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Monitoring Macroalgae in the Great Bay Estuary for 2016

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A Final Report to

The Piscataqua Region Estuaries Partnership

submitted by

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Executive Summary

In 2016, five of the eight locations with fixed intertidal transects were sampled as part of a long-term effort to monitor changes in the abundance of macroalgae in the Great Bay Estuary. Since 2013, the abundance and taxa of intertidal macroalgae have been assessed at fixed locations to serve as an indicator of ecological changes in the Estuary. Changes in the algae may reflect changes associated with excess nutrient loading, termed eutrophication, and may be especially informative of algal impacts to eelgrass meadows in the Estuary.

Macroalgae collections over the past four years have resulted in the accumulation of two years of data for six locations, three years of data for a seventh location and four years of data for an eighth location. Based upon this short-term data set we found significant cover and biomass of nuisance algae, some of these are recognized as introduced, invasive species. Monitoring results from 2016 show high levels of cover of nuisance algae, either green or red (*Ulva* and *Gracilaria*, respectively) at all sites sampled, but especially at the lowest elevations, nearest to the subtidal habitats. Visual examination of our intertidal transect data along with anecdotal observations suggest that algal populations are changing, but long-term collections will be needed to determine whether significant differences in intertidal macroalgal populations are occurring over time.

Monitoring Macroalgae in the Great Bay Estuary for 2016

Introduction

Tracking changes in macroalgae, or seaweed populations in the Great Bay Estuary is important for our understanding of how changes in environmental conditions affect the structure, function and biodiversity of the Estuary. Monitoring of eelgrass, one of the critical habitats in the Estuary, has shown significant declines over the past fifteen years (Beem and Short 2009, Short 2014). The loss in eelgrass has concerned resource managers and the public (Trowbridge 2006). Human population growth and climate change can influence nutrient loading and cycling, sediment input, and resuspension, and suitability of various estuarine habitats for supporting the growth of eelgrass as well as macroalgae, which has been shown to compete with eelgrass and reduce its success (Short et al. 1995). Fluctuations in environmental conditions can favor different species at different times, creating opportunities for non-native invasive species to establish populations in the Estuary. Mats of macroalgae can also smother other benthic species and intercept the sunlight needed by eelgrass to maintain growth, altering the habitat structure and food web of the Bay.

Standardized, repeatable sampling of macroalgae has occurred in the Estuary from time to time. Macroalgae typically grows in intertidal and shallow subtidal areas. Typically, intertidal areas are accessed by land whereas areas of subtidal macroalgae are assessed by vessel and observers use either snorkel or SCUBA. Our program uses an array of fixed sample points at locations that provide good intertidal exposure and are accessible by vehicle and on foot. These long-term sample sites are sampled using a 0.25m^2 quadrat at set tidal elevations (0.0 m, 0.5 m, etc. above Mean Low Water). The best historical data that have been archived were collected from intertidal sampling grids at fixed locations as part of graduate student projects conducted under the direction of Arthur Mathieson: in 1978 (Hardwick-Whitman and Mathieson, 1983) and 2008-2010 (Nettleton et al. 2011). Most recently, Cianciola and Burdick (2014) reoccupied several historically assessed sites and used previous project results to develop a modified protocol for macroalgal monitoring that was used in 2013 and 2014 (Burdick et al. 2016).

Project Goals and Objectives

The long-term fixed station sampling array was begun in 2013 and completed in 2014. The strategy for maintaining eight sites in a variety of estuarine areas and shoreline exposures was that sampling of the entire fixed array would be completed every other year, with three sites sampled in alternate years and two others sampled every year. Sampling in 2016 was performed at five sites for cover and biomass in July, August and October to complete a second full round of sampling.

Methods

Each location with fixed array sampling transects was set up with three transects (random distance apart but no closer than 10 m) along a 100 m length of shoreline. Sampling points were established at MLW and every 0.5 m above until the shoreline was reached where no benthic plants occurred. Elevations were found relative to the low tide line or high tide line (where low tide could not be reached, i.e., Lubberland Creek and Sunset Hill Farm). Sample sites were marked with pvc pipe and GPS. Biennial sites monitored this year included: Four Tree Island in Portsmouth, Hilton Park in Dover, and Sunset Hill Farm in Newington (Table 1). The two annually monitored sites were Adams Point in Durham and Depot Road in Stratham. All sites are shown in Figure 1 and specific sample transects/plots are shown in Figure 2.

Table 1. Macroalgae intertidal collection sites for fixed array sampling.

Site Name	Town	Location (lat/long DD)	Elevations (m above MLW)	Sample Schedule	Years Sampled
Four Tree Island	Portsmouth	43.07536N 070.74701W	0.0, 0.5, 1.0, 1.5, 2.0, 2.5	Even	2014, 2016
Hilton Park	Dover	43.12292N 070.82786W	0.0, 0.5, 1.0, 1.5, 2.0	Even	2014, 2016
Cedar Point	Durham	43.12934N 070.85283W	0.0, 0.5, 1.0, 1.5	Odd	2013, 2015
Wagon Hill Farm	Durham	43.12457N 070.87260W	0.0, 0.5, 1.0, 1.5	Odd	2013, 2015
Adams Point	Durham	43.09019N 070.86735W	0.0, 0.5, 1.0, 1.5	All	2014-16
Lubberland Creek	Newmarket	43.07427N 070.90339W	0.5, 1.0, 1.5	Odd	2013, 2015
Depot Road	Greenland	43.05611N 070.89682W	0.5, 1.0, 1.5	All	2013-16
Sunset Hill Farm	Newington	43.05751N 070.83443W	0.75, 1.0, 1.5	Even	2014, 2016

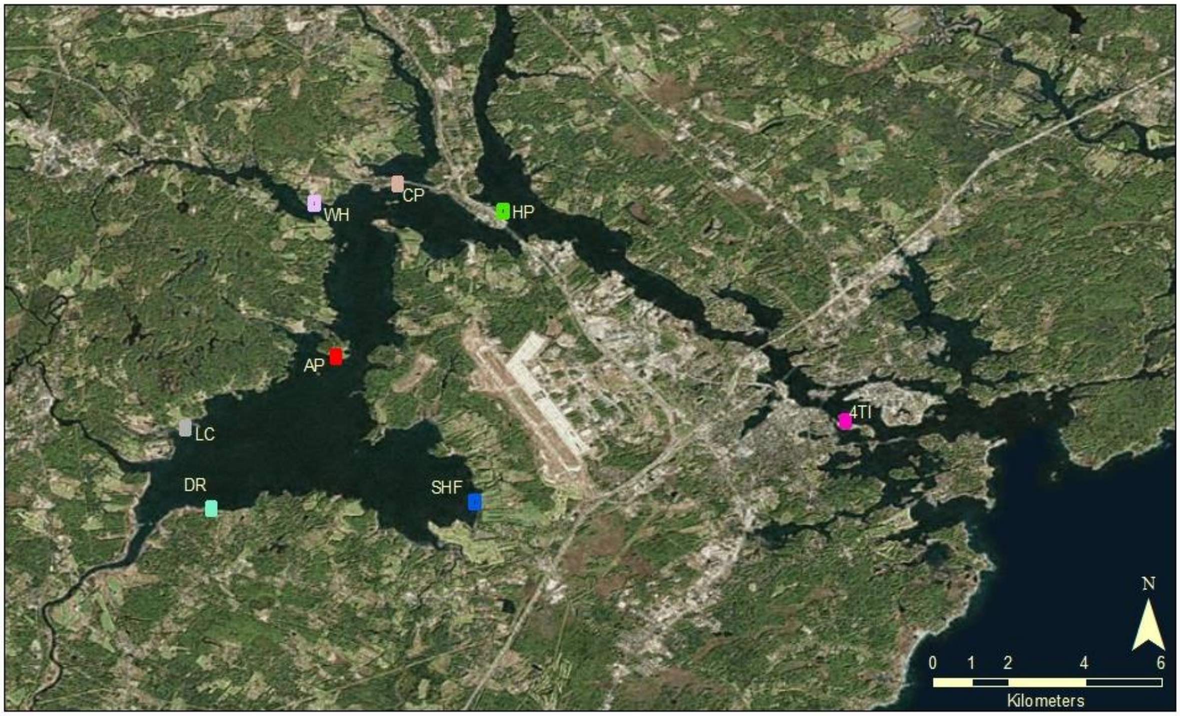


Figure 1. Eight macroalgae intertidal collection sites for fixed array sampling of the Great Bay Estuary.

Cover data for macroalgae and vascular plants were collected at the five previously established monitoring sites on three occasions: in July, August, and October. Transects and plot locations were found using a handheld Garmin Geographic Positioning System (GPS) and pvc markers. Visual estimates of percent cover were made by species or genus in a 0.25 m^2 quadrat centered landward of each sampling point on each transect. A photograph was taken and archived for each plot sampled. For the sampling effort in August, macroalgal biomass samples were collected by placing a 0.0625 m^2 quadrat two meters to the right of each cover sampling point on each transect, as determined when facing the shore. Percentage cover was estimated in the quadrat and a photograph was taken before collecting all live material in the quadrat and placing it in labeled plastic bags. In the lab, biomass samples were cleaned of sediment and detritus and sorted by species/genus. Algal material was placed in marked foil envelopes and dried at 60°C in a drying oven for five days before weighing to 0.01g.

