TIME:


SEAGRASS-WATCH MONITORING

ONE OF THESE SHEETS IS TO BE FILLED OUT FOR EACH TRANSECT YOU SURVEY

START of transect (GPS reading)

Latitude: ° ' Longitude: ° '

OBSERVER: DATE: / /

LOCATION:

SITE code: TRANSECT no.:

START TIME: END TIME:

Quadrat	Sediment	Comments	☒	% Seagrass coverage	% Seagrass species composition						Canopy height (cm)	% Algae cover	% Epi-cover
1 (0m)													
2 (5m)			☐										
3 (10m)													
4 (15m)													
5 (20m)													
6 (25m)			☐										
7 (30m)													
8 (35m)													
9 (40m)													
10 (45m)			☐										
11 (50m)													

END of transect (GPS reading)

Latitude: ° ' Longitude: ° '

Enter details:

- Observer Names: First and Surname
- Date
- Location, Site Code and Transect number
- Start Time
- End Time (when you have completed the transect)
- GPS reading at the start of the transect (peg)

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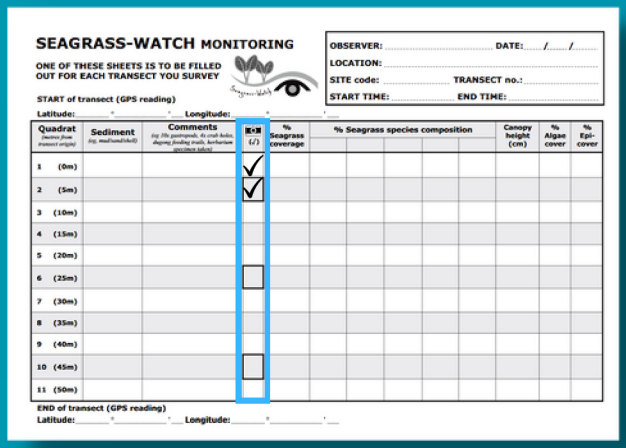
Step 2: Photoquadrat

Take a Photograph of the quadrat:

- Photographs are taken of every quadrat along each transect from 0m - 50m.
- Use a quadrat free of strings and place the photo quadrat labeller beside the quadrat and tape measure with the correct code on it.
- Photos are taken before any other measures, to avoid resuspending sediments by walking in the area which would affect the photo quality.

site code replicate transect distance (mtrs)

1. First place the photo labeller beside the quadrat with the correct Site code, Replicate number, Transect number, and Distance code on it
2. Take the photograph from an angle as vertical as possible, which includes the entire quadrat frame and the quadrat label.
3. Try to avoid having any shadows or patches of reflection off any water in the field of view.
4. Tick that a photo has been taken on the datasheet for that quadrat.



SEAGRASS-WATCH MONITORING

ONE OF THESE SHEETS IS TO BE FILLED OUT FOR EACH TRANSECT YOU SURVEY

OBSERVER: DATE: / /

LOCATION:

SITE code: TRANSECT no.:

START TIME: END TIME:

START of transect (GPS reading)

Latitude: ° ' Longitude: ° '

Quadrat (metres from transect origin)	Sediment (e.g. mud/sand/shell)	Comments (e.g. life (gastropods, fit crab holes, digging feeding trails, herbarium specimen taken)	☐ (✓)	% Seagrass coverage	% Seagrass species composition						Canopy height (cm)	% Algae cover	% Epi-cover
1 (0m)			✓										
2 (5m)			✓										
3 (10m)													
4 (15m)													
5 (20m)													
6 (25m)			☐										
7 (30m)													
8 (35m)													
9 (40m)													
10 (45m)			☐										
11 (50m)													

END of transect (GPS reading)

Latitude: ° ' Longitude: ° '

