

Standard Operating Procedure

Massachusetts Division of Marine Fisheries / MassBays National Estuary Partnership Standard Operating Procedure for Citizen Scientist Eelgrass Monitoring

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V.1., Created by T. Evans and J.Carr, 08/2018

V.2., Edited to update shoot collection methods (draft), 2019

V.3., Edited by J.Carr and F. Schenck for integration into iSeaGrass web app, 08/2020

V.4., Edited by F. Schenck for integration into iSeaGrass web app 07/2021

OBJECTIVE: Monitoring of eelgrass presence and condition. Sampling is performed according to the following procedure that documents presence/absence, percent cover, sediment, and individual shoot measurements.

I. GEAR LIST:

Shallow draft vessel

Coast guard required safety gear

Boat anchor

GPS unit with accuracy of 4 m or better

Mobile phone or tablet with access to iSeaGrass web app

Monitoring Kit contents:

Clipboard, datasheets, pencils, laminated SOPs

Underwater Splashcam digital camera, reel, and case; charged, with SD card

0.25 m² PVC quadrat drop-frame, line and float

FujiFilm topside point-and-shoot camera, charged, with SD card

Plexiglass site labeler

Secchi disk with line

Metric measuring tape

View Scope bucket

Small Danforth anchor and small mushroom anchor, line and float

Misc: zip ties, duct tape, dry erase marker, absorbent towels

Optional: mask, snorkel and fins for in-water shoot collection

II. SUMMARY

At all stations:

- Navigate to the station using GPS coordinates and anchor the boat, record actual coordinates and other topside information.
- Record secchi disk measurements at two locations on the sunny side of the boat using the view bucket.
- At the four “corners” of the boat, use the drop-frame to take a sample picture and estimate the percent cover within the quadrat using the visual guides.
- Review data to ensure accuracy. If there are any changes, cross out the original and initial the change (if using paper datasheets).
- If not an “indicator” station, raise the anchor and navigate to the next station.

Additional sampling at **indicator** eelgrass stations:

- At each of the four corners of the boat where eelgrass was observed, use the Danforth anchor or swim with mask and snorkel to take a bottom grab sample, collecting at least three shoots per sample.
- Identify the longest leaf from each shoot. Measure the leaves and estimate coverage of wasting disease and epiphytes, and record.
- Lay the shoots on the tote cover and fan the leaves, collect photos of the sample using the topside camera.
- Raise the anchor and navigate to the next station.

III. DETAILED METHODS:

1. Navigating to the station

- Volunteers navigate using their boat's GPS (or a hand held GPS unit, or cell phone if necessary) to get as close to the monitoring station as possible. Stations are defined as the area within a 10-m radius circle of the GPS location, accounting for boat swing and GPS error.
- Once on station, turn the boat into the wind or current, whichever is strongest. Anchor the boat by lowering the anchor off of the bow. Let out the necessary scope.

2. Data collection at all stations: Secchi disk

A Secchi disk is a weighted 20 cm diameter disk painted black and white with an attached line. Ideal weather conditions for accurate secchi data collection include sunny or partly sunny skies; calm winds (≤ 10 knots) and little to no chop (waves on the water). Collect secchi measurements between 10 am and 4 pm. Ideally, water level should be about 50% greater than the secchi depth so that it is viewed through the water column rather than against bottom-reflected light. This may not always be possible in shallow embayments that support seagrass. If the disk hits the bottom, record as such.

