Biennial Surveys of Seagrass Habitat in the Barnegat Bay

QUALITY ASSURANCE PROJECT PLAN

April 2025 v1.0

Approved by: Andrew McGowan 4/29/2025
Andrew McGowan, Quality Assurance Officer date
Barnegat Bay Partnership

Approved by: John Egan 4/30/25
John Egan, Project Manager date
Barnegat Bay Partnership

2.0 Table Of Contents

3.0 QAPP Distribution List

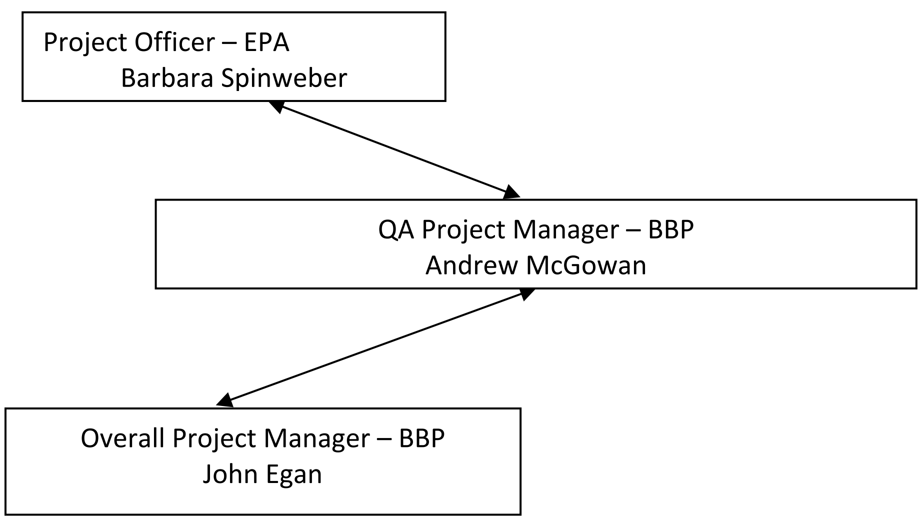
Signed copies of this Quality Assurance Project Plan (QAPP) and all subsequent revisions will be sent to the following individuals by electronic mail:

Barbara Spinweber, Project Officer, U.S. EPA, spinweber.barbara@epamail.epa.gov
Andrew McGowan, Barnegat Bay Partnership, amcgowan@ocean.edu
John Egan, Barnegat Bay Partnership, jegan@ocean.edu

4.0 Project Organization:

Overall project management will be the responsibility of John Egan. Mr. Egan will oversee the collection of samples by technical staff and will be responsible for lab analysis and maintenance of the approved QA Project Plan. Mr. Andrew McGowan will provide quality assurance management, reviewing data acquisition and data analysis protocols, and ensuring compliance with all elements of the QA Project Plan.

Organizational Chart-Lines of Communication



5.0 Special Training Needs/Certifications

Mr. Egan will provide training to all field staff in the correct procedures for enumerating and sampling of submerged aquatic vegetation. During the initial training, all field staff will first observe the process from Mr. Egan, then complete the sampling independently. Mr. Egan will assess each sample for validity and spot check technique throughout the survey period. All staff have experience in field sampling.

6.0 Problem Definition/Background

6.1 Problem Definition

This project seeks to document changes in the presence/absence, areal cover, biomass, and shoot density of seagrass habitat within the Barnegat Bay via surveys through historic seagrass beds. We will compare the findings of this survey to those conducted in 2004-2021 to assess the status and trends of seagrass within the estuary.

6.2 Background

The Barnegat Bay is a shallow, lagoonal back-barrier system located along the central New Jersey coastline between 39°31' N and 40°06' N latitude and 74°02' W and 74°20' W longitude (Figure 1). Since 2004, seagrass condition in the estuary has declined (Kennish *et al*. 2007, 2008, 2010), with aboveground and belowground biomass decreasing by 50-88% over the 2004-2006 period (Kennish *et al*. 2008, 2010). Results of seagrass sampling subsequent to 2006 indicated continued decline, with 2009 having the lowest seagrass biomass values recorded in the estuary since comprehensive *in situ* sampling of seagrass beds commenced in 2004. Recent surveys suggest some recovery has occurred in regards to percent cover in some areas, but have also demonstrated die back events (Lacey 2024).

