Ulva additions alter soil biogeochemistry and negatively impact *Spartina alterniflora* growth

E. B. Watson*, C. Wigand, A. J. Oczkowski, K. Sundberg, D. Vendettuoli, S. Jayaraman, K. Saliba, J. T. Morris

*Corresponding author: elizabeth.b.watson@gmail.com

Marine Ecology Progress Series 532: 59–72 (2015)

Supplement 1

H_1: There are differences between mean monthly porewater ammonium or phosphate concentrations from 10-25 cm of depth or peak *Spartina alterniflora* biomass or productivity data collected at Law's Point (unfertilized plots), PIE for the 2011 and 2012 growing seasons.

H_0: There are no differences between mean monthly porewater ammonium concentrations from 10-25 cm of depth or peak *Spartina alterniflora* biomass data collected at Law's Point (unfertilized plots), PIE for the 2011 and 2012 growing seasons.

Type I Error rate: α=0.05

Data table: 95% CI of mean

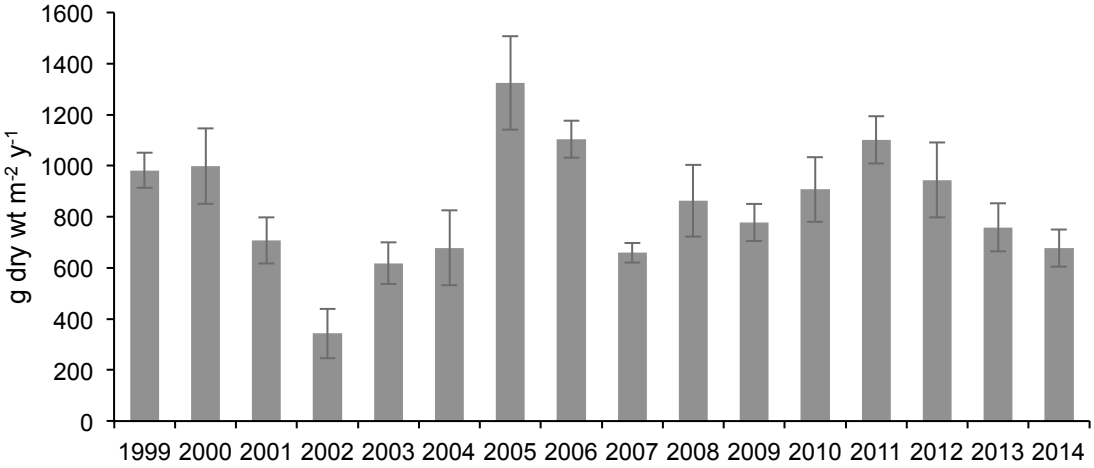
	Peak biomass ($g\ m^{-2}$)	Productivity ($g\ m^{-2}\ yr^{-1}$)	NH_4^+ (μM)	PO_4 (μM)
2011	317-861	874-1329	46.8-69.2	3.9-5.5
2012	643-925	584-1303	48.7-60.3	4.6-6.0

Although 2012 had a trend towards less biomass, the variability fell within the 95% confidence intervals. Additionally, examination of long term biomass and productivity from data from co-located plots suggest that while 2012 was lower than 2011, these years were not extremely different relative to long-term variability and trends. Error bars show SEM. In addition, no differences were found between 2011 and 2013 porewater nutrient data from co-located unfertilized plots.

