

## Supplementary Materials

**Table S1**

Spearman correlation coefficients and significance levels for the following correlations between the various environmental and biogeochemical parameters for the three substrate types.

Substrate Type	Variables	Spearman Correlation Coefficient ( <i>r</i> )	Significance Level ( <i>p</i> )
<i>T. testudinum</i>	Porewater NH <sub>4</sub> <sup>+</sup> ~ Porewater H <sub>2</sub> S	+0.69	0.01
<i>T. testudinum</i>	Seagrass Areal Cover ~ Porewater H <sub>2</sub> S	+0.70	0.01
<i>T. testudinum</i>	Surface Irradiance ~ Porewater H <sub>2</sub> S	+0.67	0.01
<i>T. testudinum</i>	Temperature ~ Porewater H <sub>2</sub> S	+0.67	0.01
<i>T. testudinum</i>	Salinity ~ Porewater H <sub>2</sub> S	+0.50	0.10
<i>T. testudinum</i>	Dissolved Oxygen ~ Porewater H <sub>2</sub> S	-0.53	0.05
<i>T. testudinum</i>	Surface Irradiance ~ Nitrogen Fixation	-0.50	0.10
<i>T. testudinum</i>	Temperature ~ Nitrogen Fixation	-0.61	0.05
<i>T. testudinum</i>	Dissolved Oxygen ~ Nitrogen Fixation	+0.53	0.10
<i>H. wrightii</i>	Surface Irradiance ~ Porewater H <sub>2</sub> S	+0.51	0.10
<i>H. wrightii</i>	Temperature ~ Porewater H <sub>2</sub> S	+0.49	0.10
<i>H. wrightii</i>	Seagrass Areal Cover ~ Porewater H <sub>2</sub> S	+0.54	0.05
<i>H. wrightii</i>	Porewater N:P ~ Nitrogen Fixation	-0.54	0.10
Unvegetated	Porewater NH <sub>4</sub> <sup>+</sup> ~ Porewater H <sub>2</sub> S	+0.87	0.01
Unvegetated	Porewater DIP ~ Porewater H <sub>2</sub> S	+0.89	0.01
Unvegetated	Porewater H <sub>2</sub> S ~ Nitrogen Fixation	+0.54	0.10
Unvegetated	Surface Irradiance ~ Nitrogen Fixation	+0.48	0.10
Unvegetated	Salinity ~ Nitrogen Fixation	+0.50	0.10

