SeagrassNet Rapid

Manual for Scientific Monitoring of Seagrass Essential Ocean Variables

September 2025

Contents

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SeagrassNet – Assessing a Critical Coastal Resource Worldwide

SeagrassNet is a scientific global monitoring program based at the Center for Coastal Studies in Massachusetts, USA, that investigates and documents the status and trends of seagrass resources worldwide using a global monitoring protocol and web-based data reporting. The program started in 2001 in the Western Pacific and now includes over 160 sites throughout the world. The mission of SeagrassNet is to coordinate and train scientists, managers, and volunteers in seagrass research and monitoring methods so that we can more effectively conserve, restore, and raise awareness of seagrasses across the globe.

Seagrasses are the only underwater flowering plant, including 72 recognized species, that inhabit shallow marine and estuarine waters. They can form vast meadows and provide nurseries, shelter, and food for a variety of commercially, recreationally, and ecologically important species (e.g., fish, sea turtle, dugong, manatee, seahorse, crustaceans). Additionally, seagrasses filter estuarine and coastal waters of nutrients, contaminants, and sediments and are closely linked to other community types, including coral reef systems and mangrove forests in the tropics, and salt marshes, kelp forests, and oyster reefs in temperate waters. They contribute to livelihoods and food security in many coastal communities and are reservoirs of "blue carbon"; fixing and storing carbon in seagrass biomass and underlying sediments.

Existing at the interface of the land margin and the world's oceans, seagrasses are threatened by numerous anthropogenic impacts as well as global climate change.

SeagrassNet Monitoring Network

The information needed to characterize the status of seagrass habitats worldwide varies by region, purpose, and capacity. Scientists have therefore adapted the concept of essential ocean variables (EOV) to seagrass habitats to facilitate comparable datasets. The goal of SeagrassNet is to measure change in seagrass EOVs:

1. changes in seagrass species composition
2. changes in percent cover
3. changes in areal extent

Alongside those three high priority variables, information on supporting variables can be just as relevant and important to status, trends and dynamics of seagrass habitats:

- Shoot length
- Shoot density
- Canopy height
- Biomass (above/below ground)

- Epiphytic algae cover
- Water clarity
- Salinity
- Sexual reproduction (fruit/flower)
- Sediment characteristics (grain size, organic and carbonate content)
- Water depth
- Water temperature
- Light availability
- Tidal information

In order for collected data to be comparable across regions and years, metadata must be collected. Metadata describes the when, where and how of data collection and includes:

- Date and time
- Location (incl GPS coordinates)
- Protocol/methodology used

The SeagrassNet rapid protocol covers how to establish a monitoring site, how to collect seagrass EOVs, supporting variables and metadata, and how to upload and publish the data collected via seagrassnet.org

Chapter 1 – General Introduction to Seagrasses

Seagrasses are angiosperms (flowering plants) that grow in the sediment of shallow marine and estuarine waters from the tropics to the poles. They evolved around 100 million years ago and today there are more than 70 described species worldwide. Seagrasses are unique amongst flowering plants, in that all but one species can live entirely immersed in seawater. *Enhalus acoroides*, an Indo-Pacific species, is the exception, as it must emerge to the surface to reproduce; all others can flower and be pollinated under water. Seagrasses are often linked to other community types such as mangroves or coral reefs in the tropics and algae beds, salt marshes and bivalve beds in temperate waters.

Several parameters are critical to whether seagrass will grow and persist. These include:

- physical parameters regulating 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)
- anthropogenic inputs that inhibit the access to available plant resources (nutrient and sediment loading as well as direct disturbances like dredging).

Various combinations of these parameters will permit, encourage or eliminate seagrass from a specific location.

Seagrasses occupy a variety of coastal habitats and typically occur in shallow, sheltered, soft-bottomed marine coastlines and estuaries. The meadows can be comprised of one or more species with sometimes up to 12 species in one meadow, particularly in the tropics. The depth range of seagrasses is usually controlled at its deepest edge by availability of light for photosynthesis. At the shallow edge, exposure at low tide, wave action and associated turbidity, and freshwater inflow determine seagrass species survival. Seagrasses can survive in the intertidal zone, especially in locations sheltered from wave action or where there is entrapment of water at low tide (e.g. reef platforms and tide pools), protecting seagrasses from exposure (to heat and drying).

The habitat complexity within seagrass meadows enhances the diversity and abundance of animals. The high primary production rates of the plants are closely linked to high production rates of associated fisheries. The meadows support numerous herbivore- and detrivore- based food webs and are considered to be very productive pastures of the sea.

The potential for seagrass loss has been well documented and can be categorized as natural (e.g. flood and storm events, disease), and/or anthropogenic (e.g. dredging, agricultural runoff, oil spills). In order to detect changes such as loss, it is useful to map the distribution and quantity

(seagrass EOVs “extent” and “% cover”) of existing meadows. Since changes can occur naturally, it is important to monitor in a statistically valid framework to scientifically determine natural variability before estimating loss or gain due to perturbations. Managers need to know what levels of change are likely to be ecologically or economically important, and monitoring surveys need to be sufficient to measure changes that are statistically significant. SeagrassNet and SeagrassNet Rapid protocols are designed to be such a scientific monitoring tool.

Chapter 2 – The Monitoring Process

2.1. What is monitoring?

Monitoring is the repeated observation of a system, usually to detect change. The level of accuracy of the detection varies according to the methodology, which should ideally be designed to:

- capture causes of change (e.g. via monitoring supporting variables)
- examine and assess acceptable ranges of change for a particular site
- measure critical levels of impacting agents

Monitoring usually focuses on a specific organism or habitat, with additional data collected on environmental conditions. Intensive monitoring of large areas or large suites of parameters is often prohibitively expensive and requires considerable expertise in the systems being studied.

2.2. Why monitor?

Environmental monitoring programs provide coastal managers with information and assist them to make decisions with greater confidence. Seagrasses are often at the downstream end of the watershed, receiving runoff from a range of agricultural, urban and industrial land-uses. Their ecological values and location in areas likely to be developed for harbors and ports have made seagrasses a useful monitoring target for assessing environmental health and impacts on coastal systems. The ideal “bio-indicator” must show measurable and timely responses to environmental impacts. Seagrass habitats act as sentinels in place because these plants, whether as individuals, populations or communities, can be relatively easily measured and rapidly reflect their environmental influences.