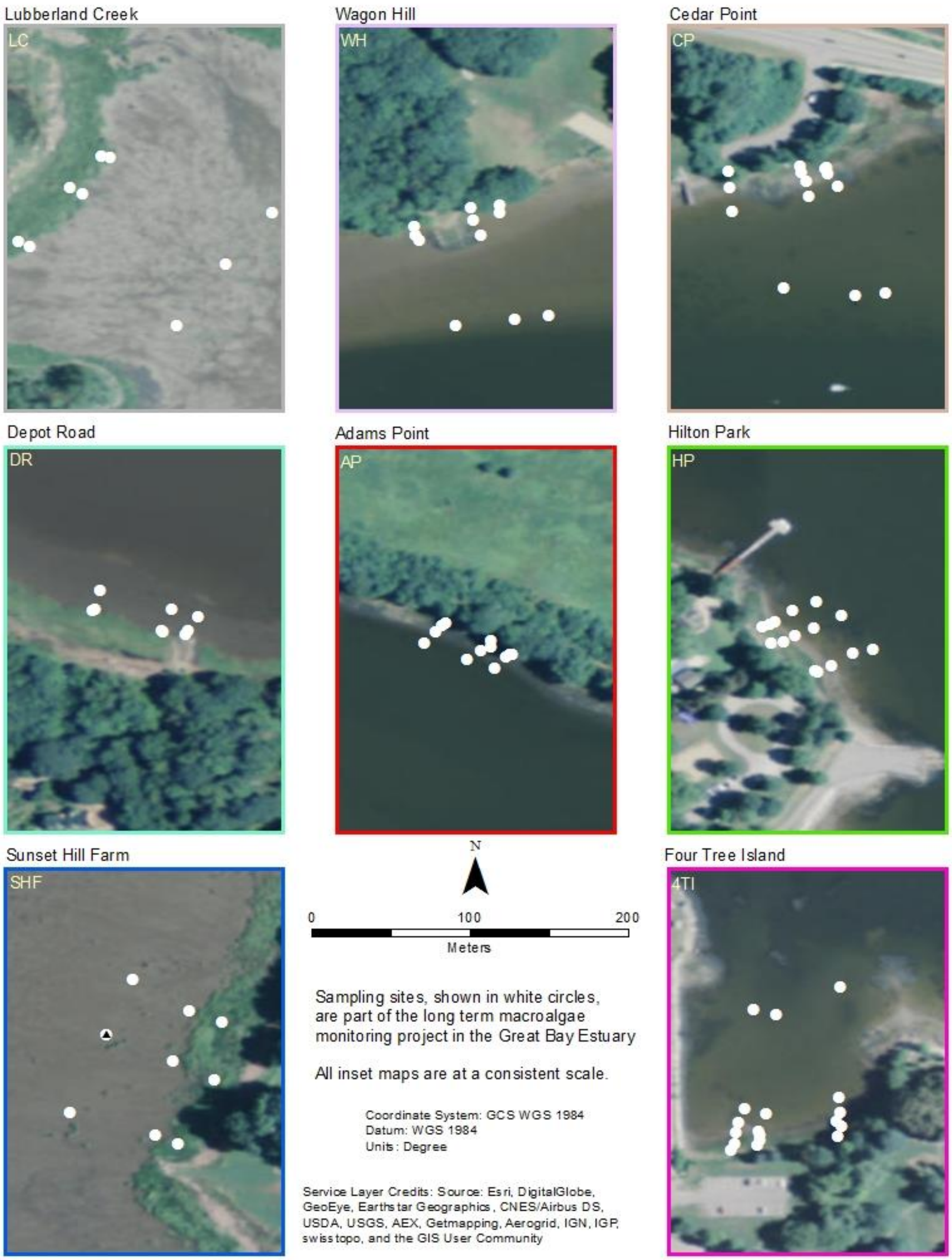


Figure 2. The eight sampling sites for intertidal macroalgae in the Great Bay Estuary. Locations were plotted with positions determined by GPS.

Species identifications were authenticated by Dr. Arthur Mathieson and nomenclature generally followed Villalard-Bohnsack (2003), with updates from Mathieson and Dawes (2017). Thus, some taxonomic changes were included; for example, the green alga *Enteromorpha intestinalis* was transferred to *Ulva intestinalis*, while the invasive red alga "*Heterosiphonia" japonica* was re-designated as *Dasysiphonia japonica.*

The research team compiled the field percent cover estimates from all three sampling periods and the laboratory biomass data from the August sampling period in an electronic spreadsheet. Microsoft Excel was used as a spreadsheet and JMP software was used for statistical analysis. Data were reduced to means for elevations within sites and over all sites for taxa and by major taxonomic groups of plants (benthic algae and vascular marsh species). Biomass sample percentage covers were regressed against plant weights after all zero cover/weight samples were removed. Predictive equations of biomass from percentage cover were forced through zero and strength of the relationship is reported as the r coefficient obtained from Pearson's correlations. For each taxon analysis reported, outliers were excluded using the quartile robust fit method in JMP. This approach could exclude from analysis some high plant masses that were valid due to several layers of algae.

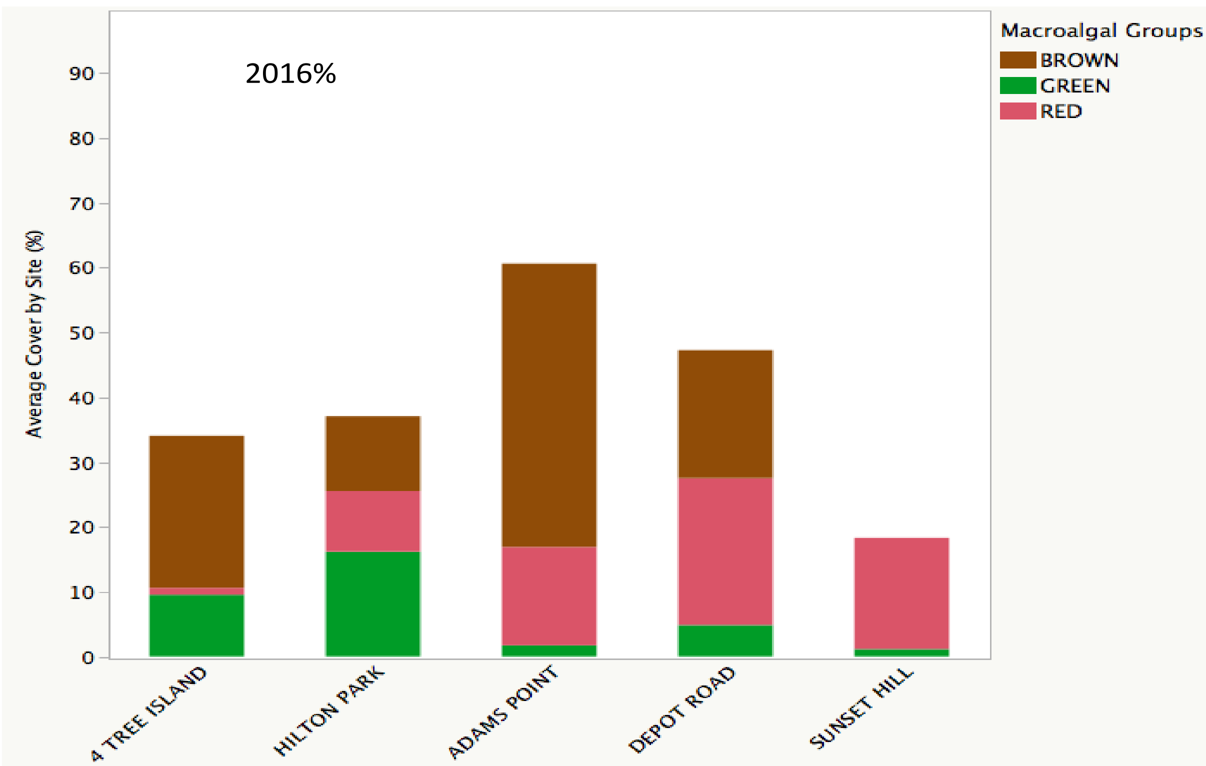
See Matso (2016) for detailed Quality Assurance Project Plan details.

Results and Discussion

Macroalgae Cover

Macroalgae were assessed at five of the eight long-term sites in 2016: both annual sites of Depot Road (Stratham) and Adams Point (Durham) and three biennial sites of Four Tree Island (Portsmouth), Hilton Park (Dover) and Sunset Hill Farm (Newington). Three collection efforts to assess percentage of algal cover were performed in late July, late August, and October. In late August, we also collected percent cover and biomass data by seaweed taxon. Over all months and sites, algae cover ranged up to 100% for macroalgae, with two groups of nuisance algae of note: *Gracilaria*, (a genus of red algae comprised mainly of one native and one invasive species) averaging 8.9% cover and *Ulva* (a genus of diverse tubular and foliose green algae, but dominated by *U. lactuca*, sea lettuce) averaging 5.6% cover. Raw cover data is available in tabular form in Appendix A. When categorized by major color types (red, green and brown) and compared across sites, the brown algae (primarily long-lived fucoids) dominated Adams Point (Figure 3). Cover of algae at Four Tree Island was dominated by greens and brown fucoid algae. Hilton Park and Depot Road, showed fairly even mixes of reds, (predominately *Gracilaria* spp.), greens (predominately *Ulva* spp.) and browns (predominately fucoids). In 2016, Sunset Hill Farm had mostly red algae, predominately *Gracilaria,* accumulating on the mudflat at the base of the salt marsh (Figure 3). Similar to the three previous years, the greatest cover of nuisance algae was found at Depot Road (Figures 3-4).

The general pattern observed in the intertidal seaweeds by major color groups and position in the estuary was perhaps clearest in 2014 and 2016, showing a steady increase in reds (mostly *Gracilaria* spp.) from the coast (Four Tree Island) to Great Bay (Depot Road and Sunset Hill Farms). The contribution of green seaweeds (mostly *Ulva* spp.) was greatest in the Piscataqua River at Hilton Park for both years but increased



dramatically at Four Tree Island in 2016 (Figures 3-4).

Figure 3. Cover of macroalgae averaged over sampling depths and three seasonal collection periods at the five sites sampled in 2016.

Figure 4. Cover of macroalgae averaged over sampling depths and seasonal collection periods at four sites in 2013, and five sites sampled in each of 2014 and 2015.

The brown algae were greatest at Four Tree Island and Adams Point and were composed largely of the long lived fucoids, *Ascophyllum nodosum* and *Fucus vesiculosus*. The spatial trend of higher contribution of red alga in Great Bay was seen for all four years, with substantial greens in Little and Great Bays as well.

The data from 2016 suggest greens are becoming prevalent in the lower part of the estuary (Figure 3). In 2015 and 2016 brown algae contributed more to the macroalgal cover than the previous two years, with very high cover at Adams Point (40 to 50%) and greater cover when compared with the same stations sampled in 2013 (Figures 3-4).

When the data are presented showing cover by elevation for each of the four years, different patterns emerge (Figure 5). First, the browns were dominant at both Four Tree Island, near the mouth of the Piscataqua River, and Adams Point, on the northern shore of Great Bay. Browns were also commonly found at the mid elevations of Hilton Park, Cedar Point and Wagon Hill Farm (Little Bay) and upper elevation of Depot Road (Great Bay). At these sites there are rocks that provide attachment sites for the brown algal holdfasts. The relatively long-lived fucoid algae are not nuisance algae and have been a feature of the Estuary's rocky shores for years (Short 1992). Where multiple years of data exist, the cover of browns was relatively greater in 2015 and 2016 (Figure 5), perhaps due to milder winters (less damage from ice, which can remove these algae from the rocks; Mathieson et al. 1982).

Red algae, primarily the Asiatic nuisance alga *Gracilaria vermiculophylla*, were mostly found in Great Bay where they accumulate at lower elevations (mudflats). At Depot Road where there are four years of data, reds became more prevalent at the 1 m elevation and less prevalent at the 0.5 meter elevation through 2015, then flip-flopped in 2016 (Figure 5). The lowest elevation at Adam's Point showed large accumulations of red algae and reds have appeared to increase at the low elevation at Hilton Park. The temporal trends in the red algae are interesting, but we are unable to assign a cause or mechanism for these changes. Some have noted these drift algae may be carried by wind-driven currents, moving seasonally in response to prevailing weather patterns (Nettleton et al. 2011).