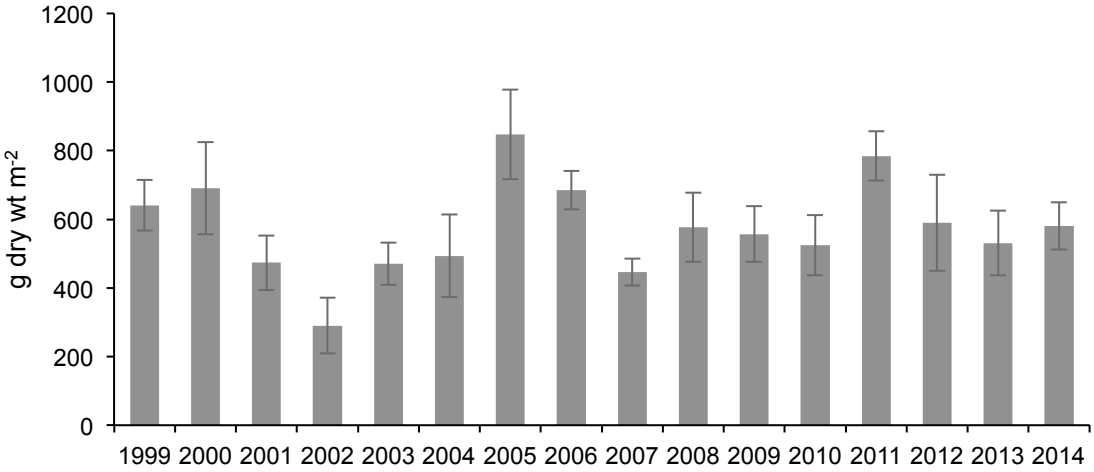
The null hypothesis could not be rejected.

Raw data is available from:
http://ecosystems.mbl.edu/pie/data/lte/LTE-MPDescription.htm

Aboveground *S. alterniflora* production at Law's Point plots



Peak aboveground *S. alterniflora* biomass at Law's Point plots



Supplement 2

Tracer Calculations

The enrichment of ^{15}N in mesocosm pots and above and belowground biomass was calculated using a mass balance approach as the absolute abundance of ^{15}N frequency in terms of *atom%* (Currie 2007) (Eqn. 1), converted to *atom % excess* by subtracting the *atom %* in background samples ($atom\ \%\ ^{15}N_b$) from amended samples ($atom\ \%\ ^{15}N_a$) (Eqn. 2). Excess ^{15}N concentration was calculated as the product of *atom % excess* ^{15}N and N pool concentration in mg g^{-1} dry weight. Tracer recovery in mesocosm soils was computed as the product of the excess ^{15}N concentration, soil bulk density, and soil volume (Eqn. 4). Tracer recovery in above and belowground biomass pools was computed as the product of the excess ^{15}N concentration and biomass weights (Eqn. 5). Tracer percent recovery was calculated as the ratio of tracer recovered to the amount added in ecosystem pool (C_i) at time (t), where $N_{C_i}(t)$ is the amount of nitrogen in pool (C_i) at time (t), and $A(t - t_0)$ is the sum of nitrogen amendments, and the subscripts a and b denote amendment and background, respectively (Currie 2007). Soil ^{15}N tracer loss for soil over the duration of the experiment was calculated as the difference between the weight of tracer added and the weight of the tracer recovered, divided by the weight of the tracer added (Eqn. 7).

$$atom\ \%\ ^{15}N = [^{15}N]/[^{14}N + {}^{15}N]100 \tag{1}$$

$$atom\ \%\ excess\ ^{15}N = atom\ \%\ ^{15}N_a - atom\ \%\ ^{15}N_b \tag{2}$$

$$mg\ excess\ ^{15}N\ g_{dw}^{-1} = atom\ \%\ excess\ ^{15}N \times mg\ N g_{dw}^{-1} \tag{3}$$

$$soil\ ^{15}N\ tracer\ recovery = excess\ ^{15}N\ concentration \times soil\ bulk\ density \times soil\ volume \tag{4}$$

$$biomass\ ^{15}N\ tracer\ recovery = \ excess\ ^{15}N\ concentration \times dry\ plant\ weight \tag{5}$$

$$percent\ recovery\ ^{15}N(C_i, t) = \left[\frac{N_{C_i}(t)\left(atom\ \%\ ^{15}N_{c_i}(t) - atom\ \%\ ^{15}N_b\right)}{A(t - t_0)(atom\ \%\ ^{15}N_a - atom\ \%\ ^{15}N_b)}\right] \tag{6}$$

$$percent\ loss\ ^{15}N(C_i, t) = \left[\frac{\left(A(t - t_0)(atom\ \%\ ^{15}N_a - atom\ \%\ ^{15}N_b)\right) - \left(N_{C_i}(t)\left(atom\ \%\ ^{15}N_{c_i}(t) - atom\ \%\ ^{15}N_b\right)\right)}{A(t - t_0)(atom\ \%\ ^{15}N_a - atom\ \%\ ^{15}N_b)}\right] \tag{7}$$