

SUPPLEMENTARY MATERIAL – B Trait by species matrix

FOR

Changes in the location of biodiversity-ecosystem function hot spots across the seafloor landscape with increasing sediment nutrient loading

BY

Simon F. Thrush, Judi E Hewitt, Casper Kraan, A.M. Lohrer, Conrad A. Pilditch, Emily Douglas

Functional trait matrix

The list of 24 traits used in building the models presented in the paper, along with a further 6 traits used in the sensitivity analysis and the coding for each of the 112 taxa collected in the experimental phase of the research. Due to space constraints the matrix is presented in two tables; Table A shows the functional trait code, characteristics and where in the analysis the trait utilised. Traits are for adult life stage only; Table B shows the coding of traits for each taxa. Fuzzy coding is used where species are likely to exhibit multiple traits (e.g., a species which is both a predator and a scavenger could be coded at 0.5 in each category)

Table A

Functional trait code	Trait type	Trait	Inclusion in model and sensitivity analysis
1	Particle movement	Surface to depth	Model
2	Particle movement	Depth to surface	Model
3	Particle movement	Surface to surface	Model
4	Particle movement	Depth to depth	Model
5	Feeding mode	Suspension	Model
6	Feeding mode	Deposit	Model
7	Feeding mode	Predator	Model
8	Feeding mode	Scavenger	Model
9	Feeding mode	Grazer	Model
10	Location in or on sediment	Surface (epifauna)	Model
11	Location in or on sediment	Attached (e.g., to shells and rocks)	Model
12	Location in or on sediment	Top 2 cm t	Model
13	Location in or on sediment	Deep (> 2cm)	Model
14	Structure created in or on sediment	Permanent burrow	Model
15	Structure created in or on sediment	Simple hole or pit	Model
16	Structure created in or on sediment	Tube structure	Model
17	Structure created in or on sediment	Mound	Model
18	Structure created in or on sediment	Trough	Model
19	Structure created in or on sediment	Trampling	Model
20	Mobility	Sedentary or limited mobility (e.g. within tube or permanent burrow)	Model
21	Mobility	Motile	Model
22	Size (longest dimension)	Small (0.5-5mm)	Model
23	Size (longest dimension)	Medium (5-20mm)	Model
24	Size (longest dimension)	Large (>20mm)	Model
25	Body shape	Worm like	Sensitivity analysis only
26	Body shape	Streamlined	Sensitivity analysis only
27	Body shape	Globulose	Sensitivity analysis only
28	Body hardness	Soft-bodied	Sensitivity analysis only
29	Body hardness	Rigid	Sensitivity analysis only
30	Body hardness	Calcified	Sensitivity analysis only

