SUPPLEMENTARY MATERIAL

Structural complexity and benthic metabolism: resolving the links between carbon cycling and biodiversity in restored seagrass meadows

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Table S1. Ambient seawater chemistry conditions at each site measured at the onset of incubations. All solute concentrations are in µmol kg^{-1} seawater. Temperature (Temp) is in °C whereas salinity (Sal), pH and aragonite saturation state (Ω_{Ar}) are unitless. Dissolved PO_4^{3+} was below detection limit in all samples and is not shown. Values are site mean±SE, n=6 per site.

Site	Date	Sal	Temp	DO	TA	pH	DIC	Ω_{Ar}	DIN	TN	DOC
Bare	22-07-07	24.8±0.0	19.3±0.0	183±7	2098±4	8.35±0.03	1779±19	3.7±0.2	10.8±0.1	20.3±1.6	280±18
3 yr	22-07-17	29.9±0.0	19.1±0.0	260±2	2217±1	8.26±0.02	1891±11	3.7±0.1	11.7±0.2	14.0±0.7	241±8
7 yr	22-07-08	24.8±0.0	19.4±0.0	255±2	2099±3	8.38±0.02	1762±13	3.9±0.1	10.9±0.1	13.2±0.3	240±8
Nat	22-07-19	28.7±0.0	19.8±0.0	274±2	2191±1	8.11±0.01	1953±3	2.8±0.1	11.7±0.1	16.3±0.9	259±20

Table S2. Taxonomic and functional diversity metrics for benthic fauna. Biomass is dry weight of pooled samples in g m^{-2} and Abundance is individuals m^{-2}. Taxonomic and functional diversity indices are transformed to effective numbers such that H_{eff} = log(H') and FD_{eff} = 1/(1-RaoQ). Note that the division between infauna and epifauna depends on sampling method, see main text for details. All values except for biomass are site mean±SE, n=6 per site for infauna and n=3 per site for epifauna. Biomass is pooled per site and values represent total biomass per site.

	Site	Biomass	Abundance	Species	H_{eff}	J'	FGR	FRic	FEve	FD_{eff}
INF	Bare	1.14	2093±951	2±0	2.14±0.40	0.92±0.03	2±0	0.06±0.05	0.74±0.05	1.01±0.01
	3yr	3.17	17593±3470	6±1	2.35±0.30	0.47±0.08	4±1	0.49±0.17	0.51±0.06	1.03±0.01
	7yr	3.96*	5735±1305	7±1	4.87±0.95	0.81±0.03	5±1	0.51±0.12	0.70±0.02	1.05±0.00
	Nat	2.37	7983±2661	7±1	4.41±0.57	0.80±0.05	5±1	0.53±0.11	0.65±0.06	1.05±0.01
EPI	Bare	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
	3yr	6.47	816±38	15±1	8.88±0.59	0.80±0.01	11±0	0.17±0.03	0.56±0.01	1.04±0.00
	7yr	5.88	1145±180	15±3	7.38±1.07	0.75±+0.02	11±2	0.19±0.09	0.63±0.01	1.03±0.00
	Nat	15.53	1113±398	18±3	10.93±2.35	0.83±0.02	12±3	0.33±0.18	0.69±0.04	1.04±0.01

* A disproportionally large gastropod specimen contributing 86% of total biomass was removed from this number. With this specimen included, the biomass in 7 yr was instead 27.69 g/m2.