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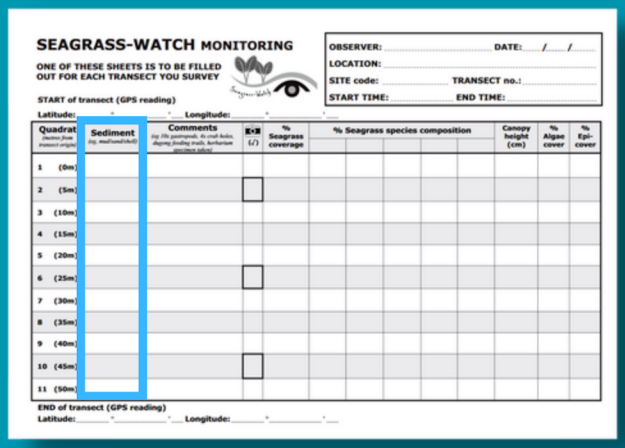
Step 3: Sediment

Describe sediment:

- To assess the sediment, dig your fingers into the top centimetre of the substrate and feel the texture.
- Note the grain size in order of dominance (e.g., Sand, Fine sand, Fine sand/Mud).
- Please do not use descriptors like Sandymud, SandyMuddy, Muddysand etc.

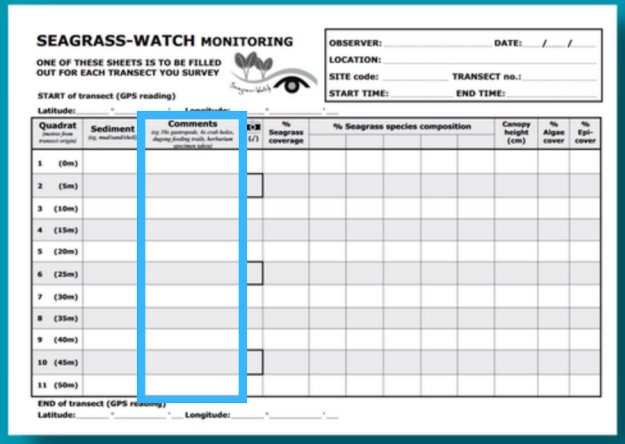
1. mud - has a smooth and sticky texture.
2. Fine sand - fairly smooth texture with some roughness just detectable.
3. Sand - rough grainy texture, particles clearly distinguishable.
4. Coarse sand - coarse texture, particles loose.
5. Gravel - very coarse texture, with some small stones.



Step 4: Other features

Describe other features and ID/count of macrofauna

- Note and count (whole numbers - never use < or > symbols) any features which may be of interest (e.g. gastropods, hermit crabs, evidence of dugong or turtle feeding, bioturbation, sediment ripples) within the comments column.
- If water covers half or more of the quadrat, measure depth in cm.



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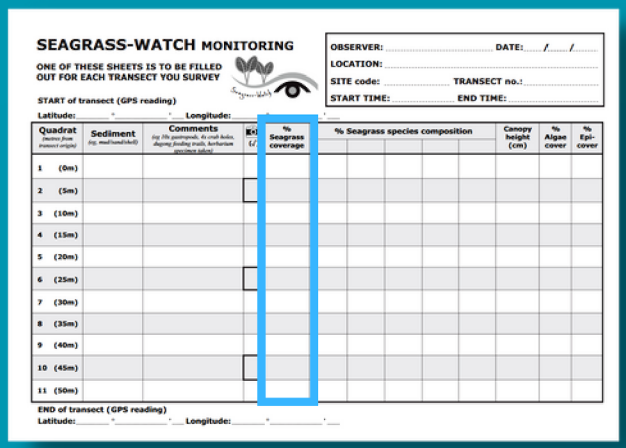
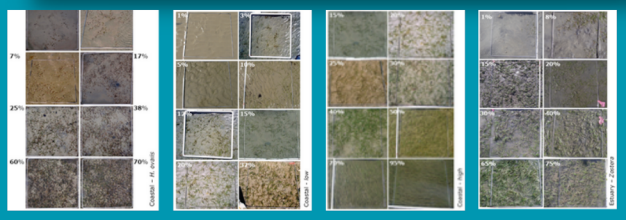
Step 5: Seagrass cover