Table B

Functional trait code	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
<i>Patirella regularis</i>	0	0	1	0	0	0	0.5	0.5	0	1	0	0	0	0	0	0	0	1	0	0	1	0	0	1			1			1
<i>Soletellina siliqua</i>	0	0	1	0	1	0	0	0	0	0	0	1	0	0	1	0	0	0	0	1	0	1	0	0			1			1
<i>Limnoperna pulex</i>	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	1	0	0	1	0	0	0	1			1			1
<i>Arcuatula senhousia</i>	1	0	0	0	1	0	0	0	0	0.33	0.33	0.33	0	0	0	0	1	0	0	1	0	0	1	0			1			1
<i>Linucula hartvigiana</i>	0	0	1	0	0	1	0	0	0	0	0	1	0	0	1	0	0	0	0	1	0	0.5	0.5	0			1			1
<i>Solemya parkinsoni</i>	0	0	1	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	1	0			1			1
<i>Arthritica bifurca</i>	0	0	1	0	0.5	0.5	0	0	0	0	0	1	0	0	1	0	0	0	0	1	0	1	0	0			1			1
<i>Lasaea parangaensis</i>	0	0	1	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	1	0	0			1			1
<i>Cyclomactra ovata</i>	1	0	0	0	0.75	0.25	0	0	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	1			1			1
<i>Paphies australis</i>	0	0	1	0	1	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1	0	0	1			1			1
<i>Theora lubrica</i>	0.25	0.25	0.25	0.25	0.75	0.25	0	0	0	0	0	0.5	0.5	0	1	0	0	0	0	1	0	0.5	0.5	0			1			1
<i>Macomona liliana</i>	0.33	0.33	0.33	0	0.25	0.75	0	0	0	0	0	0	1	0	0	0	0	1	0	1	0	0	0	1			1			1
<i>Felaniella zelandica</i>	0	0	1	0	1	0	0	0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	1	0			1			1
<i>Austrovenus stutchburyi</i>	0.33	0.33	0.33	0	1	0	0	0	0	0	0	1	0	0	0.5	0	0	0.5	0	0	1	0	0	1			1			1
<i>Anthopleura aureoradiata</i>	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	1	0			1	1		
<i>Pyromaia sp</i>	0	0	1	0	0.25	0.25	0.25	0	0.25	1	0	0	0	0	0	0	0	0	1	0	1	0	1	0			1			1
<i>Taeniogyrus dendyi</i>	0	0.33	0.33	0.33	0	1	0	0	0	0	0	0.5	0.5	1	0	0	0	0	0	0	1	0	0.5	0.5			1	1		
<i>Austrohelice crassa</i>	0.33	0.33	0.33	0	0	0.75	0	0.25	0	0.33	0	0.33	0.33	1	0	0	0	0	0	0	1	0	0	1			1			1
<i>Hemigrapsus crenulatus</i>	0	0.5	0.5	0	0	0	0	0.5	0.5	0.5	0	0.5	0	0	1	0	0	0	0	0	1	0	0	1			1			1
<i>Hemigrapsus edwardsi</i>	0	0	1	0	0	0	0	0.5	0.5	1	0	0	0	0	1	0	0	0	0	0	1	0	0	1			1			1
<i>Halicarcinus varius</i>	0	0	1	0	0	0	0.5	0.5	0	1	0	0	0	0	0	0	0	0	1	0	1	0	1	0			1			1
<i>Halicarcinus whitei</i>	0	0	1	0	0	0.3	0.3	0.3	0	1	0	0	0	0	0	0	0	0	1	0	1	0	1	0			1			1
<i>Hemiplax hirtipes</i>	0	0.5	0.5	0	0	0.3	0.3	0.3	0	0	0	0.5	0.5	0.5	0	0	0.5	0	0	0	1	0	0	1			1			1
<i>Philocheras australis</i>	0	0	1	0	0	0.3	0.3	0.3	0	0	0	0.5	0.5	0	0	0	0	0	0	0	1	0	0.5	0.5		1			1	
<i>Alpheus sp.</i>	0.33	0.33	0.33	0	0	0	0.5	0.5	0	0	0	0.5	0.5	0.5	0	0	0.5	0	0	0	1	0	1	0		1			1	
<i>Diloma subrostrata</i>	0	0	1	0	0	0.4	0	0.2	0.4	1	0	0	0	0	0	0	0	1	0	0	1	0	0	1			1			1
<i>Epitonium tenellum</i>	0	0	1	0	0	0	0.5	0.5	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	0			1			1