Table S3. Trait-by-species matrix using fuzzy coding

	Feeding mode						Bioturbation mode						Movement mode					Living habit				Env. Position		Calcification	
	Susp Fed	SurfDet	BurrDet	Pred	GrazHerb	Omni	Biodiff	Upconv	Downconv	Surfmod	Reg	NotRel	Sessile	Burrower	Crawler	Swimmer	Drifter	Free	BurrDwell	TubeDwell	Attach	Epifaunal	Infaunal	Calcifier	Non-Calcifier
Ascidiacea spp.	3	0	0	0	0	0	0	0	0	0	0	3	3	0	0	0	0	0	0	0	3	3	0	0	3
Athanas nitescens	0	0.75	0	0.75	0.75	0.75	0	0	0	0	0	3	0	0	0	3	0	3	0	0	0	3	0	0	3
Balanidae sp.1	2.5	0.5	0	0	0	0	0	0	0	0	0	3	3	0	0	0	0	0	0	0	3	3	0	3	0
Bittium reticulatum	0	3	3	3	3	3	0	0	0	3	0	0	0	0	3	0	0	3	0	0	0	3	0	3	0
Bryozoa spp.	3	0	0	0	0	0	0	0	0	0	0	3	3	0	0	0	0	0	0	0	3	3	0	3	0
Capitella capitata	0	1.5	1.5	0	0	0	0	3	0	0	0	0	0	3	0	0	0	0	3	0	0	0	3	0	3
Carcinus maenas	0	0	0	0	0	3	1	0	0	1.5	1.5	0	0	0	3	0	0	3	0	0	0	3	0	3	0
Cerastoderma edule	3	0	0	0	0	0	0	0	0	3	0	0	0	1.5	1.5	0	0	1.5	1.5	0	0	0	3	3	0
Chironomidae spp.	0	3	0	0	0	0	3	0	0	0	0	0	0	3	0	0	0	0	3	0	0	0	3	0	3
Ericthonius difformis	1.5	0	0	1.5	0	0	0	0	0	0	0	3	0	0	1.5	1.5	0	0	0	3	0	3	0	0	3
Eualus cranchii	0	1.5	0	0	1.5	0	1.5	0	0	1.5	0	0	0	0	1.5	1.5	0	3	0	0	0	3	0	0	3
Eurytemora sp.	3	0	0	0	0	0	0	0	0	0	0	3	0	0	1	1	1	1	0	0	0	3	0	0	3
Gammarus locusta	0	1	0	0	1	1	0	0	0	0	0	3	0	0	1	1	1	3	0	0	0	3	0	0	3
Gobius niger	0	0	0	3	0	0	0	0	0	0	0	3	0	0	0	3	0	3	0	0	0	3	0	0	3
Halacaridae sp.1	0	1.5	0	0	0	1.5	0	0	0	0	0	3	0	0.75	0.75	0.75	0.75	3	0	0	0	3	0	0	3
Hydrobia neglecta	0	3	0	0	0	0	0	0	0	3	0	0	0	0.75	0.75	0.75	0.75	3	0	0	0	3	0	3	0
Hydrobia sp.1	0	**3**	0	0	0	0	0	0	0	3	0	0	0	0.75	0.75	0.75	0.75	3	0	0	0	3	0	3	0