Estimate seagrass percent cover:

- Looking down on the quadrat from above, estimate the total percentage of the seabed (substrate) within the quadrat covered by seagrass. Estimate the footprint/shadow provided by the seagrass shoots.
- Always use the percent cover photo standards (calibration sheets) as your guide, estimating cover as accurate as possible, e.g. 27%, 61%
- If cover is below 3%, you can count the seagrass shoots and calculate percent cover using the rule of 1 shoot = 0.1%. Please note: this will be greater for shoots of larger sized species.





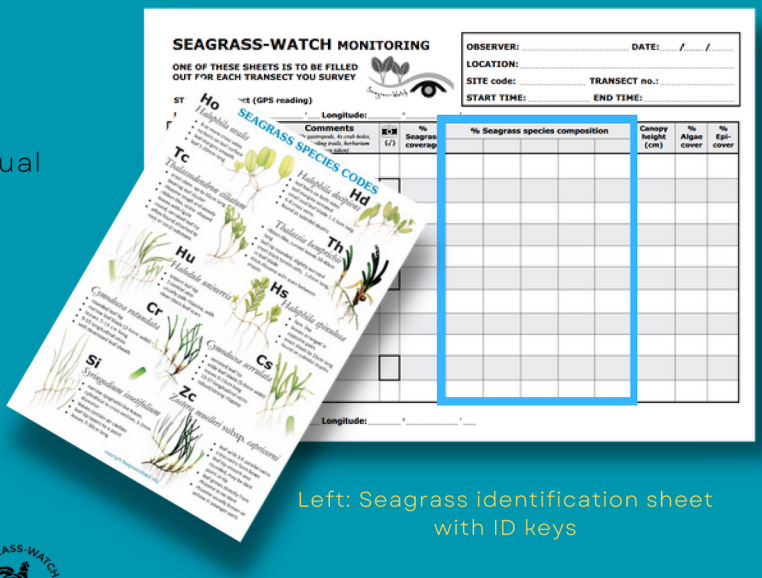
Above: Examples of Seagrass-Watch percent cover photo standards (calibration sheets)

Step 6: Seagrass species

Estimate seagrass species composition:

- Identify the species of seagrass within the quadrat and determine the percent contribution of each species (starting with least abundant, total composition must equal 100%)
- Use seagrass species identification keys provided and use more than 1 feature to identify each species

Composition of all species must equal 100 %, regardless of the total cover
eg. *Halodule uninvervis* 70%, *Halophila ovalis* 30%, or *Halodule uninvervis* 100%



Left: Seagrass identification sheet with ID keys

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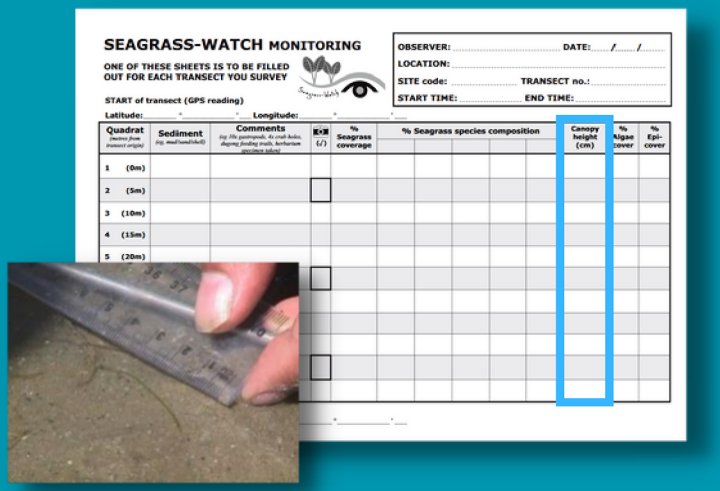
Step 7: Canopy height

Measure seagrass canopy height:

- Measure canopy height (in centimetres) of the dominant strap-leaf species.
- Do this by haphazardly selecting 3 leaf blades from within the quadrat, ignoring the tallest 20%.
- Extend each leaf to its maximum length/height, without uprooting, and measure from the sediment to the leaf tip.
- Enter all 3 measures onto datasheet



Extend each leaf to its maximum length/height, without uprooting, and measure from the sediment to the leaf tip.