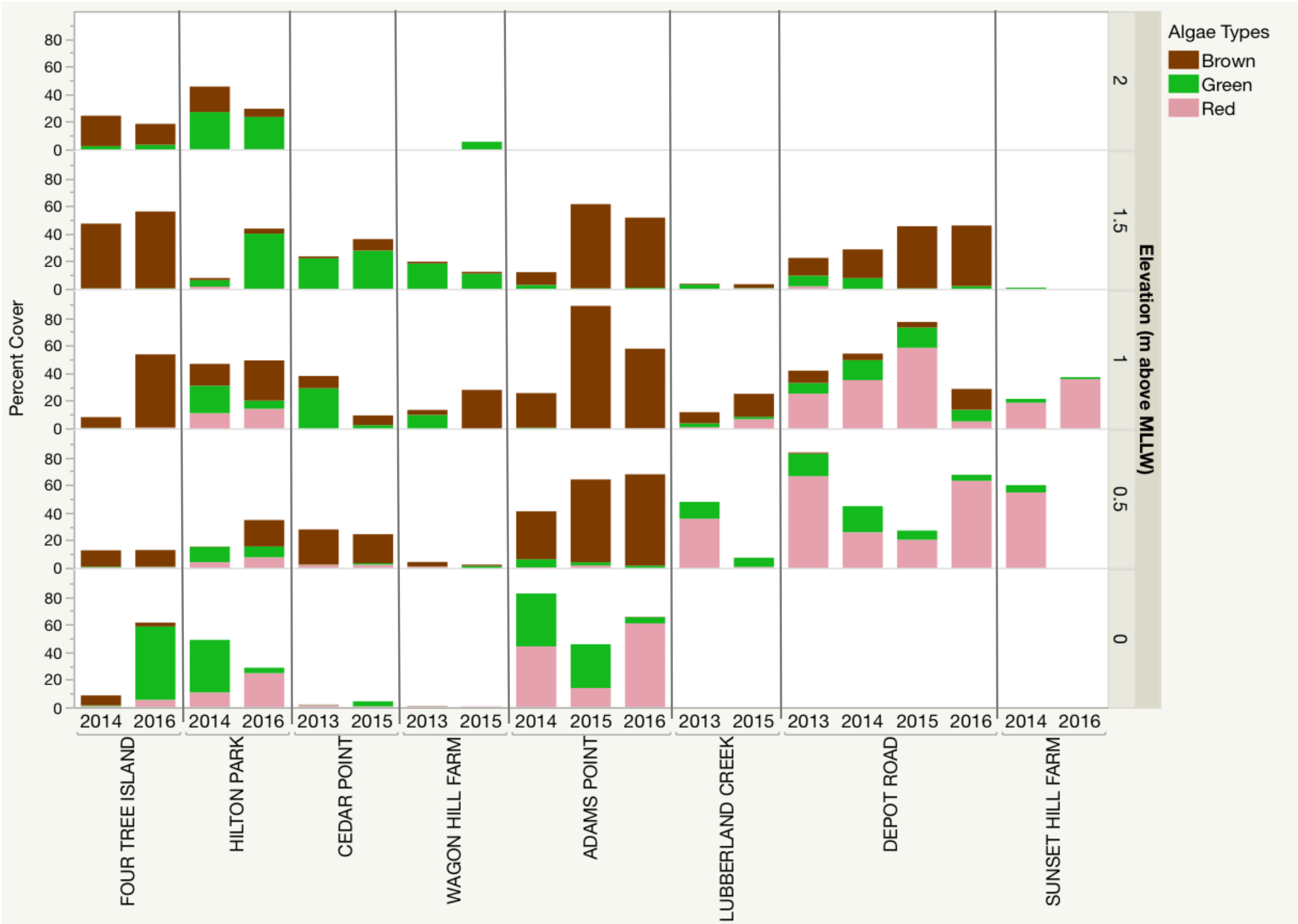


Figure 5. Cover of macroalgae at all sites sampled during four years and shown for each elevation, averaged over the three transects. Highest elevation at FTI had no algae and was omitted from graph and lowest sample elevation at SHF was actually 0.75 m (not 0.5 m) above MLLW. Some sites had no 0.0 m elevation stations (LC, DR, and SHF) and some had no 2.0 m elevations (CP, LC, DR, and SHF).

Green algae, composed primarily of the nuisance *Ulva* species, were the most common type of macroalgae in the mid-estuary (Hilton Park, Cedar Point and Wagon Hill Farm). Greens were also important at lower elevation sampling points in Great Bay (Adams Point, Lubberland Creek, and Depot Road) and at Four Tree Island in 2016 (Figure 5).
No consistent temporal trends were observed in the green algae over the last four years, though the cover of green algae covering the mudflat at Four Tree Island had not been observed previously.

From 2013 to 2016 we have not observed dramatic increases in macroalgae in the Estuary. However, anecdotal observations show red algae persisting through the winter as dominant cover in many intertidal embayments along tidal tributaries like the Oyster River and then being rapidly covered by the green alga *Ulva* the following summer (personal observations, DB and ACM, 2016).

Paired Cover and Biomass

Following the collection protocol, a 0.0625 m^2 quadrat was placed two meters to the right of each sampling site (facing shoreward) and after estimation of cover and photographing the plot, all algae within the plot were collected and processed to determine biomass. We have accumulated significant numbers of data points for four taxa of algae: blade-forming *Ulva* (green), *Gracilaria* spp. (red) and the two species of brown fucoid algae: *Ascophyllum nodosum* and *Fucus vesiculosus*. The 2013-15 data were combined with new data collected in 2016 to generate correlations (Figure 6).

We used the Quartile Robust Fit method in JMP statistical software to identify and justify removal of some outliers (much greater or lesser weight than expected for the amount of cover). Although the correlation coefficients ($r = 0.64$ to 0.87) indicate fairly good correspondence between percentage of cover and biomass, there is still quite a bit of variability in the data, even after removing some outliers. One of our ultimate goals is to develop cover-biomass relationships to create regressions of algal cover data that can be used to estimate algal biomass for each of the major taxa at the various collection sites.

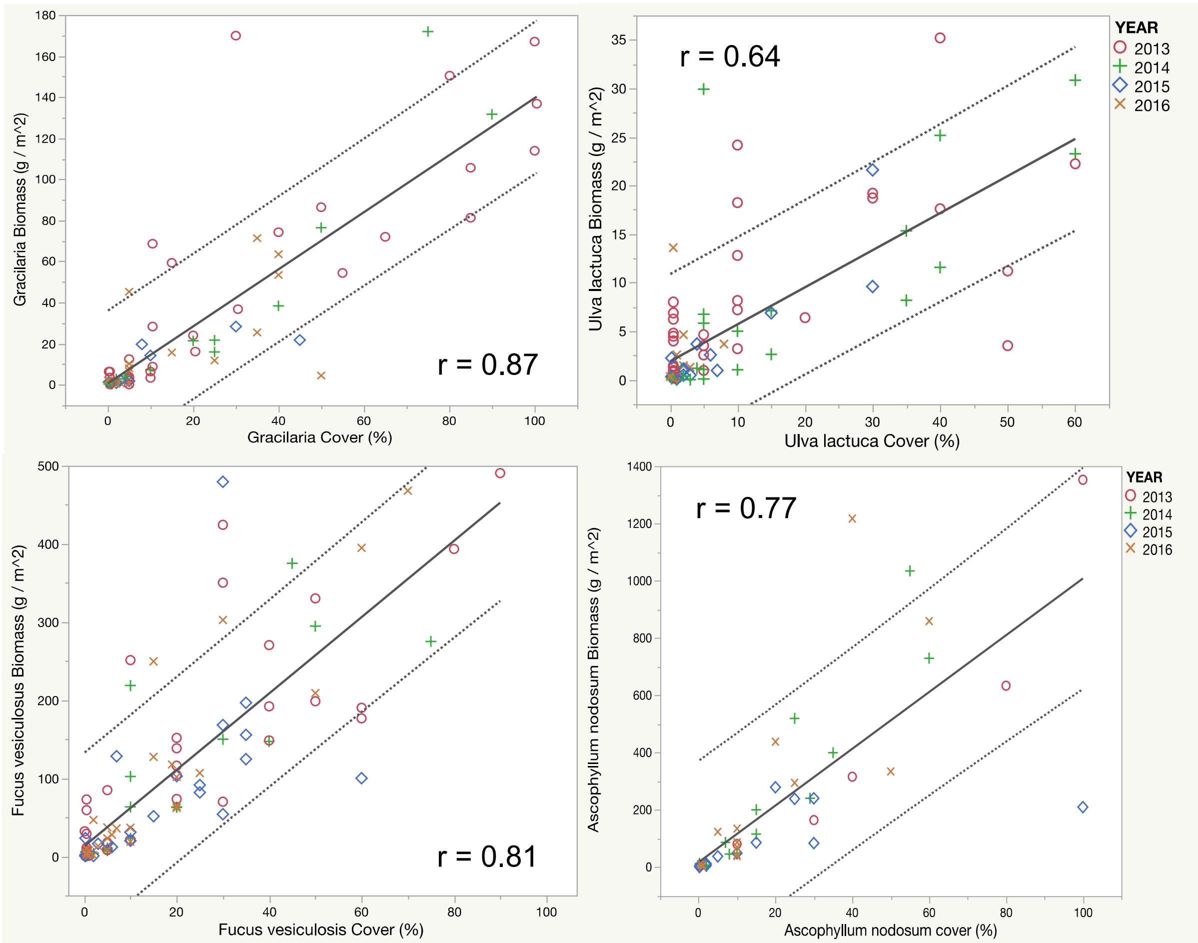


Figure 6. Correlations of percentage visual cover (x-axes) and biomass (y-axes) from the 0.0625 m^2 quadrats for the 2013, 2014, 2015 and 2016 combined data. Best fit lines and 90% confidence intervals are shown. Outliers were excluded from *Gracilaria* (6 outliers excluded), *Ulva* (8), *Ascophyllum* (5) and *Fucus* (5) using Quartile Robust Fit method (JMP 2015).

Summary and Conclusions

In 2016, high levels of cover of nuisance green or red algae (*Ulva* and *Gracilaria*, respectively) were found at the lowest or next to lowest elevations at all sites. Monitoring results from 2015 and 2016 show increasing cover of the long-lived brown algae species, *Fucus vesiculosus* and *Ascophyllum nodosum*, perhaps due to relatively mild winters. Biomass collections in 2016 increased sample size and strengthened our ability to predict biomass from cover data.

Anecdotal observations suggest that intertidal macroalgal populations appear to be increasing over time, but developing a statistically significant pattern of increase using standardized protocols will require a longer time series.

Acknowledgements

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References

Beem, N. and F.T. Short. 2009. Subtidal Eelgrass Declines in the Great Bay Estuary, NH-ME. Estuaries and Coasts 32: 202-205.

Burdick, D.M., A.C. Mathieson, C.R. Peter and S. Nick. 2016. Monitoring Macroalgae in the Great Bay Estuary for 2014. Final Report. The Piscataqua Region Estuaries Partnership. 19 pp.

Cianciola, E. and D. Burdick 2014. Results of 2013 Macroalgal Monitoring and Recommendations for Future Monitoring in Great Bay Estuary, New Hampshire. PREP Publications. Paper 41. http://scholars.unh.edu/prep/41

Hardwick-Whitman, M.N. and Mathieson, A.C. 1983. Intertidal Macroalgae and Macroinvertebrates: Seasonal and Spatial Abundance Patterns Along an Estuarine Gradient. Estuarine, Coastal and Shelf Science 16: 113-129.

JMP 2015. Version JMP pro 12. SAS Institute, Cary, North Carolina.

Mathieson, A.C. and C.J. Dawes. 2017. Seaweeds of the Northwest Atlantic. University of Massachusetts Press, Amherst, MA.