Lepidonotus squamatus	0	0	0	1.5	0	1.5	0	0	0	0	0	3	0	0.5	2.5	0	0	3	0	0	0	3	0	0	3
Littorina sp.1	1.5	0	0	0	1.5	0	0	0	0	3	0	0	0	0	3	0	0	3	0	0	0	3	0	3	0
Marshallora adversa	0	0	0	3	0	0	0	0	0	0	0	3	0	0	3	0	0	3	0	0	0	3	0	3	0
Microdeutopus gryllotalpa	0	1	0	0	2	0	3	0	0	0	0	0	0	0	1	1	1	0	0	3	0	3	0	0	3
Monocorophium insidiosum	3	0	0	0	0	0	3	0	0	0	0	0	2	0	0	1	0	0	0	3	0	3	0	0	3
Musculus subpictus	3	0	0	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	0	0	3	3	0	0	3
Mysis relicta	1.5	0	0	0	0	1.5	0	0	0	0	0	3	0	0	1.5	1.5	0	3	0	0	0	3	0	0	3
Mytilus edulis	3	0	0	0	0	0	0	0	0	0	0	3	3	0	0	0	0	0	0	0	3	3	0	3	0
Nassarius reticulatus	0	1.5	0	1.5	0	0	0	0	0	0	0	3	0	1.5	1.5	0	0	3	0	0	0	3	0	3	0
Nematoda spp.	0	1.5	1.5	0	0	0	0	0	0	3	0		3	1.5	1.5	0	0	3	0	0	0	0	3	0	3
Nereididae spp.	0.2	1.8		0.5		0.5	3	0	0	0	0	0	0	1	1	1	0	0	3	0	0	0	3	0	3
Pagurus bernhardus	1	1	0	1	0	0	0	0	0	0	0	3	0	0	3	0	0	3	0	0	0	3	0	0	3
Palaemon adspersus	0	0	0	0	0	3	0	0	0	0	0	3	0	0.75	0.75	0.75	0.75	3	0	0	0	3	0	0	3
Phyllodocidae sp.1	0	0	0	3	0	0	3	0	0	0	0	0	0	3	0	0	0	3	0	0	0	0	3	0	3
Platynereis dumerilii	0	0	0	1	1	1	3	0	0	0	0	0	0	0	1.5	1.5	0	3	0	0	0	3	0	0	3
Pusillina inconspicua	0	1.5	0	0	1.5	0	0	0	0	3	0	0	0	0.75	0.75	0.75	0.75	3	0	0	0	3	0	3	0
Pusillina sarsii	0	1.5	0	0	1.5	0	0	0	0	3	0	0	0	0.75	0.75	0.75	0.75	3	0	0	0	3	0	3	0
Rissostomia membranacea	0	1.5	0	0	1.5	0	0	0	0	3	0	0	0	0.75	0.75	0.75	0.75	3	0	0	0	3	0	3	0
Sagartiogeton viduatus	1.5	0	0	0	0	1.5	0	0	0	0	0	3	3	0	0	0	0	1.5	0	0	1.5	3	0	0	3
Scoloplos armiger	0	1.5	1.5	0	0	0	3	0	0	0	0	0	0	3	0	0	0	0	3	0	0	0	3	0	3
Spirorbis sp.1	3	0	0	0	0	0	0	0	0	0	0	3	3	0	0	0	0	3	0	3	0	3	0	3	0

