

Table S1. Literature citations used to determine NPS literature trait characterizations. The number and identify of the species found in references is listed. Full references follow this table.

Author	Year	N Spp	Species
Swift, D. R., and R. B. Nicholas.	1987	1	<i>Diadesmis confervacea</i>
Whitmore, T.J.	1989	21	<i>Achnanthidium minutissimum</i> , <i>Amphora ovalis</i> , <i>Asterionella ralfsii</i> , <i>Cyclotella meneghiniana</i> , <i>Denticula elegans</i> , <i>Eunotia formica</i> , <i>Eunotia glacialis</i> , <i>Eunotia incisa</i> , <i>Eunotia monodon</i> , <i>Eunotia naegeli</i> , <i>Eunotia pectinalis</i> , <i>Eunotia pectinalis</i> var. <i>undulata</i> , <i>Fragilaria crotonensis</i> , <i>Fragilaria vaucheriae</i> , <i>Hantzschia amphioxys</i> , <i>Melosira varians</i> , <i>Sellaphora pupula</i> var. <i>rectangularis</i> , <i>Synedra acus</i> , <i>Synedra delicatissima</i> var. <i>angustissima</i> , <i>Synedra rumpens</i> , <i>Synedra ulna</i>
Raschke, R. L.	1993	2	<i>Eunotia flexuosa</i> , <i>Navicula cryptotenella</i>
Van Dam, H., A. Mertens, and J. Sinkeldam	1994	17	<i>Achnanthes coarctata</i> , <i>Achnanthes minutissima</i> var. <i>jackii</i> , <i>Achnanthidium caledonicum</i> , <i>Achnanthidium exiguum</i> , <i>Achnanthidium exilis</i> , <i>Achnanthidium minutissimum</i> , <i>Adlafia bryophila</i> , <i>Adlafia minuscula</i> , <i>Caloneis bacillum</i> , <i>Cocconeis placentula</i> var. <i>lineata</i> , <i>Craticula cuspidata</i> , <i>Craticula molestiformis</i> , <i>Cymbella aspera</i> , <i>Cymbella delicatula</i> , <i>Cymbella gracilis</i> , <i>Cymbella mesiana</i> , <i>Cymbella proxima</i> , <i>Diploneis oblongella</i> , <i>Gomphonema minutum</i> , <i>Nitzschia acidoclinata</i>
McCormick, P. V., and R. J. Stevenson	1998	2	<i>Nitzschia filiformis</i> , <i>Sellaphora minima</i>
Cooper, S. R., J. Huvane, P. Vaithiyanathan, and C. J. Richardson	1999	41	<i>Achnanthidium caledonicum</i> , <i>Achnanthidium exiguum</i> , <i>Adlafia minuscula</i> , <i>Amphora veneta</i> , <i>Anomoeoneis sphaerophora</i> f. <i>costata</i> , <i>Caloneis bacillum</i> , <i>Cocconeis placentula</i> var. <i>lineata</i> , <i>Cyclotella meneghiniana</i> , <i>Cymbella mesiana</i> , <i>Denticula kuetzingii</i> , <i>Diadesmis confervacea</i> , <i>Diploneis elliptica</i> , <i>Encyonopsis evergladianum</i> , <i>Encyonopsis microcephala</i> , <i>Eunotia camelus</i> , <i>Eunotia glacialis</i> , <i>Eunotia naegeli</i> , <i>Fragilaria capucina</i> var. <i>gracilis</i> , <i>Fragilaria capucina</i> var. <i>mesolepta</i> , <i>Fragilaria synegrotesca</i> , <i>Gomphonema gracile</i> , <i>Gomphonema parvulum</i> , <i>Hantzschia amphioxys</i> , <i>Kobayasiella subtilissima</i> , <i>Mastogloia smithii</i> , <i>Navicula cryptocephala</i> , <i>Nitzschia amphibia</i> , <i>Nitzschia frustulum</i> , <i>Nitzschia intermedia</i> , <i>Nitzschia linearis</i> , <i>Nitzschia nana</i> , <i>Nitzschia palea</i> , <i>Pinnularia divergens</i> , <i>Pinnularia gibba</i> , <i>Pinnularia viridis</i> ,