2.3. Measuring change in seagrass meadows

Seagrass meadows can change in several ways; there can be change in

- biomass
- area
- shape
- depth
- location
- species composition
- plant growth and productivity
- associated flora and fauna

Change may comprise a combination of some or all of these factors and can occur naturally and on a regular, seasonal, basis. Environmental monitoring programs require knowledge of these patterns of natural change. They also require cost-effective data collection, selection of appropriate parameters and scales, and measures of change which are statistically appropriate for determining if management action is required.

Choosing the most efficient and appropriate parameter(s) to monitor is equally important. Seagrass species composition and its quantity (e.g. % cover, total area) can be measured relatively quickly. Historically, these are the most commonly monitored parameters and have recently been named Seagrass Essential Ocean Variables by the Global Ocean Observing System (GOOS).

In addition to seagrass EOVs, a suite of other physical and biological parameters can be added to the protocol as funds and time become more readily available. Physical parameters usually include: depth, sediment type, light availability, salinity and temperature. Biological parameters include: shoot length/canopy height, shoot density, above- and below-ground biomass, epiphytic algae cover and presence of seagrass fruit/flowers.

While SegarassNet rapid insists on the monitoring of seagrass EOVs (species compositions, % cover, areal extent), including additional parameters is encouraged but not mandatory.

Chapter 3 – SeagrassNet site selection and transect establishment

Safety First!

In all SeagrassNet activities, safety must come first! Please use common sense and best practices at all times. It is better to postpone fieldwork than to take a risk. Always know how to call for help in an emergency!

3.1. Site selection

3.1.1. Background

Selecting a good monitoring site is the first step – and a very critical step -- in any monitoring effort. The selected monitoring site(s) should be representative of the seagrass communities in that location. For a site to be typical or representative, it should contain the same assemblage of seagrass species found throughout the area, reflect the depth range where seagrasses are typically found, and in general not be exceptional in any characteristic. The site should also be continuous with a fairly even distribution of seagrass without any large empty patches or physical disruptions (e.g. reefs, tidal channels). The need for a homogeneous seagrass meadow is to enable the collection of replicate samples reflecting the natural conditions but not incorporating a high degree of variability. In this way, long-term change can more easily be detected. A site which can be visited without difficulty is preferred since repeated access over the long term will be required. Choosing a site away from any large human or natural impact is important to ensure long-term repeated monitoring without total loss of the seagrass habitat in that location. In addition to monitoring a pristine location, additional sites can be chosen based on special interests (e.g., a restoration area or impacted area).

It can be useful to review any available information on the distribution and status of seagrass meadows in the region before choosing a site.

3.1.2. In the field

It is common courtesy to visit and inform local leaders about the effort, provide them with a background on the program, discuss the monitoring objectives, the importance of seagrass and answer any questions they may have. In some cases you may need to secure an official permit (e.g., marine park) BEFORE you first visit the site. Find out the local regulations and follow them. Be sure not to trespass and be sure to clean up any trash after monitoring.

Once you have decided on the approximate location, you will need to choose the site for the transect and prepare a sketch map of the area around the transect site, this may be for the whole seagrass meadow or for a geographically defined area (e.g., bay, reef top).

It is important to note that the chosen locations and all transects within must be easily accessible to ensure continued monitoring.

Necessary materials & equipment

To choose the site and mark the transect, you will need:

- Geographic Positioning System (GPS) device such as a phone or a handheld navigator
- Datasheets and pencil
- Suitable field clothing and footwear

- Temporary markers (e.g. sticks, flags, floats)
- Aerial photographs or marine charts (if available)

- Go to the general area that you have identified as a potential seagrass location to map and monitor. The aim is to create a sketch map (with or without GPS coordinates) that describes the general pattern of seagrass in the area. Use GPS to map the boundaries of the bed, if possible. Otherwise, draw a representative map (Fig.1) using a nautical chart or whatever is available.
- If mapping can be conducted at low tide when the seagrass meadow is exposed, the boundaries can be mapped by walking or wading around the perimeter of the meadow and making observations every 5 – 25 meters depending on size of the area and time available. If the meadow is too large, this will not be feasible; a rougher map will have to suffice.
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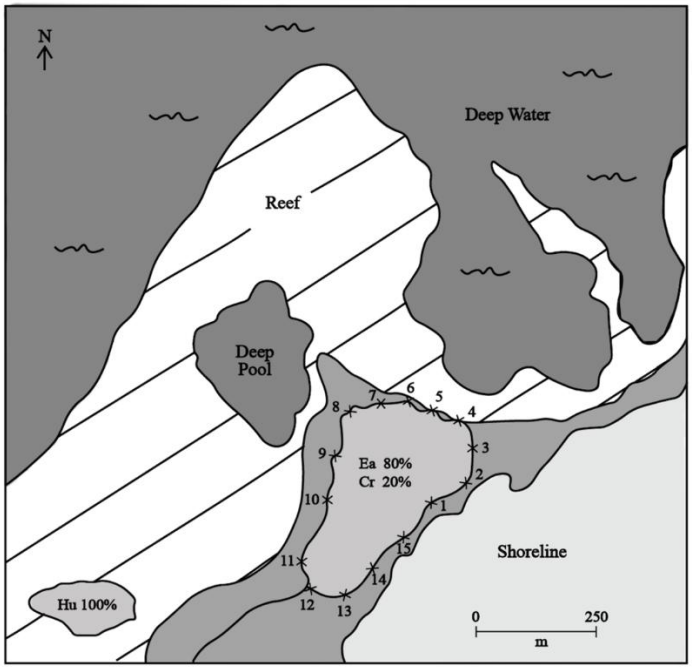


COUNTRY: Federated States of Micronesia
LOCATION: Anon Reef

DESCRIPTION OF SITE: A large intertidal reef flat, which extends to a reef slope with a deep water drop off. A dense continuous meadow dominated by Enhalus with some Cymodocea is near shore. Adjacent patch of Halodule that extends into the coral

GPS WAYPOINTS
Date: 15 June 2021 Time start: 10:00 Time finish: 13:30

Map Reference	Latitude	Longitude
1	5°20.2356	162°57.072
2	5°20.2644	162°57.1056
3	5°20.304	162°57.1146
4	5°20.3322	162°57.1056
5	5°20.3388	162°57.0702
...		