Mathieson, A.C., C.A. Penniman, P.K. Busse, and E. Tveter-Gallagher. 1982. Effects of ice on *Ascophyllum nodosum* with the Great Bay estuarine system of New Hampshire-Maine. Journal of Phycology 18:331-336.

Matso K. 2016. Great Bay Estuary Macroalgae Monitoring Program for 2016 Quality Assurance Project Plan. http://scholars.unh.edu/qapp/5/

Nettleton, J.C. C.D. Neefus, A.C. Mathieson, and L.G. Harris. 2011. Tracking environmental trends in the Great Bay Estuarine System through comparisons of historical and present-day green and red algal community structure and nutrient content. Final Report. Great Bay National Estuarine Research Reserve System, Durham, NH. 101 pp.

Short, F.T. (ed.) 1992. The Ecology of the Great Bay Estuary, New Hampshire and Maine: An Estuarine Profile and Bibliography. NOAA Coastal Ocean Program Publication. pp. 222.

Short, F. 2014. Eelgrass Distribution in the Great Bay Estuary for 2013. University of New Hampshire Report. Piscataqua Region Estuaries Partnership, Durham, NH. 9 pp.

Short, F.T., D.M. Burdick, J. Kaldy. 1995. Mesocosm experiments quantify the effects of coastal eutrophication on eelgrass, *Zostera marina* L. Limnology and Oceanography 40:740-749.

Trowbridge, P. 2006. State of the Estuaries. New Hampshire Estuaries Program, Durham, NH. 32 pp.

Villalard-Bohnsack, M. 2003. Illustrated Key to the Seaweeds of New England, 2nd edition. The Rhode Island Natural History Survey, Kingston, RI. pp. 149 pp.

Appendices

Appendix A: Cover (%) Data Table

Appendix B: Percentage Cover (%) and Biomass (grams dry weight per sample) Data Table

Appendix C: Site descriptions

Appendix A: Percentage Cover Data Table

Date	Year	Month	Site	Transect	Elev	Sample Type	Blade Ulva	Tube Ulva	Gracilaria spp.	A. nodosum	A. nod v. s.	F. vesiculosus	F. ves v. sc.	Dasysiphonia japonica	Polysiphonia	Callathamnion corymbosum	S. alterniflora	S. patens	J. gerardii	L. nashii	SADE
7/21/16	2016	JULY	SANDY POINT	A	0.5	$0.25 m^2$	5	0	0.5	0	0	0	0	0	0	0	0	0	0	0	0
7/21/16	2016	JULY	SANDY POINT	B	0.5	$0.25 m^2$	4	0	90	0	0	0	0	0	0	0	0	0	0	0	0
7/21/16	2016	JULY	SANDY POINT	C	0.5	$0.25 m^2$	1	0	5	0	0	0	0	0	0	0	0	0	0	0	0
7/21/16	2016	JULY	SANDY POINT	A	1.0	$0.25 m^2$	3	0	1	0	0	0	0	0	0	0	0	0	0	0	0
7/21/16	2016	JULY	SANDY POINT	B	1.0	$0.25 m^2$	3	0	0	0	0	10	0	0	0	0	0	0	0	0	0
7/21/16	2016	JULY	SANDY POINT	C	1.0	$0.25 m^2$	60	0	30	0	0	1	0	0	0	0	0	0	0	0	0
7/21/16	2016	JULY	SANDY POINT	A	1.5	$0.25 m^2$	0	0	0	50	0	25	0	0	0	0	0	0	0	0	0
7/21/16	2016	JULY	SANDY POINT	B	1.5	$0.25 m^2$	2	0	0	5	0	30	0	0	0	0	50	0	0	0	0
7/21/16	2016	JULY	SANDY POINT	C	1.5	$0.25 m^2$	0	0	0	0		50	0	0	0	0	40	0	0	0	0
7/25/16	2016	JULY	4 TREE ISLAND	A	0.0	$0.25 m^2$	15	50	0	0	0	0	0	0	0	0	0	0	0	0	0
7/25/16	2016	JULY	4 TREE ISLAND	B	0.0	$0.25 m^2$	1	40	0	0	0	2	0	0	0	0	0	0	0	0	0
7/25/16	2016	JULY	4 TREE ISLAND	C	0.0	$0.25 m^2$	0	1	0	0	0	10	0	0	0	0	0	0	0	0	0
7/25/16	2016	JULY	4 TREE ISLAND	A	0.5	$0.25 m^2$	0	0.5	0	0	0	2	0	0	0	0	0	0	0	0	0
7/25/16	2016	JULY	4 TREE ISLAND	B	0.5	$0.25 m^2$	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0
7/25/16	2016	JULY	4 TREE ISLAND	C	0.5	$0.25 m^2$	1	0	0	0	0	45	0	0	0	0	0	0	0	0	0
7/25/16	2016	JULY	4 TREE ISLAND	A	1.0	$0.25 m^2$	0	0	0	60	0	10	0	0	0	0	0	0	0	0	0
7/25/16	2016	JULY	4 TREE ISLAND	B	1.0	$0.25 m^2$	0	0	0	5	0	15	0	0	0	0	0	0	0	0	0
7/25/16	2016	JULY	4 TREE ISLAND	C	1.0	$0.25 m^2$	0	0	0	20	0	30	0	0	0	0	15	0	0	0	0
7/25/16	2016	JULY	4 TREE ISLAND	A	1.5	$0.25 m^2$	0	0	0	10	0	15	0	0	0	0	40	0	0	0	0
7/25/16	2016	JULY	4 TREE ISLAND	B	1.5	$0.25 m^2$	0	0	0	5	0	50	0	0	0	0	35	0	0	0	0
7/25/16	2016	JULY	4 TREE ISLAND	C	1.5	$0.25 m^2$	0	0	0	5	0	75	0	0	0	0	15	0	0	0	0
7/25/16	2016	JULY	4 TREE ISLAND	A	2.0	$0.25 m^2$	0	0	0	65	0	20	0	0	0	0	0	0	0	0	2
7/25/16	2016	JULY	4 TREE ISLAND	B	2.0	$0.25 m^2$	0	0	0	0	0	15	0	0	0	0	40	35	0	0	2
7/25/16	2016	JULY	4 TREE ISLAND	C	2.0	$0.25 m^2$	0	0	0	3	0	1	0	0	0	0	50	10	0	1	5
7/25/16	2016	JULY	4 TREE ISLAND	A	2.5	$0.25 m^2$	0	0	0	0	0	0	0	0	0	0	0	30	40	0	2
7/25/16	2016	JULY	4 TREE ISLAND	B	2.5	$0.25 m^2$	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7/25/16	2016	JULY	4 TREE ISLAND	C	2.5	$0.25 m^2$	0	0	0	0	0	0	0	0	0	0	0	3	90	0	0
7/20/16	2016	JULY	ADAMS POINT	A	0.0	$0.25 m^2$	20	0	15	0	0	0	0	0	0	0	0	0	0	0	0
7/20/16	2016	JULY	ADAMS POINT	B	0.0	$0.25 m^2$	5	0	70	0	0	0	0	0	0	0	0	0	0	0	0
7/20/16	2016	JULY	ADAMS POINT	C	0.0	$0.25 m^2$	10	0	40	2	0	0	0	0	0	0	0	0	0	0	0
7/20/16	2016	JULY	ADAMS POINT	A	0.5	$0.25 m^2$	0	0	0	50	0	40	0	0	0	0	0	0	0	0	0
7/20/16	2016	JULY	ADAMS POINT	B	0.5	$0.25 m^2$	0	0	0	25	0	15	0	0	0	0	0	0	0	0	0
7/20/16	2016	JULY	ADAMS POINT	C	0.5	$0.25 m^2$	0	0	0	35	0	60	0	0	0	0	0	0	0	0	0
7/20/16	2016	JULY	ADAMS POINT	A	1.0	$0.25 m^2$	0	0	0	5	0	40	0	0	0	0	0	0	0	0	0
7/20/16	2016	JULY	ADAMS POINT	B	1.0	$0.25 m^2$	0	0	1	30	0	25	0	0	0	0	0	0	0	0	0
7/20/16	2016	JULY	ADAMS POINT	C	1.0	$0.25 m^2$	0	0	0	90	0	10	0	0	0	0	0	0	0	0	0
7/20/16	2016	JULY	ADAMS POINT	A	1.5	$0.25 m^2$	0	0	0	0	0	5	0	0	0	0	25	0	0	0	0
7/20/16	2016	JULY	ADAMS POINT	B	1.5	$0.25 m^2$	0	0	0	40	0	30	0	0	0	0	20	0	0	0	0
7/20/16	2016	JULY	ADAMS POINT	C	1.5	$0.25 m^2$	0	0	0	80	0	10	0	0	0	0	10	0	0	0	0
7/26/16	2016	JULY	HILTON PARK	A	0.0	$0.25 m^2$	0	3	0	0	0	0	0	2	0	0	0	0	0	0	0