7.0 Project/Task Description

We propose to sample seagrass beds using the protocols of the SeagrassNet approach (Short *et al*. 2002) adopted by Kennish *et al.* (2007, 2008, 2010) and by Lacey (2016, 2018, 2020, 2022, 2024) for previous seagrass studies in the estuary. This includes the collection of seagrass above and belowground biomass via cores, and macroalgae, seagrass, and "other" coverage via quadrat, at a series of 9 locations within the Barnegat Bay (Figure 1). These locations are a subset of the 15 studied by Kennish *et al.* from 2004-2011, selected to represent the major seagrass species (*Ruppia maritima* and *Zostera marina*) found in the northern and central/southern sections of the estuary, respectively. Samples will be collected at the beginning (May/June) and end (October/November) of the growing season to document both annual and inter-annual changes in seagrass demographics.

This project will be conducted biennially, with two discrete field sampling events (May/June and October/November) each sampling year. Laboratory analysis of samples will begin with the first field collection and extend through November, with data analysis to follow. A final report will be available by March of each sampling year.

	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Field Sampling	X	X				X	X				
Lab analysis	X	X				X	X				
Data analysis								X	X	X	X
Final report											X

8.0 Quality Objectives and Criteria for Measurement Data

8.1 Accuracy and Precision

The accuracy and precision of the abiotic and biotic data will vary with methodology (core vs quadrat samples).

For core samples (determining biomass), to ensure a more accurate assessment of the sampling area, ten core samples are collected from each location, and the mean of the samples dry weights is used to represent the sampling location. By using ten cores, as opposed to fewer, a more complete and accurate representation of the true biomass is achieved. In regards to precision, roots and shoots are separated before drying in an air circulating over at 50°C for at least 72 hours. To ensure precision (*i.e.* the true dried weight of the sample), the final sample weight is measured on the same scale three consecutive times, with the average representing the dry weight. The same scale is used for all samples collected in a given season. For percent cover (quadrat sampling), to ensure more accurate assessment of the sampling area, the visually determined percent coverage is taken at ten separate locations.

8.2 Bias

To limit bias, samples are collected only within 50m of the original sampling location from previous studies (Kennish 2004-2011, Lacey 2016-2024). To limit bias in core samples, all samples must be approved by the Project Manager or BBP Quality Assurance Officer before being sieved and bagged for later analysis. To limit bias in percent cover, two observers are utilized for all samples, and must reach agreement on % cover of each category before recording the coverage.

Staff are trained by the Project Manager and BBP Quality Assurance Officer in taking cores, separating roots from shoots, and scraping off epiphytes.

8.3 Representativeness

The seagrass community in Barnegat Bay is typically dominated by eel grass (*Zostera marina*) in the southern and central portions of the bay and widgeon grass (*Ruppia maritima*) in the northern segment of the bay. In order to capture this distribution, we selected survey locations that are in historic beds of both types, as documented by earlier work. The sites selected also span the salinity, temperature, and nutrient gradients known to exist in Barnegat Bay.

8.4 Comparability

All biotic sample collection and handling methods, sample preparation, and analytical procedures will follow methodologies in which the quantitative output can be directly compared to published literature values and existing NJDEP and EPA data. In addition, biotic data will be reported in a format that can also be directly compared to Kennish *et al.* (2008) and prior Stockton/BBP efforts.

8.5 Completeness

As this data is to be used in a status and trends assessment the completeness goal for all samples collected is 100%. Minimum requirements for biotic sample collection compliance are 80% of samples per parameter per sampling date. If more than 20% of samples are not collected or lost during processing then a second sampling trip for that time period will occur to collect the missing data if feasible.

8.6 Sensitivity

The minimum detection limit for biomass is 0 g/m^2. The minimum percent cover is 0 %.

9.0 Non-Direct Measurement (Secondary Data)

There will be no use of secondary data with this project.

10. Field Monitoring Requirements

10.1 Monitoring Process Design

The field teams will collect biotic data at the 9 sampling sites established during the 2015 monitoring effort. If a seagrass bed is no longer present at that location, we will circle that point at increasing 5m distances until SAV is found, and that will serve as the edge of the sampling area. Sites will be sampled in May/June and again in October/November. The crew will locate the sampling stations by use of Global Positioning Satellite System (GPS), which is accurate within 3.5 meters depending on atmospheric effects and sky blockage. At the sites all sampling crews will uniformly collect samples following established sampling protocols and methods as outlined in this document. Field data samples include above and belowground biomass, percent cover, and blade height of *Zostera marina*. Samples collected from the field will be taken to BBP for analysis.