Figure 1. An example of a representative sketch map of a monitoring site and a brief description. Add GPS points (here n=15) if possible

- Find and put a temporary marker at the inner (near to the beach) and outer (towards the open sea) edges of the seagrass meadow. The outer edge is defined for SeagrassNet monitoring as the seaward limit of the strap-leaved seagrasses; the petiolate (having a leaf

on a stem) seagrasses often extend to depths not accessible (even beyond access by SCUBA) and thus cannot be reliably sampled in our monitoring effort.

- When deciding on the best location for the SeagrassNet monitoring transect, please consider:
    - Is seagrass the dominant habitat at the site? Yes
    - Is the seagrass community representative of seagrasses in the area? Yes
    - Are there any large sand banks, reef structures or other physical disruptions in the middle of the transect location? No
    - Is the site logistically (e.g. access, safety) feasible? Yes
- In the area that you think will be suitable for the SeagrassNet monitoring transect, place a temporary marker or flag in the sediment within the continuous seagrass meadow approximately 1 meter inside the meadow. Walk, paddle or swim out from the shore to the outer edge of the seagrass meadow and place a temporary weighted marker (a rock with a rope and float attached) within the seagrass approximately 1 meter inshore of the continuous seagrass meadow edge.

Note on using GPS data:
When downloading the data, check the device settings and take note of the datum. Datums that record positions in longitude/latitude coordinates often include WGS (World Geodetic System). The SeagrassNet program uses WGS84 and encourages expressing latitude and longitudes as decimal degrees.

3.2. Transect establishment and marking

3.2.1. Background

Transect establishment is important to ensure consistency of the monitoring program, and is done once you have identified the most appropriate monitoring site. Transect establishment should be achieved with minimum disturbance of the surrounding seagrass meadow. The transect will be marked with three permanent station markers on the middle and each end of the 50m measuring tape at stations A, B, and C. These permanent station markers will be kept throughout the monitoring program regardless of changes in the seagrass community.

Finding the transect for subsequent monitoring events will be made easier by ensuring that the permanent transect markers are secure, and by preparing a good sketch map and description of the site, ideally using GPS to identify the exact coordinates of stations A, B, and C. When you prepare the map and description, write it in a way that someone who has never been to the site could find it.

3.2.2. In the field

Necessary materials & equipment

- 50m measuring tape (waterproof; e.g. made of fiberglass)
- 6 temporary markers (e.g. sticks, flags, PVC pipe)
- 9 permanent markers (e.g. screw or sand anchors)
- Geographic Positioning System (GPS) device such as a phone or a handheld navigator
- Hand held compass
- Sketch map for site location
- SeagrassNet datasheet
- Notebook and pencil

Refer to Figure 2. Example of the profile of a monitoring transect layout and Figure 3. An example of a monitoring transect layout.

Transect establishment

- Go to the temporary marker that you placed about 1 m inside the continuous seagrass meadow seaward from the beach/ inner edge of the seagrass meadow. This will be the center point of transect A = A25. A25 must be established so that the 50 meter transect (25 meters to the right and 25 meters to the left, parallel to the shore) lies within the continuous seagrass meadow. Hammer or screw a permanent post/ marker into the sediment so that only a few centimeters remain above the sediment. This mark will be the permanent marker for A25 (shallow). Take note of any landmarks or features which will help you relocate the site easily. If possible, mark a tree on the land to help you relocate the site.
- Take the GPS reading for A25 and record the position clearly and legibly on the datasheet. Use your sketch map to draw the position of the location; this will be valuable when you or someone else has to come back to find the transect in the future.
- To establish C25, take a compass bearing from the permanent marker on A25 to the outer/ deep seagrass edge temporary marker. The transect should be approximately perpendicular (90 degrees) to the shore. This will be the center point of transect C = C25. C25 is established so that the 50 meter transect (25 meters to the right and 25 meters to the left) lies within the continuous seagrass meadow. (Remember that the outer edge is defined for SeagrassNet monitoring as the seaward limit of the strap-leaved seagrasses.)
- Install a permanent marker at C25 and record the bearing between C and A on the datasheet. Record the GPS position and water depth at C25. It is more important that transect C is accessible than it being strictly 1 m inside the deep edge of the bed. Therefore, choose a depth at which monitoring is not too difficult to work in or presents

too many logistical challenges that may prevent consistent monitoring in the future (i.e. change in team members and skill level).

- Locate B25 on the bearing between A25 and C25. Record the actual depth and GPS position of B25. Measure and record the distances between A25 and B25, and B25 and C25.
- Install the permanent marker for B25. This will be the center point of transect B = B25. B25 is established so that the 50 meter transect (25 meters to the right and 25 meters to the left)

If the transects are being established on a reef flat, then the offshore transect (C) and the mid-depth transect (B) will be chosen differently. Transect C is inside the continuous seagrass meadow of the reef flat and is not necessarily the deepest transect. Transect B is halfway between A and C, regardless of depth. Or transect B may be located at an interesting seagrass species transition, i.e., adjacent to a zone of species change.

