Seagrass Habitats: Survey Design

v 0.1.1

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Introduction

Seagrasses are among the most ubiquitous coastal habitats in the world, and the communities they support provide a range of valuable ecosystem services. They are also among the most threatened, so understanding their structure and function—and how they are changing in the face of local and global stressors—is key to understanding their future.

In this document, we provide MarineGEO's standard survey design for sampling seagrass habitats, including key measurements of the plants, associated fauna, and other properties of the ecosystem. Additionally, we provide define best practices for site selection, layout, and workflow.

The overall design and replication adheres as closely as possible to other seagrass monitoring programs, such as SeagrassNET and Seagrass Watch. Our goal is to provide a standardized sampling design and measurements of the key aspects of seagrass habitats that can be compared globally.

Additional copies of this document, protocols, field datasheets, data entry templates, instructional videos, literature, and more can be found on the MarineGEO protocol website: https://marinegeo.github.io.

Modules

Core (Required)

- Environmental parameters
- Seagrass density (cover, composition, and shoot density)
- Seagrass shoots (leaf length, width, epiphytes)
- Predation ('Squidpops')

Recommended

- Large mobile fauna (Beach seine or Visual census)
- Sediment organic matter
- Seagrass biomass
- Seagrass epifauna

Workflow

Preparation:

1. Identify the required and any recommended modules above that you wish to conduct at your site

2. Download copies of the protocols, field data sheets, and data entry templates
3. Familiarize yourself with the methods (including data preparation and submission) of each protocol, and consult instructional videos at https://marinegeo.github.io/ (if available)
4. Contact marinegeo@si.edu to schedule a brief conference to discuss your project and address any questions before proceeding to the next steps

Site Selection:

1. Identify one or more seagrass beds to sample. Beds should be:
    a. typical of your region;
    b. large enough to deploy three 50-m transects;
    c. reasonably accessible;
    d. generally persistent (so that they can be visited from year-to-year).
2. Contact marinegeo@si.edu to verify your sites with our team and to receive permanent standard MarineGEO site codes before heading to the field.
3. Record GPS coordinates at each sampling location. Take photos of the surrounding landscape and some underwater photos of the seagrass habitat for each trip. Also record field notes on the general layout and condition of the habitat, conspicuous features or organisms, etc.
4. Lay out and mark the positions of three 50-m fixed transects with durable infrastructure so that they can be relocated in the future: these transects are intended to be permanent (i.e., sampled repeatedly). Place the transects parallel to shore and representing the shallow (inshore), middle (interior), and deep (offshore) parts of the bed (Fig. 1):
    a. If the bed is intertidal or relatively shallow, select transects that are increasingly far from shore and separated by the largest distance that is logistically feasible.
    b. If the bed extends into water too deep to work in, deploy the transects at the maximum distance from shore that is logistically feasible.
    c. Ensure that the transects are reasonably independent (separated by a minimum of 5-10 m). If it's not possible to arrange 3 transects within the bed so that they are not overlapping or they are too close, contact marinegeo@si.edu for further guidance.
    d. If in subsequent years the margins of the bed change such that the transects are no longer in seagrass, conduct as many of the surveys as possible at the former position, then move

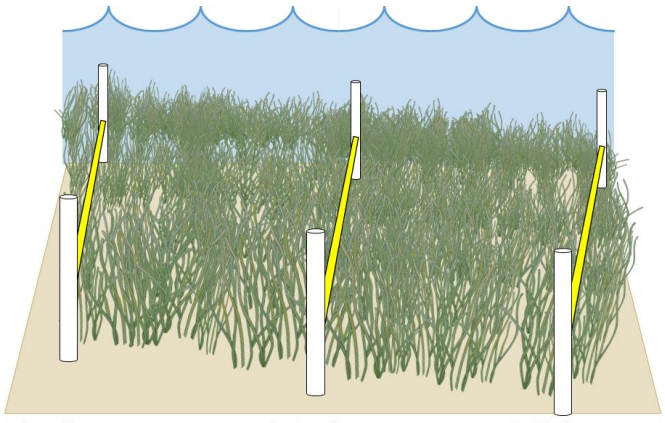

Figure 1. Position of three 50-m transects within a bed.

the transect to a new fixed position so that as much of the transect is in seagrass as possible.

Fieldwork: Day 1

1. Measure environmental conditions.
2. Deploy predation assay (*n* =25 'Squidpops') positioned roughly every 2 m along a *single* transect (Fig. 2). Choose one of the three transects that will ensure that the baits are submerged for the entire 24-hourt deployment.
3. One hour after deployment, score bait loss from the predation assay.
4. *RECOMMENDED*: *Before* deploying predation assay, quantify fishes (and large mobile invertebrates) by conducting either a Beach seine or a Diver visual census.