Step 8: Algae cover

Estimate algae percent cover:

- Looking down on the quadrat from above, determine the percent cover of non-epiphytic algae in the quadrat.
- Non-epiphytic algae are those plants that are not attached to the seagrass but they may cover or overlie the seagrass blades.
- Estimate the total percentage of the seabed (substrate) within the quadrat covered by macroalgae (independent of seagrass cover)
- Macroalgae is not attached to seagrass leaves and may be attached to rocks, shells or may be drift
- Algal cover is recorded using the same visual technique used for seagrass cover.

Algal percent cover standard

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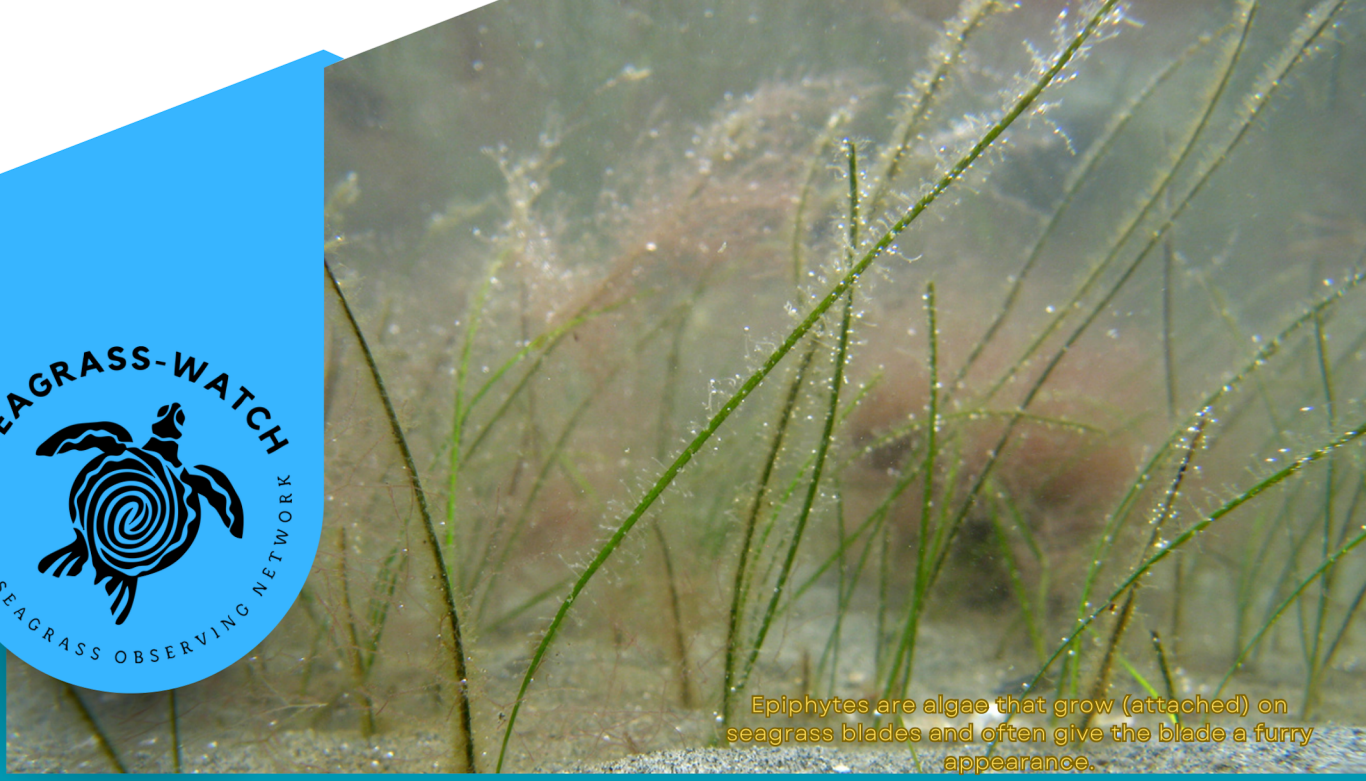
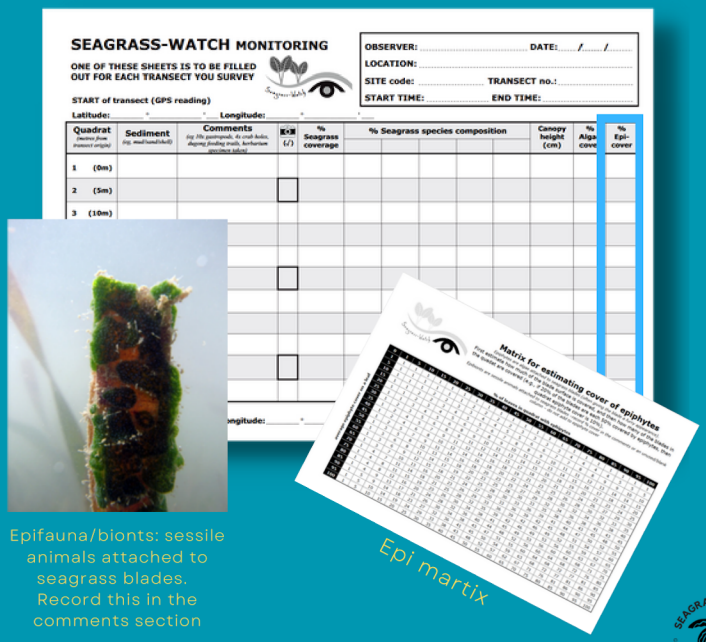