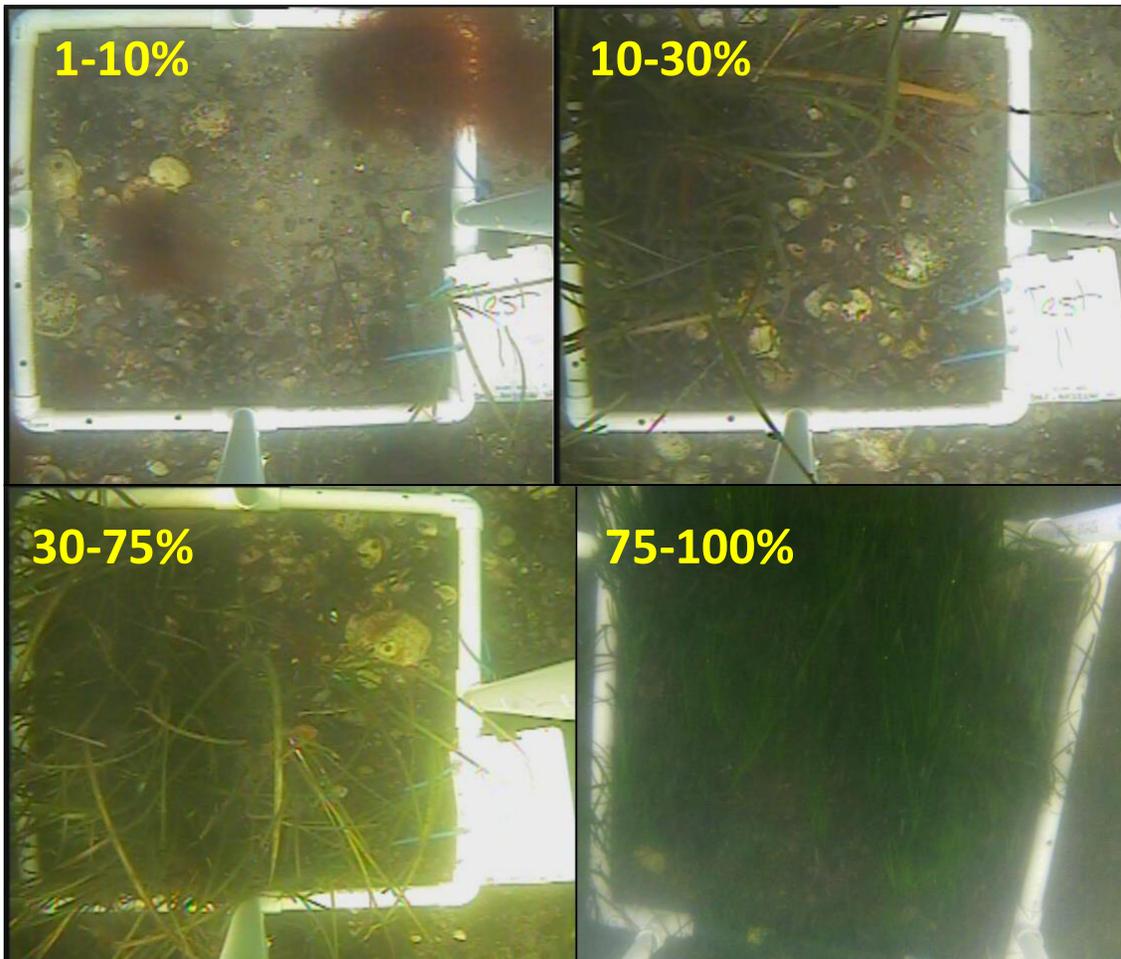
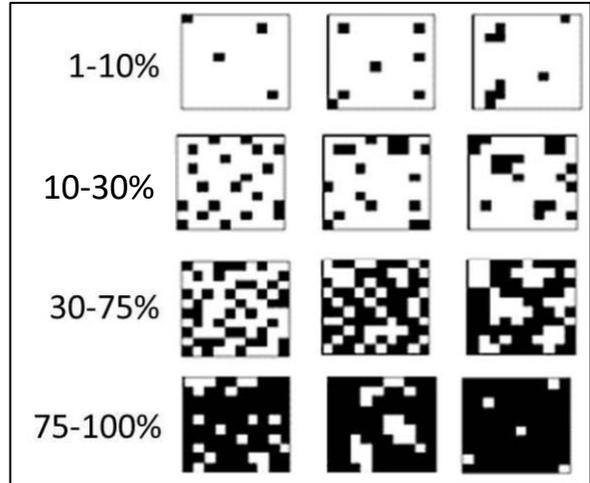
- Record the time, weather observations, water depth and other trip information.
- Remove your sunglasses, as they will give you an inaccurate reading (but be sure to wear regular corrective lenses if you need them).
- Unwind several meters of the Secchi disk rope from the holder.
- Lean over the sunny side of the boat if using a view bucket and submerge the bottom 1-2" of the bucket into the water. If not using a view bucket, use the shaded side of the boat.
- Another volunteer slowly lowers the secchi disk into the water until the viewer can no longer see it. Slowly raise the disk. When the secchi disk reappears, mark the rope at the surface of the water with a clothespin.
- Bring the secchi disk back on board and measure the length of the line from the disk to the clothespin location with your measuring tape and record. Repeat and record.
- If two different people will regularly be making secchi measurements, both should take the first few measurements to ensure that the results are similar.
- Useful website with tips: <https://www.nalms.org/secchidipin/>