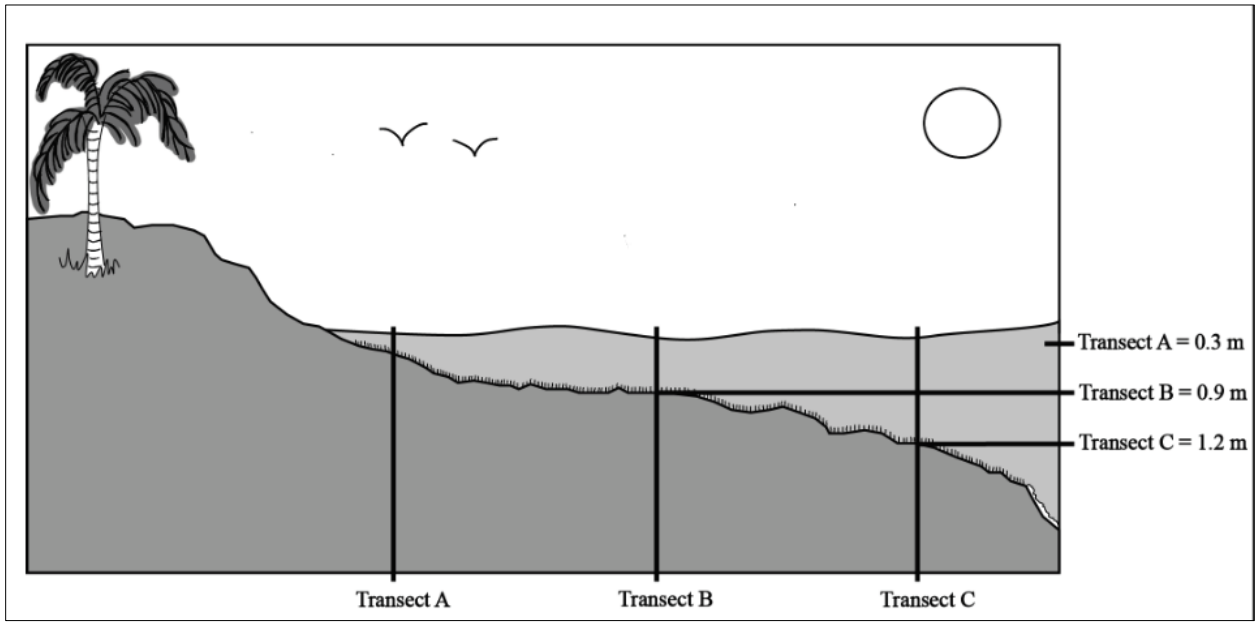


Figure 2. Example of the profile of a transect layout for a monitoring site.

Laying out the transects for the first monitoring event

The goal is to create straight 50 meter transects, parallel to shore, that follow similar depth contours at each transect respectively. Permanent markers will be installed in the center (25), to the left (L or 0), and to the right (R or 50) (Fig. 3.).

- Start at A25. The permanent station marker is the center of your 50m transect.

- Laying out the transects will require 2-3 people, commitment and a sense of humour!
- One person stands at the permanent station marker facing out to sea, holding the tape measure.
- Next, the second person takes the loose end of the tape measure and walks, wades or swims 25 meters to the left of the station marker, keeping roughly parallel to the beach. At 25 meters from the permanent marker (center or 25), place a temporary marker (e.g. stick or flag) and secure the tape measure. This is transect position L (left, facing the sea) or 0.
- Then, the second (or third) person takes the other end of the tape measure and walks, wades or swims 25 meters to the right of the station marker keeping roughly parallel to the beach and places a temporary marker at the end of the tape measure to secure it in place. This is cross-transect position R (right, facing the sea) or 50.
- The person at the permanent station marker in the center (center or 25) should ensure that the transect is roughly parallel to the beach, is a 50 m straight line, and lies entirely within the seagrass meadow. To ensure that the transect is running straight, the people at the left and at the right pull the tape tight and the person at the center directs them until the 25 meter mark is exactly over the permanent marker at A25.
- Use permanent markers to mark both ends of the transect and record the GPS positions for L/0, C/25 and R/50 markers and take a compass bearing of the transect.
- At completion of transect A, roll up the tape measure and repeat for transects B and C.
- You can now start the seagrass monitoring :)

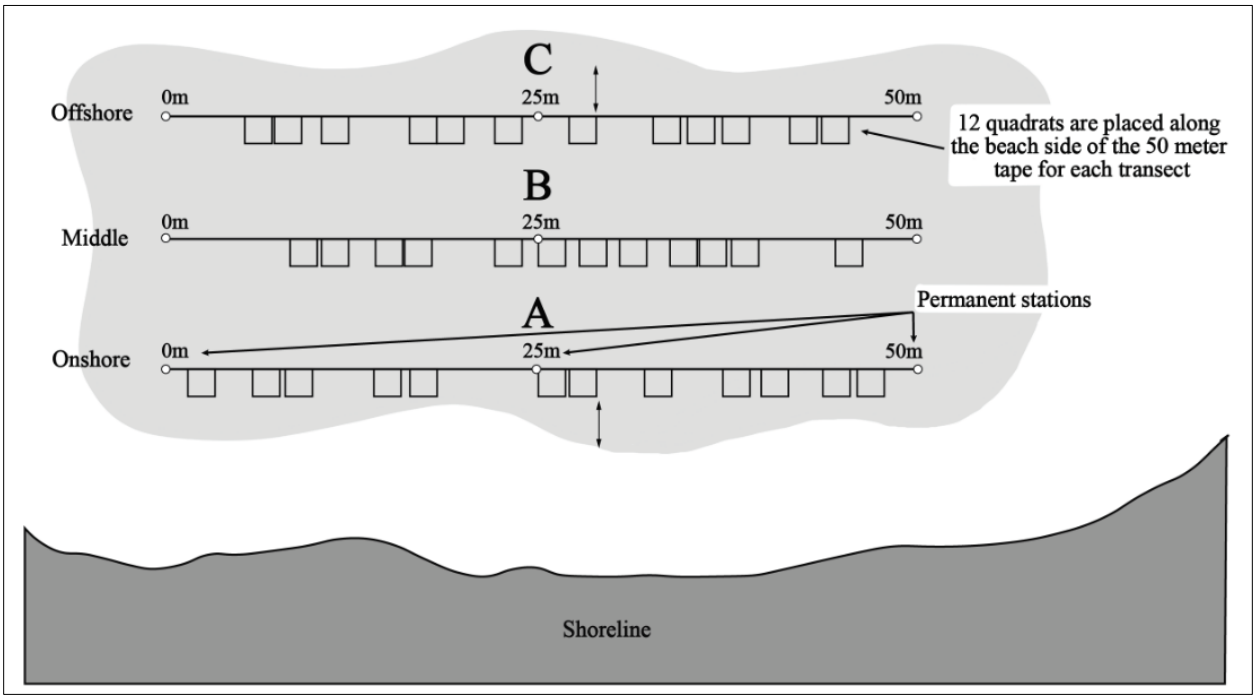


Figure 3. Example of a monitoring site layout viewed from above.