10.2 Monitoring Methods

In general, to increase ease of work, sampling is performed at or near low tide, with light wind and minimal wave energy. SOP for BBP staff is listed in Appendix 1.

Percent Cover:

A quadrat measuring 1 m on each side with an area of 1 m^2 will be randomly placed 10 times within an 50m radius at each sampling site to measure seagrass (split by species), macroalgae, and “other” (sponge, bare substrate, etc.) coverage. The percent cover of seagrass (separately for each species), macroalgae, and “other” will then be estimated *in situ* by two divers using a scale of 0 to 100 in increments of 5. Both divers must agree on all categories before the cover is recorded on the field data sheet (Appendix 2). Within each quadrat containing

Zostera marina blade height will be taken once by carefully grabbing a clump of leaf blades, ignoring the tallest 20% and measuring one height to the nearest mm. If the quadrat does not contain *Zostera* a blade height of zero is recorded.

Biomass:

A total of 10 cores will be taken haphazardly within the 50m radius at each site to collect aboveground and belowground (roots and rhizomes) seagrass tissue for biomass estimates. The cores are taken with beveled clear PVC (10.23 cm diameter). Samples will be collected by staff, and brought to the Project Manager or BBP Quality Assurance Officer for inspection. Cores must not have any cut seagrass blades, and above and belowground biomass should still be connected (*i.e.* the blades are still connected to the roots and not free floating in the soil or sieve. Acceptance is judged by the Project Manager or BBP Quality Assurance Officer. Accepted cores are sieved (1.0 cm mesh box sieve) and washed clean of sediment in the field and all plant material will be placed in plastic bags in a cooler until taken back to the lab for processing (Short *et al*., 2002; Sidik *et al*., 2001).

10.3 Field Quality Control (QC)

Sampling and QA procedures vary among the methods. If problems occur, such as lost, contaminated, mislabeled or improperly handled samples, these problems will be documented in the appropriate project record-keeping location (field or laboratory logs). If practical, replacement samples will be obtained. If differences between temporal or spatial characteristics of the replacement samples and the original samples have a bearing on project activities or objectives, such differences will be noted in all subsequent documentation and products in which the replacement samples were used.

No core samples are bagged without visual acceptance by the Project Manager or BBP Quality Assurance Officer.

No percent cover is recorded unless the quadrat is reviewed by two divers and they reach agreement on each category.

The BBP Quality Assurance Officer accompanies at least once field day per sampling window (spring and fall) to ensure adherence to the QAPP. A brief summary report is generated with findings.

10.4 Lab Quality Control (QC)

The scale used in the laboratory (Ohaus Pioneer Analytical Balance, Model PX124, 120g x 0.0001g, with Internal Calibration), has an internal calibration procedure (see manufacturers specifications https://cdn.thomassci.com/FetchFile.ashx?id=779b7614-aa8b-410f-af6e-8d7b53a663b3). Manufacturers specifications will be followed. We will perform a class I accuracy check using 100 mg class I weight, and a 50 g class I weight per the NJAC7:18 laboratory certification regulations, once in May/June and once in October prior to use. Results are expected to be within 5% of class I weight values. The scale will be zeroed as necessary. No samples are processed with a scale which does not return correct weights as described above.

10.5 Data Quality Control (QC)

Ten percent of the data entered into excel by BBP staff is checked by the BBP Quality Assurance Officer. If any errors are found, 100% of the data will be checked.

