



Supplement of

Linking marine benthic biodiversity and ecosystem functions related to carbon cycling in a continental mud depocenter

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Table S1. Traits to estimated bioturbation and bioirrigation potential, including sediment particle reworking (R), mobility (M), burrow type (Bt), feeding type (FT), and injection pocked depth (ID), with the respective categories and scores.

Trait	Score	Category
Sediment particle reworking (R)	1	Epifauna.
	2	Surficial modifiers.
	3	Upward /downward conveyors.
	4	Biodiffusors.
	5	Regenerators.
Mobility (M)	1	Organisms that live in fixed tubes.
	2	Limited movement.
	3	Slow, free movement through the sediment matrix.
	4	Free movement burrow system.
Burrow type (Bt)	1	Epifauna, internal irrigation (e.g. Siphons).
	2	Open irrigation (U- or Y-shape burrows).
	3	Blind ended irrigation (e.g.blind ended burrows, no burrow systems).
Feeding type (FT)	1	Surface filter feeder.
	2	Predator.
	3	Deposit feeder.
Injection pocket depth (ID)	4	Subsurface filter feeder.
	1	0–2 cm.
	2	2–5 cm.
	3	5–10 cm.
	4	> 10 cm.

Table S2. Analysis of variance (ANOVA) table for the comparison of the infauna ash-free dry mass between the four infauna clusters.

Source	Df	Sum of squares	Mean square	F-value	p (> F)
Cluster	3	31.88	10.626	2.264	0.0936
Residuals	46	215.88	4.693		

Table S3. Summary of distance-based redundancy analysis (dbRDA) to identify the environmental variables that best explained the dissimilarities among the infauna community. Significant results ($p < 0.05$) are shown in bold.

Source	Df	Sum of squares	F-value	p (> F)
Model	7	4.0560	4.7373	0.0001
Residual	42	5.1371		
Environmental variable	Df	Sum of squares	F-value	p (> F)
Sorting	1	0.3503	2.8636	0.0050
Skewness	1	0.5157	4.2164	0.0006
Kurtosis	1	1.0112	8.2672	0.0001
D50	1	0.3565	2.9144	0.0078
OC	1	0.1291	1.0552	0.3514
Salinity	1	0.9857	8.0588	0.0001
Bottom Shear Stress	1	0.7076	5.7853	0.0002
Residual	42	5.1371		

Table S4. Summary of the simple slope analysis to explore the biodiversity-ecosystem function relationship along environmental gradients. The t-value indicates how strongly the slope differs from zero, and the p-value represents the probability of observing this t-value if the true slope was zero. Significant results ($p < 0.05$) are shown in bold.

Ecosystem function	Diversity index	Interaction environmental variables	Moderator value	Slope	Standard Error	t-value	p-value
BP _C	¹ D	Bottom shear stress	-1 S.D.	0.91	7.95	-3.10	0.00
			Mean	1.09	4.34	-2.20	0.03
			+1 S.D.	1.27	4.78	1.15	0.26
BP _C	¹ D	Salinity	-1 S.D.	30.08	6.50	1.22	0.23
			Mean	31.24	4.16	-1.71	0.09
			+1 S.D.	32.40	6.80	-3.26	0.00
BP _C	² D	Bottom shear stress	-1 S.D.	0.91	12.20	-3.48	0.00
			Mean	1.09	6.37	-2.78	0.01
			+1 S.D.	1.27	6.85	1.02	0.31
BP _C	² D	Salinity	-1 S.D.	30.08	8.76	0.94	0.35
			Mean	31.24	6.10	-2.08	0.04
			+1 S.D.	32.40	10.01	-3.35	0.00
BP _C	E _{1,0}	Bottom shear stress	-1 S.D.	0.91	236.42	-4.65	0.00
			Mean	1.09	150.45	-4.16	0.00