Table S4. Photosynthetic parameters at the different sites, including maximum photosynthesis (Pm), initial slope (alpha), irradiance at compensation (Ik), respiration (R) and the adjusted R2 of the fitted curves.

Site	P_m	α	I_k	R	Adj. R^2
Bare	2.52	0.007	379.70	0.93	0.74
3yr	8.26	0.024	345.60	3.47	0.45
7yr	6.68	0.069	96.54	3.52	0.59
Nat	9.33	0.088	106.30	4.88	0.58

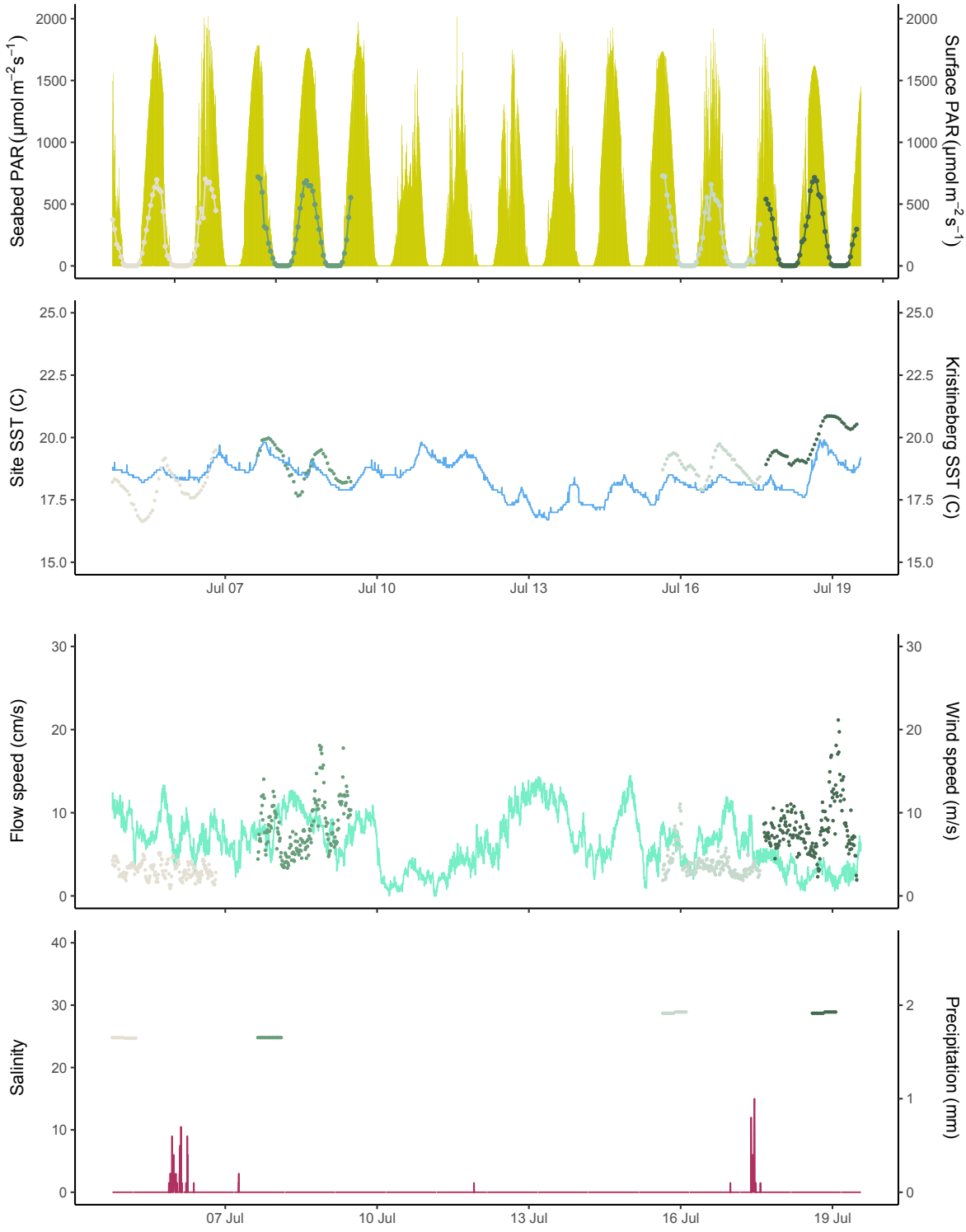

Figure S1. Weather data (right y axes) and measurements during EC deployments (left y axes). Weather data was obtained from the weather station located at Kristineberg Marine Research Station (https://www.weather.loven.gu.se/kristineberg/en/data.shtml)