Chapter 4 – SeagrassNet rapid transect measures

Monitoring for SeagrassNet rapid should occur once a year, during the same month every year (ideally during peak biomass, e.g. summer). Use reliable tide tables or web-based tide charts to identify a good daytime low tide for monitoring.

Before going to the field you need to assemble and check all the equipment and re-familiarize the monitoring team with the data sheet and the methodology. After finding the site and laying out the 50 meter tape measure at the first transect, the actual monitoring begins.

4.1. Seagrass Essential Ocean Variable

Necessary materials and equipment:

- Three 50m measuring tapes (waterproof), with the random sampling sites pre-marked on each tape (A, B and C tapes for individual transect lines).
- Depth measuring device (e.g. meter stick)
- Geographic Positioning System (GPS) device such as a phone or a handheld navigator to find permanent markers
- Your sketch map to aid in finding permanent markers
- Seagrass %cover standard sheet (see appendix 2)
- One large quadrat (50x50 cm)
- One small quadrat (25x25 cm)
- Datasheets and pencil

The following information is recorded at the start of each monitoring event:

- Location: the geographical name of the location (e.g. name of bay, reef, harbor) plus the nearest city
- Transect number: assigned code for each monitoring location
- Names of monitoring team members
- Sampling date and start time: day of the month, month in letters, year (e.g. 23Jun25)
- Country (also state province/state if needed)
- Transect: choose between A, B, and C
- Any comments or observations

Monitoring is done on the beach side of the tape, therefore you should **always walk on the seaward side to avoid footprints where you will be monitoring!**

After finding your permanent transect markers, lay out the 50 meter transect tape, starting at the left side of the transect (A0) stretching the tape to A25 and A50. It is helpful to attach the measuring tape to the permanent markers, e.g. with cable ties. You can now start the seagrass monitoring!

At completion of station A sampling, roll up the tape measure and repeat for transects B and C.

NOTE: If the edge of the seagrass meadow at permanent transect A or C has shifted so that all of a transect no longer has seagrass, establish a new transect A' or C' one meter inside the new edge of the continuous bed. Conduct the monitoring from these new transects and note the change on the data sheet. Measure and record the distance from A to A' or C to C'. Record on the data sheet that all quadrats on the original transect are now "0" -- i.e., no seagrass is present.

4.2. SeagrassNet rapid quadrat measurements

For each of the three transects, you will measure 12 quadrats. The position of the quadrats will be on the beach side of the measuring tape at selected locations (Figs. 3 & 4). The locations are shown below; they were predetermined using random numbers.

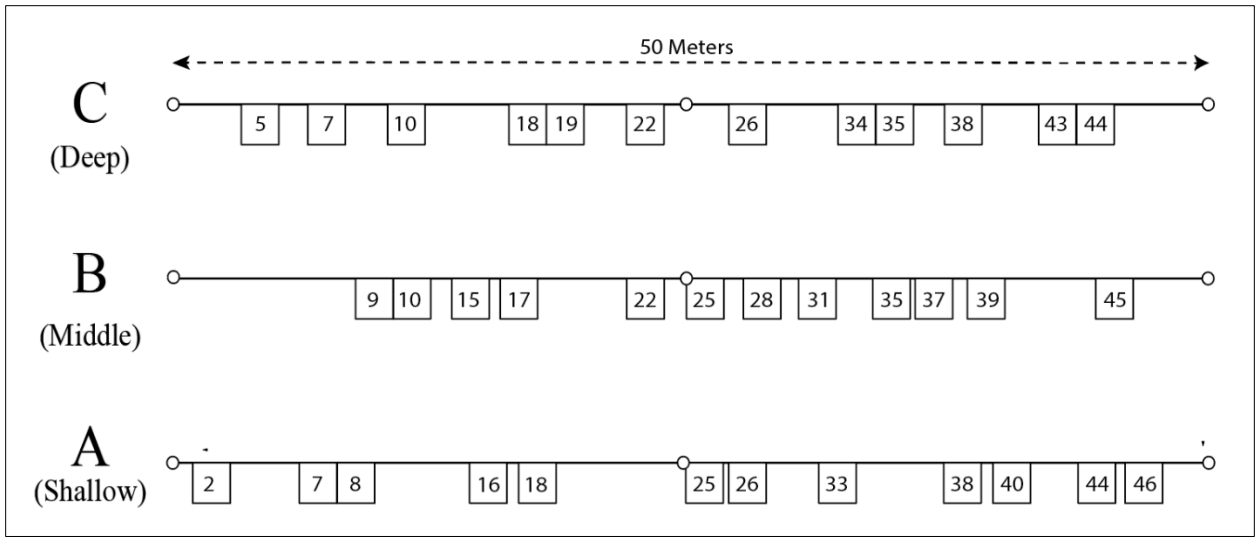


Figure 4. Location (distance) of quadrats along each transect.

4.2.1. General field procedure

For intertidal sites, the best time to monitor is at low tide.

- At each transect, start at the quadrat closest to 0 meters.
- At the quadrat mark, place the quadrat to the beach side of the tape measure while facing the beach. The bottom right corner of the quadrate should be at the randomly selected

meter mark. For example, the first random quadrat on transect A is at 2 meters. The quadrat should be placed from 2.0 to 2.5 meters.

- On the datasheet, enter the pre-selected distance number for each quadrat.

4.2.2. Percent cover

Determine the total percentage cover (% cover) of seagrass within each quadrat (use the percentage cover guide in the appendix). If the quadrat lands on an area with no seagrass this should be recorded as 0 (zero). If seagrass is present, record the appropriate % cover for all species combined within the quadrat under "All Species".