Functional trait code	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
<i>Micrelenchus tenebrosus</i>	0	0	1	0	0	0.4	0	0.2	0.4	1	0	0	0	0	0	0	0	1	0	0	1	0	0	1			1			1	
<i>Turbonilla aoteana</i>	0	0	1	0	0	0	0.5	0.5	0	0	0	1	0	0	0	0	0	1	0	0	1	0.5	0.5	0			1			1	
<i>Nudibranch</i>	0	0	1	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	1	0	0	1			1	1			
<i>Eatoniella sp.</i>	0	0	1	0	0	0.3	0	0.3	0.3	1	0	0	0	0	0	0	0	1	0	0	1	1	0	0			1			1	
<i>Zeacumantus lutulentus</i>	0	0	1	0	0	1	0	0	0	0	0	1	0	0	0	0	0	1	0	0	1	0	1	0			1			1	
<i>Cominella adpersa</i>	0	0	1	0	0	0	0.5	0.5	0	1	0	0	0	0	0	0	0	1	0	0	1	0	0	1			1			1	
<i>Cominella glandiformis</i>	0	0	1	0	0	0	0.5	0.5	0	1	0	0	0	0	0	0	0	1	0	0	1	0	0	1			1			1	
<i>Xymene plebeius</i>	0	0	1	0	0	0	0.5	0.5	0	0	0	1	0	0	1	0	0	0	0	0	1	0	0	1			1			1	
<i>Nassarius burchardi</i>	0	0	1	0	0	0	0.5	0.5	0	1	0	0	0	0	0	0	0	1	0	0	1	0	0	1			1			1	
<i>Euterebra tristis</i>	0	0	1	0	0	0.25	0.25	0.25	0.25	0.5	0	0.5	0	0	0	0	0	0	0	0	1	1	0	0			1			1	
<i>Neoguraleus sinclairii</i>	0	0	1	0	0.5	0.5	0	0	0	1	0	0	0	0	0	0	0	1	0	0	1	0	1	0			1			1	
<i>Haminoea zelandica</i>	0	0	1	0	0	0.5	0	0	0.5	0.5	0	0.5	0	0	0	0	0	1	0	0	1	0	0.5	0.5			1			1	
<i>Notoacmea scapha</i>	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	1	0	1	0	0.5	0.5	0			1			1	
<i>Ischyroceridae</i>	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0		1			1		
<i>Protohyale sp.</i>	0	0	0.5	0.5	1	0	0	0	0	0	0	0.5	0.5	0.75	0	0	0.25	0	0	0	1	0	0	1							
<i>Liocarcinus sp.</i>	0	0	1	0	0	0	0.5	0.5	0	1	0	0	0	0	0	0	0	0	1	0	1	0	0	1			1		1		
<i>Austrominius modestus</i>	0	0	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	1	0	0			1			1
Nemertean	0.25	0.25	0.25	0.25	0	0	0.5	0.5	0	0	0	0.5	0.5	0	0	0	0	0	0	0	1	0.33	0.33	0.34	1			1			
Oligochaeta tubificid	0.25	0.25	0.25	0.25	0	0	0.5	0.5	0	0	0	0.5	0.5	1	0	0	0	0	0	0	1	1	0	0	1			1			
<i>Corophium sp.</i>	0.5	0	0.5	0	1	0	0	0	0	0	0	0.5	0.5	1	0	0	0	0	0	0	1	0	1	0		1			1		
<i>Paracorophium excavatum</i>	0.5	0	0.5	0	1	0	0	0	0	0	0	0.5	0.5	1	0	0	0	0	0	0	1	0	1	0		1			1		
<i>Dexaminidae</i>	0	0	1	0	0	0.5	0	0.25	0.25	0	0	0.5	0.5	0	0	0	0	0	0	0	1	0	1	0		1			1		
<i>Methalimedon sp.</i>	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	0		1			1		
<i>Liljborgiidae</i>	0	0	1	0	0	0.5	0	0.25	0.25	0	0	1	0	0	0	0	0	0	0	0	1	0	1	0		1			1		
<i>Lysianassidae</i>	0	0	1	0	0	0.5	0	0.25	0.25	0	0	1	0	0	0	0	0	0	0	0	1	0	1	0		1			1		
<i>Paracalliope novizealandiae</i>	0	0	1	0	0	0.5	0	0.25	0.25	0	0	1	0	0	0	0	0	0	0	0	1	1	0	0		1			1		
<i>Phoxocephalidae</i>	0	0	1	0	0	0.3	0.3	0.3	0	0	0	0.5	0.5	0	0	0	0	0	0	0	1	0	1	0		1			1		
<i>Torridoharpinia hurleyi</i>	0	0	1	0	0	0	0.5	0.5	0	0	0	0.5	0.5	0	0	0	0	0	0	0	1	0	1	0		1			1		
<i>Waitangi brevirostris</i>	0	0	1	0	0	0.5	0	0.25	0.25	0	0	1	0	0	0	0	0	0	0	0	1	0	1	0		1			1		
<i>Cyclaspis thomsoni</i>	0	0	1	0	0	1	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1	1	0	0		1			1		
<i>Colurostylis lemorum</i>	0	0	1	0	0	1	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1	1	0	0		1			1		