**Table S2**

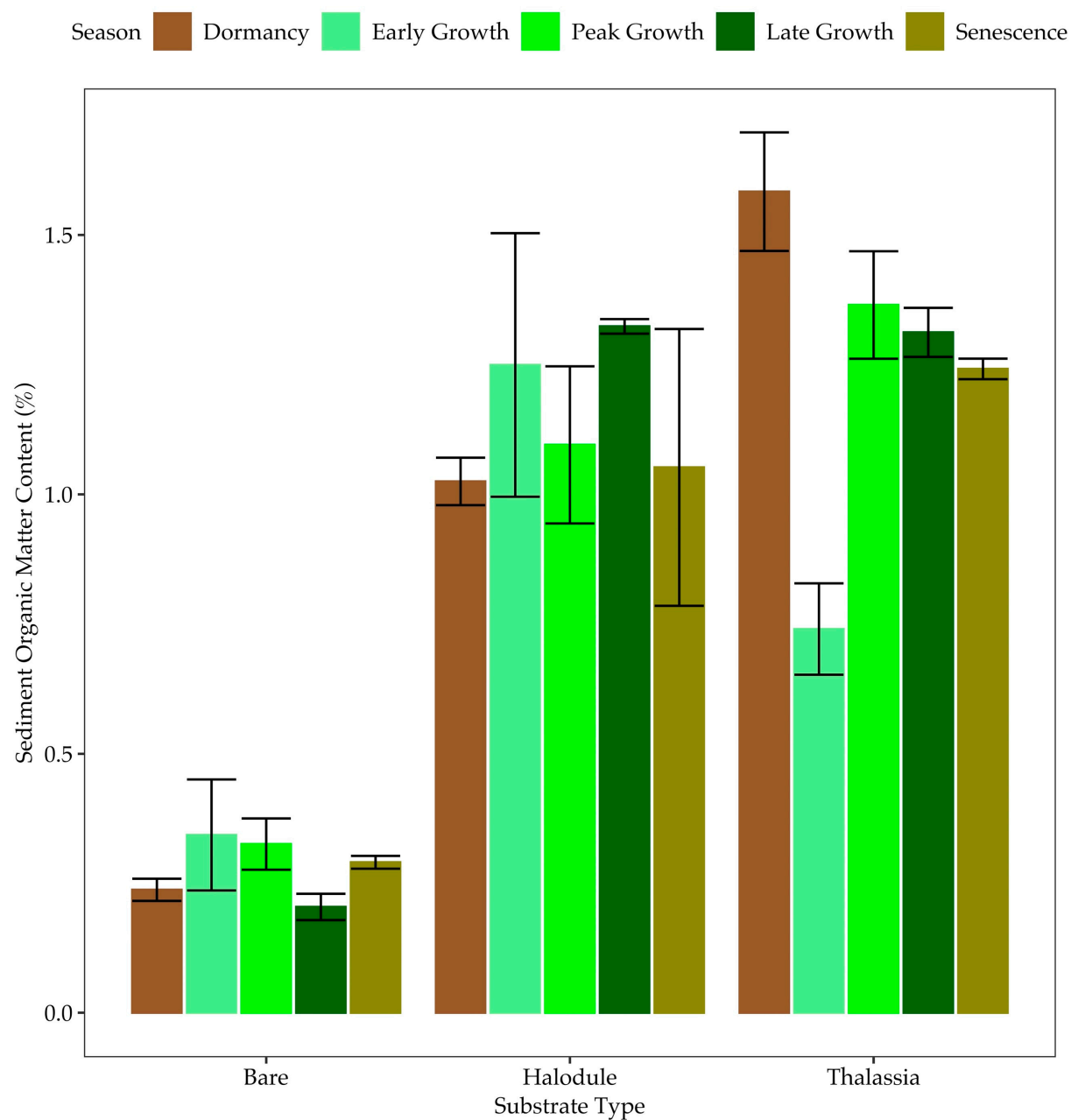
Eigenvalues for principal components calculated by R for the PCA biplot found in Figure 7, the percent variation explained by each principal component, and the total cumulative percent variation explained by eigenvectors.

Principal Component	Eigenvalues	Percent Variation	Cumulative Percent Variation
1	4.64	27.3	27.3
2	3.60	21.2	48.5
3	2.12	12.5	61.0
4	1.71	10.1	71.0
5	1.14	6.72	77.7