Date	Year	Month	Site	Transect	Elev	Sample Type	Blade Ulva	Tube Ulva	Gracilaria spp.	A. nodosum	A. nod v. s.	F. vesiculosus	F. ves v. sc.	Dasysiphonia japonica	Polysiphonia	Callathamnion corymbosum	S. alterniflora	S. patens	J. gerardii	L. nashii	SADE
7/26/16	2016	JULY	HILTON PARK	B	0.0	0.25 m^2	5	0	20	0	0	0	0	0	0	0	0	0	0	0	0
7/26/16	2016	JULY	HILTON PARK	C	0.0	0.25 m^2	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0
7/26/16	2016	JULY	HILTON PARK	A	0.5	0.25 m^2	0	9	2	8	0	0	0	0	2	0	0	0	0	0	0
7/26/16	2016	JULY	HILTON PARK	B	0.5	0.25 m^2	1	4	3	0	0	0	0	0	7	0	0	0	0	0	0
7/26/16	2016	JULY	HILTON PARK	C	0.5	0.25 m^2	20	15	0	25	0	0	0	0	5	0	0	0	0	0	0
7/26/16	2016	JULY	HILTON PARK	A	1.0	0.25 m^2	0	1	1	65	0	1	0	0	10	0	0	0	0	0	0
7/26/16	2016	JULY	HILTON PARK	B	1.0	0.25 m^2	15	10	2	0	0	0	0	0	15	0	0	0	0	0	0
7/26/16	2016	JULY	HILTON PARK	C	1.0	0.25 m^2	0	5	0	15	0	0	0	0	5	0	0	0	0	0	0
7/26/16	2016	JULY	HILTON PARK	A	1.5	0.25 m^2	0	10	0	0	0	0	0	0	0	0	40	0	0	0	0
7/26/16	2016	JULY	HILTON PARK	B	1.5	0.25 m^2	15	25	0	0	0	5	0	0	0	0	20	0	0	0	0
7/26/16	2016	JULY	HILTON PARK	C	1.5	0.25 m^2	0	65	0	1	0	5	0	0	0	0	25	0	0	0	0
7/26/16	2016	JULY	HILTON PARK	A	2.0	0.25 m^2	0	0	0	1	0	2	0	0	0	0	40	0	0	0	0
7/26/16	2016	JULY	HILTON PARK	B	2.0	0.25 m^2	0	0	0	15	0	0	0	0	0	0	60	0	0	0	0
7/26/16	2016	JULY	HILTON PARK	C	2.0	0.25 m^2	0	0	0	0	0	9	0	0	0	0	80	0	0	0.5	0.5
8/3/16	2016	AUGUST	SUNSET HILL	A	0.75	0.25 m^2	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0
8/3/16	2016	AUGUST	SUNSET HILL	B	0.75	0.25 m^2	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
8/3/16	2016	AUGUST	SUNSET HILL	C	0.75	0.25 m^2	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8/3/16	2016	AUGUST	SUNSET HILL	A	1.0	0.25 m^2	0	0	60	0	0	0	0	0	0	0	20	0	0	0	0
8/3/16	2016	AUGUST	SUNSET HILL	B	1.0	0.25 m^2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
8/3/16	2016	AUGUST	SUNSET HILL	C	1.0	0.25 m^2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8/3/16	2016	AUGUST	SUNSET HILL	A	1.5	0.25 m^2	0	0	0	0	0	0	0	0	0	0	90	0	0	0	0
8/3/16	2016	AUGUST	SUNSET HILL	B	1.5	0.25 m^2	0	0	0	0	0	0	0	0	0	0	85	0	0	0	0
8/3/16	2016	AUGUST	SUNSET HILL	C	1.5	0.25 m^2	0	0	0	0	0	0	0	0	0	0	85	0	0	0	0
8/19/16	2016	AUGUST	ADAMS POINT	A	0.0	0.25 m^2	2	0	40	0	0	0	0	0	0	40	0	0	0	0	0
8/19/16	2016	AUGUST	ADAMS POINT	B	0.0	0.25 m^2	3	0	60	0	0	0	0	0	0	35	0	0	0	0	0
8/19/16	2016	AUGUST	ADAMS POINT	C	0.0	0.25 m^2	0	0	70	0	0	0	0	30	0	0	0	0	0	0	0
8/19/16	2016	AUGUST	ADAMS POINT	A	0.5	0.25 m^2	0	0	0	10	0	30	0	0	0	0	0	0	0	0	0
8/19/16	2016	AUGUST	ADAMS POINT	B	0.5	0.25 m^2	0	0	0	20	0	35	0	0	0	0	0	0	0	0	0
8/19/16	2016	AUGUST	ADAMS POINT	C	0.5	0.25 m^2	0	0	0	90	0	3	0	0	0	0	0	0	0	0	0
8/19/16	2016	AUGUST	ADAMS POINT	A	1.0	0.25 m^2	0	0	0	1	0	40	0	0	0	0	0	0	0	0	0
8/19/16	2016	AUGUST	ADAMS POINT	B	1.0	0.25 m^2	0	0	0	5	0	25	0	0	0	0	0	0	0	0	0
8/19/16	2016	AUGUST	ADAMS POINT	C	1.0	0.25 m^2	0	0	0	90	0	10	0	0	0	0	0	0	0	0	0
8/19/16	2016	AUGUST	ADAMS POINT	A	1.5	0.25 m^2	0	0	0	5	0	25	0	0	0	0	20	0	0	0	0
8/19/16	2016	AUGUST	ADAMS POINT	B	1.5	0.25 m^2	0	0	0	40	0	5	0	0	0	0	20	0	0	0	0
8/19/16	2016	AUGUST	ADAMS POINT	C	1.5	0.25 m^2	0	0	0	50	0	20	0	0	0	0	1	0	0	0	0
8/22/16	2016	AUGUST	HILTON PARK	A	0.0	0.25 m^2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8/22/16	2016	AUGUST	HILTON PARK	B	0.0	0.25 m^2	5	0	25	0	0	0	0	0	0	0	0	0	0	0	0
8/22/16	2016	AUGUST	HILTON PARK	C	0.0	0.25 m^2	0	2	30	0	0	0	0	0	0	0	0	0	0	0	0
8/22/16	2016	AUGUST	HILTON PARK	A	0.5	0.25 m^2	0	4	0	70	0	0	0	0	0	0	0	0	0	0	0
8/22/16	2016	AUGUST	HILTON PARK	B	0.5	0.25 m^2	5	0	0	1	0	2	0	0	0	0	0	0	0	0	0

Date	Year	Month	Site	Transect	Elev	Sample Type	Blade Ulva	Tube Ulva	Gracilaria spp.	A. nodosum	A. nod v. s.	F. vesiculosus	F. ves v. sc.	Dasysiphonia japonica	Polysiphonia	Callathamnion corymbosum	S. alterniflora	S. patens	J. gerardii	L. nashii	SADE
8/22/16	2016	AUGUST	HILTON PARK	C	0.5	$0.25 m^2$	1	4	10	40	0	1	0	0	10	0	0	0	0	0	0
8/22/16	2016	AUGUST	HILTON PARK	A	1.0	$0.25 m^2$	0	1	2	85	0	0	0	0	0	0	0	0	0	0	0
8/22/16	2016	AUGUST	HILTON PARK	B	1.0	$0.25 m^2$	3	3	10	0	0	0	0	0	30	0	0	0	0	0	0
8/22/16	2016	AUGUST	HILTON PARK	C	1.0	$0.25 m^2$	1	2	20	10	0	0.5	0	0	5	0	0	0	0	0	0
8/22/16	2016	AUGUST	HILTON PARK	A	1.5	$0.25 m^2$	0	2	0	0	0	0	0	0	0	0	50	0	0	0	0
8/22/16	2016	AUGUST	HILTON PARK	B	1.5	$0.25 m^2$	2	2	0	0	0	1	0	0	0	0	30	0	0	0	0
8/22/16	2016	AUGUST	HILTON PARK	C	1.5	$0.25 m^2$	0	15	0	5	0	5	0	0	0	0	30	0	0	0	0
8/22/16	2016	AUGUST	HILTON PARK	A	2.0	$0.25 m^2$	0	0	0	0	0	0	0	0	0	0	35	0	0	0	0
8/22/16	2016	AUGUST	HILTON PARK	B	2.0	$0.25 m^2$	0	0	0	5	0	0	0	0	0	0	60	0	0	0	0
8/22/16	2016	AUGUST	HILTON PARK	C	2.0	$0.25 m^2$	0	0	0	0	5	0	0	0	0	0	80	0	0	0	2
8/22/16	2016	AUGUST	DEPOT ROAD	A	0.5	$0.25 m^2$	0.5	0	1	0	0	0	0	0	0	0	0	0	0	0	0
8/22/16	2016	AUGUST	DEPOT ROAD	B	0.5	$0.25 m^2$	5	0	90	0	0	0	0	5	0	0	0	0	0	0	0
8/22/16	2016	AUGUST	DEPOT ROAD	C	0.5	$0.25 m^2$	10	0	90	0	0	0	0	0	0	0	0	0	0	0	0
8/22/16	2016	AUGUST	DEPOT ROAD	A	1.0	$0.25 m^2$	1	0	2	0	0	3	0	0	0	0	0	0	0	0	0
8/22/16	2016	AUGUST	DEPOT ROAD	B	1.0	$0.25 m^2$	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0
8/22/16	2016	AUGUST	DEPOT ROAD	C	1.0	$0.25 m^2$	0.5	0	0	0	0	55	0	0	0	0	15	0	0	0	0
8/22/16	2016	AUGUST	DEPOT ROAD	A	1.5	$0.25 m^2$	0	0	0	10	0	40	0	0	0	0	0	0	0	0	0
8/22/16	2016	AUGUST	DEPOT ROAD	B	1.5	$0.25 m^2$	0	0	0	0	0	30	0	0	0	0	30	0	0	0	0
8/22/16	2016	AUGUST	DEPOT ROAD	C	1.5	$0.25 m^2$	0	0	0	0	0	30	0	0	0	0	60	0	0	0	0
8/23/16	2016	AUGUST	FOUR TREE ISLAND	A	0.0	$0.25 m^2$	20	30	0	0	0	0	0	0	0	0	0	0	0	0	0
8/23/16	2016	AUGUST	FOUR TREE ISLAND	B	0.0	$0.25 m^2$	0	5	0	0	0	0	0	3	0	0	0	0	0	0	0
8/23/16	2016	AUGUST	FOUR TREE ISLAND	C	0.0	$0.25 m^2$	0	0	0	5	0	3	0	5	0	0	0	0	0	0	0
8/23/16	2016	AUGUST	FOUR TREE ISLAND	A	0.5	$0.25 m^2$	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
8/23/16	2016	AUGUST	FOUR TREE ISLAND	B	0.5	$0.25 m^2$	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
8/23/16	2016	AUGUST	FOUR TREE ISLAND	C	0.5	$0.25 m^2$	0	0	0	0	0	30	0	2	2	0	0	0	0	0	0
8/23/16	2016	AUGUST	FOUR TREE ISLAND	A	1.0	$0.25 m^2$	0	0	0	65	0	5	0	0	0	0	0	0	0	0	0
8/23/16	2016	AUGUST	FOUR TREE ISLAND	B	1.0	$0.25 m^2$	0	0	0	0	75	8	0	0	0	0	0	0	0	0	0
8/23/16	2016	AUGUST	FOUR TREE ISLAND	C	1.0	$0.25 m^2$	0	0	0	2	0	5	0	5	0	0	15	0	0	0	0
8/23/16	2016	AUGUST	FOUR TREE ISLAND	A	1.5	$0.25 m^2$	0	0	0	15	0	15	0	0	0	0	50	0	0	0	0
8/23/16	2016	AUGUST	FOUR TREE ISLAND	B	1.5	$0.25 m^2$	0	0	0	0	1	40	0	0	0	0	35	0	0	0	0
8/23/16	2016	AUGUST	FOUR TREE ISLAND	C	1.5	$0.25 m^2$	0	0	0	5	15	55	0	0	0	0	20	0	0	0	0
8/23/16	2016	AUGUST	FOUR TREE ISLAND	A	2.0	$0.25 m^2$	0	0	0	0	0	10	0	0	0	0	50	0	0	0	10
8/23/16	2016	AUGUST	FOUR TREE ISLAND	B	2.0	$0.25 m^2$	0	0	0	0	0	5	0	0	0	0	30	45	0	0	1
8/23/16	2016	AUGUST	FOUR TREE ISLAND	C	2.0	$0.25 m^2$	0	0	0	0	3	0	0	0	0	0	25	20	0	2	10
8/23/16	2016	AUGUST	FOUR TREE ISLAND	A	2.5	$0.25 m^2$	0	0	0	0	0	0	0	0	0	0	0	12	7	0	1
8/23/16	2016	AUGUST	FOUR TREE ISLAND	B	2.5	$0.25 m^2$	0	0	0	15	0	0	0	0	0	0	0	0	0	0	0
8/23/16	2016	AUGUST	FOUR TREE ISLAND	C	2.5	$0.25 m^2$	0	0	0	0	0	5	0	0	0	0	0	10	20	0	0
8/31/16	2016	AUGUST	SUNSET HILL	A	0.75	$0.25 m^2$	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
8/31/16	2016	AUGUST	SUNSET HILL	B	0.75	$0.25 m^2$	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
8/31/16	2016	AUGUST	SUNSET HILL	C	0.75	$0.25 m^2$	5	0	20	0	0	0	0	0	0	0	0	0	0	0	0

