10-7-2016

Great Bay Estuary Macroalgae Monitoring Program for 2016 Quality Assurance Project Plan

Kalle Matso
University of New Hampshire

Great Bay Estuary Macroalgae Monitoring Program for 2016 Quality Assurance Project Plan

A1. Title and Approval Sheet

Great Bay Estuary Macroalgae Monitoring Program for 2016
Quality Assurance Project Plan

October 7, 2016

FINAL

Prepared by:
Kalle Matso
Piscataqua Region Estuaries Partnership
kalle.matso@unh.edu

Name	Project Role	Organization	Signature & Date
David Burdick	Project Manager	University of New Hampshire	10-10-16
Kalle Matso	Project QA Manager	Piscataqua Region Estuaries Partnership	10-10-2016
Jean Brochi	USEPA Project Manager	EPA	1-30-2017
Nora Conlon	USEPA QA Manager	EPA	2/8/2017

A2 – Table of Contents

APPENDICES

LIST OF TABLES

LIST OF FIGURES

A3 – Distribution List

Table 1 presents a list of people who will receive the approved QAPP, the QAPP revisions, and any amendments.

Table 1. QAPP distribution list.

Name	Project Role	Organization	Email Address
David Burdick	Project Manager	University of New Hampshire	david.burdick@unh.edu
Kalle Matso	Project QA Manager	Piscataqua Region Estuaries Partnership	kalle.matso@unh.edu
Jean Brochi	USEPA Project Manager	EPA	brochi.jean@epa.gov
	USEPA QA Manager	?	?

Based on EPA-NE Worksheet #3

A4 – Project/Task Organization

The project will be completed by the Piscataqua Region Estuaries Partnership (PREP) and the University of New Hampshire Jackson Estuarine Laboratory (JEL).

Funding for the project will be provided by PREP through the "Monitoring Collaborative."

The Project Manager will be David Burdick of UNH. The Project Manager will be responsible for coordinating all program activities. The Project Manager will manage all field staff, be responsible for "stop/go" decisions in the field, coordinate data analysis and will be responsible for all final products. The Project Manager will be responsible for establishing transects at each of the sampling sites, field data collection, and collecting and processing biomass samples.

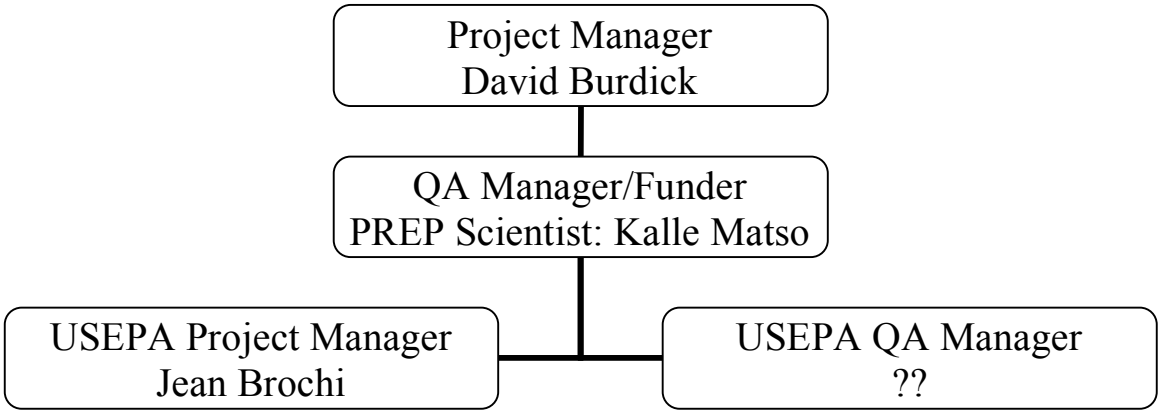
The Project QA Manager will be Kalle Matso. The QA Manager will be responsible for working with the Project Manager to address any deviations from the procedures in the QA Project Plan, the results of the quality control (QC) tests, and whether the reported data meet the data quality objectives of the project.