Author	Year	N Spp	Species
			<i>Rhopalodia gibba</i> , <i>Sellaphora minima</i> , <i>Sellaphora pupula</i> , <i>Sellaphora seminulum</i> , <i>Synedra ulna</i>
Pan, Y., R. J. Stevenson, P. Vaithiyathan, J. Slate, and C. J. Richardson	2000	2	<i>Gomphonema gracile</i> , <i>Nitzschia amphibia</i> f. <i>frauenfeldii</i>
Slate, J. E., and R. J. Stevenson	2000	11	<i>Caloneis bacillum</i> , <i>Cocconeis placentula</i> var. <i>lineata</i> , <i>Craticula cuspidata</i> , <i>Cyclotella meneghiniana</i> , <i>Epthemia adnata</i> , <i>Eunotia formica</i> , <i>Lemnicola hungarica</i> , <i>Navicula cryptocephala</i> , <i>Nitzschia frustulum</i> , <i>Sellaphora minima</i> , <i>Synedra ulna</i>
Winter, J. G., and H. C. Duthie	2000	2	<i>Achnanthidium minutissimum</i> , <i>Amphora pediculus</i>
Gaiser, E. E., J. C. Trexler, R. D. Jones, D. L. Childers, J. H. Richards, and L. J. Scinto	2006	12	<i>Achnanthidium caledonicum</i> , <i>Amphora veneta</i> , <i>Encyonema evergladianum</i> , <i>Encyonopsis microcephala</i> , <i>Eunotia flexuosa</i> , <i>Eunotia incisa</i> , <i>Fragilaria synegrotesca</i> , <i>Gomphonema parvulum</i> , <i>Mastogloia smithii</i> , <i>Navicula cryptotenella</i> , <i>Nitzschia amphibia</i> , <i>Rhopalodia gibba</i>
Potapova, M., and D. F. Charles	2007	125	<i>Achnanthes minutissima</i> var. <i>jackii</i> , <i>Achnanthidium caledonicum</i> , <i>Achnanthidium exiguum</i> , <i>Achnanthidium exilis</i> , <i>Achnanthidium minutissimum</i> , <i>Adlafia bryophila</i> , <i>Adlafia minuscula</i> , <i>Amphora copulata</i> , <i>Amphora ovalis</i> , <i>Amphora pediculus</i> , <i>Amphora veneta</i> , <i>Bacillaria paradoxa</i> , <i>Brachysira microcephala</i> , <i>Caloneis bacillum</i> , <i>Cocconeis placentula</i> var. <i>lineata</i> , <i>Craticula accomoda</i> , <i>Craticula cuspidata</i> , <i>Craticula molestiformis</i> , <i>Cymbella delicatula</i> , <i>Cymbella mesiana</i> , <i>Denticula elegans</i> , <i>Denticula kuetzingii</i> , <i>Diadesmis confervacea</i> , <i>Diploneis oblongella</i> , <i>Diploneis parma</i> , <i>Encyonema auerswaldii</i> , <i>Encyonema minutum</i> , <i>Encyonema silesiacum</i> , <i>Encyonopsis cesatii</i> , <i>Encyonopsis evergladianum</i> , <i>Encyonopsis microcephala</i> , <i>Epthemia adnata</i> , <i>Epithemia sores</i> , <i>Eunotia bilunaris</i> , <i>Eunotia flexuosa</i> , <i>Eunotia incisa</i> , <i>Eunotia monodon</i> , <i>Eunotia pectinalis</i> , <i>Eunotia prarerrupta</i> , <i>Fragilaria capucina</i> var. <i>gracilis</i> , <i>Fragilaria crotonensis</i> , <i>Fragilaria synegrotesca</i> , <i>Fragilaria tenera</i> , <i>Fragilaria vaucheriae</i> , <i>Gomphonema affine</i> , <i>Gomphonema angustatum</i> , <i>Gomphonema calvatum</i> , <i>Gomphonema gracile</i> ,