4.2.3. Seagrass species

Identify which seagrass species are found inside the quadrat and record the species on the datasheet using the species abbreviations. See the Regional Supplement for species identifications guides. Next, determine the percent cover by species of each of the species and record this on the data sheet. We suggest determining the % cover for the species with the lowest % cover first and then working up from there.

The sum of all species % cover must equal the total % cover, e.g., TOTAL = 25%, *Thalassia testudinum* 5%, *Halodule wrightii* 20%

4.2.4. General field procedure (continued)

- Check that you have completed the datasheet for the quadrat and move to the next randomly chosen location along the measuring tape until you have completed the information for 12 quadrats.
- At the completion of the 12 quadrats, move to the next transect

4.2.5. Distance to seagrass edge and last shoot

To define the extent of the seagrass growth at the time of monitoring, 2 measurements are taken: distance to edge (distance to the edge of the continuous meadow in meters) and distance to last shoot (distance to the most inshore shoot from transect A and the most offshore shoot from transect C (see Fig. 5). Measurements will be taken at the 0, 25 and 50 meter marks. Fo SeagrassNet rapid monitoring, the outer edge of the meadow is defined as the seaward limit of the strap-leaved seagrass (petiolate seagrasses, having a leaf on a stem) often extend too deep to monitor).

- Using a 50m tape, measure the distance from the left, center, and right positions perpendicularly to the limit of seagrass from the shallow (A) and deep (C) transects.

- Record the distance on the datasheet in meters to the nearest tenth of a meter.
- If the edge of the seagrass has contracted inside the position of the cross-transect, record the distance as negative.
- Finally, on the back of the datasheet, provide a thorough site description (diagram/picture) of the site, specifying where the inner and outer edges of the meadow are located.

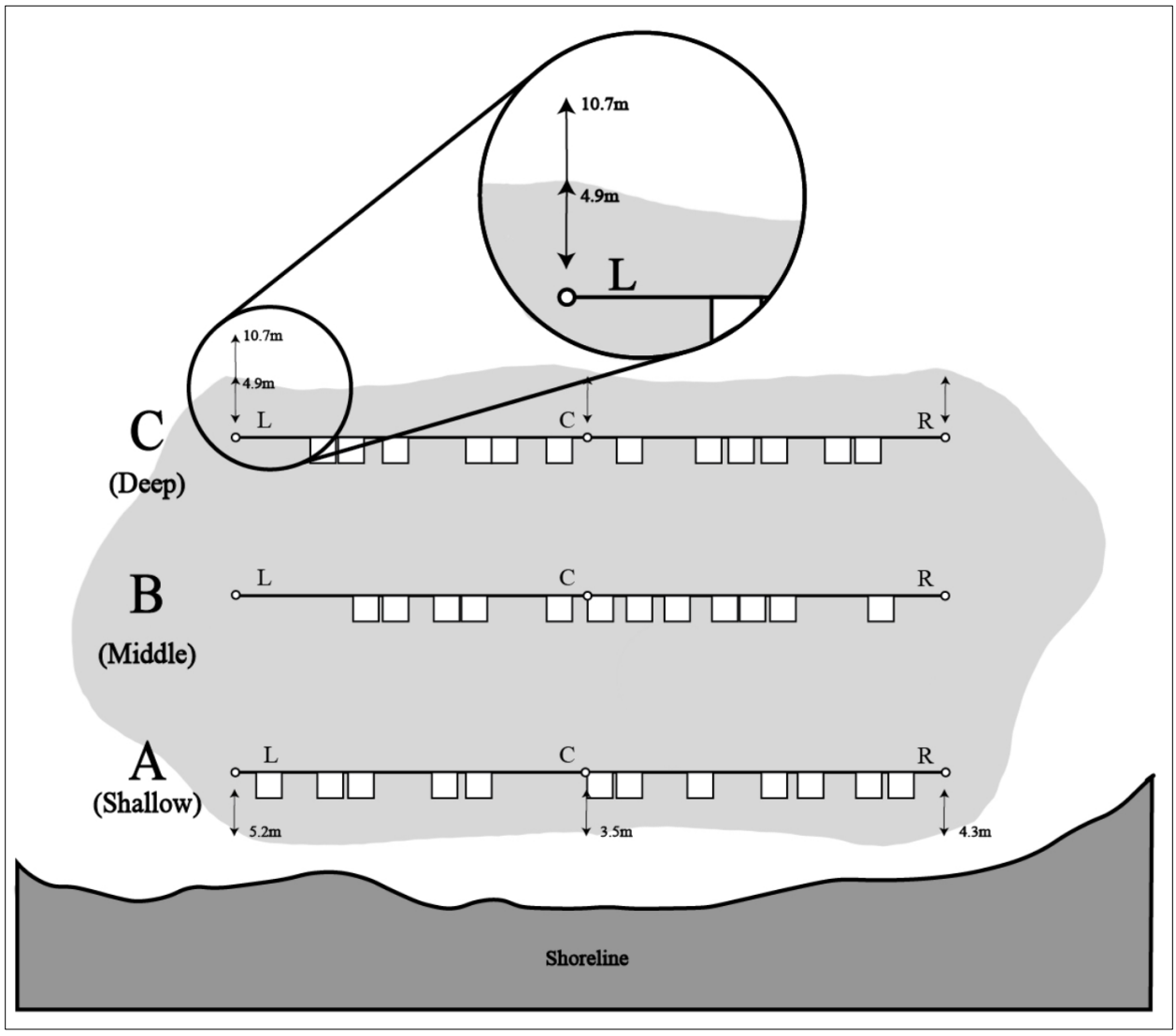


Figure 5. Example of how to determine and measure the distance to edge for both continuous meadows and last shoot.

Congratulations, you have now completed monitoring SeagrassNet rapid seagrass EOVs! Before you leave the location, make sure your datasheets are filled in! Visit www.seagrassnet.org to upload your data via our data portal. Please get in touch with us if you encounter any issues.