3. Camera set up and operation: Follow the laminated camera guide included in the camera case.

4. Data collection at all stations: pictures and percent cover data

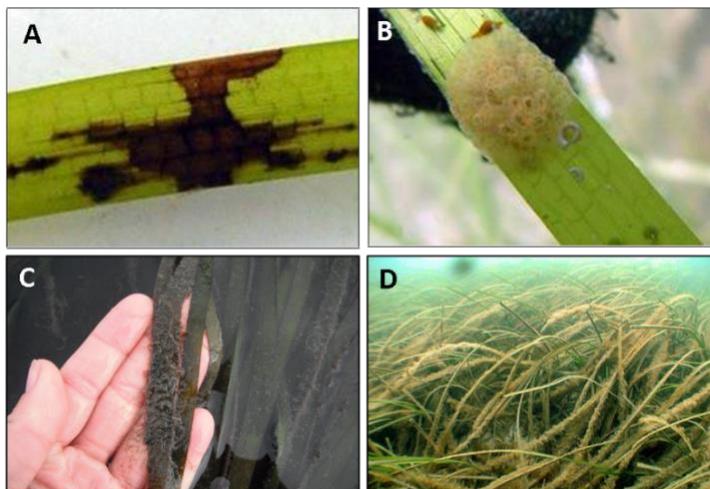
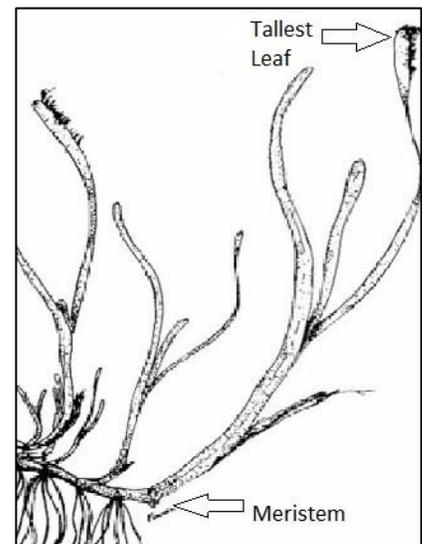
- Four samples will be collected off the four corners of the boat.
- Beginning on the windward and up-current side of the boat, with the camera on, lower the drop-frame over the side. Once it hits the bottom leave it there for several seconds to allow sediment to settle. View the camera screen to ensure the quadrat landed flat.

- Look at the monitor and ensure that the image is of the whole quadrat and the bottom (and/or eelgrass) is clearly visible. On the DVR unit, press the “OK” or “record” button to take a picture. If you are unsure if a picture was taken, press the “Preview” button on the DVR unit to view the last image captured.
- Record the timestamp from the picture.
- Record sediment type as mud, clay, sand, gravel and/or cobble (all that apply) and note other benthic characteristics (mussels, debris, algae or other observation).
- Estimate the percent cover of eelgrass using the following bins (**0%**, **1-10%**, **10-30%**, **30-75%**, **75-100%**) and the provided coverage guide (right).
- Repeat at the remaining 3 corners of the boat.
- If this is an indicator station, continue to step (5).



5. Additional data collection at **indicator** stations: Eelgrass length and width measurements, and stressor indices

- If eelgrass was present at a given corner of the boat, collect shoot samples by tossing the Danforth anchor out about 5 feet from the boat and gently dragging it several feet, attempting to collect at least three eelgrass shoots. Slowly pull it up, deploying again as necessary. This will be repeated at each of the four corners of the boat that contained eelgrass during the drop-frame sampling (e.g. if all four corners had eelgrass, then four shoot samples will be collected, each containing three shoots, totaling 12 shoots from that station). Alternatively, participants are welcome to snorkel for sample collection. This option requires the use of a personal mask, a boat which can accommodate entry and exit from the water, and a captain who is comfortable with participants swimming from their boat. If this option is used, the swimmer should safely free-dive down to the eelgrass and pick one shoot at a time by pinching the plant below its meristem (see figure below) and applying an upward pulling/twisting motion. Grabbing clumps of shoots should be avoided; as should grabbing from the leaves which can lead to plant damage and incomplete samples.
- From the sample, select three intact shoots and place the shoots on the white tote lid along the ruler, fanning the leaves. Use the FujiFilm topside camera to collect an overall photograph of the entire sample, with the ruler in view, as well as any close-up photographs of wasting disease, epiphytes, or other observations that are of interest.
- Identify the longest leaf in each of the three sample plants. Measure the length and width of the leaf using the measuring tape. Length is measured from the meristem to the leaf tip (see below), and width is measured across the widest part of the leaf. If the tallest leaf is broken indicate this with an asterisk (*) or in the notes. Record the measurements.
- Estimate cover of epiphytes (encrusting algae or tunicates) and wasting disease on the three leaf samples and assign none, low, med. or high (see two guides below).
- Discard plants overboard and repeat at remaining corners. (Note: If colleagues or scientists request sampling collection, samples should be placed in clean, clearly labeled zip-lock bags and stored on ice in a cooler until transfer to the requester).



