The following supplement accompanies the article

Foliar DMSO:DMSP ratio and metal content as indicators of stress in *Spartina alterniflora*

Caroline R. McFarlin, Merryl Alber*

Department of Marine Sciences, University of Georgia, Athens, Georgia 30602, USA

*Corresponding author. Email: malber@uga.edu

Marine Ecology Progress Series 474: 1–13 (2013)

Supplement. Measurements of DMSP and DMSO concentrations in the roots of *Spartina alterniflora*, and a compilation of the range of literature values of tissue metal concentrations

Table S1. *Spartina alterniflora.* Mean (SE) concentration of root DMSP and DMSO (µmol g^{-1} fresh weight) and the DMSO:DMSP ratio in samples (N) collected in healthy, edge, and affected zones at dieback, horse, and snail sites (see 'Materials and methods' in the main text for details of the disturbance types). Roots from wrack sites were unavailable for analysis. The highest mean concentrations per zone are shown in **bold**, in order to highlight trends

Disturbance type	Zone	DMSP		DMSO		DMSO:DMSP	
		Mean (SE)	N	Mean (SE)	N	Mean (SE)	N
Dieback	Affected	0.09 (0.012)	6	0.01 (0.01)	6	**0.93 (0.02)**	6
	Edge	0.91 (0.15)	8	0.22 (0.06)	8	0.66 (0.05)	8
	Healthy	**1.55 (0.32)**	8	**0.22 (0.11)**	8	0.51 (0.05)	8
Horse	Affected	0.69 (0.12)	10	0.21 (0.06)	10	**0.43 (0.15)**	10
	Edge	0.83 (0.17)	10	0.09 (0.03)	10	0.11 (0.02)	10
	Healthy	**1.15 (0.19)**	10	**0.34 (0.07)**	10	0.39 (0.11)	10
Snail	Affected	0.74 (0.31)	8	0.14 (0.04)	8	0.78 (0.10)	8
	Edge	0.96 (0.21)	8	**0.90 (0.64)**	8	**0.96 (0.29)**	8
	Healthy	**1.10 (0.19)**	8	0.74 (0.41)	8	0.87 (0.21)	8

Table S2. *Spartina alterniflora.* Reported means and ranges (μg g^{-1} dry weight) of tissue elemental composition in leaves of *S. alterniflora* (unless otherwise noted). Concentrations were taken from experimental control plants or from plants in natural field settings where possible, unless otherwise noted. NC: North Carolina, GA: Georgia, SC: South Carolina, LA: Louisiana, NJ: New Jersey

Source, location	Al	As	B	Ba	Ca	Cd	Co	Cr	Cu	Fe	K	Mg	Mn	Na	Ni	P	Pb	Si	Sr	Zn
Broome et al. (1975), NC					3100–3200					530–702	7700–9500	2900–3400	20–31	22900–25000		900–1200				
Gallagher (1975), GA			5–12		700–2100				5–14		6300–11200	4300	26–55			1400–1600			15–24	12–38
Linthurst (1979), NC					1500–3000				5–12	221–555	10200–14300	2400–3000	28–141	17000–20000		1100–1200				20–53
Gallagher et al. (1980), GA					~1500					~650	~10000	~3700	~110			~1700				
Linthurst & Seneca (1981), NC[a]					2500–3400				5–13	99–250	12100–14400	3000–4000	30–74	17000–21400		1800–2200				17–30
Broome et al. (1986), NC					2500					623	7800	4660	36	29500		900				
Ornes & Kaplan (1989), SC					2200–2600						12300–12900	3500				1600–1900				
Alberts et al. (1990), GA	119–471								4.2–6.0	128–385			30–103							6–14
Bradley & Morris (1991)					1603–2004						8602–14706	4133–8509		117708						
Ornes et al. (1998), SC	200–5000		2–10						0.25–8	200–1750			20–125							3–25
Carbonell et al. (1998), LA		0.25–0.5			3600						18330	2230		4720		2630				
Hester et al. (2002), LA[b]				~6–15																
Windham et al. (2003), NJ								1.25–4.0	3.7–6.5								0.75–3.10			22–40
White (2004), GA	1542				3385					939	9470	4774	257	9551		1667		2477	51,6	
Mahon & Carman (2008), LA								~0.5–1.0	~5–8						~2–5					~10–40
Hempel et al.						0.1–		<0.02	4–37	182–			857		2–5		<0.12–			18–

(continues)