11.0 ANALYTICAL REQUIREMENTS

Biotic samples will be analyzed at the Barnegat Bay Partnership laboratory. Seagrass will be removed from bags and placed in large plastic trays. Each replicate and each site will receive its own plastic sorting tray. Within a tray, the plants will be separated by species. The total number of shoots (separately for each species) will be recorded on the lab datasheet (shoots are classified as where the leaf meristem meets the stem or rhizome). Then, shoots and roots will be separated with a razor blade, cutting just below the leaf sheath, thus separating the specimen into aboveground and belowground biomass. Shoots with large epiphytes will have the epiphytes removed by hand. The sample will then be rinsed with deionized water to remove epiphytes and sediment. The sample will be placed into pre-weighed, numerically pre-labeled and cataloged aluminum foil envelopes. Each sample will be recorded on the lab data sheet with the following sample ID system: site number; date; replicate number; species (Z = *Zostera* and R = *Ruppia);* Above Ground/Below Ground (AG/BG); and Tare # (eg BB10 5/20/25, 1, Z, AG, 001). All samples will be placed in a gravity circulating oven at 50°C for a minimum of 72 hours. After at least 72 hours, each sample will be weighed 3 consecutive times using the same scale and all weights will be recorded on the lab data sheet where the average of the 3 weights will be recorded (Appendix 3). Biomass will be reported as g dry weight (DW) m^{-2}; (Duarte and Kirkman, 2001). Cores should be processed upon return to the lab, but may stay in a refrigerator for up to 72 hours before processing, if necessary. All data from the lab data sheets will be entered into excel.

12.0 Sample Handling and Custody Requirements

Prior to all sampling dates all materials will be cleaned and an inventory of materials necessary for the field and in the laboratory will be completed by the Project Manager (Appendix 1). Plastic bags for samples will be pre-labeled with the site and replicate number on them. Aluminum envelopes for weighing samples will be labeled with the catalog system (001, 002, and onward). The initial weight of the empty and labeled envelop is recorded on the lab data sheet (Appendix 3).

In the field, all core samples must be approved by the Project Manager or BBP Quality Assurance Officer before bagging. Bagged samples will be moved on-board into a cooler upon bagging. Percent cover numbers will immediately be transcribed onto a datasheet by BBP staff and the datasheet will be kept on board at all times. Before leaving the sampling location the Project Manager will ensure all core samples have been taken and are accounted for and labeled, and percent cover information was transcribed correctly.

Upon return to the lab, BBP staff will also digitally enter the percent cover and seagrass biomass data into an excel sheet which is stored on the BBP drive (backed up daily), in the file location Z:\Grants Contracts and Sub-awards\BIL funding\FFY2023\Biennial Seagrass Monitoring.

In the lab, the Project Manager will ensure that all core samples are processed separately (in separate bins) to avoid mixing species, sites, and replicates, and will ensure that all labeled aluminum envelopes receive the correct core sample. Weights of samples from the gravity circulating oven at a minimum of 72 hours and subsequent measurements are recorded on a lab datasheet kept in the BBP lab (Appendix 3). The lab data sheet is then transcribed by BBP staff into the same excel sheet which contains the percent cover and seagrass biomass information. Dried samples are preserved until all data entry has occurred and a cursory review of entered data is performed by the QA manager to ensure data was entered correctly (no decimal places in wrong position, etc.).

13.0 TESTING, INSPECTION, MAINTENANCE, AND CALIBRATION REQUIREMENTS

13.1 Instrument/Equipment Testing, Inspection and Maintenance

All sampling gear and laboratory instrumentation will be maintained in good repair as per manufacturer's recommendations to ensure proper function.

13.2. Instrument/Equipment Calibration and Frequency

Analytical balances – the balance will be calibrated according to the manufacturer specifications, and will also undergo a class I weight test using 100 mg class I weight and a 50 g class I weight once in the spring before use and once in the fall before use. Measurements from the scale are expected to be within 5% of the class I weight, else the scale will not be used. The scale will only be used on level surface, and anti-vibration marble slab prior to each use; analyst will check that scale is at 0 prior to weighing all samples; scale will be tared as necessary.

Each piece of routine tools common to most laboratories (e.g., drying ovens, freezers, etc.) will have an assigned logbook in which the calibration or performance records are maintained. Other equipment such as sample drying ovens should be monitored on a routine basis during periods of use to ensure their performance.

13.3 Inspection/Acceptance of Supplies and Consumables

Prior to field sampling, the Project Manager will ensure all supplies are unbroken and useable. No sample will be taken with broken cores or quadrats, and no samples will be taken without pre-labeled sample bags and aluminum envelopes.

No samples will be taken with a scale which does not meet the criteria listed above.

14.0 DATA MANAGEMENT

Field data (percent cover, blade height, site, replicate number) are recorded onto a field datasheet (Appendix 2) on board the BBP vessel. Core samples are stored in plastic bags labeled with site and replicate number.

Initial weights of the aluminum envelopes (labeled with catalog system) are recorded on the BBP lab datasheet (Appendix 3). All subsequent dry weights for each sample are also recorded on the BBP lab datasheet.