Date	Year	Month	Site	Transect	Elev	Sample Type	Blade Ulva	Tube Ulva	Gracilaria spp.	A. nodosum	A. nod v. s.	F. vesiculosus	F. ves v. sc.	Dasysiphonia japonica	Polysiphonia	Callathamnion corymbosum	S. alterniflora	S. patens	J. gerardii	L. nashii	SADE
8/31/16	2016	AUGUST	SUNSET HILL	A	1.0	0.25 m^2	0	0	40	0	0	0	0	0	0	0	40	0	0	0	0
8/31/16	2016	AUGUST	SUNSET HILL	B	1.0	0.25 m^2	0	0	25	0	0	0	0	0	0	0	0	0	0	0	0
8/31/16	2016	AUGUST	SUNSET HILL	C	1.0	0.25 m^2	0	0	20	0	0	0	0	0	0	0	0	0	0	0	0
8/31/16	2016	AUGUST	SUNSET HILL	A	1.5	0.25 m^2	0	0	0	0	0	0	0	0	0	0	80	0	0	0	0
8/31/16	2016	AUGUST	SUNSET HILL	B	1.5	0.25 m^2	0	0	0	0	0	0	0	0	0	0	90	0	0	0	0
8/31/16	2016	AUGUST	SUNSET HILL	C	1.5	0.25 m^2	0	0	0	0	0	0	0	0	0	0	85	0	0	0	0
10/18/16	2016	OCTOBER	FOUR TREE ISLAND	A	0.0	0.25 m^2	2	95	0	3	0	0	0	0	0	0	0	0	0	0	0
10/18/16	2016	OCTOBER	FOUR TREE ISLAND	B	0.0	0.25 m^2	45	49	0	0	0	1	0	5	0	0	0	0	0	0	0
10/18/16	2016	OCTOBER	FOUR TREE ISLAND	C	0.0	0.25 m^2	1	89	0	0	0	0	0	10	0	0	0	0	0	0	0
10/18/16	2016	OCTOBER	FOUR TREE ISLAND	A	0.5	0.25 m^2	0	0	0	1	0	12	0	0	0	0	0	0	0	0	0
10/18/16	2016	OCTOBER	FOUR TREE ISLAND	B	0.5	0.25 m^2	0	0	0	0	0	0.5	0	0	0	0	0	0	0	0	0
10/18/16	2016	OCTOBER	FOUR TREE ISLAND	C	0.5	0.25 m^2	0	0	0	0	0	15	0	0	0	0	0	0	0	0	0
10/18/16	2016	OCTOBER	FOUR TREE ISLAND	A	1.0	0.25 m^2	0	0	0	40	0	25	0	0	0	0	0	0	0	0	0
10/18/16	2016	OCTOBER	FOUR TREE ISLAND	B	1.0	0.25 m^2	0	0	0	0	60	35	0	0	0	0	0	0	0	0	0
10/18/16	2016	OCTOBER	FOUR TREE ISLAND	C	1.0	0.25 m^2	0	0	0	0	12	5	0	0	0	0	7	0	0	0	0
10/18/16	2016	OCTOBER	FOUR TREE ISLAND	A	1.5	0.25 m^2	2	1	0	20	0	25	0	0	0	0	30	0	0	0	0
10/18/16	2016	OCTOBER	FOUR TREE ISLAND	B	1.5	0.25 m^2	0	0	0	5	0	70	0	0	0	0	10	0	0	0	0
10/18/16	2016	OCTOBER	FOUR TREE ISLAND	C	1.5	0.25 m^2	0	0	0	15	0	60	0	0	0	0	20	0	0	0	0
10/18/16	2016	OCTOBER	FOUR TREE ISLAND	A	2.0	0.25 m^2	0	0	0	0	0	7	0	0	0	0	65	0	0	0	1
10/18/16	2016	OCTOBER	FOUR TREE ISLAND	B	2.0	0.25 m^2	0	0	0	0	2	2	0	0	0	0	20	60	0	0	1
10/18/16	2016	OCTOBER	FOUR TREE ISLAND	C	2.0	0.25 m^2	0	0	0	2	0	1	0	0	0	0	35	25	0	1	5
10/18/16	2016	OCTOBER	FOUR TREE ISLAND	A	2.5	0.25 m^2	0	0	0	0	0	0	0	0	0	0	0	5	1	0	1
10/18/16	2016	OCTOBER	FOUR TREE ISLAND	B	2.5	0.25 m^2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
10/18/16	2016	OCTOBER	FOUR TREE ISLAND	C	2.5	0.25 m^2	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0
10/18/16	2016	OCTOBER	HILTON PARK	A	0.0	0.25 m^2	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0
10/18/16	2016	OCTOBER	HILTON PARK	B	0.0	0.25 m^2	20	0	25	0	0	0	0	0	10	0	0	0	0	0	0
10/18/16	2016	OCTOBER	HILTON PARK	C	0.0	0.25 m^2	0	0	30	0	0	0	0	0	2	0	0	0	0	0	0
10/18/16	2016	OCTOBER	HILTON PARK	A	0.5	0.25 m^2	0.5	0	2	5	0	0	0	2	3	0	0	0	0	0	0
10/18/16	2016	OCTOBER	HILTON PARK	B	0.5	0.25 m^2	4	0	2	0	0	0	0	0	5	0	0	0	0	0	0
10/18/16	2016	OCTOBER	HILTON PARK	C	0.5	0.25 m^2	1	0	0	20	0	0	0	0	7	0	0	0	0	0	0
10/18/16	2016	OCTOBER	HILTON PARK	A	1.0	0.25 m^2	3	3	5	85	0	0	0	0	0	0	0	0	0	0	0
10/18/16	2016	OCTOBER	HILTON PARK	B	1.0	0.25 m^2	3	1	5	0	0	0	0	0	11	0	0	0	0	0	0
10/18/16	2016	OCTOBER	HILTON PARK	C	1.0	0.25 m^2	0	2	2	0.5	0	0	0	0	4	0	0	0	0	0	0
10/18/16	2016	OCTOBER	HILTON PARK	A	1.5	0.25 m^2	0	30	0	0	0	2	0	0	0	0	30	0	0	0	0
10/18/16	2016	OCTOBER	HILTON PARK	B	1.5	0.25 m^2	5	25	0	0	0	5	0	0	0	0	20	0	0	0	0
10/18/16	2016	OCTOBER	HILTON PARK	C	1.5	0.25 m^2	3	50	0	1	0	3	0	0	0	0	15	0	0	0	0
10/18/16	2016	OCTOBER	HILTON PARK	A	2.0	0.25 m^2	0	0	0	0	0	0	0	0	0	0	40	0	0	0	0
10/18/16	2016	OCTOBER	HILTON PARK	B	2.0	0.25 m^2	0.5	0	1	6	0	5	0	0	0	0	55	0	0	0	0
10/18/16	2016	OCTOBER	HILTON PARK	C	2.0	0.25 m^2	0	0.5	0	5	0	0.5	0	0	0	0	70	0	0	0	0.5
10/31/16	2016	OCTOBER	ADAMS POINT	A	0	0.25 m^2	0	0	20	0	0	0	0	5	0	0	0	0	0	0	0

SULI	A. patula	Vaucherria	Wrack	Black tar algae	Ruppia	Ceramium virgatum	Ectocarpus fasciculatus	Heterosiphonia japonica	Gayralia	Porphyra	C. crispus	Mastocarpus stellatus	Neosiphonia harveyii	Cladophora	Hildenbrandia	Daysa baillouviana		GREEN	RED	BROWN	MARSH PLANTS
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		5	0.5	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		4	90	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		1	5	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		3	1	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		3	0	10	0
0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0		60	31	1	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	75	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		2	0	35	50
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	50	40
0	0	0	0	0	0	10	0	0	0	0	0	0	0	0	0	0		65	10	0	0
0	0	0	0	0	0	15	1	0	0	0	0	0	0	0	0	0		41	15	3	0
0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0		1	1	10	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0.5	0	2	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		1	0	1	0
0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0		1	1	45	0
0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0		0	0	70	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	20	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	50	15
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	25	40
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	55	35
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	80	15
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	85	2
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	15	77
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	4	66
5	0.5	0	15	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	77.5
0	0	0	80	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	93
0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0		20	20	0	0
0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0		5	80	0	0
0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0	0		10	50	2	0
0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0		1	0	90	0
0	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0	0		10	0	40	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	95	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	45	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	1	55	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	100	0
0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0		1	0	5	25
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	70	20
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	90	10
0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0		3	7	0	0

SULI	A. patula	Vaucheria	Wrack	Black tar algae	Ruppia	Ceramium virgatum	Ectocarpus fasciculatus	Heterosiphonia japonica	Gayralia	Porphyra	C. crispus	Mastocarpus stellatus	Neosiphonia harveyii	Cladophora	Hildenbrandia	Daysa baillouvina		GREEN	RED	BROWN	MARSH PLANTS
0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0		5	22	0	0
0	0	0	0	0	0	25	0	0	0	0	0	0	0	0	0	0		0	55	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		9	4	8	0
0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0		5	13	0	0
0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0		35	7	25	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		1	11	66	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		25	17	0	0
0	0	0	0	0	0	0	0	0	0	0	0.5	0	0	0	0	0		5	5.5	15	0
0	0	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0		30	0	0	40
0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0		50	0	5	20
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		65	0	6	25
0	0	40	0	0	0	0	0	0	0	0	0	0	0	0	0	0		40	0	3	40
0	0	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0		20	0	15	60
0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0		10	0	9	81
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		2	1	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	2	0	0
0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0		6	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	60	0	20
0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0		0	1	0	0
0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	90
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	85
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	85
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		2	80	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		3	95	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	100	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	40	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	55	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	93	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	41	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	30	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	100	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	30	20
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	45	20
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	70	1
0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0		0	2	0	0
0	0	0	0	0	0	3	0	0	0	0	10	0	0	0	0	0		5	38	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		2	30	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		4	0	70	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		5	0	3	0

SULI	A. patula	Vaucherria	Wrack	Black tar algae	Ruppia	Ceramium virgatum	Ectocarpus fasciculatus	Heterosiphonia japonica	Gayralia	Porphyra	C. crispus	Mastocarpus stellatus	Neosiphonia harveyii	Cladophora	Hildenbrandia	Daysa baillouvina		GREEN	RED	BROWN	MARSH PLANTS
0	0	0	0	0	0	3	0	0	0	0	0	1	0	0	0	0		5	24	41	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		1	2	85	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		6	40	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		3	25	10.5	0
0	0	15	0	0	0	0.5	0	0	0	0	0	0	0	0	0	0		17	0.5	0	50
0	0	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0		34	0	1	30
0	0	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0		40	0	10	30
0	0	60	0	0	0	0	0	0	0	0	0	0	0	0	0	0		60	0	0	35
0	0	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0		30	0	5	60
0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0		1	0	5	82
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0.5	1	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		5	95	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		10	90	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		1	2	3	0
0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0		0	5	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0.5	0	55	15
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	50	0
0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0		10	0	30	30
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	30	60
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		50	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		5	3	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	35	0	0		35	5	8	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	1	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	1	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	4	30	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0		0	0	70	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	83	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	5	7	15
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	30	50
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	41	35
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	75	20
0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0		5	0	10	60
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	5	76
0	0	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0		20	0	3	57
10	0	0	70	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	30
0	0	0	65	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	15	0
0	0	0	60	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	5	30
0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0		0	1	0	0
0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0		0	1	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		5	20	0	0