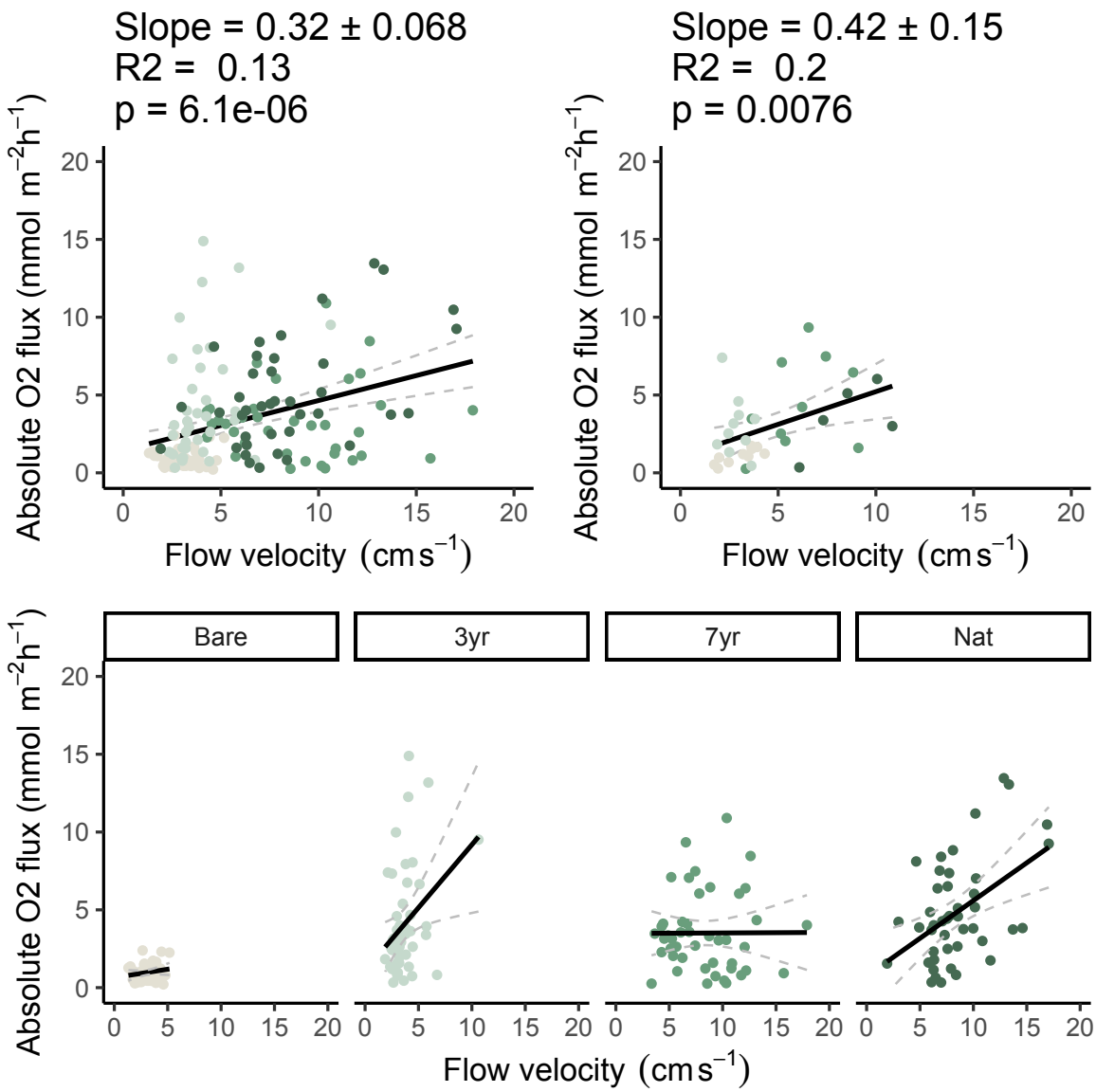

Figure S2. Linear regression analyses of flow velocity and absolute oxygen fluxes. Top left panel show daytime values and top right panel shows nighttime. The bottom panel shows linear regression analyses for each site, black line is linear fit and dashed grey lines illustrate the 95% confidence interval of the slope. There was only a significant correlation in the 3 yr and Natural meadow.

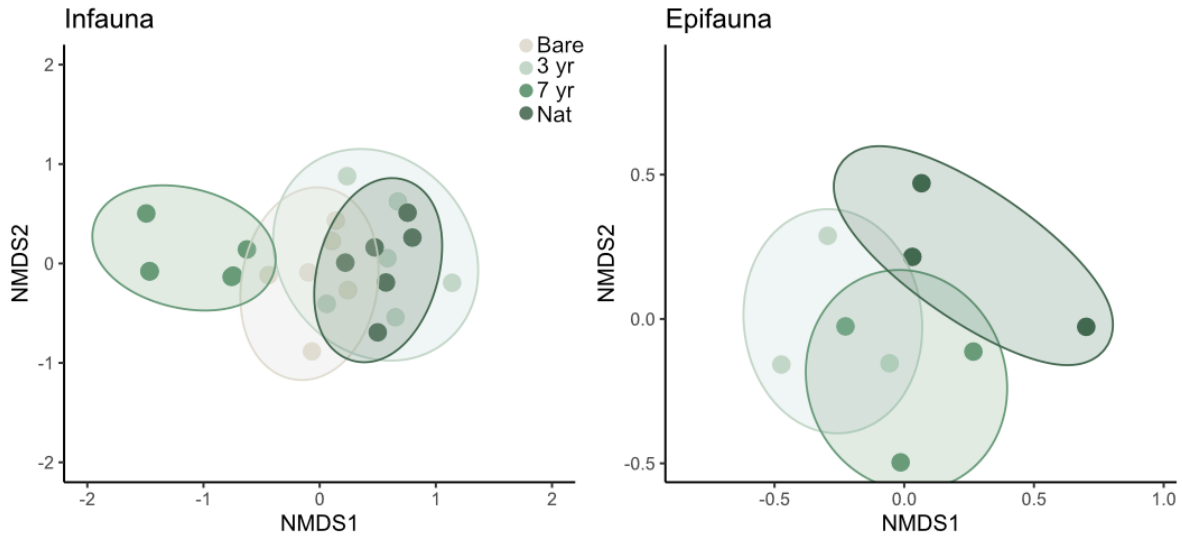

Figure S3. Non-metric multidimensional scaling (NMDS) of infauna (left) and epifauna (right). 2D stress level 0.15 and 0.11, respectively.