The principal user of the data from this project will be PREP, who will circulate results to its many partners. The Project Manager will send a report to PREP at the end of the project with the final data and the QA Manager's reports.

The QA Project Plan will be written for the 2016 macroalgae monitoring season, but will be valid for four years (2016-2019) with yearly updates through sampling and analysis plan amendments. This plan must be at least provisionally approved by all funders before field work on this project begins.

Figure 1 shows an organizational chart for this project.

Figure 1 Project organizational chart.



A5 – Problem Definition/Background

Macroalgal blooms can be a sign of estuarine ecosystem impairment because they can occur in response to elevated nitrogen inputs. In addition, macroalgae can entangle and ultimately outcompete eelgrass in shallow subtidal environments. Therefore, PREP aims to track the abundance of macroalgae in the Great Bay Estuary as an indicator of estuarine health.

The objective of this project is to determine trends in macroalgae abundance by means of repeated sampling over time using standardized methods. Eight sites will be monitored altogether. Five sites will be monitored each year such that each site is monitored once every two years with one site monitored every year.

Trends of macroalgae abundance published in PREP State of Our Estuaries reports (PREP, 2013) are of interest to the United States Environmental Protection Agency (USEPA), the New Hampshire Department of Environmental Services (NHDES), and the Great Bay Municipal Coalition (GBMC) due to ongoing permitting decisions for wastewater treatment facilities discharging to the estuary. The historical macroalgae data available at this time are based on a repeated transect sampling approach. Therefore, PREP and UNH JEL intend to continue to use a repeated transect sampling scheme while incorporating new sites into the long-term macroalgae monitoring program.

The data generated through the Great Bay Estuary long-term macroalgae monitoring program will be used by PREP and its partners to evaluate trends in macroalgae abundance over time and make other resource decisions.

A6 – Project/Task Description

The main tasks for the project are:

1. Hire Field Assessment Team

A team of two individuals will be hired to perform fieldwork for the 2016 macroalgae monitoring season. The team will be responsible for re-establishing transects at the selected monitoring sites (see Appendix D for more details on sites) by the end of July and collecting data during spring tides between July and September of 2016. Sampling will take place either in early Summer (approximately June20 to July 14) or Mid-Summer (approximately July 30-August 20th). The field assessment team will perform any laboratory tasks that the monitoring protocol requires and will perform data entry tasks so as to provide the QA Manager with an electronic version of the data collected.

2. Prepare QA Project Plan

A QA Project Plan for macroalgae monitoring will be produced by the Project Manager and QA Manager, with help from the USEPA Project Manager. This plan will be developed before field work on this project begins. The QA Project Plan will be written for the 2016 monitoring season but will be valid for four years (2016-2019) with yearly updates through sampling and analysis plan amendments.

3. Establish Monitoring Transects

The Project Manager will direct the field assessment team in laying out 3 random transects at each site. Transects will be delineated in July during spring tide. The field assessment team will store the

spatial locations of transect points in a GPS (accuracy = ~ two meters) and transfer them to an ArcGIS file, to be included in the final report.

4. Conduct Monitoring for 2016

The field assessment team will be responsible for monitoring the abundance of macroalgae during spring tides between July and October at the five sites selected for the 2016 monitoring rotation. The field assessment team will provide the Project Manager with an electronic version of the data collected by November 1, 2016.

5. Prepare Quality Assurance Reports

The Project QA Manager will prepare a QA Report evaluating whether or not the data quality objectives for the project have been met (see Section A7 and B5) by November 15, 2016.

6. Issue Final Reports, Data Management, and Archiving

After completing the quality control tests and verification/validation process (see Sections D1-D3), the the Project Manager will prepare a final data report that will be available to the public through the PREP website. See Section C2 for lists of information that will be included in the final reports. All data associated with the project will be archived electronically by PREP.