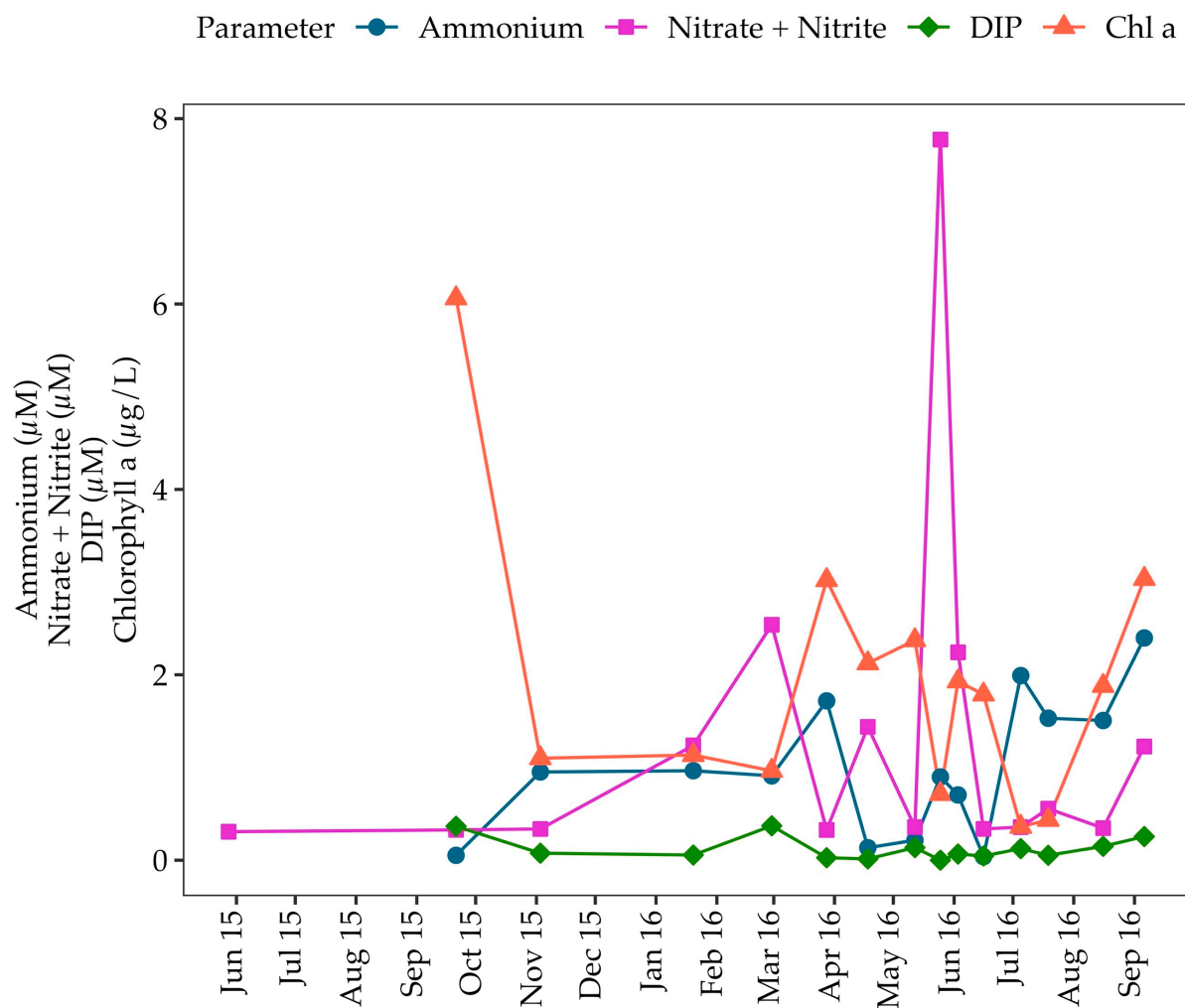
**Table S3**

Contributions of each variable represented in Figure 7 to PC1 and PC2.

Variable	Principal Component 1	Principal Component 2
Porewater N:P	0.279	-0.286
Dissolved Oxygen (mg L <sup>-1</sup> )	0.228	0.274
Chlorophyll <i>a</i> (µg L <sup>-1</sup> )	0.018	-0.068
Porewater NH <sub>4</sub> <sup>+</sup> (µM)	0.018	-0.351
Water Column DIP (µM)	0.011	0.017
pH	-0.006	0.025
Water Column NO <sub>3</sub> +NO <sub>2</sub> (µM)	-0.010	0.019
Nitrogen Fixation Rate (mg N m <sup>-2</sup> d <sup>-1</sup> )	-0.063	0.314
Water Column NH <sub>4</sub> <sup>+</sup> (µM)	-0.068	-0.172
Surface Irradiance (%)	-0.261	-0.341
Salinity (PSU)	-0.281	-0.341
Temperature (°C)	-0.295	-0.379
Porewater DIP (µM)	-0.302	0.095
Percent Organic Matter (%)	-0.345	0.306
Percent Water (%)	-0.366	0.257
Percent Areal Cover (%)	-0.372	0.181
Porewater H <sub>2</sub> S (µM)	-0.380	-0.083



**Figure S1.** Sediment organic matter content during major periods of the seagrass growth cycle. Error bars represent the standard error of the mean.



**Figure S2.** Water column chlorophyll *a* ( $\mu\text{g L}^{-1}$ ), ammonium ( $\mu\text{M}$ ), nitrate and nitrite ( $\mu\text{M}$ ) and DIP ( $\mu\text{M}$ ) concentrations from September 2015 through September 2016 at Big Sabine Point.