BP _C	E _{1,0}	Salinity	+1 S.D.	1.27	218.32	-0.70	0.48
			-1 S.D.	30.08	208.54	-1.13	0.26
			Mean	31.24	160.61	-4.55	0.00
			+1 S.D.	32.40	226.63	-5.41	0.00
BP _C	E _{1,0}	D50	-1 S.D.	34.88	255.82	-5.20	0.00
			Mean	75.86	172.35	-5.15	0.00
			+1 S.D.	116.83	207.46	-2.15	0.04
			-1 S.D.	81.34	254.88	-5.29	0.00
BP _C	E _{1,0}	D90	Mean	164.01	168.45	-5.55	0.00
			+1 S.D.	246.69	204.36	-2.55	0.01
			-1 S.D.	0.03	235.10	-1.84	0.07
			Mean	0.05	180.56	-4.99	0.00
BP _C	E _{1,0}	Clay	+1 S.D.	0.07	289.35	-4.74	0.00
			-1 S.D.	0.91	5.49	-3.23	0.00
			Mean	1.09	3.00	-2.30	0.03
			+1 S.D.	1.27	3.30	1.20	0.24
IP _C	¹ D	Bottom shear stress	-1 S.D.	30.08	5.41	1.35	0.18
			Mean	31.24	3.46	-2.20	0.03
			+1 S.D.	32.40	5.65	-3.98	0.00
			-1 S.D.	0.91	8.37	-3.70	0.00
IP _C	² D	Bottom shear stress	Mean	1.09	4.37	-2.90	0.01
			+1 S.D.	1.27	4.70	1.20	0.24
			-1 S.D.	30.08	7.38	1.10	0.28
			Mean	31.24	5.14	-2.36	0.02
IP _C	² D	Salinity	+1 S.D.	32.40	8.44	-3.83	0.00
			-1 S.D.	0.91	158.08	-5.37	0.00
			Mean	1.09	100.60	-4.01	0.00
			+1 S.D.	1.27	145.98	0.29	0.77
IP _C	E _{1,0}	Bottom shear stress	-1 S.D.	30.08	182.30	-0.53	0.60
			Mean	31.24	140.40	-4.13	0.00
			+1 S.D.	32.40	198.11	-5.36	0.00
			-1 S.D.	34.88	230.58	-4.77	0.00
IP _C	E _{1,0}	D50	Mean	75.86	155.35	-4.63	0.00
			+1 S.D.	116.83	186.99	-1.81	0.08
			-1 S.D.	81.34	234.01	-4.72	0.00
			Mean	164.01	154.66	-4.74	0.00
IP _C	E _{1,0}	D90	+1 S.D.	246.69	187.63	-1.92	0.06
			-1 S.D.	0.03	202.99	-1.30	0.20
IP _C	E _{1,0}	Clay	-1 S.D.	0.03	202.99	-1.30	0.20

			Mean	0.05	155.90	-4.70	0.00
			+1 S.D.	0.07	249.83	-4.81	0.00
			-1 S.D.	0.91	188.87	-3.68	0.00
P	FR _{ed}	Bottom shear stress	Mean	1.09	160.47	-1.26	0.21
			+1 S.D.	1.27	245.76	1.18	0.24
			-1 S.D.	30.08	428.30	2.39	0.02
P	FR _{ed}	Salinity	Mean	31.24	185.37	0.30	0.76
			+1 S.D.	32.40	237.53	-3.83	0.00
			-1 S.D.	0.92	244.51	-0.15	0.88
P	FR _{ed}	Kurtosis	Mean	1.43	173.19	-2.03	0.05
			+1 S.D.	1.94	198.94	-3.35	0.00
			-1 S.D.	0.91	601.42	-3.49	0.00
R	FR _{ed}	Bottom shear stress	Mean	1.09	510.96	-0.87	0.39
			+1 S.D.	1.27	782.57	1.54	0.13
			-1 S.D.	30.08	1295.57	2.88	0.01
R	FR _{ed}	Salinity	Mean	31.24	560.74	0.81	0.42
			+1 S.D.	32.40	718.53	-3.93	0.00
			-1 S.D.	0.92	804.50	0.08	0.94
R	FR _{ed}	Kurtosis	Mean	1.43	569.83	-1.66	0.10
			+1 S.D.	1.94	654.57	-3.00	0.00

Figure S1. Distribution of ash-free dry mass (mg 0.1 m⁻²) among taxonomic groups of the benthic macrofauna in the four infauna clusters.