A7 – Quality Objectives and Criteria

Data quality objectives for the macroalgae monitoring program are summarized in Table 2.

Table 2. Data quality objectives, criteria, and quality control protocols for the macroalgae monitoring program.

Data Quality Objective	Criteria	Protocol
Precision	Biomass measurements should be maintained to 1/100 of a gram.	Field assessment team will measure biomass with a balance that has been calibrated according to UNH standards.
Bias	Percent cover estimates should be comparable across members of the field assessment team within ±10%	Field assessment team members will "calibrate" their visual interpretations of percent cover in the field during transect establishment. The field assessment team will also review photographs and associated percent cover estimates from previous years before the field season begins.
Spatial accuracy	GPS units should have a reported accuracy less than or equal to 2 meters.	Check reported accuracy of field GPS units.
Comparability	Field and laboratory data should be collected using standardized methods.	Check that protocols from the QAPP were used for field observations. The QA Manager should use filtering functions to check the field assessment team's spreadsheets for data entry errors. All percent cover values should fall into one of the categories specified in the sampling methods. All biomass values should be between 0 and 500 grams. A minimum of 10% of field observations should be checked against electronic spreadsheets.
Completeness	Field observations should be made for macroalgae cover at all pre-determined elevations at each site (from 0.0 to 2.5, with .5 intervals).	Check field observations for completeness by elevation. Document reasons for any deviations from sampling protocol.

Representativeness	Monitoring sites, dates, and transects should include suitable, accessible macroalgae habitat that is spatially dispersed around Great Bay and should include the annual period of peak new macroalgal growth.	Compare macroalgae monitoring sites and dates with monitoring plans and results for other ecosystem health indicators in Great Bay Estuary at least after every 2 monitoring rotations (i.e. every 4 years).
Sensitivity	The percent cover categories should be equally sensitive to changes in cover for both high and low cover values.	Examine statistically significant changes in cover. If fewer statistically significant changes are found in one portion of the cover spectrum, evaluate options for subdividing the category/categories to better capture variation in macroalgal cover in that range.

A8 – Special Training/Certification

UNH JEL will train the field assessment team in the implementation of the long-term macroalgae monitoring protocol during transect establishment. The training will be based on the QA Project Plan document.

A9 – Documents and Records

QA Project Plan

The QA Manager will be responsible for maintaining the approved QA Project Plan and for distributing the latest version to all parties on the distribution list in section A3. A copy of the approved plan will be made available on the PREP website (prepestuaries.org) at least until the project is complete.

Reports to Management and the Public

The Project Manager will provide final data reports to PREP, and PREP will share with its partners. See Section C2 for details about these reports. The final reports will be available on the PREP website for at least one year.

Archiving

The QA Project Plan and final reports will be kept on file with PREP (in electronic formats) for a minimum of 10 years.

B1 – Sampling Process Design

The sampling process for this project will follow a repeated sampling design. A total of nine sites will be sampled in a full 2-year monitoring rotation, with five sites sampled each year. One of the sites will be sampled every year. The following sites, which were monitored in 2008-2010 and 2013, will be included in the 2-year monitoring rotation: 1) Depot Road, 2) Lubberland Creek, 3) Cedar Point, and 4) Wagon Hill Farm. Additional sites include: Sunset Hill Farm, Adams Point, Dover Point and Four Tree Island.

Three transects will be established at each site in May or June of the site's first year in rotation. All transects will have sampling points at 0.5, 1.0, and 1.5 meters above MLLW, and sampling points at MLLW where practicable. The spacing between transects at a site will be determined using a random numbers table that includes values between 5 and 50 meters. Each transect will be assigned a letter, A, B, or C. The letter "A" will be assigned to the transect that is on the left side of the center transect when facing toward shore from Great Bay.