Author	Year	N Spp	Species
			<i>Gomphonema insigne</i> , <i>Gomphonema intricatum</i> , <i>Gomphonema mexicanum</i> , <i>Gomphonema minutum</i> , <i>Gomphonema olivaceoides</i> , <i>Gomphonema parvulum</i> , <i>Gomphonema pumilum</i> , <i>Gomphoenma sarcophagus</i> , <i>Gomphonema truncatum</i> , <i>Gomphosphenia grovei</i> , <i>Gyrosigma acuminatum</i> , <i>Hantzschia amphioxys</i> , <i>Hippodonta capitata</i> , <i>Hippodonta hungarica</i> , <i>Luticola mutica</i> , <i>Luticola naviculoides</i> , <i>Mastogloia smithii</i> , <i>Melosira varians</i> , <i>Navicula arvensis</i> f. <i>major</i> , <i>Navicula cari</i> , <i>Navicula cincta</i> , <i>Navicula cryptocephala</i> , <i>Navicula cryptotenella</i> , <i>Navicula erifuga</i> , <i>Navicula exilis</i> , <i>Navicula germainii</i> , <i>Navicula gregaria</i> , <i>Navicula lanceolata</i> , <i>Navicula laterostrata</i> , <i>Navicula menisculus</i> , <i>Navicula notha</i> , <i>Navicula radiosa</i> , <i>Navicula recens</i> , <i>Naviucla rostellata</i> , <i>Navicula stroemii</i> , <i>Navicula submuralis</i> , <i>Navicula trivialis</i> , <i>Navicula wallacei</i> , <i>Neidium dubium</i> , <i>Nitzschia acicularis</i> , <i>Nitzschia amphibia</i> , <i>Nitzschia amphibia</i> f. <i>frauenfeldii</i> , <i>Nitzschia angustata</i> , <i>Nitzschia archibaldii</i> , <i>Nitzschia capitellata</i> , <i>Nitzschia filiformis</i> , <i>Nitzschia fonticola</i> , <i>Nitzschia frustulum</i> , <i>Nitzschia hantzschiana</i> , <i>Nitzschia incognita</i> , <i>Nitzschia intermedia</i> , <i>Nitzschia lacuum</i> , <i>Nitzschia liebethruthii</i> , <i>Nitzschia linearis</i> , <i>Nitzschia palea</i> , <i>Nitzschia palea</i> var. <i>debilis</i> , <i>Nitzschia perminuta</i> , <i>Nitzschia sigmoidea</i> , <i>Nitzschia supralitorea</i> , <i>Nitzschia tropica</i> , <i>Nitzschia vitrea</i> , <i>Pinnularia microstauron</i> , <i>Placoneis exigua</i> , <i>Planothidium rostratum</i> , <i>Psammothidium marginulatum</i> , <i>Pseudostaurosira brevistriata</i> , <i>Rhoicosphenia abbreviata</i> , <i>Rhopalodia brebissonii</i> , <i>Rhopalodia gibba</i> , <i>Sellaphora bacillum</i> , <i>Sellaphora laevissima</i> , <i>Sellaphora pupula</i> , <i>Sellaphora pupula</i> var. <i>rectangularis</i> , <i>Sellaphora seminulum</i> , <i>Synedra acus</i> , <i>Synedra delicatissima</i> var. <i>angustissima</i> , <i>Synedra ulna</i>

Author	Year	N Spp	Species
Slate, J. E., and R. J. Stevenson	2007	49	<i>Achnantheidium caledonicum</i> , <i>Achnantheidium exiguum</i> , <i>Amphora veneta</i> , <i>Caloneis bacillum</i> , <i>Cocconeis placentula</i> var. <i>lineata</i> , <i>Craticula cuspidata</i> , <i>Craticula molestiformis</i> , <i>Cyclotella meneghiniana</i> , <i>Diadesmis confervacea</i> , <i>Diploneis oblongella</i> , <i>Diploneis ovalis</i> , <i>Encyonema neomesianum</i> , <i>Encyonopsis microcephala</i> , <i>Epithemia</i> spp., <i>Eunotia camelus</i> , <i>Eunotia flexuosa</i> , <i>Eunotia formica</i> , <i>Eunotia glacialis</i> , <i>Fragilaria capucina</i> var. <i>gracilis</i> , <i>Fragilaria synegrotesca</i> , <i>Fragilaria tenera</i> , <i>Gomphonema affine</i> , <i>Gomphonema gracile</i> , <i>Gomphonema parvulum</i> , <i>Gomphonema tenellum</i> , <i>Gomphonema vibriodes</i> , <i>Hantzschia amphioxys</i> , <i>Kobayasiella subtilissima</i> , <i>Lemnicola hungarica</i> , <i>Mastogloia smithii</i> , <i>Navicula cryptocephala</i> , <i>Navicula cryptotenella</i> , <i>Navicula podzorskii</i> , <i>Nitzschia amphibia</i> f. <i>frauenfeldii</i> , <i>Nitzschia frustulum</i> , <i>Nitzschia nana</i> , <i>Nitzschia palea</i> var. <i>debilis</i> , <i>Nitzschia perminuta</i> , <i>Nitzschia radicola</i> , <i>Nitzschia serpentiraphe</i> , <i>Nupela silvahercynia</i> , <i>Pinnularia acrosphaeria</i> , <i>Pinnularia divergens</i> , <i>Rhopalodia gibba</i> , <i>Sellaphora laevisissima</i> , <i>Sellaphora minima</i> , <i>Sellaphora seminulum</i> , <i>Synedra acus</i> , <i>Synedra ulna</i>
Zalack, J., and R. J. Stevenson	2010	1	<i>Mastogloia smithii</i>