Data from the field sheet and lab sheet are entered by BBP staff into the excel sheet containing the data for this project, stored on the BBP’s electronic drive (backed up daily).

QAPPs, any revisions, analysis results, final reports, and QA checks are also stored in the same folder location.

15.0 ASSESSMENTS AND OVERSIGHT

See section 10.3-10.5

16.0 DATA REVIEW, VERIFICATION, VALIDATION AND USABILITY

16.1 Data Review, Verification, and Validation

- The Project Manager ensures all sample bags are labeled before sampling, and all aluminum envelopes are labeled with the catalog system and weighed before sampling.
- All BBP staff participating must review the SOP (Appendix 1).
- Core samples are not bagged unless they are visually accepted by the Project Manager of BBP Quality Assurance Officer.
- Bagged cores must be immediately moved to the onboard cooler. The Project Manager ensures the cooler is properly chilled throughout the day.
- The sampling site is not vacated before the Project Manager ensures all samples are on board and all data has been collected and properly labeled.
- The BBP Quality Assurance Officer accompanies the field team at least once per sampling window to ensure adherence to the QAPP.
- In the lab, all envelopes are pre-weighed and labeled. The lab datasheet remains in the lab in a binder while samples are being processed. The Project Manager will periodically review the lab datasheet to ensure no weights are far beyond expected ranges (based on previous years of data).
- The Project Manager ensures all samples are processed separately (sites, replicates, and then species), and above and below ground biomass are not mixed.
- The Project Manager ensures the scale is operating correctly, and that samples are sufficiently dried before recording a final weight.
- 10% of data entered into excel is checked by the BBP Quality Assurance Officer, and if any errors are present, 100% of the data is reviewed.

16.2 Reconciliation With User Requirements

Any deviations from this QAPP will be marked with a flag in the excel sheet and an explanation tab for what the deviation was. These data are used in assessments of seagrass health throughout he estuary by the BBP. Other data users will need to review the QAPP and decide if the QAPP procedures are sufficient for their uses.

17.0 REPORTING, DOCUMENTS AND RECORDS

All electronic project documents are located on the BBP drive in the folder located in Z:\Grants Contracts and Sub-awards\BIL funding\FFY2023\Biennial Seagrass Monitoring. Hard copies of the lab and field data sheets are stored indefinitely in the BBP office.

Final reports are also posted on the BBP website (barnegatbaypartnership.org).

REFERENCES

Duarte, C.M. and H. Kirkman. 2001. Methods for the measurement of seagrass abundance and depth. In Global Seagrass Research Methods. Coles, R.G., F.T. Short ,and C.T. Short (eds). Elsevier Science B.V., Amsterdam pp 141-154.

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Sidik, B.J., S.O. Bandeira, and N.A. Milchakova. 2001. Methods to measure macroalgal biomass and abundance in seagrass. 2001. In Global Seagrass Research Methods. Coles, R.G., F.T. Short, and C.T. Short (eds). Elsevier Science B.V., Amsterdam pp 223-236.

Figure 1. Barnegat Bay-Little Egg Harbor Estuary showing all historic sampling transects in green dots (from Kennish *et al* work). Transects are numbered from south to north. We will sample at Transects 1, 3, 6, 8, 10, 12, 13, 14, and 15.