Chapter 5 – SeagrassNet data policy

Goals

- Facilitate integration of data from sites around the world
- Provide regional and global assessment of seagrass conditions
- Promote synthetic analyses and reporting
- Assure that SeagrassNet data is handled and acknowledged appropriately

Definitions

SeagrassNet Program Directors and Advisory Team – individuals responsible for starting SeagrassNet (Short, Coles, Fortes and Koch) and for operating the global SeagrassNet program currently (Mittermayr, Plaisted, Novak, Lefcheck and Gaeckle) and in the future .

SeagrassNet Collaborator – individual trained in the SeagrassNet methods who is coordinating the collection and submission of SeagrassNet data for a site or a region with several sites.

SeagrassNet Cohort – group responsible for collecting data using the SeagrassNet protocol under the direction of a Team Leader.

Data Set Owner – individual or institution holding the intellectual property rights to the data generated at a given site; the dataset owner is identified when a SeagrassNet Cohort joins the network. Note: the data set ownership for a specific site may change over time (e.g. if funding source or Team Leader affiliation changes).

Data User – individual to whom access has been granted to a specific data set (also includes the Data Set Owner).

General Considerations

Data Ownership

Ownership of data from each SeagrassNet site is determined by mutual agreement based on who is doing the data collection and the sources of funds that support the monitoring program. Ownership of data generated at individual SeagrassNet sites resides with one of three entities:

(1) ownership lies with one or more of the SeagrassNet Project Director(s) responsible for funding the monitoring, or

(2) ownership lies with one or more of the SeagrassNet Project Director(s) responsible for funding the monitoring as well as with the Collaborator collecting the data, or

(3) ownership lies exclusively with the Collaborator if the monitoring is funded by sources other than by SeagrassNet.

Data ownership for each site will be posted on the SeagrassNet web site. Ownership of the data may be transferred from one or several SeagrassNet Project Directors to a Collaborator or from a Collaborator to one or several Project Directors by mutual agreement.

Data Set Use

Access to all data sets is available to the general public via the website www.seagrassnet.org

Data Use Agreement

1. Acceptable use of data from the SeagrassNet database will be restricted to educational, academic, research, government, or other not-for-profit purposes. Data users are permitted to produce and distribute derived works from SeagrassNet data provided that they are freely accessible to all interested parties.

2. In any publication involving SeagrassNet data, SeagrassNet will be formally acknowledged as: "The data used is part of SeagrassNet (Global Seagrass Monitoring Network), was collected by {*collaborator name*} and was made available through the database at www.seagrassnet.org".

3. Data Set Owners have the right to analyze and publish their own data. All data analysis, publications and SeagrassNet-based products involving other Data Set Owners must follow the rules described below.

4. The Data User will notify, in writing, all Data Set Owners when any work, derivative work, or publication based on or derived from the data set is prepared, and invite consultation, collaboration and/or co-authorship as soon as the data analysis process begins.

5. Active collaboration between a Data Set Owner and a Data User, including consultation on analytic methods, interpretation of results, and dissemination of results, will merit co-authorship of the Data Set Owner.

6. SeagrassNet Program Directors are to be notified in a timely manner of any data use or plans for publications.

7. If the Data Set Owner for a site changes, the new Date Set Owner will be invited to enter into the Data Use Agreement. Previously collected data will continue to reside in the SeagrassNet database and will be accessible subject to terms of data use. The original Data Set Owner will be acknowledged and/or involved in any appropriate publications.

APPENDIX 1 – SUMMARY

Necessary equipment and materials for SeagrassNet rapid

- SeagrassNet monitoring manual
- percent cover standard and species ID sheet
- GPS device such as a phone or a handheld navigator to find permanent markers
- Compass
- 0.25 m^2 quadrat (50 x 50 cm)
- 0.0625 m^2 quadrat (25 x 25 cm)
- waterproof data sheets (3 per site, one for each transect)
- plastic clip board
- 30 cm rulers
- 50 m measuring tapes
- permanent station markers (e.g. 9 screw anchors)

Sampling intervals – Once a year during peak biomass

Establishing SeagrassNet rapid site

1. Locations of interest ranging from pristine to stressed
2. Three (A, B, C) transects per location: perpendicular to shore, 50m long
    - Transect C (deep) (1 m into the bed from the offshore edge of the continuous meadow) mark with a permanent marker and record GPS location
    - Transect B (mid depth) (between deep and shallow or at an interesting transition between species) mark with a permanent marker and record GPS location (with the assumption that cross-transects are independent)
    - Transect A (shallow) (1 m into the bed from the onshore edge of the continuous meadow) mark with a permanent marker and record GPS location

Monitoring a SeagrassNet rapid site

1. Go to your sampling site and find the permanent markers along the transect.

2. At one of the central permanent markers, set up the transect using the 50m measuring tape to prepare for the sampling procedure along that transect (Chapter 4). Avoid walking on the shoreward side of the measuring tape, as this is the area to be sampled.

3. Record information in the header of the datasheet and include any interesting observations (e.g., depth limit of species, etc.)

4. Sampling procedure for SeagrassNet rapid quadrat measures

- Place a sampling quadrat (using the predetermined random distances provided on the datasheet) on the shoreward side of the 50m tape. Position the quadrat so that the lower right corner of the quadrat is on the random distance mark when the person placing the quadrat is facing the shore.
- Identify the seagrass species present in the quadrat and enter the species codes on the data sheet.
- Estimate % cover and % cover of each species in the quadrat using Appendix 2 in the back of the Manual.