References for Table S1

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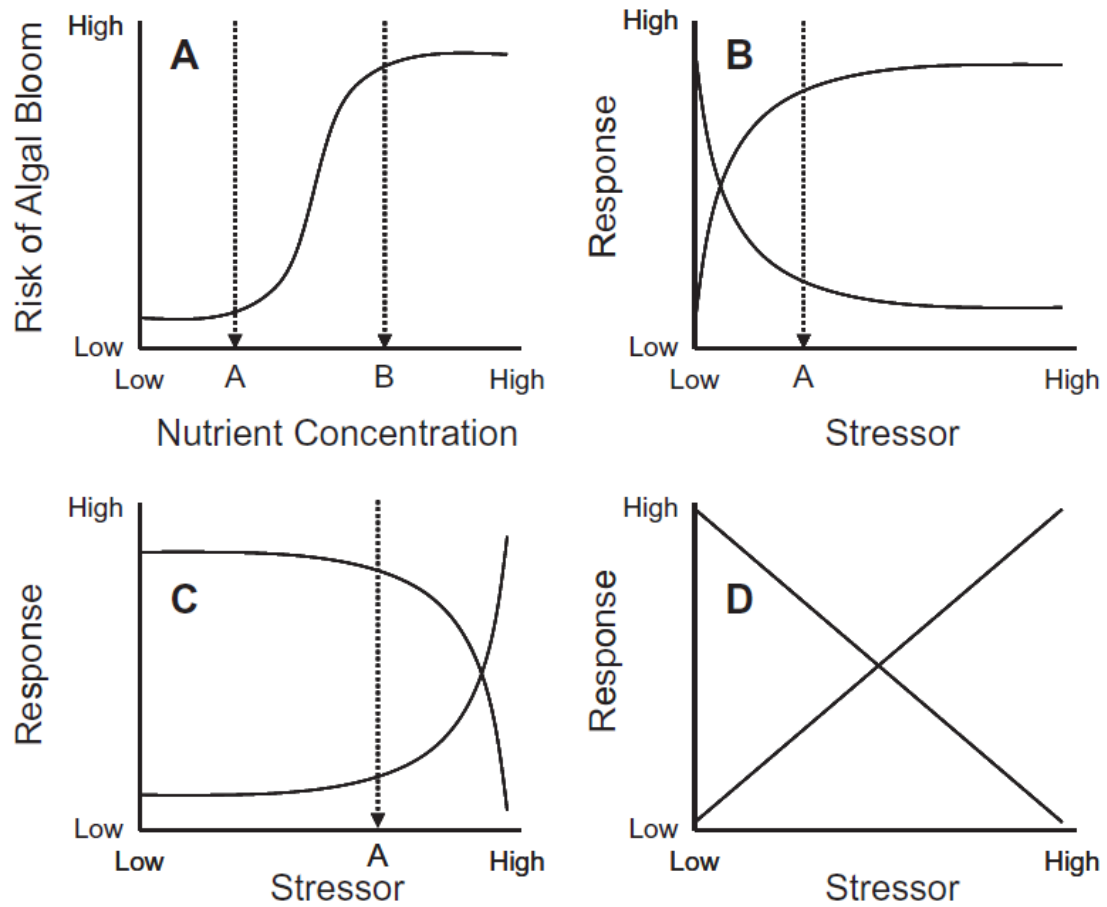


Fig. S1. Figures indicating the range of stressor–response relationships possible from Stevenson (2011). Figures are drawn to illustrate changes in algal bloom risk with increasing nutrient concentrations, but they could apply to any set of dependent and independent variables. The vertical, dotted arrows indicate thresholds along the stressor gradient where changes in state occur, defined by resilience and absolute condition of the state.