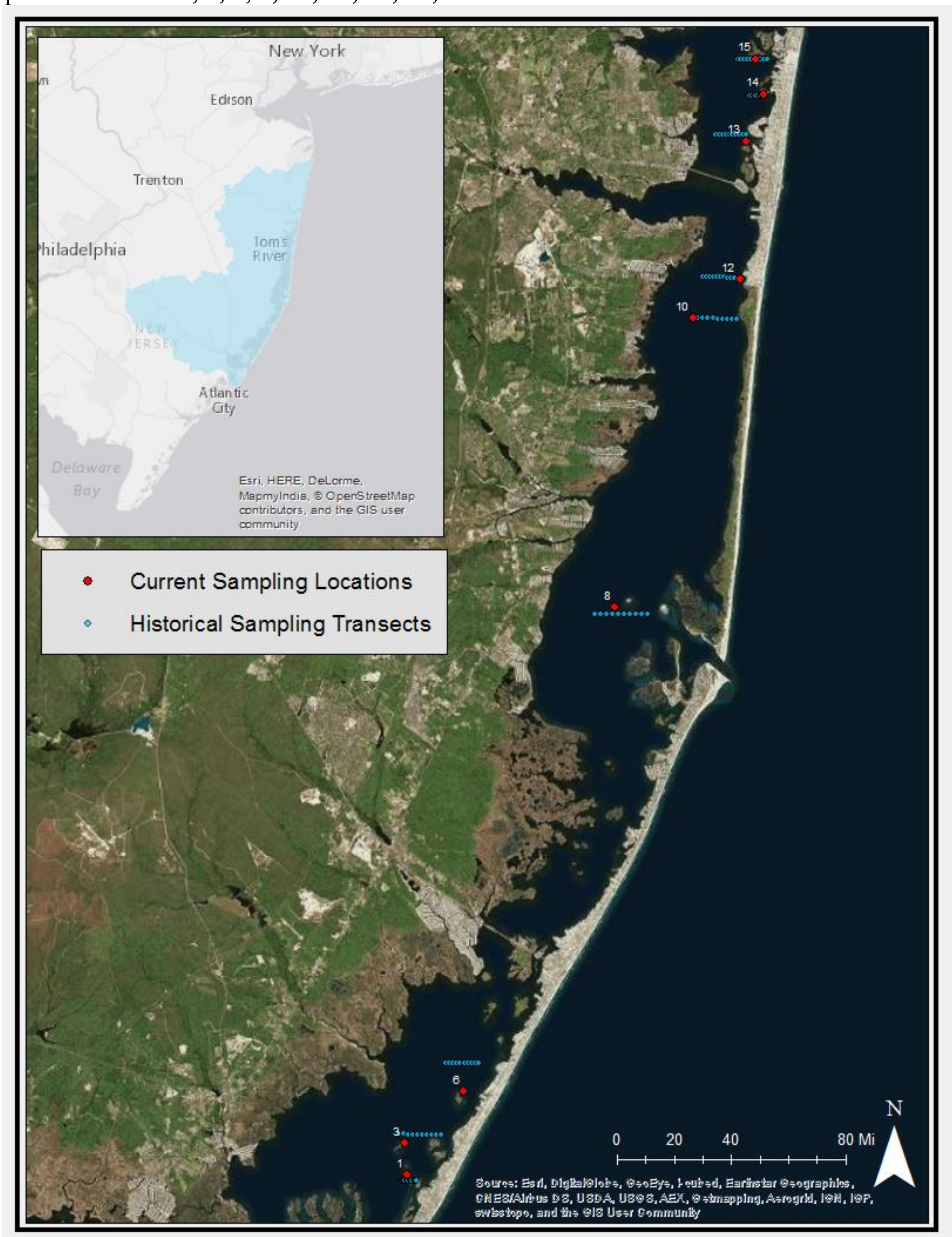

Table 1: Coordinates (Decimal degrees) of seagrass sampling stations. Site number refers to location in relationship to previously established research transects (#1-15). See Figure 1 for representation of all transects and current sampling sites.

Latitude	**Longitude**	**Site #**
39.57246	74.25129	1
39.58443	74.25255	3
39.6039	74.22392	6
39.78495	74.14985	8
39.89312	74.11174	10
39.90771	74.08906	12
39.95913	74.08618	13
39.9767	74.0773	14
39.98976	74.08128	15

APPENDICES

Appendix 1. Standard Operating Procedures for entire project

Appendix 1.1 Field Sampling

Before Leaving the Dock:

Make sure that the following items are prepared and are on the boat or are ready in the laboratory once the sampling is complete. Check off each item as it is addressed.

General

a. Field sheets
b. Pencils
c. Sharpies
d. Plastic clipboard
e. Dive gear (mask, snorkel, wet suit, dive belt)
f. State boaters safety card
g. In water dive flag
h. Boat key
i. Anchor
j. Diver Ladder

Biotic

a. biomass corers and orange stakes for visibility
b. m^2 quadrat
c. field sieve
d. ruler
e. 10 gallon-sized pre-labeled Ziploc bags for *Z marina* and *R maritima* per site

In Lab

a. Labeled and weighed aluminum envelopes for each site, each replicate, each species and above and belowground biomass (max of 40 envelopes per sampling site)
b. Lab datasheet with initial weights of cataloged envelopes
c. Analytical balance has been subjected to class I weight test
d. Gravity circulating oven

Locating the Station:

1) Use handheld GPS to motor towards the site. Allow time for GPS to "hone in" closer to site.
2) Anchor nearby (as close as possible without interfering with diver in water), considering wind and current.
3) Record site location, time (EST), and general weather conditions on field sheet.