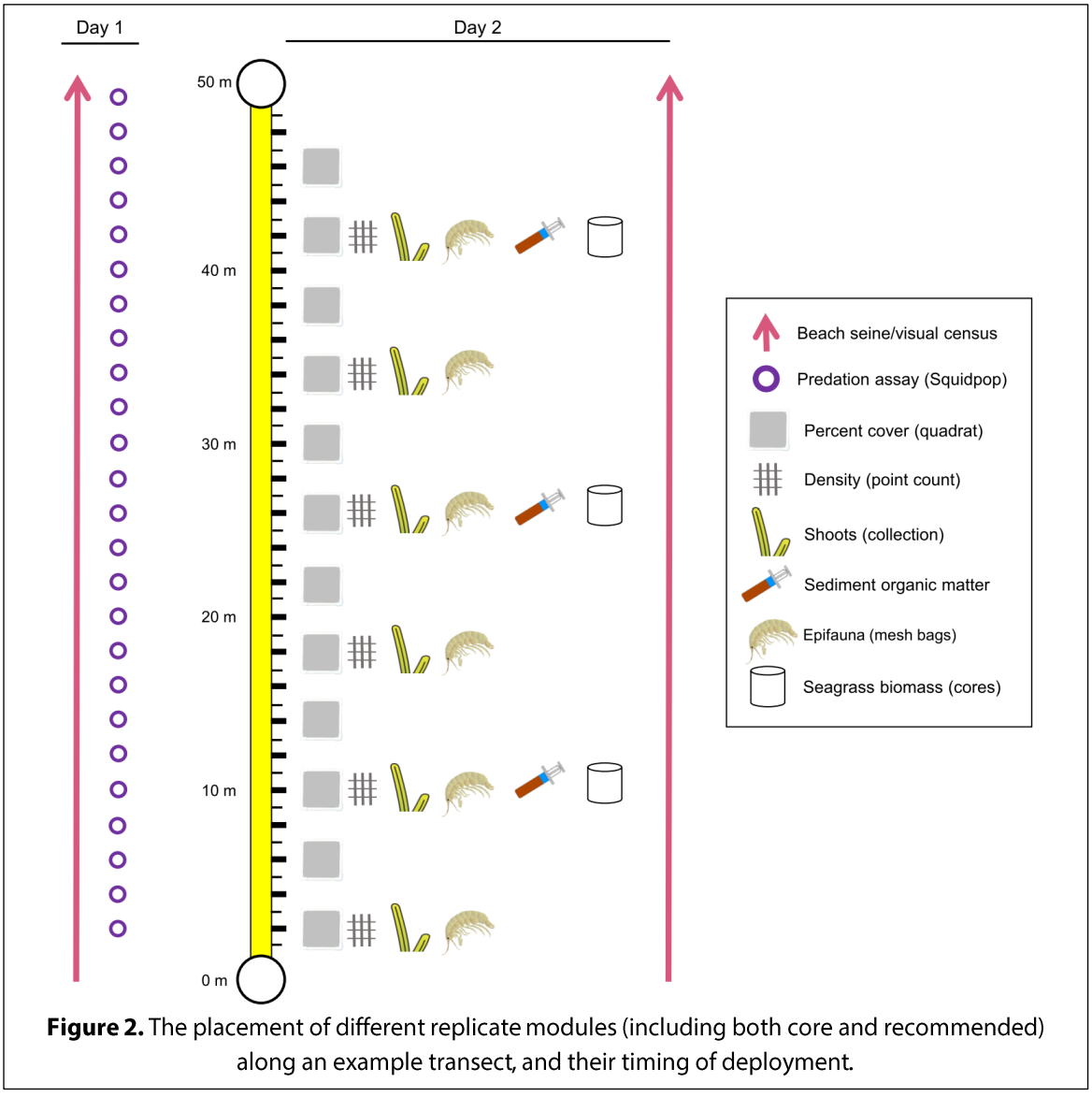

Figure 2. The placement of different replicate modules (including both core and recommended) along an example transect, and their timing of deployment.

Fieldwork: Day 2

1. Return to the site.
2. Conduct a second replicate of either the Beach seine or a Diver visual census.
3. Score 24-h bait loss from predation assay. Retrieve stakes and any associated markers.
4. Along each transect, conduct the following (Fig. 2):
    a. Use Seagrass density protocol to survey percent cover, composition, and shoot density (every 4 m, *n* = 12 per transect).
    b. Use Seagrass shoots protocol to collect shoots for later measurement of leaf characteristics, fouling load, and disease in the lab (every 4 m, *n* = 6 per transect).
    c. *RECOMMENDED:* Use Sediment organic matter protocol to sample organic carbon in sediments for later processing in the lab (every 8 m, *n* = 3 per transect).
    d. *RECOMMENDED*: Use Seagrass biomass protocol to sample above- and belowground biomass of seagrass, and composition of infaunal community for later processing in the lab (every 8 m, *n* = 3 per transect).
    e. *RECOMMENDED*: Use Seagrass epifauna protocol to sample epifaunal community structure for later processing in the lab (every 4 m, *n* = 6 per transect).
5. Destructive samples (biomass cores, shoot collections, epifauna collections) should be taken randomly at least 1-m from the permanent quadrat positions (Fig. 3).
6. Return all samples to the lab for processing.