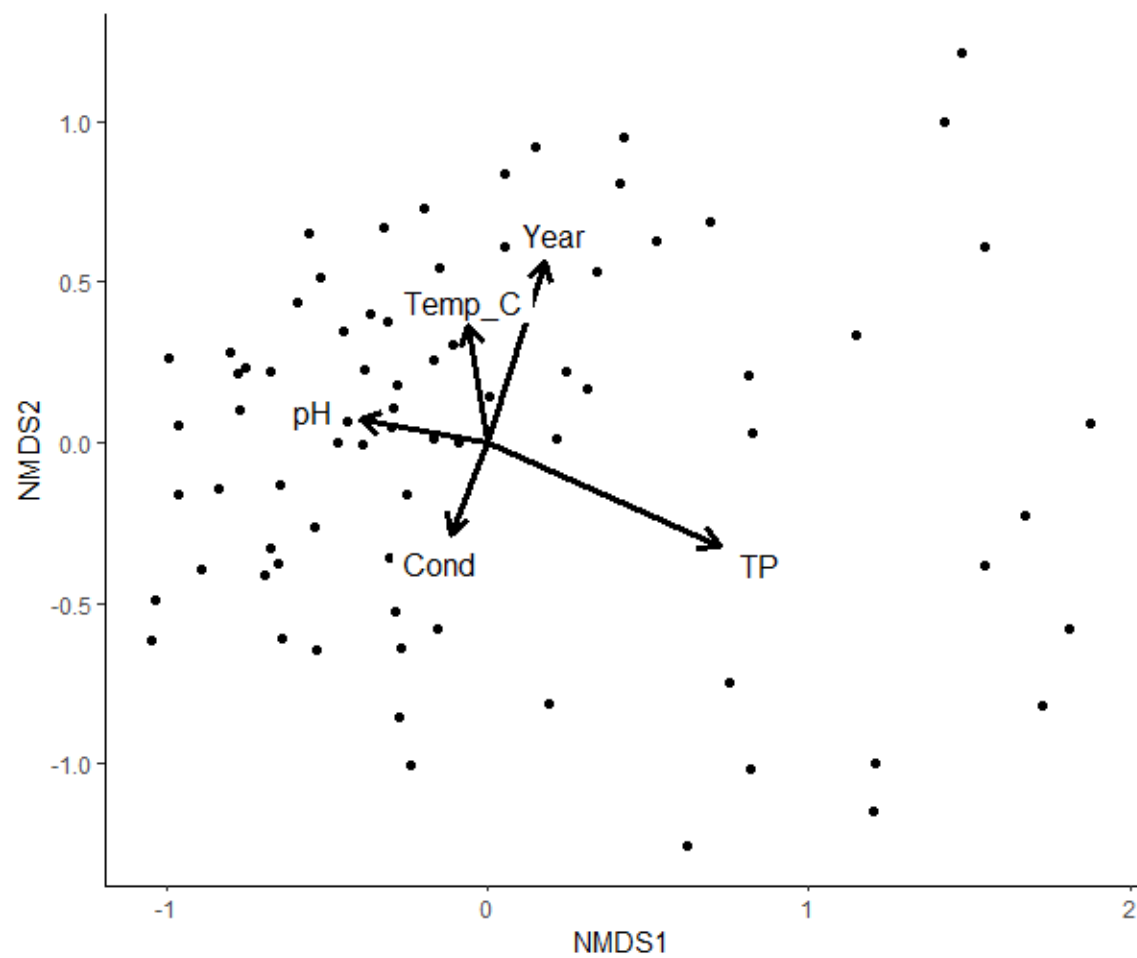


Fig. S2. Graphical results of NMDS ordination of 78 samples with all chemistries from the calibration dataset.

Table S2. Strength of ecological factor and taxonomist relationships with NMDS axes indicated by the coefficient of determination (R^2) and associated attained significance (p).