(2008), Argentina[c]						0.8				510							2.1			103
Salla et al. (2011), LA								2.0–4.0	6.0–8.0	310–920							0.5–3.0			26–42
Cambrollé et al. (2011), Spain[d]							<0.1	1.4–14							<0.5					

[a]Reporting elemental range of greenhouse plants grown under salinity of 15 to 30 ppt

[b]Measurements represent the average elemental tissue composition of *S. alterniflora*, *S. patens*, *S. cynosuroides*, *Avicennia germinans* in topsoil

[c]Sites were suspected of contamination

[d]Measurements were from *S. densiflora* and *S. maritima* in sites suspected of metal contamination

LITERATURE CITED

Alberts JJ, Price MT, Kania M (1990) Metal concentration in tissues of *Spartina alterniflora* (Loisel.) and sediments of Georgia salt marshes. Estuar Coast Shelf Sci 30:47–58

Bradley PM, Morris JT (1991) Relative importance of ion exclusion, secretion and accumulation in *Spartina alterniflora* Loisel. J Exp Bot 42:1525–1532

Broome SW, Woodhouse WW, Seneca ED (1975) The relationship of mineral nutrients to growth of *Spartina alterniflora* in North Carolina: I. Nutrient status of plants and soils in natural stands. Journal Series of the North Carolina Agricultural Experiment Station, North Carolina State University, Raleigh, NC, p 295–301

Broome SW, Seneca ED, Woodhouse WW (1986) Long-term growth and development of transplants of the salt-marsh grass *Spartina alterniflora.* Estuaries 9:63–74

Cambrollé J, Mateos-Naranjo E, Redondo-Gómez S, Luque T, Figueroa ME (2011) The role of two *Spartina* species in phytostabilization and bioaccumulation of Co, Cr, and Ni in the Tinto-Odiel estuary (SW Spain). Hydrobiologia 671:95–103

Carbonell AA, Aarabi MA, DeLaune RD, Gambrell RP, Patrick WH (1998) Arsenic in wetland vegetation: availability, phytotoxicity, uptake and effects on plant growth and nutrition. Sci Total Environ 217:189–199

Gallagher J (1975) Effect of an ammonium nitrate pulse on the growth and elemental composition of natural stands of *Spartina alterniflora* and *Juncus roemerianus.* Am J Bot 62:644–648

Gallagher J, Reimold R, Linthurst R, Pfeiffer W (1980) Aerial production, mortality, and mineral accumulation-export dynamics in *Spartina alterniflora* and *Juncus roemerianus* plant stands in a Georgia salt-marsh. Ecology 61:303–312

Hempel M, Botté SE, Negrin VL, Chiarello MN, Marcovecchio JE (2008) The role of the smooth cordgrass *Spartina alterniflora* and associated sediments in the heavy metal biogeochemical cycle within Bahía Blanca estuary salt marshes. J Soils Sediments 8:289–297

Hester MW, Shaffer GP, Willis JM, DesRoches DJ (2002) Restored drill cuttings for wetland creation: results of a mesocosm approach to emulate field conditions under varying salinity and hydrologic conditions. Report. US Department of Energy, National Petroleum Technology Office, Tulsa, OK

Linthurst RA (1979) The effect of aeration on the growth of *Spartina alterniflora* Loisel. Am J Bot 66:685–691

Linthurst RA, Seneca ED (1981) Aeration, nitrogen, and salinity as determinants of *Spartina alterniflora* Loisel. growth response. Estuaries 4:53–63

Mahon S, Carman KR (2008) The influence of salinity on the uptake, distribution, and excretion of metals by smooth cordgrass, *Spartina alterniflora* (Loisel.), grown in sediment contaminated by multiple metals. Estuaries Coasts 31:1089–1097

Ornes WH, Kaplan DI (1989) Macronutrient status of tall and short forms of *Spartina alterniflora* in a South Carolina salt marsh. Mar Ecol Prog Ser 55:63–72

Ornes WH, Sajwan KS, Loganathan BG, Chetty CS (1998) Comparison of selected element concentrations in tall and short forms of *Spartina alterniflora.* Mar Pollut Bull 36:390–395

Salla V, Hardaway CJ, Sneddon J (2011) Preliminary investigation of *Spartina alterniflora* for phytoextraction of selected heavy metals in soils from Southwest Louisiana. Microchem J 97:207–212

Windham L, Weis JS, Weis P (2003) Uptake and distribution of metals in two dominant salt marsh macrophytes, *Spartina alterniflora* (cordgrass) and *Phragmites australis* (common reed). Estuar Coast Shelf Sci 56:63–72