Once at the Station: (for specific information about each protocol please see Appendix 2.2)

1) Divers enters water and place dive flag.

2) Divers obtains seagrass cores from 10 haphazardly selected locations within 50m of the original GPS point. Cores are taken by reaching hand into core, gently guiding seagrass blades into the PVC, then tamping down the beveled edge a few inches into the sediment and pulling back out. Divers can scoop underneath the PVC to ensure a better removal of the core.
3) Accepted cores are placed on box sieve and gently sieved, removing excess sediment.
4) Sieved cores are brought to Project Manager or BBP Quality Assurance Officer for visual inspection and acceptance. Cores cannot have any cut shoots.
5) Accepted cores are placed the in the appropriate bag and then into the cooler on board.
6) Two divers obtain percent cover metrics by reaching agreement at ten separate locations within 50m of the original GPS location. % cover is recorded in increments of 5% and is obtained separately for each seagrass species, macroalgae,and "other".
7) If *Zostera* is present in the quadrat, one diver uses the ruler to record one blade height of *Zostera* (in mm), ignoring the tallest 20% of blades.
8) Project Manager ensures all samples have been collected, labeled, and datasheet is filled out before leaving.

Upon return:

Field Sheets

1) Sheets are transcribed into an excel sheet in the Z drive. Hard copies are stored in the Program Scientist Office.
2) 10 % of data are checked by the BBP Quality Assurance Officer, if errors are present 100% of the data is checked.

Biomass:

1) Biomass samples are cross-checked with field sheets to assure all samples are accounted for.
2) Biomass samples from the day are placed in the refrigerator (max 72 hours).
3) All biomass samples should be kept in the refrigerator and processed within 72 hrs. If unable to process within 72 hrs, samples should be frozen.

Other:

1) The field sheets should be transcribed into a digital spreadsheet as soon as possible.

Seagrass Biomass Processing *(Duarte and Kirkman, 2001):*

1. This process should be supervised by the Project Manager to ensure samples are tracked correctly.
2. Pre-weighed aluminum envelopes should be labelled with a system (001, 002, 003), which is linked to the datasheet, where each envelope corresponds to a site number; date; replicate number; species (Z = *Zostera* and R = *Ruppia);* Above Ground/Below Ground (AG/BG); and Tare # (*e.g.* BB10 5/20/25, 1, Z, AG, 001) are listed.
3. Labelled aluminum envelopes should be pre-weighed, and this weight listed in the lab datasheet. Ensure scale has undergone class I weight test and passed before use. Also ensure scale is showing zero before weighing and is located on marble slab and is level.
4. Remove seagrass from bag and separate by species. Place different species from a single core into different plastic trays. Make sure that the entire sample has been removed from the bag.
5. Count the number of shoots (separately for each species) and record this number on the lab datasheet.
6. Remove large epiphytes with fingers rinse with DI water to remove.
7. Separate leaves from the rhizome directly below the leaf sheath with razor blade into aboveground and belowground biomass. Above ground and below ground biomass are then placed into cataloged and pre-weighed aluminum envelopes.
8. Place all samples in a gravity circulating oven at 50°C for a minimum of 72 hours.
9. After at least 72 hours, weigh each sample 3 times using the same scale. Record all weights on the appropriate data sheet.
10. Biomass is measured as g Dry Weight (g DW). To determine the final sample dry weight, average the three sample weights taken after at least 72 hours and subtract the weight of the aluminum foil envelope from this average.
11. Biomass is converted from g Dry Weight (DW) cm^{-2} to g DW m^{-2} by using the following equation: $\frac{x\ g\ DW}{380\ cm^2} \times \frac{10{,}000\ cm,^2}{1\ m^s} = x\ g\ DW\ m^{-2}$

Appendix 2 Field data sheet

Crew			Replicate 1		Replicate 2	
Date			%Zostera		%Zostera	
Time			%Ruppia		%Ruppia	
Site			%Macroalgae		%Macroalgae	
Field Condition Notes:			%Other		%Other	
			Blade Height (mm)		Blade Height (mm)	
			Epiphytic Coverage		Epiphytic Coverage	

