Supporting Information. Thrush, S.F., J.E. Hewitt, R.V. Gladstone-Gallagher, C. Savage, C. Lundquist, T. O'Meara, A. Vieillard, J.R. Hillman, S. Mangan, E.J. Douglas, D.E. Clark, A.M Lohrer, and C. Pilditch. 2020. Cumulative stressors reduced the self-regulating capacity of coastal ecosystems. Ecological Applications.

Appendix S1

Table S1. Description of the relationships between variables used to populate the Ecosystem Interaction Network in Figure 1.

Variable	Effected variables	Relationship	Reference
Macomona **(>20mm)**	Chl a	Grazing, interference with smaller macrofauna	(Thrush et al. 1997, Lelieveld et al. 2003, Volkenborn et al. 2012, Pratt et al. 2014, Van Colen et al. 2015, Woodin et al. 2016)
	BOC	Respiration, bioirrigation	
	Organic matter	Death, excretion	
	Mud	Sediment destabilization	
	Gravel	Shell production	
	NH_4 flux	Bioirrigation, excretion	
	Denitrification	Bioirrigation, excretion	
Austrovenus **(>20mm)**	Chl a	Bioturbation	(Thrush et al. 2006, Jones et al. 2011, Woodin et al. 2016)
	BOC	Respiration, Bentho-pelagic coupling	
	Organic matter	Death, Bentho-pelagic coupling	
	Mud	Bioturbation, Bentho-pelagic coupling	
	Gravel	Shell production	
	NH_4 flux	Excretion, bioturbation	
	Denitrification	Excretion	
Primary production	Chl a	Growth	
	BOC	O_2 Production	

	NH_4 flux	O2 production, uptake of nutrients	
Benthic Chlorophyll a (Chl a)	*Macomona* *Austrovenus* BOC Organic matter Mud NH_4 flux PAR	Food resource Food resource O_2 Production, Respiration Primary production, decomposition Binding fine particles, sediment stability Sediment permeability Sediment stability affects turbidity	(Cahoon et al. 1999, Van de Koppel et al. 2001, Ehrenhauss et al. 2004, Thrush et al. 2006, Van Colen et al. 2013)
Benthic oxygen consumption (BOC)	*Macomona* Denitrification	Hypoxia DNRA (Dissimilatory nitrate reduction to ammonium, also known as nitrate/nitrite ammonification)	
Organic matter	Primary production BOC NH_4 flux Denitrification	Nutrient provision Oxidation REDOX chemistry DNRA, carbon source	(Knowles 1082 , Ehrenhauss et al. 2004)
Mud	*Macomona* *Austrovenus* BOC Organic matter Gravel NH_4 flux	Habitat suitability Habitat suitability, elevated suspended sediment Sediment permeability Co-occurrence on fine particles Co-related Permeability, particle surface area for microbes	(Sloth et al. 1995, Huettel and Rusch 2000, Douglas et al. 2018)

	Denitrification Average daily max light (PAR)	Permeability, particle surface area for microbes Suspended sediment concentrations	
Gravel	*Macomona* *Austrovenus* Primary production BOC Mud NH_4 flux Denitrification	Habitat suitability Habitat suitability Sediment permeability Permeability, particle surface area for microbes Co-related Permeability, particle surface area for microbes Permeability, particle surface area for microbes	(Huettel and Rusch 2000, Hewitt et al. 2005, Cummings et al. 2007, Ellingsen et al. 2007, Hewitt et al. 2009)
Temperature	*Macomona* *Austrovenus* Chl a BOC NH_4 flux Denitrification	Metabolic scaling Metabolic scaling Metabolic scaling Metabolic scaling Metabolic scaling and viscosity effects in water which will alter diffusion rates Metabolic scaling	(Seitzinger 1988, Brown et al. 2004, Wallenstein et al. 2006)
Sediment-water NH_4 flux (NH_4 efflux)	Primary production Denitrification	Nutrient provision Substrate provision	(Solan et al. 2004)
Denitrification	-	-	
Average daily max light (PAR)	Primary production	Photosynthesis	

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