Variable	R^2	p
mat P	0.624	0.001
Temp_C	0.128	0.005
pH	0.162	0.002
Conductivity	0.086	0.041
H2O Year	0.349	0.001
H2O_Pres	0.000	1.000
Habitat	0.273	0.001
Color	0.161	0.001
taxonomist	0.173	0.001

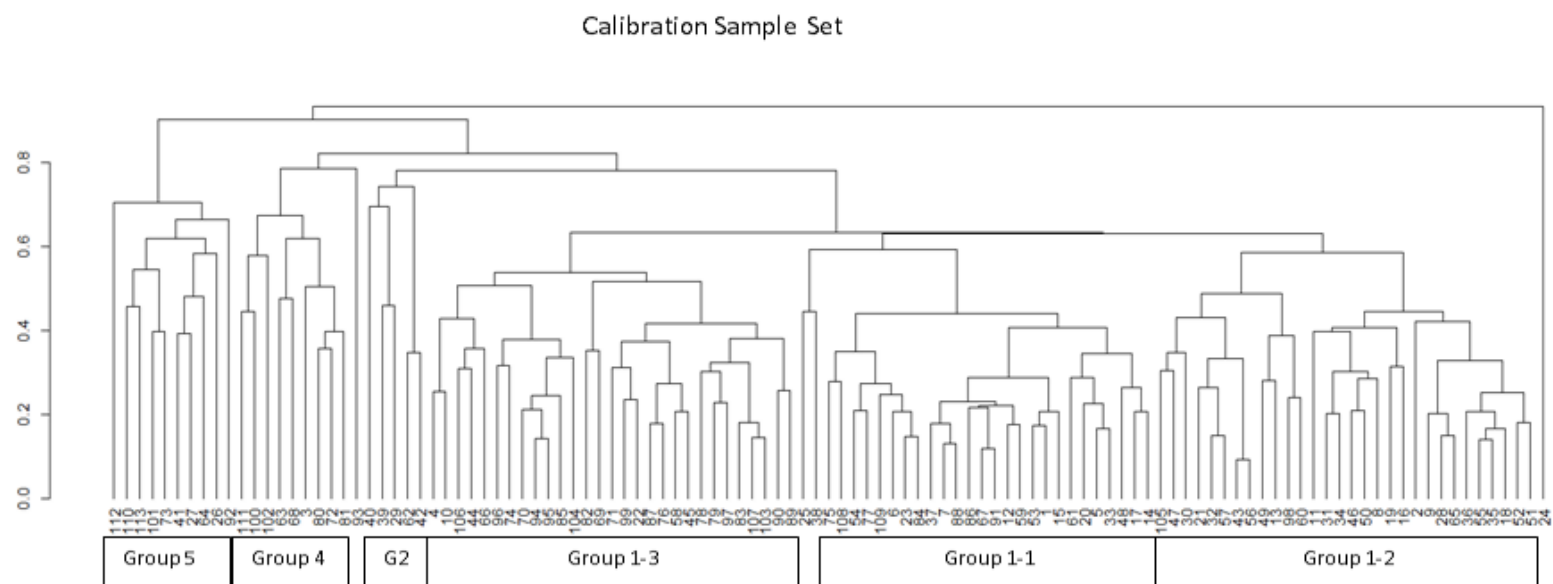


Fig. S3. Results of cluster analysis with Bray Curtis formula and all 113 samples from different sites in the calibration data set.