Replicate 3		Replicate 4		Replicate 5		Replicate 6	
%Zostera		%Zostera		%Zostera		%Zostera	
%Ruppia		%Ruppia		%Ruppia		%Ruppia	
%Macroalgae		%Macroalgae		%Macroalgae		%Macroalgae	
%Other		%Other		%Other		%Other	
Blade Height (mm)		Blade Height (mm)		Blade Height (mm)		Blade Height (mm)	
Epiphytic Coverage		Epiphytic Coverage		Epiphytic Coverage		Epiphytic Coverage	

Appendix 3 Lab Datasheet with tare weights of the aluminum foil envelopes. Seagrass biomass data sheet with the three dry weights taken after at least 72 hours in the oven, and the final dry weight calculated as the average of the three dry weights minus the initial envelope weight.

Tare #	Wt 1	Wt 2	Wt Avg
001	5.6667	5.6667	5.6667
002	4.5960	4.5968	4.5964
003	6.0271	6.0269	6.0270
004	3.8992	3.9003	3.8998
005	3.7806	3.7796	3.7801
006	4.1762	4.1759	4.1761
007	4.5224	4.5232	4.5228
008	4.9552	4.9549	4.9551
009	5.0879	5.0883	5.0881
010	4.9287	4.9286	4.9287
011	4.7652	4.7670	4.7661
012	4.6983	4.6991	4.6987
013	4.1983	4.1983	4.1983
014	4.2219	4.2215	4.2217
015	4.4536	4.4539	4.4538
016	3.8403	3.8409	3.8406
017	4.2712	4.2716	4.2714
018	4.1598	4.1614	4.1606
019	4.6262	4.6273	4.6268

Seagrass Biomass Data Sheet

Site #	Date	Rep	Spp/VF	AG/BG	Tare #	Foil wt	DW g 1	DW g 2	DW g 3	Average DW	Total Weight	# of Shoots
BB10	5/20/2025	1	Z	AG	001	5.667	5.7441	5.7454	5.747	5.7455	0.0788	3
BB10	5/20/2025	1	Z	BG	002	4.596	4.6237	4.6249	4.6256	4.624733333	0.028333333	
BB10	5/20/2025	2	Z	AG	003	6.027	6.0364	6.0373	6.0375	6.037066667	0.010066667	1
BB10	5/20/2025	2	Z	BG	004	3.9	3.9021	3.903	3.9031	3.902733333	0.002983333	
BB12	5/20/2025	1	R	AG	005	3.78	3.7963	3.797	3.7973	3.796866667	0.016766667	7
BB12	5/20/2025	1	R	BG	006	4.176	4.1837	4.1854	4.1851	4.184733333	0.008683333	
BB12	5/20/2025	1	Z	AG	007	4.523	4.7962	4.7974	4.7984	4.797333333	0.274533333	7
BB12	5/20/2025	1	Z	BG	008	4.955	5.6041	5.6037	5.6046	5.604133333	0.649083333	
BB12	5/20/2025	2	Z	AG	009	5.088	5.1346	5.1352	5.1354	5.135066667	0.046966667	2
BB12	5/20/2025	2	Z	BG	010	4.929	5.0339	5.0345	5.0351	5.0345	0.10585	
BB12	5/20/2025	3	Z	AG	011	4.766	4.964	4.9658	4.9665	4.965433333	0.199333333	8
BB12	5/20/2025	3	Z	BG	012	4.699	4.754	4.7553	4.7555	4.754933333	0.056233333	
BB12	5/20/2025	4	Z	AG	013	4.198	4.4208	4.4211	4.4216	4.421166667	0.222866667	6
BB12	5/20/2025	4	Z	BG	014	4.222	4.6441	4.644	4.6445	4.6442	0.4225	
BB12	5/20/2025	5	R	AG	015	4.454	4.4725	4.4726	4.4719	4.472333333	0.018583333	4
BB12	5/20/2025	5	R	BG	016	3.841	3.8513	3.8514	3.8519	3.851533333	0.010933333	
BB12	5/20/2025	5	Z	AG	017	4.271	4.2887	4.2883	4.2885	4.2885	0.0171	2
BB12	5/20/2025	5	Z	BG	018	4.161	4.332	4.3318	4.332	4.331933333	0.171333333	

Key	
Rep	Replicate
Spp/VF	Species
AG/BG	Above ground/Below ground
DW	Dry weight