SULI	A. patula	Vaucherria	Wrack	Black tar algae	Ruppia	Ceramium virgatum	Ectocarpus fasciculatus	Heterosiphonia japonica	Gayralia	Porphyra	C. crispus	Mastocarpus stellatus	Neosiphonia harveyii	Cladophora	Hildenbrandia	Daysa baillouvina		GREEN	RED	BROWN	MARSH PLANTS
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	40	0	40
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	25	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	20	0	0
0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	80
0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	90
0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	85
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		97	0	3	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		94	5	1	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		90	10	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	13	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0.5	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	15	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	65	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	95	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	17	7
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		3	0	45	30
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	75	10
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	75	20
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	7	66
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	4	81
0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0		5	0	3	66
15	10	0	65	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	32
1	0	0	50	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	1	1
0	0	0	96	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	2
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	2	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		20	35	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	32	0	0
0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0		2.5	7	5	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		4	7	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		1	7	20	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		6	5	85	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		4	16	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		2	6	0.5	0
0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0		40	0	2	30
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		30	0	5	20
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		53	0	4	15
0	0	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0		20	0	0	40
0	0	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0		25.5	1	11	55
0	0	3	10	0	0	0	0	0	0	0	0	0	0	0	0	0		3.5	0	5.5	70.5
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	25	0	0

SULI	A. patula	Vaucheria	Wrack	Black tar algae	Ruppia	Ceramium virgatum	Ectocarpus fasciculatus	Heterosiphonia japonica	Gayralia	Porphyra	C. crispus	Mastocarpus stellatus	Neosiphonia harveyii	Cladophora	Hildenbrandia	Daysa baillouviana		GREEN	RED	BROWN	MARSH PLANTS
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	7	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	90	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		1	0	27	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		2	0	60	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0.5	0	95	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	20	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	27	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	100	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		5	0	30	10
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		1	0	56	5
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	61	1
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	100	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		6	94	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		7	92	0.5	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		5	3	2	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	3	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		3	0	65	3
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		3	0	50	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0		2.5	0	30	30
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	45	45
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1		0.5	5	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		4	72	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		1	41	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		12	45	0	35
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	95	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0.5	35	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	80
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	50
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	60

Appendix B: Percentage Cover (%) and Biomass (grams dry weight per sample) Data Table

DATE	SITE	TRANSECT	ELEVATION	Sample Size (m2)	Blade Ulva %	BladeUlva Bio	Tube Ulva %	Tube Ulva Bio	Grac. Spp %	Grac. Spp. Bio	A. nod %	A. nod Bio	A. nod v. s. %	A. nod v. s. Bio	F. ves %	F. ves Bio	G. vermiculophylla %	G. vermiculophylla Bio	G. tikvahiae %	G. tikvahiae Bio	D. japonica %	D. japonica Bio	S. alterniflora %	S. alterniflora Bio	Vaucheria %	Vauch Bio	S. patens %	S. patens Bio	J. gerardii %	J. gerardii Bio
8/19/16	ADAMS POINT	A	0.0	0.0625	2	0.29			40	3.97																				
8/19/16	ADAMS POINT	B	0.0	0.0625	2	0.09			10																					
8/19/16	ADAMS POINT	C	0.0	0.0625	1	0.16			50	0.28											49	6.95								
8/19/16	ADAMS POINT	A	0.5	0.0625											20	4														
8/19/16	ADAMS POINT	B	0.5	0.0625							25	18.41			55	39.67														
8/19/16	ADAMS POINT	C	0.5	0.0625							60	53.68			5	2.32														
8/19/16	ADAMS POINT	A	1.0	0.0625											5	0.52														
8/19/16	ADAMS POINT	B	1.0	0.0625							10	2.45			25	6.66														
8/19/16	ADAMS POINT	C	1.0	0.0625							10	4.38			70	29.26														
8/19/16	ADAMS POINT	A	1.5	0.0625							20	27.39			1	0.47							59	18.65						
8/19/16	ADAMS POINT	B	1.5	0.0625							10	8.46			60	24.69							20	3.74						
8/19/16	ADAMS POINT	C	1.5	0.0625							95	136.54			2	2.91							3	0.32						
8/22/16	HILTON PARK	A	0.0	0.0625					3	0.04																				
8/22/16	HILTON PARK	B	0.0	0.0625					5	2.83																				
8/22/16	HILTON PARK	C	0.0	0.0625					25	0.74																				
8/22/16	HILTON PARK	A	0.5	0.0625	0.5	0.03	1	0.01	0.5	0.09	97	176.13																		
8/22/16	HILTON PARK	B	0.5	0.0625	1	0.01	2	0.005	5	0.03	10	2.71																		
8/22/16	HILTON PARK	C	0.5	0.0625					5	0.41	50	20.89																		
8/22/16	HILTON PARK	A	1.0	0.0625	0.5	NA	2	0.06	15	0.98	1	0.51			19	7.35														
8/22/16	HILTON PARK	B	1.0	0.0625	1	0.02	3	0.02	40	3.34																				
8/22/16	HILTON PARK	C	1.0	0.0625	3	0.08	1	0.01	35	4.46	1	0.12									25	0.03								
8/22/16	HILTON PARK	A	1.5	0.0625			15	2.67							1	0.06							60	11.26	5	NA				
8/22/16	HILTON PARK	B	1.5	0.0625			5	0.12	0.5	0.08													60	9.08	25	1.57				
8/22/16	HILTON PARK	C	1.5	0.0625	1	NA	3	0.01	0.5	0.02					2	0.08							6	1.11	20	1.67				
8/22/16	HILTON PARK	A	2.0	0.0625					2	0.13													30	6.39	50	0.45				
8/22/16	HILTON PARK	B	2.0	0.0625							40	76.05			0.5	0.57							50	31.41	10	NA				
8/22/16	HILTON PARK	C	2.0	0.0625									45	64.58	5	1.45							49	41.75	0.5	0.03				
8/22/16	DEPOT ROAD	A	0.5	0.0625					0.5	NA																				
8/22/16	DEPOT ROAD	B	0.5	0.0625	0.5	0.85			89	44.8											10	0.39								
8/22/16	DEPOT ROAD	C	0.5	0.0625	8	0.23	0.5	NA	5	0.64																				
8/22/16	DEPOT ROAD	A	1.0	0.0625					5	0.5			95	130.31																
8/22/16	DEPOT ROAD	B	1.0	0.0625	1	NA			2	0.09					20	6.35														
8/22/16	DEPOT ROAD	C	1.0	0.0625	2	NA			2	0.02					50	13.06							5	2.37						
8/22/16	DEPOT ROAD	A	1.5	0.0625							100	155.51																		
8/22/16	DEPOT ROAD	B	1.5	0.0625					0.05	0.13					10	1.17							80	132.52						
8/22/16	DEPOT ROAD	C	1.5	0.0625											30	18.91							15	33.73						
8/23/16	FOUR TREE ISLAND	A	0.0	0.0625	0.5	0.01	60	0.06													10	0.11								
8/23/16	FOUR TREE ISLAND	B	0.0	0.0625																										
8/23/16	FOUR TREE ISLAND	C	0.0	0.0625			6	0.06													1	0.01								
8/23/16	FOUR TREE ISLAND	A	0.5	0.0625											3	0.83														
8/23/16	FOUR TREE ISLAND	B	0.5	0.0625																										
8/23/16	FOUR TREE ISLAND	C	0.5	0.0625											10	2.29														
8/23/16	FOUR TREE ISLAND	A	1.0	0.0625											7	2.24														
8/23/16	FOUR TREE ISLAND	B	1.0	0.0625	0.5	0.01							5	2.08	6	1.73							20	13.2						
8/23/16	FOUR TREE ISLAND	C	1.0	0.0625									15	4.23	20	3.87							20	10.36						
8/23/16	FOUR TREE ISLAND	A	1.5	0.0625	0.05	0.02					10	5.45			15	15.6							30	9.46						
8/23/16	FOUR TREE ISLAND	B	1.5	0.0625									1	0.41	65	47.72							35	28.42						
8/23/16	FOUR TREE ISLAND	C	1.5	0.0625							5	7.73	10	34.06	45	37.75							40	31.48						
8/23/16	FOUR TREE ISLAND	A	2.0	0.0625											0.5	0.29							60	37.61	10	0.18				
8/23/16	FOUR TREE ISLAND	B	2.0	0.0625									5	2.92	0.5	0.14							35	18.81			40	5.21		
8/23/16	FOUR TREE ISLAND	C	2.0	0.0625									1	0.16									45	11.95	20	0.06				
8/23/16	FOUR TREE ISLAND	A	2.5	0.0625																										
8/23/16	FOUR TREE ISLAND	B	2.5	0.0625							0.5	0.72			15	7.96														
8/23/16	FOUR TREE ISLAND	C	2.5	0.0625																										
8/31/16	SUNSET HILL FARM	A	0.75	0.0625					1	NA																				
8/31/16	SUNSET HILL FARM	B	0.75	0.0625					2	0.03																				
8/31/16	SUNSET HILL FARM	C	0.75	0.0625					5	0.16																				
8/31/16	SUNSET HILL FARM	A	1.00	0.0625					35	1.59													15	NA						
8/31/16	SUNSET HILL FARM	B	1.00	0.0625					1	0.02																				
8/31/16	SUNSET HILL FARM	C	1.00	0.0625					2	0.12																				
8/31/16	SUNSET HILL FARM	A	1.50	0.0625																			65	53.17						
8/31/16	SUNSET HILL FARM	B	1.50	0.0625																			60	164.04						
8/31/16	SUNSET HILL FARM	C	1.50	0.0625																			60	51.58						