Taxon Names	Taxon Codes	Col 1	Col 2	Col 3	Col 4							Col 83	Col 84	Col 85	Col 86
Diadesmis confervacea Kützing	Diaconfe													2	
Gomphonema parvulum (Kützing) Kützing	Gomparvu													2	1
Ulnaria ulna (Nitzsch) Compère	Ulnulna													1	1
Eunotia glacialis Meister	Eunglaci														
Nitzschia spp.	Nitzschia														
Caloneis bacillum (Grunow) Cleve	Calbacil													1	2
Gomphonema affine Kützing	Gomaffin														
Nitzschia archibaldii Lange-Bertalot	Nitarchi														2
Pinnularia acrosphaeria (Brébisson) Smith	Pinacros										1				2
Encyonema minutum (Hilse) Mann	Encminut													1	
Nitzschia palea var. tenuirostris Grunow	Nitpalet														2
Nitzschia gracilis Hantzsch	Nitgraci													1	
Caloneis spp.	Caloneis														1
Nitzschia amphibia Grunow	Nitamphi										2				
Nitzschia nana Grunow ex Van Heurck	Nitnana														
Eunotia bilunaris (Ehrenberg) Souza	Eunbilun				1									1	2
Gomphonema minutum (Agardh) Agardh	Gomminut	1												1	
Nitzschia palea var. debilis (Kützing) Grunow	Nitpaled		1	1											
Eunotia naegelii Migula	Eunnaege														2
Nitzschia filiformis (W. Smith) Schütt	Nitfilif													1	
Nitzschia acidoclinata Lange-Bertalot	Nitacido														2
Eunotia camelus Ehrenberg	Euncamel														
Nitzschia perminuta (Grunow) Peragallo	Nitpermi														
Gomphonema auritum Braun	Gomaurit		1	2								1	2	1	
Ulnaria delicatissima var. angustissima (Grunow) Grunow	UIndelva													1	1
Gomphonema spp.	Gomphonema			1											
Pinnularia viridiformis Krammer	Pinvirid										1				
Pinnularia microstauron (Ehrenberg) Cleve	Pinmicro														2
Pinnularia subcapitata Gregory	Pinsubca													1	
Nitzschia radicular Hustedt	Nitradic														
Eunotia flexuosa (Brébisson ex Kützing) Kützing	Eunflexu										2				
Nitzschia subacicularis Hustedt	Nitsubac													1	
Rhopalodia gibba (Ehrenberg) Müller	Rhogibba										2				1
Sellaphora pupula (Kützing) Mereschkowsky	Selpupul														
Diploneis ovalis (Hilse) Cleve	Dipovali														
Adlafia spp.	Adlafia														1
Encyonema silesiacum (Bleisch) Mann	Encsiles	1	1	2	2						1		2	1	
Amphora ovalis (Kützing) Kützing	Ampovalis														
Eunotia formica Ehrenberg	Eunformi											1			
Cyclotella meneghiniana Kützing	Cycmeneg				1						1				2
Gomphonema pumilum (Grunow) Reichardt and Grunow	Gompumil														
Sellaphora saugerresii (Desmazières) Wetzel and Grunow	Selsauge				1									2	2
Fragilaria tenera (Smith) Lange-Bertalot	Fratener		1												
Navicula cryptotenella Lange-Bertalot	Navcryptn	1	2	2	1						2		2	2	
Encyonema auerswaldii Rabenhorst	Encauers														1
Eunotia spp.	Eunotia										1				
Gomphonema gracile Ehrenberg	Gomgraci				2						2		2	1	
Encyonopsis microcephala (Grunow) Krammer	Encmicro			2	2										
Diploneis oblongella (Nägeli ex Kützing) Ross	Dipoblon		1												
Nitzschia sp. 1	Nitsp1		2	2	1						2				
Diploneis parva Cleve	Dipparma										1			1	
Navicula cryptocephala Kützing	Navcrypt										2		2	1	
Navicula reichardtiana Lange-Bertalot	Navreich														1
Sellaphora stroemii (Hustedt) Kobayasi	Selstroee	1													
Adlafia bryophila (Petersen) Moser, Lange-Bertalot and Grunow	Adlbryop	2	2	2										1	1
Brachysira ocalanensis Shaylor and Siver	Braocala	2	2	2	1										
Achnanthisidium minutissimum (Kützing) Czarnecki	Achminut	2			2										
Encyonema evergladianum Krammer	Enceverg	2													1
Pinnularia spp.	Pinnularia											2	1		
Nitzschia serpentirapha Lange-Bertalot	Nitserpe	1			1						2				
Fragilaria syngrotesca Lange-Bertalot	Frasyneg	2	2	1											
Eunotia nymmanniana Grunow	Eunnyman										2			1	
Mastogloia calcarea Sylvia S. Lee, E.E. Gaiser, and Grunow	Mascalca	1													
Navicula radiosa Kützing	Navradio				1						1				

Fig. S4. b) Species names associated with codes and rows of relative abundances in Fig. S4a. Species names for rows in Fig. S4 can be matched here using the color patterns of cells in the first 4 and last 4 samples that are shown here in the heat map (Fig. S4a).

Table S3. Low and high P taxa traits determined by literature, regression, and TITAN, as well as taxa mat P optima. Taxa are listed in order of abundance determined by the sum of taxon relative abundances in all calibration data set samples for the first 24 taxa, then alphabetically if they were observed in the dataset, and then alphabetically if they were not observed in the dataset by had traits determined by the literature. 1 indicates either a low or high P trait is present and 0 indicates it is absent. Then number of samples in which a taxon was observed is indicated by NoSamp.