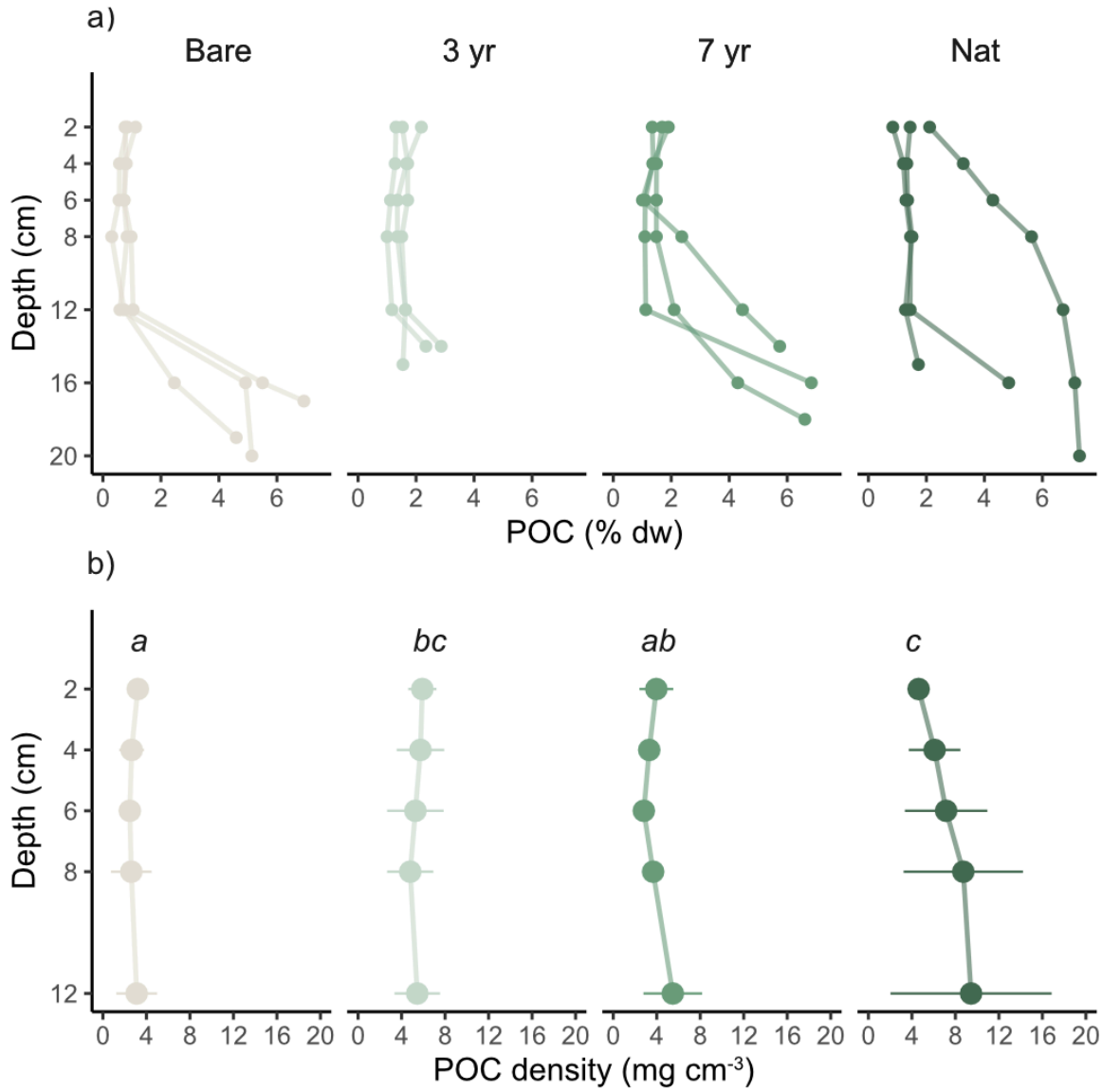

Figure S4. Sediment depth profiles of a) particulate organic carbon concentration (POC % dry weight) from all sediment core slices and b) the average 0-12 POC density. Letters in italics indicate between-site differences in POC density between 0-12 cm based on Tukey's post hoc test (α=0.05).

