

Environmental influences on growth and morphology of *Thalassia testudinum*

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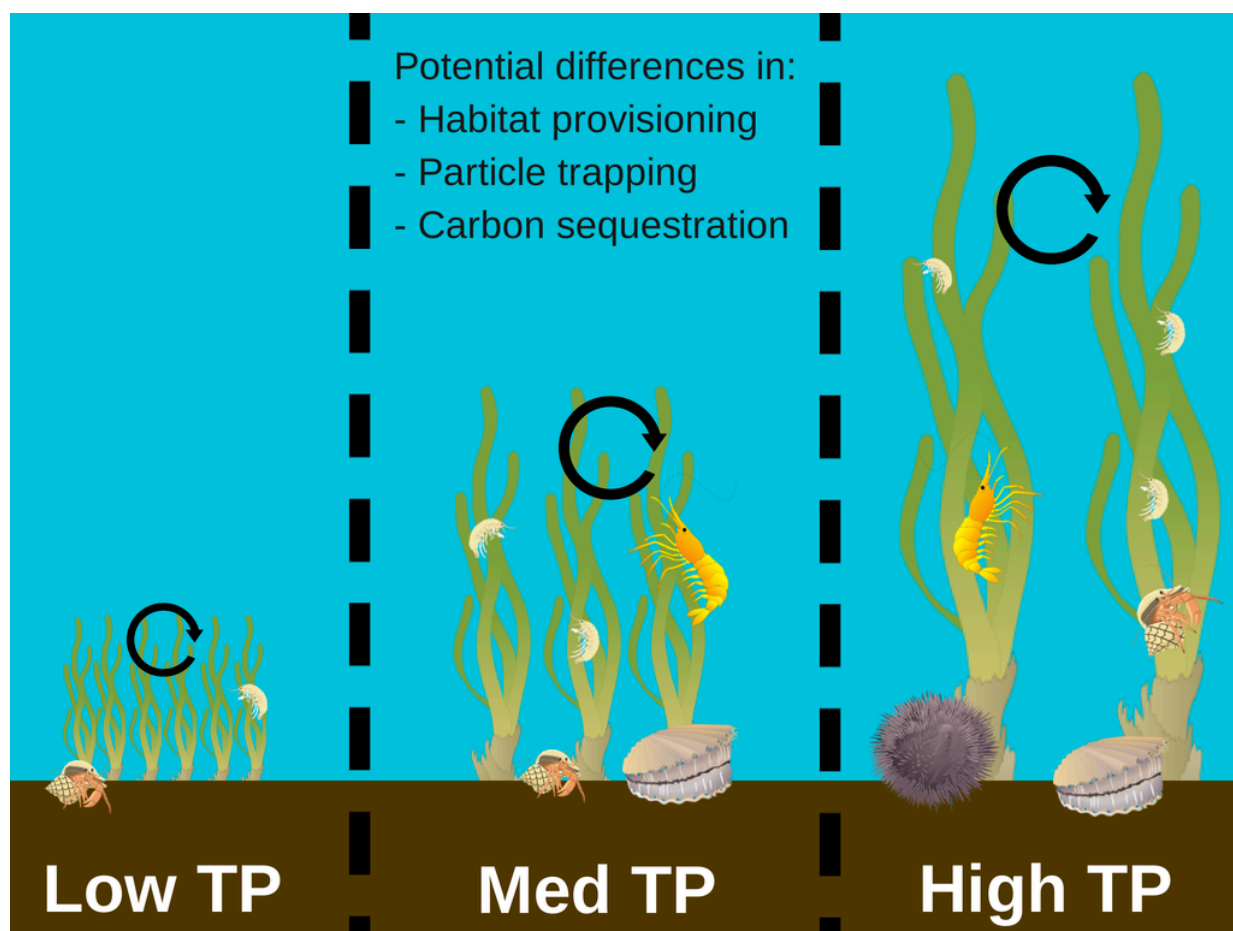


Figure S1. Conceptual diagram illustrating the general increase in *Thalassia testudinum* shoot height, leaf length, leaf width, and leaf area shoot⁻¹ and decrease in shoot density along a gradient of total phosphorus (TP) concentrations. These differences in aboveground structure are hypothesized to influence associated ecosystem services such as habitat provisioning (represented by various creatures), turbidity reduction and carbon sequestration (represented by curved arrows). Drawing not to scale. Animal and grass image credits: Chip Chenery, Tracy Saxby, Sander Scheffers, and Dieter Tracey, IAN Image Library (<http://ian.umces.edu/imagelibrary>).