DATE	SITE	TRANSECT	ELEVATION	Sample Size (m2)	Blade Ulva %	BladeUlva Bio	Tube Ulva %	Tube Ulva Bio	Grac. Spp %	Grac. Spp. Bio	A. nod %	A. nod Bio	A. nod v. s. %	A. nod v. s. Bio	F. ves %	F. ves Bio	G. vermiculophylla %	G. vermiculophylla Bio	G. tikvahiae %	G. tikvahiae Bio	D. japonica %	D. japonica Bio	S. alterniflora %	S. alterniflora Bio	Vaucheria %	Vauch Bio	S. patens %	S. patens Bio	J. gerardii %	J. gerardii Bio
8/19/16	ADAMS POINT	A	0.0	0.0625	2	0.29			40	3.97																				
8/19/16	ADAMS POINT	B	0.0	0.0625	2	0.09			10																					
8/19/16	ADAMS POINT	C	0.0	0.0625	1	0.16			50	0.28											49	6.95								
8/19/16	ADAMS POINT	A	0.5	0.0625											20	4														
8/19/16	ADAMS POINT	B	0.5	0.0625							25	18.41			55	39.67														
8/19/16	ADAMS POINT	C	0.5	0.0625							60	53.68			5	2.32														
8/19/16	ADAMS POINT	A	1.0	0.0625											5	0.52														
8/19/16	ADAMS POINT	B	1.0	0.0625							10	2.45			25	6.66														
8/19/16	ADAMS POINT	C	1.0	0.0625							10	4.38			70	29.26														
8/19/16	ADAMS POINT	A	1.5	0.0625							20	27.39			1	0.47							59	18.65						
8/19/16	ADAMS POINT	B	1.5	0.0625							10	8.46			60	24.69							20	3.74						
8/19/16	ADAMS POINT	C	1.5	0.0625							95	136.54			2	2.91							3	0.32						
8/22/16	HILTON PARK	A	0.0	0.0625					3	0.04																				
8/22/16	HILTON PARK	B	0.0	0.0625					5	2.83																				
8/22/16	HILTON PARK	C	0.0	0.0625					25	0.74																				
8/22/16	HILTON PARK	A	0.5	0.0625	0.5	0.03	1	0.01	0.5	0.09	97	176.13																		
8/22/16	HILTON PARK	B	0.5	0.0625	1	0.01	2	0.005	5	0.03	10	2.71																		
8/22/16	HILTON PARK	C	0.5	0.0625					5	0.41	50	20.89																		
8/22/16	HILTON PARK	A	1.0	0.0625	0.5	NA	2	0.06	15	0.98	1	0.51			19	7.35														
8/22/16	HILTON PARK	B	1.0	0.0625	1	0.02	3	0.02	40	3.34																				
8/22/16	HILTON PARK	C	1.0	0.0625	3	0.08	1	0.01	35	4.46	1	0.12									25	0.03								
8/22/16	HILTON PARK	A	1.5	0.0625			15	2.67							1	0.06							60	11.26	5	NA				
8/22/16	HILTON PARK	B	1.5	0.0625			5	0.12	0.5	0.08													60	9.08	25	1.57				
8/22/16	HILTON PARK	C	1.5	0.0625	1	NA	3	0.01	0.5	0.02					2	0.08							6	1.11	20	1.67				
8/22/16	HILTON PARK	A	2.0	0.0625					2	0.13													30	6.39	50	0.45				
8/22/16	HILTON PARK	B	2.0	0.0625							40	76.05			0.5	0.57							50	31.41	10	NA				
8/22/16	HILTON PARK	C	2.0	0.0625									45	64.58	5	1.45							49	41.75	0.5	0.03				
8/22/16	DEPOT ROAD	A	0.5	0.0625					0.5	NA																				
8/22/16	DEPOT ROAD	B	0.5	0.0625	0.5	0.85			89	44.8											10	0.39								
8/22/16	DEPOT ROAD	C	0.5	0.0625	8	0.23	0.5	NA	5	0.64																				
8/22/16	DEPOT ROAD	A	1.0	0.0625					5	0.5			95	130.31																
8/22/16	DEPOT ROAD	B	1.0	0.0625	1	NA			2	0.09					20	6.35														
8/22/16	DEPOT ROAD	C	1.0	0.0625	2	NA			2	0.02					50	13.06							5	2.37						
8/22/16	DEPOT ROAD	A	1.5	0.0625							100	155.51																		
8/22/16	DEPOT ROAD	B	1.5	0.0625					0.05	0.13					10	1.17							80	132.52						
8/22/16	DEPOT ROAD	C	1.5	0.0625											30	18.91							15	33.73						
8/23/16	FOUR TREE ISLAND	A	0.0	0.0625	0.5	0.01	60	0.06													10	0.11								
8/23/16	FOUR TREE ISLAND	B	0.0	0.0625																										
8/23/16	FOUR TREE ISLAND	C	0.0	0.0625			6	0.06													1	0.01								
8/23/16	FOUR TREE ISLAND	A	0.5	0.0625											3	0.83														
8/23/16	FOUR TREE ISLAND	B	0.5	0.0625																										
8/23/16	FOUR TREE ISLAND	C	0.5	0.0625											10	2.29														
8/23/16	FOUR TREE ISLAND	A	1.0	0.0625											7	2.24														
8/23/16	FOUR TREE ISLAND	B	1.0	0.0625	0.5	0.01							5	2.08	6	1.73							20	13.2						
8/23/16	FOUR TREE ISLAND	C	1.0	0.0625									15	4.23	20	3.87							20	10.36						
8/23/16	FOUR TREE ISLAND	A	1.5	0.0625	0.05	0.02					10	5.45			15	15.6							30	9.46						
8/23/16	FOUR TREE ISLAND	B	1.5	0.0625									1	0.41	65	47.72							35	28.42						
8/23/16	FOUR TREE ISLAND	C	1.5	0.0625							5	7.73	10	34.06	45	37.75							40	31.48						
8/23/16	FOUR TREE ISLAND	A	2.0	0.0625											0.5	0.29							60	37.61	10	0.18				
8/23/16	FOUR TREE ISLAND	B	2.0	0.0625									5	2.92	0.5	0.14							35	18.81			40	5.21		
8/23/16	FOUR TREE ISLAND	C	2.0	0.0625									1	0.16									45	11.95	20	0.06				
8/23/16	FOUR TREE ISLAND	A	2.5	0.0625																										
8/23/16	FOUR TREE ISLAND	B	2.5	0.0625							0.5	0.72			15	7.96														
8/23/16	FOUR TREE ISLAND	C	2.5	0.0625																										
8/31/16	SUNSET HILL FARM	A	0.75	0.0625					1	NA																				
8/31/16	SUNSET HILL FARM	B	0.75	0.0625					2	0.03																				
8/31/16	SUNSET HILL FARM	C	0.75	0.0625					5	0.16																				
8/31/16	SUNSET HILL FARM	A	1.00	0.0625					35	1.59													15	NA						
8/31/16	SUNSET HILL FARM	B	1.00	0.0625					1	0.02																				
8/31/16	SUNSET HILL FARM	C	1.00	0.0625					2	0.12																				
8/31/16	SUNSET HILL FARM	A	1.50	0.0625																			65	53.17						
8/31/16	SUNSET HILL FARM	B	1.50	0.0625																			60	164.04						
8/31/16	SUNSET HILL FARM	C	1.50	0.0625																			60	51.58						

Appendix C: Site Descriptions

The macroalgal sampling site at Four Tree Island lies east of the causeway between boulder fields on the island and a point on Peirce Island to the east. Access is provided by the adjacent parking lot. The water depth shallows above mean lower low water (MLLW, 0.0 m elevation) into a broad mudflat with coarsening sediments as elevations rise above 0.5 m elevation and flats begin to grade into a low marsh with *Spartina alterniflora* at 1.0 m. Low marsh dominated the next two elevations at 1.5 and 2.0 m, and then high marsh dominated by *Spartina patens* (2.5 m) occurred at the uppermost samples.

The sampling area at Dover Point lies on the northeast side of the point on the Piscataqua River, approximately 200 meters north of the boat launch about 50 meters north of the northernmost portion of Hilton Park and its parking area. The shore is characterized by subtidal boulders (0.0 m) grading into a narrow intertidal mudflat (0.5 and 1.0 m) with scattered rocks before a short step (at 1.5 m) up to low marsh (sampled at 2.0 m). Since trees shade out the uppermost portion of a fringing marsh that adjoins vertical rocky outcrop, only unvegetated areas were evident at 2.5 m and so this elevation was not sampled.

The transects at Cedar Point lie on the south side with their upper elevations close to the parking lot (southwest corner of the Scammel Bridge), which is above a steep bedrock embankment (access to the shore is provided by stairs). Subtidal mud bottom slopes steeply up to the edge of the intertidal at 0.0 m elevation MLLW and the mudflats continue at 0.5 and 1.0 elevations, where the sediments coarsen as a narrow band of low marsh is approached. The marsh is sampled at 1.5 meters in elevation. A rocky outcrop extends shore-normal between the second and third transects that is colonized by fucoid algae.

The sampling site at Wagon Hill Farm lies just north of the artificial beach created and maintained by the Town of Durham as part of the park. Access to the site from the main lot occurs by heading eastward across several fields to the shore. The transects run across a wide mudflat from intertidal elevations (0.0, 0.5 and 1.0 m MLLW) to a narrow fringing marsh (1.5 m) that is shaded by overhanging trees and shows strong signs of erosion. The third, northernmost, transects runs into a derelict pier characterized as a crib-construction and filled by cobble and larger rock, with fucoid algae attached to some of the exposed rock.

Along the southern shoreline of Adams Point lies the three sampling transects that extend south toward the Footman Islands. Access to the site is provided by state-maintained walking trails and wooden steps constructed along the steep embankment of shale bedrock. Fringing marsh is discontinuous at the site, occurring between coarse shale 'beach'. The edge of the intertidal is characterized by small boulders and rocks (at 0.0 m elevation) that grade up into mudflat interspersed with rocks (0.5 and 1.0 m), often colonized by fucoid algae (primarily *Fucus vesiculosus*). At 1.5 m there can either be a fringing marsh or unconsolidated shale.

Land holdings of The Nature Conservancy (TNC) extend from the middle of Lubberland Creek north through the extensive salt marsh and several points and islands. The sampling location is accessed through a TNC trail that begins on the opposite side of Bay Road from their trail head parking lot. As the trail approaches the shoreline and salt marsh, strike off toward the shore and continue along the shore until a large mowed field extending to the marsh edge is reached. Three transects extend across the marsh into a broad very flat mudflat that extends into the Bay between a point and island. One sample set is collected from the mudflat (0.5 m elevation), another just as the low marsh is reached (1.0 m), and a final set is located in the low marsh (1.5 m). An osprey platform with active nest is located in the adjacent upland field and so sampling should be restricted to mid-July or later to avoid disrupting any fledglings.

The Great Bay National Estuarine Research Reserve (GBNERR) has as its headquarters at the Sandy Point Discovery Center located on the southern shore of Great Bay. The transects are located from the GBNERR kayak launch extending westward and accessed by the adjacent parking lot. The mud flats are flat and broad and the 0.0 m elevation could not be accessed by walking across the mudflat (beyond 1 km), and so the three transects began at 0.05 m elevation where the mudflat began to slope upward. The 1.0 elevation was also in mudflat but within 10 meters of a fringing marsh and the 1.5 m elevation was in low marsh at the two western transects and on a rock pile adjacent to the launch for the eastern transect.

On the eastern shore of Great Bay, extensive mudflats grade into fringing salt marsh before the land rises into uplands that were historically farmed. One farm (Sunset Hill) in Newington has been set aside for conservation by the NH Fish and Game. This site has shorelines adjacent to mown fields and knobs of bedrock that show rocky outcrops along the shoreline. The private site is accessed by permission from NH Fish and Game and the first transect has its highest elevation near a derelict crib construction pier. The remaining two shore normal transects are found to the north. Similar to the Lubberland Creek and Depot Road sites, mean low water could not be reached on foot and the lowest elevation was chosen at 0.75 above MLLW, approximately 100 m seaward of the continuous edge of the low marsh (tiny marsh islands were common, but very few extended lower than 0.75 m elevation). The sampling sites at 1.0 m elevation were also in mudflat, but close to the continuous low marsh, where the 1.5 m samples were collected.