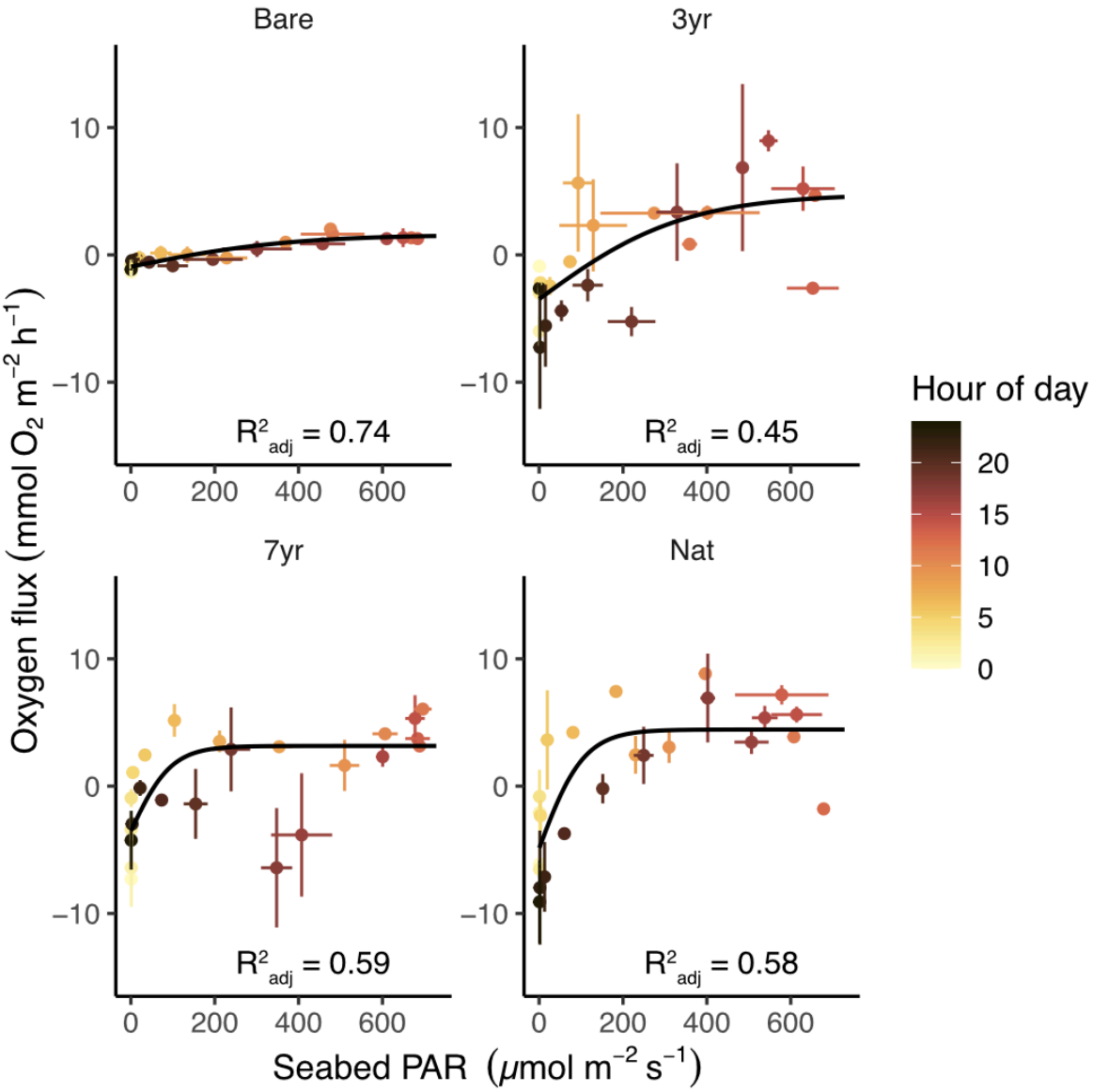

Figure S5. Photosynthesis-Irradiance (P-I) relationships fitted with hyperbolic tangent functions. Points indicate mean±SE between deployment days.