5. SeagrassNet rapid cross-transect measures

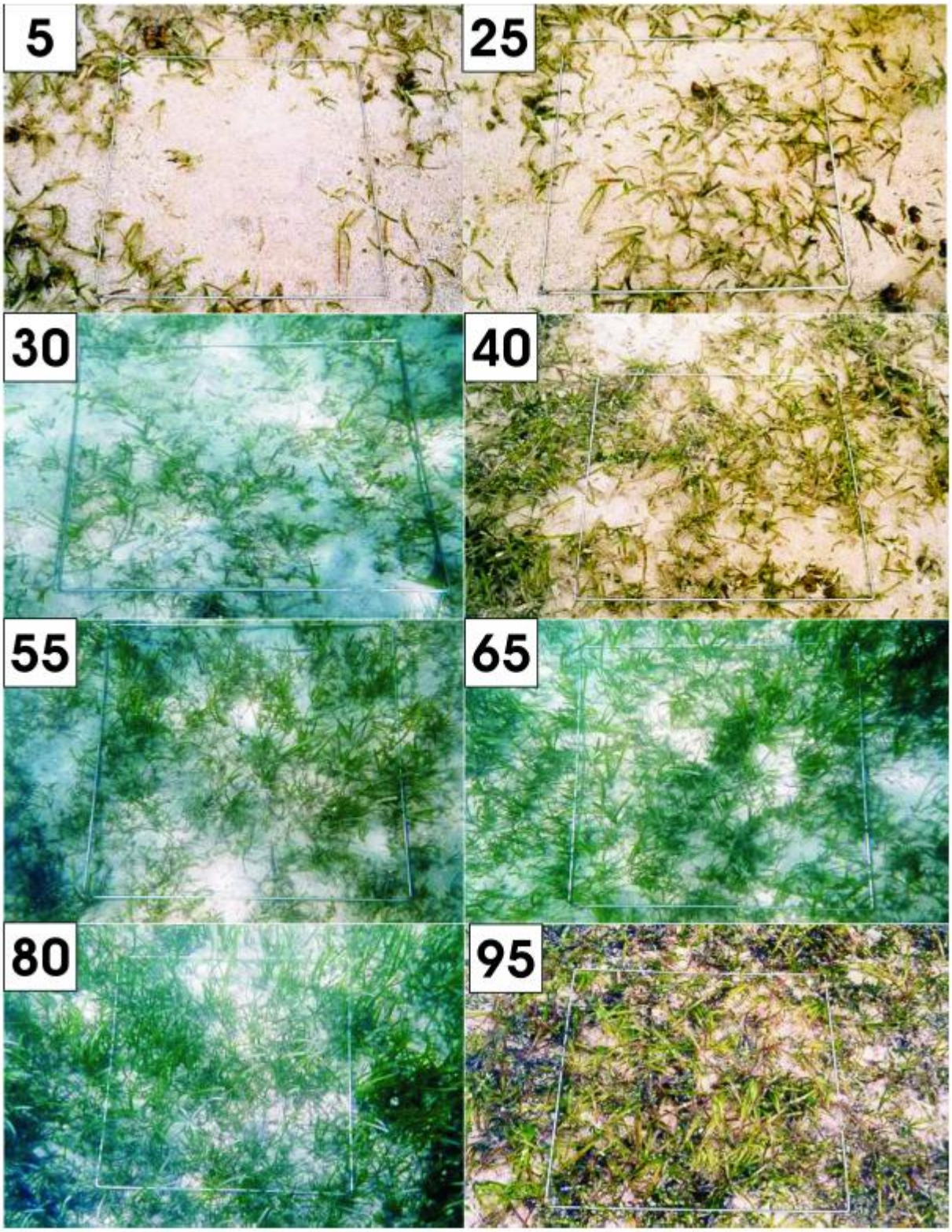
- Measure distance to edge and distance to last shoot at the 0m, 25m, and 50m points on transects A and C.

6. Repeat for all transects

7. Post-sampling procedures

- Wash all gear in fresh water and dry
- Submit all data to SeagrassNet via the website: www.seagrassnet.org

APPENDIX 2 – SEAGRASS % COVER PHOTO GUIDE



APPENDIX 3 – SEAGRASS SPECIES ABBREVIATIONS

Aa	Amphibolis antarctica
Ag	Amphibolis griffithii
Ca	Cymodocea angustata
Cn	Cymodocea nodosa
Cr	Cymodocea rotundata
Cs	Cymodocea serrulata
Ea	Enhalus acoroides
Ha	Halophila australis
Hb	Halophila beccarii
Hc	Halophila capricorni
Hd	Halophila decipiens
He	Halophila engelmanni
Hf	Halophila euphlebia
Hg	Halodule emarginata
Hh	Halophila hawaiiana
Hi	Halodule ciliata
Hj	Halophila johnsonii
Hk	Halophila nipponica
Hl	Halophila baillonii
Hm	Halophila minor
Hn	Halophila spinulosa
Ho	Halophila ovalis
Hp	Halodule pinifolia
Hq	Halophila ovata
Hr	Halodule bermudensis
Hs	Halophila stipulacea
Ht	Halophila tricostata
Hu	Halodule uninervis
Hv	Halodule beaudettei
Hw	Halodule wrightii
Hy	Halophila sulawesii
La	Lepilaena australis
Lc	Lepilaena cylindrocarpa
Lm	Lepilaena marina
Pa	Posidonia australis
Pc	Posidonia coriacea
Pd	Posidonia denhartogii
Pf	Posidonia ostenfeldii
Pg	Posidonia angustifolia
Pi	Phyllospadix iwatensis
Pj	Phyllospadix japonicus
Pk	Posidonia kirkmanii
Pn	Posidonia sinuosa
Po	Posidonia oceanica
Pp	Potamogeton pectinatus
Pr	Phyllospadix serrulatus
Ps	Phyllospadix scouleri
Pt	Phyllospadix torreyi
Rc	Ruppia cirrhosa (spiralis)
Re	Ruppia megacarpa
Rf	Ruppia filifolia
Rm	Ruppia maritime
Rp	Ruppia polycarpa
Rt	Ruppia tuberosa
Sf	Syringodium filiforme
Si	Syringodium isoetifolium
Tc	Thalassodendron ciliatum
Th	Thalassia hemprichii
Tp	Thalassodendron pachyrhizum
Tt	Thalassia testudinum
Za	Zostera asiatica
Zc	Nanozostera muelleri
Zf	Zostera pacifica
Zh	Heterozostera chilensis
Zj	Nanozostera japonica
Zl	Zostera caulescens
Zm	Zostera marina
Zn	Nanozostera noltii
Zo	Heterozostera polychlamys
Zp	Nanozostera capensis
Zr	Heterozostera nigricaulis
Zs	Zostera caespitosa
Zt	Heterozostera tasmanica