Monitoring at a site will consist of 3 site visits during spring tide between July and September.

See Appendix D for more details on Sampling Sites.

B2 – Sampling Methods

For each site visit, the field assessment team will measure percent cover and biomass of macroalgae at each point on the three transects using the following methods, which are consistent with previous studies. Note that the macroalgae is not distributed uniformly on the flats. Also, there have been no studies characterizing the distribution of nuisance macroalgae in estuaries. Our sample scheme of three transects that are randomly selected at 10 to 50 meters apart and sampled every 0.5 m in elevation was chosen to address this variability; however, the approach may need to be modified in the future.

Percent cover

Lay out a 0.5 meter x 0.5 meter PVC quadrat and visually estimate the percent of the ground covered by each species of macroalgae. Classify each cover value as either <1%, 5%, 10% or any multiple of 10% thereafter. Estimate one cover value for all "blade-forming" species of *Ulva*, one cover value for all "tube-forming" species of Ulva, and one cover value for all species of *Gracilaria*. Photograph the quadrat. Collecting tissue for DNA analysis may be incorporated into the protocol if time and resources permit.

Biomass

Before going into the field, write out sample labels containing the following information on Rite in the Rain paper: site name, transect letter, elevation, date. Place each label in a 1-gallon plastic bag.

At each sampling point, lay out a 0.25 meter x 0.25 meter PVC quadrat 2 meters (8 paces) west of percent cover plot. Record percent cover by species using cover classes described for percent cover assessment of 0.25 m^2 plots before collecting material from within the quadrat. Material with holdfasts outside of the plot will be cut and collected. While hand-collecting will be sufficient for most samples, the field assessment team will carry a set of shears and/or a knife that can be used to cut aboveground biomass within the plot boundaries if needed. When resampling in August and September, collect second sample immediately west of the first, and collect the third sample immediately south of the second. A set of tongs of the same dimensions may be used to collect biomass from subtidal sites.

Transport samples to JEL in a cooler as soon as sampling has been completed for the day. Follow Biomass Analysis SOP as articulated in Appendix E.

B3 – Sample Handling and Custody

Biomass and any voucher specimens collected will be held in the custody of UNH JEL. Biomass samples will be held at UNH JEL at least until the Project Manager has received and reviewed the electronic data for the current year. After this time, samples that are brought to UNH JEL by the field assessment team may be given to the marine/estuarine collections of the UNH Hodgdon Herbarium or the herbarium of another institution at the discretion of UNH JEL.

B4 – Analytical Methods

At the end of each sampling season, the field assessment team will integrate the percent cover and biomass data collected in the current year into the existing regressions expressing the relationship between cover and biomass for each species. The Project QA Officer will screen the regression plots for outliers. He/she will remove outlying data points from the regression plots and annotate these data points where they appear in the electronic data tables.

B5 – Quality Control

The Project QA Officer will check that the data quality objectives were met using the criteria and methods from 2 in Section A7.

B6 – Instrument/Equipment Testing, Inspection, Maintenance

The field assessment team will be responsible for checking the batteries in the GPS and digital camera before traveling to sampling sites each day that this equipment is in use. The GPS, camera, and a spare set of batteries will be taken into the field in a resealable plastic sampling bag or other watertight container. The field assessment team will also transfer photographs from the camera to a computer at the end of each sampling day to ensure that the camera has sufficient memory available to store new pictures on the next sampling day.

B7 – Instrument/Equipment Calibration and Frequency

Not applicable.

B8 – Inspection/Acceptance Requirements for Supplies and Consumables

The field assessment team will replace GPS/camera batteries when they reach their expiration dates.