Functional trait code	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
<i>Diastylopsis elongata</i>	0	0	1	0	0	1	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1	1	0	0		1			1	
Cirolanidae	0	0	1	0	0	0	0.5	0.5	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0.5	0.5		1			1	
<i>Exosphaeroma planulum</i>	0	0	1	0	0	0	0.5	0.5	0	0	0	1	0	0	0	0	0	0	0	0	1	0.5	0.5	0		1			1	
<i>Exosphaeroma waitemata</i>	0	0	1	0	0	0	0.5	0.5	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	0		1			1	
<i>Isocladus sp.</i>	0	0	1	0	0	0	0.5	0.5	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	0		1			1	
Mysid shrimp	0	0	1	0	0	1	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1	0.5	0.5	0		1			1	
<i>Phoronis sp.</i>	0	0	0	0	1	0	0	0	0	0.33	0	0.33	0.33	0	0	1	0	0	0	1	0	0	1	0	1			1		
<i>Stylochidae sp.</i>	0	0	1	0	0	0.25	0.25	0.25	0.25	1	0	0	0	0	0	0	0	1	0	0	1	0	1	0			1	1		
<i>Barantolla leptae</i>	0	1	0	0	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	1	0	0	1			1		
<i>Capitella sp.</i>	0	1	0	0	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	1	0	0	1			1		
<i>Heteromastus filiformis</i>	0	1	0	0	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0.5	0.5	0	1			1		
<i>Notomastus sp.</i>	0	1	0	0	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	0	1	1			1		
<i>Harmothoe sp.</i>	0.25	0.25	0.25	0.25	0	0	0.5	0.5	0	0	0	0.5	0.5	0	0	0	0	0	0	0	1	0	1	0	1			1		
<i>Lepidastheniella comma</i>	0.25	0.25	0.25	0.25	0	0	0.5	0.5	0	0	0	0.5	0.5	0	0	0	0	0	0	0	1	0	0.5	0.5	1			1		
Dorvilleidae	0	0	1	0	0	0	0.5	0.5	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	0	1			1		
Eunicidae	0.25	0.25	0.25	0.25	0	0	0.5	0.5	0	0	0	0.5	0.5	0	0	1	0	0	0	0	1	0	1	0	1			1		
Lumbrineridae	0.25	0.25	0.25	0.25	0	0	0.5	0.5	0	0	0	0.5	0.5	1	0	0	0	0	0	0	1	0	1	0	1			1		
<i>Armandia maculata</i>	0	1	0	0	0	1	0	0	0	0	0	0.5	0.5	1	0	0	0	0	0	0	1	0	1	0	1			1		
<i>Travisia olens</i>	0	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	1	0	0	1	0	0	1		1		1		
<i>Glycera americana</i>	0.25	0.25	0.25	0.25	0	0	1	0	0	0	0	0.5	0.5	0	0	0	0	0	0	0	1	0	0	1	1			1		
<i>Glycinde trifida</i>	0.25	0.25	0.25	0.25	0	0	0.5	0.5	0	0	0	0.5	0.5	0	0	0	0	0	0	0	1	0	0.5	0.5	1			1		
Hesionidae	0.25	0.25	0.25	0.25	0	0	0.5	0.5	0	0	0	0.5	0.5	0	0	0	0	0	0	0	1	1	0	0	1			1		
<i>Oxydromus angustifrons</i>	0.25	0.25	0.25	0.25	0	0	0.5	0.5	0	0	0	0.5	0.5	0	0	0	0	0	0	0	1	1	0	0	1			1		
<i>Aglaophamus macroura</i>	0.25	0.25	0.25	0.25	0	0	0.5	0.5	0	0	0	0.5	0.5	0	0	0	0	0	0	0	1	0	0.5	0.5	1			1		
<i>Ceratonereis sp.</i>	0.25	0.25	0.25	0.25	0	0.25	0.25	0.25	0.25	0	0	0.5	0.5	1	0	0	0	0	0	0	1	0.5	0.5	0	1			1		
<i>Nicon aestuariensis</i>	0.25	0.25	0.25	0.25	0	0.25	0.25	0.25	0.25	0	0	0.5	0.5	1	0	0	0	0	0	0	1	0	0.5	0.5	1			1		
<i>Perinereis vallata</i>	0.25	0.25	0.25	0.25	0	0	0.5	0.5	0	0	0	0.5	0.5	1	0	0	0	0	0	0	1	0	0.5	0.5	1			1		
<i>Platynereis australis</i>	0.25	0.25	0.25	0.25	0	0	0.5	0.5	0	0	0	0.5	0.5	1	0	0	0	0	0	0	1	0	1	0	1			1		
Phyllodocidae	0.25	0.25	0.25	0.25	0	0	0.5	0.5	0	0	0	0.5	0.5	0	0	0	0	0	0	0	1	0	0.5	0.5	1			1		
Exogoninae	0	0	1	0	0	0	0.5	0.5	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	0	1			1		
<i>Sphaerosyllis semiverrucosa</i>	0.25	0.25	0.25	0.25	0	0	0.5	0.5	0	0	0	0.5	0.5	0	0	0	0	0	0	0	1	1	0	0	1			1		
Syllidae	0.25	0.25	0.25	0.25	0	0	0.5	0.5	0	0	0	0.5	0.5	0	0	0	0	0	0	0	1	0	1	0	1			1		
Syllinae	0.25	0.25	0.25	0.25	0	0	0.5	0.5	0	0	0	0.5	0.5	0	0	0	0	0	0	0	1	0	1	0	1			1		
<i>Owenia petersonae</i>	0	0	0.5	0.5	0.33	0.33	0	0	0.33	0.33	0	0.33	0.33	0	0	1	0	0	0	1	0	0	0	1	1			1		
<i>Euchone sp.</i>	0	0	0	0	1	0	0	0	0	0.33	0	0.33	0.33	0	0	1	0	0	0	1	0	0	1	0	1			1		