Step 9: Epiphyte cover

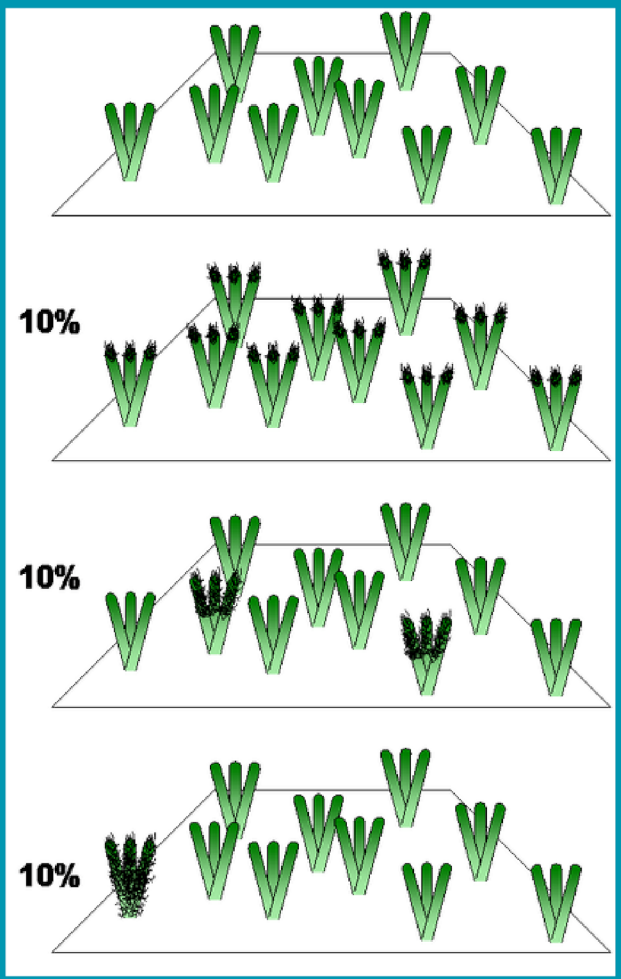
Estimate epiphyte percent cover:

- Epiphytes are algae that grow (attached) on seagrass blades and often give the blade a furry appearance.
- First estimate how much of an average seagrass leaf surface is covered, and then how many of the leaves in the quadrat are covered. For example, if 20% of the blades are each 50% covered by epiphytes, then quadrat epiphyte cover is 10%. Use the epiphyte matrix to assist you.
- Do not include epifauna with epiphytes. Epifauna are sessile animals attached to seagrass blades –record % cover of epifauna in the comments or an unused/blank column – do not add to epiphyte cover.



Epi martix

Epifauna/bionts: sessile animals attached to seagrass blades. Record this in the comments section



The diagram above shows how the distribution of epiphytes on seagrass leaves can vary throughout a quadrat. In this example

- Top quadrat has no epiphytes present.
- Second quadrat – 10% of all the leaves in the quadrat are covered by epiphytes
- Third quadrat – some leaves may be covered by epiphytes, and
- Fourth quadrat – only 1 shoot is totally covered by epiphytes.

Note that the last 3 quadrats equate to 10% epiphyte cover

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Step 10: Specimen

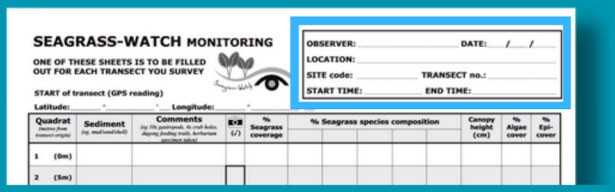
Take a voucher seagrass specimen if required:

- Place seagrass samples in a labelled plastic bag with a little seawater and a waterproof label.
- Select a representative specimen of the species and ensure that you have all the plant parts including the rhizomes and roots.
- Collect plants with fruits and flowers structures if possible.

- Correctly pressed and preserved seagrass specimens are invaluable for future reference material.
- If stored properly, the specimens will provide a record that not only supports data and published reports, but increases in value over time

Step 10: Move to next quadrat

- Repeat steps 2 to 9 for the remaining 32 quadrats
- Record End time



SEAGRASS-WATCH MONITORING

ONE OF THESE SHEETS IS TO BE FILLED OUT FOR EACH TRANSECT YOU SURVEY

OBSERVER: DATE: / /

LOCATION:

SITE code: TRANSECT no.:

START TIME: END TIME:

START of transect (GPS reading)

Latitude: ° ' " Longitude: ° ' "

Quadrat (metres from transect origin)	Sediment (e.g. mud/sand/shell)	Comments (e.g. fish gastropods, 4x crab holes, digging, feeding trails, herbarium specimen taken)	K+R (✓)	% Seagrass coverage	% Seagrass species composition						Canopy height (cm)	% Algae cover	% Epi-cover
1 (0m)													
2 (5m)													

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WRAP UP

At completion of monitoring

At completion of monitoring
Check data sheets are filled in fully.

- Remove equipment from site (e.g. non-permanent pegs)

Step 1. Wash & pack gear

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

Store gear for next sampling

Step 2. 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.
- Allow to dry the press in a dry/warm/dark place for a minimum of two weeks. For best results, replace the newspaper after 2-3 days.

Step 3. Submit all data

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

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CONTACT US

admin@seagrasswatch.org

www.seagrasswatch.org

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QLD 4879. AUSTRALIA

This project is part of the International Climate Initiative (IKI). The Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) supports this initiative on the basis of a decision adopted by the German Bundestag.