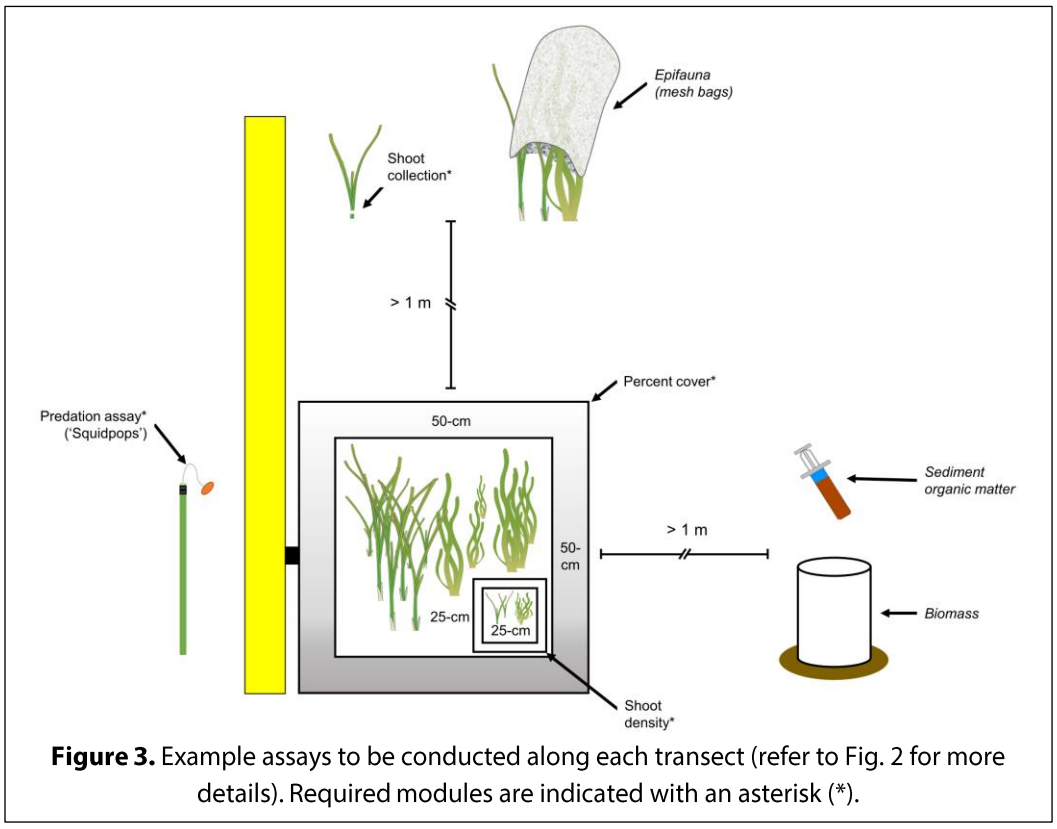

Figure 3. Example assays to be conducted along each transect (refer to Fig. 2 for more details). Required modules are indicated with an asterisk (*).

Sample processing:

1. Activities from Day 1 require no post-processing.
2. The samples on Day 2 should be processed within the following time frames:
    a. Seagrass shoot collections: within 24-h
    b. *RECOMMENDED:* Sediment organic matter: within 1-3 days
    c. *RECOMMENDED:* Seagrass biomass cores:
        i. Macrophytes: within 24-h;
        ii. Dry mass: within 1-3 days;
        iii. Infauna (preserved): at leisure
    d. *RECOMMENDED*: Seagrass epifauna:
        i. Macrophytes: within 24-h;
        ii. Dry mass: within 1-3 days;
        iii. Epifauna (preserved): at leisure

Data Submission

1. Label the site observations and photographs, and share with marinegeo-data@si.edu. Name the site image files using the standard convention, which includes the MarineGEO site code, specific location, subject, and date (yyyymmdd) separated by underscores, e.g., "BEL-CBC_Twin-Cays_landscape_20190101.jpg").
2. For the individual modules, transfer data from all datasheets (field and lab) onto the appropriate data entry template(s). Refer to the individual protocols for further guidelines regarding metadata and images.