B9 – Non-direct Measurements

Information on tides will be used to determine the dates and times at which site establishment and sampling will occur. NOAA Tide Predictions at Fort Point, Dover Point, and the Squamscott River span the study area:

- Fort Point (Portsmouth Harbor)
  http://tidesandcurrents.noaa.gov/noaatidepredictions/NOAATidesFacade.jsp?Stationid=8423898
- Dover Point
  http://tidesandcurrents.noaa.gov/noaatidepredictions/NOAATidesFacade.jsp?Stationid=8421897
- Squamscott River
  http://tidesandcurrents.noaa.gov/noaatidepredictions/NOAATidesFacade.jsp?Stationid=8422687

B10 – Data Management

Field and laboratory data will be entered into standardized electronic spreadsheets by the field assessment team. The field assessment team will assign filenames to photographs using the sample labeling scheme: site name, transect letter, elevation, and date. The field assessment team will provide the Project QA Manager with copies of all electronic files via an electronic data transfer system, such as Dropbox, or on a flash drive within 10 business days of the completion of laboratory work for the current field season. The Project QA Manager will deliver the electronic files and QA Report to the Project Manager via an electronic data transfer system or on a flash drive within 10 business days of the date upon which she/he received the files from the field assessment team. Files will be stored in a dedicated project directory on the PREP computers.

C1 – Assessments and Response Actions

The field assessment team will report any difficulties it has adhering to the QA Project Plan to PREP and the Project Manager. At a minimum, the Project Manager will complete the following checks with the field assessment team while the project is proceeding.

- Confirm site successful transect establishment (by 8/1/16).
- Conference with field assessment team and PREP between July and August monitoring.
- Review and approve any other reports provided by contractors

The Project Manager will initiate appropriate response actions after each check, if needed. The Project Manager will consult with PREP to make decisions such as replacing sites that were originally selected for the current monitoring rotation, moving transects or sampling points, changing scheduled monitoring dates, and making adjustments to the sampling methods.

C2 – Reports to Management

The electronic files containing percent cover data, biomass data, and photographs will be transmitted with the QA Report to the Project Manager by the QA Officer. The Project Manager will prepare a summary report to provide to the project funders and will incorporate the data collected through this project into the PREP State of Our Estuaries reports.

D1 – Data Review, Verification and Validation

After field work is complete for the season, the field assessment team will have 10 business days to deliver electronic files containing the percent cover and biomass data and photographs it has collected to the Project QA Manager. The Project QA Manager will independently assess that the data quality objectives from Section A7 have been met using the criteria and methods from Sections A7 and B5. He/she will reach out to the field assessment team with questions that arise or to address problems that have been found. Upon performing quality control tests, the Project QA Officer will prepare a QA Report documenting his/her findings and provide the report to the Project Manager along with the final electronic data files within 10 business days of his/her receipt of the data files from the field assessment team.

D2 – Verification and Validation Procedures

The Project Manager will review the QA Report from the Project QA Officer to see if there have been deviations from the QA Project Plan and if the data quality objectives have been met. Any decisions made regarding the usability of the data will be left to the Project Manager; however, the Project Manager may consult with project personnel and funders, if necessary.

D3 – Reconciliation with User Requirements

The Project Manager will be responsible for reconciling the data collected with the requirements of the study (the ultimate use of the data). Results that are qualified by the Project Manager may still be used if the limitations of the data are clearly reported to decision-makers. The decision-making process will be:

1. The Project Manager will review data with respect to sampling design.
2. The Project Manager will review the QA Report from the Project QA Manager.
3. If the data quality objectives from Section A7 are met, the user requirements have been met and the macroalgae abundance data can be used without qualification.
4. If the data quality objectives from Section A7 have not been met, the Project Manager will consult with PREP and EPA personnel and make a recommendation about whether the macroalgae abundance data are still usable for their intended purpose or whether the data need to be qualified or rejected. The Project Manager may also initiate appropriate corrective actions to improve the quality of the data, if possible. Corrective actions may include providing comments on the data tables produced by the field assessment team and asking for revisions.
5. The Project Manager will document this decision-making process in a memorandum that will be appended to the QA Report.