Table S1. Results from ANCOVA with a) shoot height, b) leaf area, and c) shoot density as the dependent variable, 24-month moving average TP as the independent variable, and sampling event as a covariate. Asterisks indicate significance level (***) = <0.001, ** = <0.01, * = <0.05)

a) Ln Shoot Height	Estimate	p	
Base Intercept – Spring 2010	3.389	<0.001	***
Base Slope – Spring 2010	0.123	0.003	**
Intercept - Summer 2010	0.446	0.594	
Intercept - Spring 2011	0.215	0.773	
Intercept - Summer 2011	0.778	0.331	
Intercept - Spring 2012	1.139	0.135	
Intercept - Summer 2012	1.001	0.164	
Intercept - Summer 2013	1.232	0.093	
Slope - Summer 2010	-0.020	0.726	
Slope - Spring 2011	-0.020	0.673	
Slope - Summer 2011	-0.056	0.261	
Slope - Spring 2012	-0.115	0.018	*
Slope - Summer 2012	-0.068	0.145	
Slope - Summer 2013	-0.048	0.307	
b) Log ₁₀ Blade Area	Estimate	p	
Base Intercept – Spring 2010	3.097	<0.001	***
Base Slope – Spring 2010	0.058	0.057	
Intercept - Summer 2010	-0.064	0.920	
Intercept - Spring 2011	-0.055	0.923	
Intercept - Summer 2011	0.255	0.677	
Intercept - Spring 2012	0.352	0.542	
Intercept - Summer 2012	0.417	0.445	
Intercept - Summer 2013	-0.257	0.641	
Slope - Summer 2010	0.002	0.960	
Slope - Spring 2011	0.001	0.972	
Slope - Summer 2011	-0.028	0.461	
Slope - Spring 2012	-0.057	0.117	
Slope - Summer 2012	-0.027	0.440	
Slope - Summer 2013	-0.012	0.735	
c) Shoot Density	Estimate	p	
Base Intercept – Spring 2010	957.72	0.002	**
Base Slope – Spring 2010	-36.96	0.051	
Intercept - Summer 2010	-286.90	0.480	
Intercept - Spring 2011	-87.76	0.812	
Intercept - Summer 2011	-208.36	0.582	
Intercept - Spring 2012	-80.83	0.875	
Intercept - Summer 2012	-248.77	0.461	
Intercept - Summer 2013	-38.78	0.909	
Slope - Summer 2010	14.19	0.604	
Slope - Spring 2011	8.35	0.713	
Slope - Summer 2011	13.23	0.571	
Slope - Spring 2012	-5.71	0.918	
Slope - Summer 2012	13.51	0.538	
Slope - Summer 2013	9.17	0.679	

Table S2. Results from the multivariate Biota and Environment Matching (BEST) analysis in PRIMER 6. Rank correlation method: Spearman, method: BIOENV, maximum number of variables: 5, resemblance analysed between samples using Bray-Curtis similarity on range-normalized data matrices.

Water Quality Variables

- 1 TP
- 2 TN
- 3 Temp
- 4 Sal
- 5 pH
- 6 Color
- 7 Chl
- 8 I₀%

Global Test Results

Sample statistic (Rho): 0.63

Significance level of sample statistic: 1%

Number of permutations: 99 (Random sample)

Number of permuted statistics greater than or equal to Rho: 0

Best results

No. Variables	Correlation	Variables Selected
2	0.630	1,7
3	0.629	1,6,8
4	0.625	1,6-8
3	0.614	1,6,7
4	0.598	1,5,6,8
4	0.593	1,5-7
3	0.592	1,5,6
5	0.591	1,4-6,8
2	0.589	6,7
5	0.585	1,5-8

Correlation Table for Water Quality Variables	TP	TN	Depth	Temp	Sal	pH	DO	Color	Chl	K _d
TP										
TN	0.47									
Depth	-0.21	-0.33								
Temp	-0.04	-0.29	-0.23							
Sal	0.09	-0.50	-0.15	0.79						
pH	-0.44	0.20	0.34	0.14	-0.08					
DO	0.41	0.15	-0.71	0.44	0.47	-0.23				
Color	0.92	0.39	-0.35	-0.10	0.08	-0.64	0.35			
Chl	0.98	0.58	-0.20	-0.08	0.06	-0.30	0.42	0.88		
K _d	0.72	0.25	-0.67	0.32	0.50	-0.44	0.83	0.70	0.71	
I _z	-0.52	0.05	-0.70	0.19	0.04	0.15	0.36	-0.40	-0.47	0.10
I ₀ %	-0.48	0.01	-0.75	0.25	0.08	0.07	0.39	-0.33	-0.46	0.13

Table S3. Reported values for stable nitrogen and carbon isotope ratios ($\delta^{15}\text{N}$ and $\delta^{13}\text{C}$) for *Thalassia testudinum* leaf tissue (updated from Fourqurean et al. 2005).