Wasting disease (A) and epiphyte coverage (B-D) on eelgrass. Photos from Cornell Cooperative Extension/SeagrassLI.org and @PLNReynolds

INDEX FOR MEASURING COVERAGE OF WASTING DISEASE AND EPIPHYTES



Image altered from Burdick et al. 1993.

6. Cleaning and storage

- At the end of each field day, inspect all equipment to ensure everything is accounted for and in similar condition to when it was received at the beginning of the day. If any items are missing, damaged, or altered in any way, note the change(s) and inform the organizer.
- Rinse all gear that came in contact with salt water, taking particular care with the camera and lowering frame. Soak the camera in a tub of warm water.
- Be careful not to allow any cables, connections, or electronic equipment from the waterproof box to come into contact with water. The two plugs attached to the camera cable reel must also remain clean and dry at all times.
- Inspect the camera case to make sure it has remained clean and dry after each use. If necessary, carefully clean that monitor screen with a paper towel. If water is present in the box, remove it as soon as possible with a dry paper towel and inspect all electronic equipment to ensure no damage occurred.
- Allow all gear to dry and store in a cool, dry place.
- Recharge batteries if needed, and give SD card to the organizer.
- If you collected data via the iSeagrass web app, use the button at the bottom of your trip screen to upload the data when your phone connects to the internet via cellular data or wifi.
- If you collected data via paper data sheets, give the data sheets to the organizer.

IV. iSeaGrass Web App User Guide

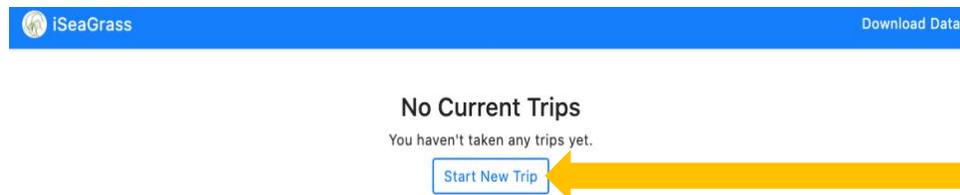
1. How to Collect Data

Step 1: At the beginning of the day, click on the 'Go to your trips' button.



Step 2: Click on the 'Start New Trip' button.

Note: If you collect over multiple days, start a new trip at the beginning of each day.



Step 3: Complete the fields in the 'Trip Details' section.

The screenshot shows the iSeaGrass mobile application interface. At the top, there is a blue header with the iSeaGrass logo on the left and a 'Download Data' button on the right. Below the header is a navigation bar with a back arrow and the text '< Save and Back to trips'. The main section is titled 'Trip Details' and contains several input fields: 'Crew Members' with a 'Full name...' text box and a sub-note 'This lets us reach out to you later if we have any questions.'; 'Trip Date' with a date picker showing '05/25/2021'; and 'Boat Name' with an empty text box. To the right of the 'Boat Name' field is a blue 'Add Station' button. Below these fields is a 'Stations' section with a light gray background, displaying 'No Stations' and a blue 'Add Station' link. At the bottom, there is an 'Actions' section with two buttons: a green 'Upload Trip Data' button and a red 'Delete This Trip' button. Three yellow arrows point to the 'Full name...', 'Trip Date', and 'Boat Name' input fields.

Step 4: Once you've navigated to a sampling station, click on either of the 'Add Station' buttons.

This screenshot is identical to the one above, showing the iSeaGrass 'Trip Details' form. In this version, two yellow arrows point to the 'Add Station' buttons. One arrow points to the blue 'Add Station' button located to the right of the 'Boat Name' input field. The other arrow points to the blue 'Add Station' link located in the center of the 'Stations' section, which currently displays 'No Stations'.

Step 5: Start by filling out the fields in the station tab and move to the other tabs following the data collection protocol.