Functional trait code	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
<i>Asychis sp.</i>	0	1	0	0	0	1	0	0	0	0.33	0	0.33	0.33	0	0	1	0	0	0	1	0	0	0	1	1			1		
<i>Macroclymenella stewartensis</i>	0	1	0	0	0	1	0	0	0	0.33	0	0.33	0.33	0	0	1	0	0	0	1	0	0	0.5	0.5	1			1		
<i>Orbinia papillosa</i>	0	0.5	0	0.5	0	1	0	0	0	0	0	0.5	0.5	0	0	0	1	0	0	0	1	0	1	0	1			1		
<i>Scoloplos cylindrifer</i>	0	0.5	0	0.5	0	1	0	0	0	0	0	0.5	0.5	0	0	0	1	0	0	0	1	0	1	0	1			1		
<i>Aricidea sp.</i>	0	0.5	0	0.5	0	1	0	0	0	0	0	1	0	1	0	0	0	0	0	0	1	1	0	0	1			1		
<i>Levinsinia gracilis</i>	0	0.5	0	0.5	0	1	0	0	0	0	0	0.5	0.5	0	0	0	0	0	0	0	1	0.5	0.5	0	1			1		
<i>Paradoneis lyra</i>	0	0.5	0	0.5	0	1	0	0	0	0.33	0	0.33	0.33	1	0	0	0	0	0	0	1	1	0	0	1			1		
<i>Scalibregmatidae</i>	0	0	0	1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0.5	0.5	1			1		
<i>Cirratulidae</i>	0	0	1	0	0	1	0	0	0	0	0	0.5	0.5	1	0	0	0	0	0	0	1	0	1	0	1			1		
<i>Magelona dakini</i>	0.25	0.25	0.25	0.25	0	1	0	0	0	0	0	0.5	0.5	0	0	0	0	0	0	0	1	1	0	0	1			1		
<i>Aonides trifida</i>	0.25	0.25	0.25	0.25	0.25	0.75	0	0	0	0	0	0.5	0.5	0	0	0	0	0	0	0	1	1	0	0	1			1		
<i>Boccardia syrtis</i>	0.5	0	0.5	0	0.5	0.5	0	0	0	0.33	0	0.33	0.33	0	0	1	0	0	0	1	0	0.5	0.5	0	1			1		
<i>Polydora cornuta</i>	0.5	0	0.5	0	0	1	0	0	0	0.33	0	0.33	0.33	0	0	1	0	0	0	1	0	0.5	0.5	0	1			1		
<i>Prionospio aucklandica</i>	0.25	0.25	0.25	0.25	0	1	0	0	0	0	0	0.5	0.5	0	0	0	0	0	0	0	1	0.5	0.5	0	1			1		
<i>Pseudopolydora sp F</i>	0.25	0.25	0.25	0.25	0	1	0	0	0	0	0	0.5	0.5	0	0	0	0	0	0	0	1	0	1	0			1	1		
<i>Pseudopolydora sp T</i>	0.5	0	0.5	0	0	1	0	0	0	0	0	0.5	0.5	0	0	1	0	0	0	1	0	0.5	0.5	0	1			1		
<i>Scolecopides benhami</i>	0.25	0.25	0.25	0.25	0	1	0	0	0	0	0	0.5	0.5	0	0	0	1	0	0	0	1	0	1	0	1			1		
<i>Microspio maori</i>	0.25	0.25	0.25	0.25	0	1	0	0	0	0	0	0.5	0.5	0	0	0	0	0	0	0	1	1	0	0	1			1		
<i>Pectinaria australis</i>	0	1	0	0	0	1	0	0	0	0	0	0.5	0.5	0	0	1	0	0	0	1	0	0	1	0	1			1		
<i>Chiton glaucus</i>	0	0	1	0	0	0	0	0	1	0	1	0	0	0	0	0	0	1	0	1	0	0	0.5	0.5			1			1