Location	$\delta^{15}\text{N}$	$\delta^{13}\text{C}$	Reference
Northwest Florida			
Big Lagoon, Florida & Mobile Bay, Alabama	4.77 to 7.17	-10.45 to -10.21	Prado et al. 2012
St. Joseph Bay, Florida	4.1	-10.2	Marco-Mendez et al. 2012
St. Joseph Bay, Florida	5.6	-7.7	Vander Zanden et al. 2013
<i>Northeast Florida</i>			
Indian River Lagoon, Florida	3.7	-14.6	Vaslet et al. 2012
<i>Southwest and Central Florida</i>			
Central Gulf Coast	-4.9 to 2.7	-16.6 to -11.2	present study
Tampa Bay		-9.6 to -11.0	Durako & Hall 1992
<i>South Florida</i>			
Florida Bay	2.8 to 3.2	-7.5 to -6.5	Behringer & Butler 2006
Florida Bay	-1.0 to 9.4		Corbett et al. 1999
Florida Bay	6	-10.7	Fourqurean & Schrlau 2003
Florida Bay	3.4	-13.6	Harrigan et al. 1989
Florida Bay	5.3 to 5.9	-9.1 to -8.5	Orem et al. 1999
Florida Bay		-9.9 to -6.9	Williams et al. 2009
Florida Keys	-2.2 to 5.4	-13.0 to -5.3	Campbell & Fourqurean 2009
Florida Keys	1.9	-10.5	Lamb et al. 2012
Florida Keys		-12.5	McMillan et al. 1980
Florida Keys	5.5	-10.5	Schwamborn & Criales 2000
Florida Keys	2.3	-14.0	Vaslet et al. 2012
South Florida	-1.2 to 3.7	-12.3 to -6.1	Anderson & Fourqurean 2003
South Florida		-15.3 to -8.7	Fleming et al. 1990
South Florida	-4.3 to 9.4	-13.5 to -5.2	Fourqurean et al. 2005
South Florida		-16.3 to -7.3	Lin et al. 1991
South Florida	1.9 to 3.2	-14 to -7.0	Zieman et al. 1984
<i>Range for Florida</i>	-4.3 to 9.4	-16.3 to -6.1	
<i>Other locations</i>			
Bahamas Bank		-4.9 to -9.7	Burdige et al. 2010
Great Inagua, Bahamas	0.4 to 1.8	-7.1 to -6.4	Vander Zanden et al. 2013
Belize	2.97	-6.34	Abed-Navandi & Dworschak 2005
Belize		-12.3 to -11.1	Ambler et al. 1994
Belize	1.4	-16.0	Vaslet et al. 2012
Jamaica	4.3	-11.1	Macko et al. 1981
Nicaragua	3.5	-13.2	Macko et al. 1981
Nicaragua	2.6 to 4.3	-10.4 to -7.8	Vander Zanden et al. 2013
Panama	2.45 to 3.58		Carruthers et al. 2005b
Puerto Rico	1.82	-8.51	Olsen et al. 2010
St. Croix, U.S. Virgin Islands		-10.0 to -9.9	McMillan et al. 1980
Texas		-9.04	Benedict & Scott 1976
Texas		-11.4	Benedict et al. 1980
Texas		-8.9	Fry & Parker 1979
Texas	2.9 to 5.7		Fry et al. 1987
Texas		-10.8	Jones et al. 2003
Texas	3.9	-8.9	Macko et al. 1981
Texas		-11.0 to -8.3	McMillan et al. 1980
Veracruz, Mexico		-10.9	McMillan et al. 1980
Yucutan, Mexico	1.7 to 9.1		Carruthers et al. 2005a
Yucutan, Mexico	5.0 to 8.0		Mutchler et al. 2007
Yucutan, Mexico	3.4 to 8.0		Mutchler et al. 2010
Yucutan, Mexico	0.2 to 10.8		Sánchez et al. 2013
<i>Range of all values</i>	-4.3 to 10.8	-16.3 to -6.1	

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