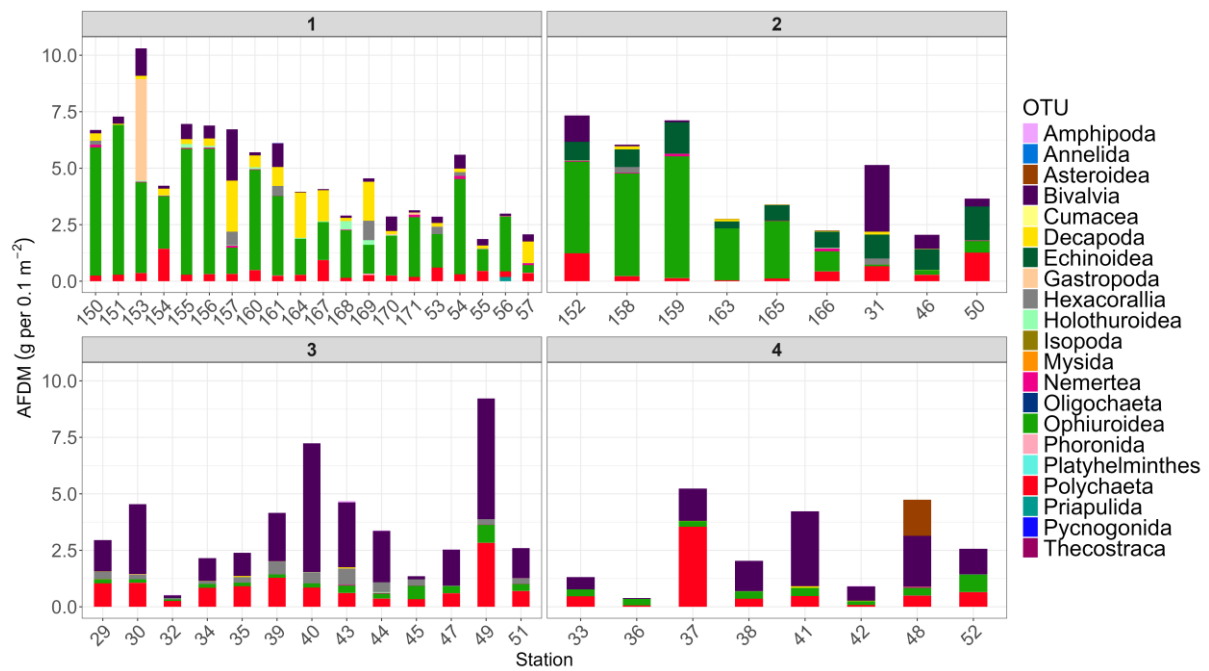


Figure S2. Environmental variables at each station, with darker colors and larger symbols representing higher measured or modelled values.

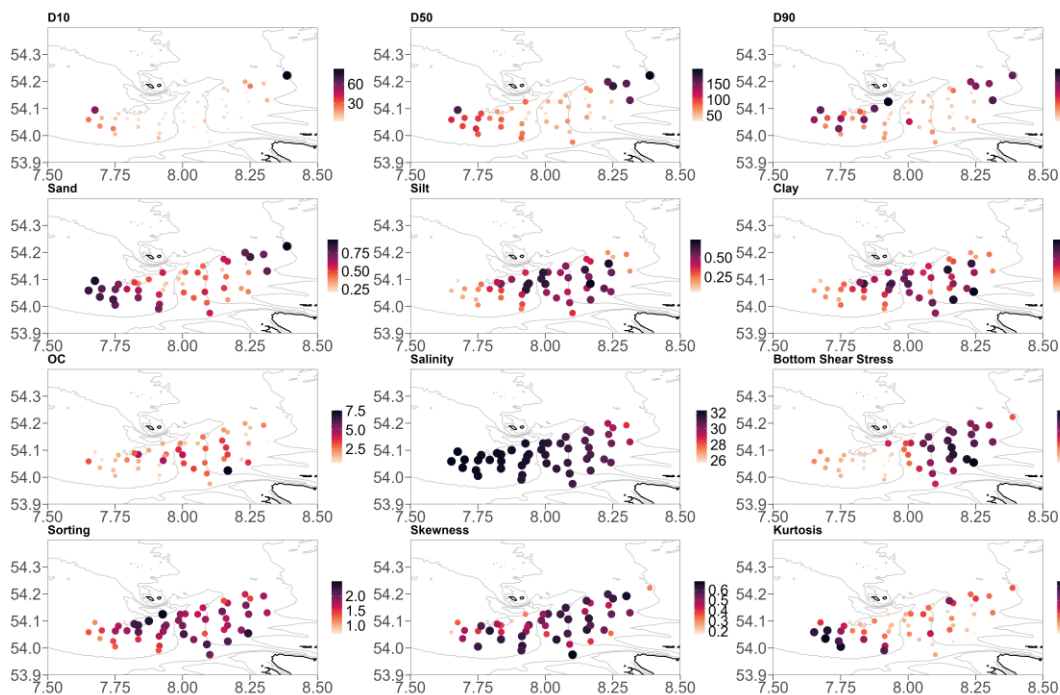


Figure S3. Interaction plots displaying the variations of the relationships between diversity indices and ecosystem functions along environmental gradients. The moderator values correspond to the selected points along the environmental gradient: -1 S.D. (one standard deviation below the mean), Mean, and +1 S.D. (one standard deviation above the mean). Each plot is annotated and corresponded to the result in Table 3.