The screenshot shows the ISeaGrass app interface. At the top, there is a blue header with the ISeaGrass logo on the left and a 'Download Data' button on the right. Below the header is a navigation bar with a back arrow and the text '< Save and Back to Trip'. The main content area is divided into several sections. The first section is the 'Station' tab, which is currently active and shows a dropdown arrow on the right with a yellow arrow pointing to it. Below this are three input fields: 'Station ID', 'Harbor', and 'Notes'. To the right of the 'Station ID' field is a checkbox labeled 'Indicator Station?'. Below the input fields is a green button labeled 'Save and Back to Trip'. Below the green button is a 'Settings' link with a right-pointing arrow. The second section is a list of other tabs: 'Location', 'Weather', 'Secchi Drop', and 'Drop Frames 0/4'. Each tab has a right-pointing arrow, and a yellow arrow points to each of these arrows.

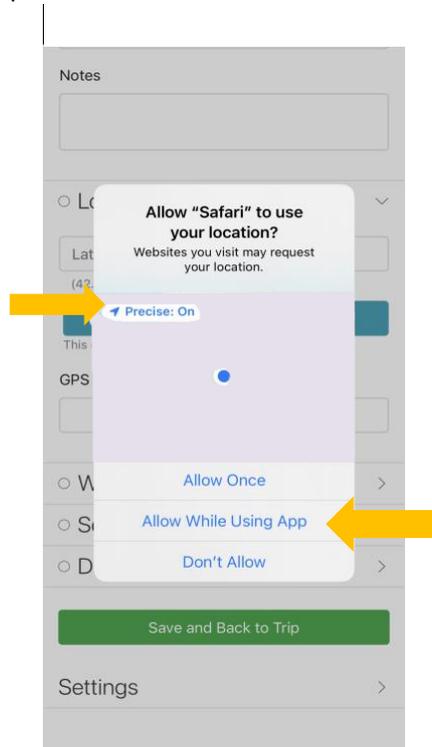
Step 6: Once all the fields have been completed click 'Save and Back to Trip'. Repeat for subsequent stations.

Note: Tabs where all fields have been completed will display green checks beside them.

The screenshot shows the ISeaGrass app interface after completing the station. The blue header and 'Download Data' button are still present. The navigation bar now shows '< Save and Back to Trip'. The main content area shows a list of tabs: 'Station Practice 1', 'Location', 'Weather', 'Secchi Drop', and 'Drop Frames 4/4'. Each tab has a green checkmark on the left and a right-pointing arrow on the right. The 'Weather' tab is highlighted with a grey background. Below the list is a green button labeled 'Save and Back to Trip' with a yellow arrow pointing to it. Below the green button is a 'Settings' link with a right-pointing arrow.

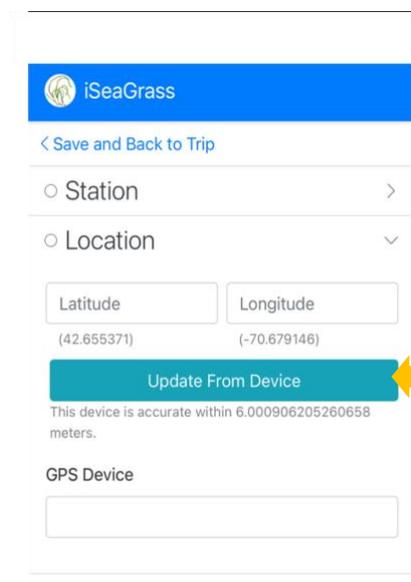
2. How to Collect Station Location from Device

Step 1: When you open the location tab you may be prompted to allow your default internet browser to use your location. Click the 'Allow While Using App' button. Also click on the precise location feature to turn it 'On'.



Step 2: Click on the 'Update From Device' button. The iSeaGrass App will automatically populate the 'Latitude' and 'Longitude' fields as well as the 'GPS Device' field.

Note: Device accuracy may improve while at the station and subsequent clicks on the 'Update From Device' button will override previously collected GPS coordinates for the station. At most locations the device should be able to obtain an accuracy within 10m.



3. How to Upload Data

Step 1: Once sampling has concluded for the day and you are connected to a Wi-Fi network, click on the 'Upload Trip Data' button.

iSeaGrass Download Data

[< Save and Back to trips](#)

Trip Details

Crew Members

Practice Seagrass

Full name...

This lets us reach out to you later if we have any questions.

Trip Date

05/25/2021

Boat Name

Practice Boat

Stations

[Add Station](#)

Station Practice 1
(42.34, -70.94) >

Station Practice 2
(42.35, -70.89) >

Actions

[Upload Trip Data](#)

Requires Internet. This will upload the current trip data to the server. You can upload multiple times if you want and only the most recent will be saved.

[Delete This Trip](#)

Remove this trip from your device. This is safe to do once you have uploaded the data.