Harmonized_Name	NoSam p	RAsum	Low P			High P			Optima
			Li t	Reg r	TITA N	Li t	Reg r	TIT AN	
Encyonopsis microcephala (Grunow) Krammer	210	44.433	1	1	1	0	0	0	7.787
Mastogloia calcarea Lee, Gaiser, Van de Vijver, Edlund, et Spauld.	176	34.542	1	1	1	0	0	0	7.320
Encyonema evergladianum Krammer	157	22.873	1	1	1	0	0	0	6.818
Brachysira ocalanensis Shayler and Siver	206	17.440		1	1		0	0	7.723
Nitzschia sp. 1	218	17.251		1	1		0	0	7.610
Fragilaria synegrotesca Lange-Bertalot	175	10.436	1	1	1	0	0	0	8.074
Adlafia bryophila (Petersen) Moser, Lange-Bertalot and Metzeltin	144	3.831		1	1		0	0	7.510
Nitzschia serpentiraphe Lange-Bertalot	69	2.184		1	1		0	0	7.245
Sellaphora stroemii (Hustedt) Kobayasi	27	0.179			1			0	7.246
Diploneis oblongella (Nägeli ex Kützing) Ross	13	0.047	1		1	0		0	6.794
Navicula reichardtiana Lange-Bertalot	10	0.034			1			0	7.728
Encyonema silesiacum (Bleisch) Mann	224	16.305	1	0	0	0	1	1	8.780
Navicula cryptotenella Lange-Bertalot	211	12.763		0	0		1	1	8.484
Achnanthidium minutissimum (Kützing) Czarnecki	170	11.607			0			1	8.435
Nitzschia amphibia Grunow	109	7.513	0	0	0	1	1	1	10.227
Gomphonema auritum Braun	133	3.546		0	0		1	1	9.374
Gomphonema gracile Ehrenberg	133	2.950		0	0		1	1	8.776
Eunotia nymanniana Grunow	48	2.565		0	0		1	1	10.166
Nitzschia palea var. debilis (Kützing) Grunow	67	2.418	0	0	0	1	1	1	9.680
Eunotia naegelia Migula	76	2.030	0	0	0	1	1	1	9.669
Eunotia camelus Ehrenberg	37	1.637		0	0		1	1	9.401
Nitzschia filiformis (W. Smith) Schütt	37	1.622	0	0	0	1	1	1	10.214

Harmonized_Name	NoSam p	RAsum	Low P			High P			Optima
			Li t	Reg r	TITA N	Li t	Reg r	TIT AN	
Gomphonema parvulum (Kützing) Kützing	33	1.574	0	0	0	1	1	1	10.516
Navicula cryptocephala Kützing	57	1.220			0			1	8.966
Achnanthidium	12	0.101		0			1		10.803
Achnanthidium exiguum (Grunow) Czarnecki	3	0.020	0			1			8.381
Achnanthidium rosenstockii	1	0.003							
Adlafia	47	0.300							8.727
Amphora	1	0.002							8.614
Amphora copulata (Kützing) Schoeman and Archibald	6	0.022	0			1			7.525
Amphora ovalis (Kützing) Kützing	10	0.038							8.640
Anomoeoneis	1	0.002							
Aulacoseira	4	0.437							10.780
Aulacoseira ambigua (Grunow) Simonsen	1	0.007							9.937
Aulacoseira granulata (Ehrenberg) Simonsen	1	0.003							
Aulacoseira italica (Ehrenberg) Simonsen	1	0.005							11.764
Brachysira	4	0.008							
Brachysira vitrea (Grunow) Ross	3	0.021							
Caloneis	11	0.059		0	0		1	1	10.071
Caloneis alpestris (Grunow) Cleve	1	0.025							9.647
Caloneis bacillum (Grunow) Cleve	12	0.122	0	0		1	1		11.384
Caloneis fontinalis (Grunow) Cleve-Euler	2	0.048							10.022
Chamaepinnularia	3	0.010							7.021
Chamaepinnularia mediocris (Krasske) Lange-Bertalot	4	0.036							9.175
Chamaepinnularia submuscolata (Krasske) Lange-Bertalot	3	0.009							8.373
Cocconeis placentula Ehrenberg	4	0.007							8.812
Craticula cuspidata (Kützing) Mann	4	0.014	0			1			8.797
Craticula halophila (Grunow ex Van Heurck) Mann	1	0.002							8.012
Craticula subminuscula (Manguin) Wetzel et al.	1	0.006							
Cyclotella meneghiniana Kützing	76	0.368	0	0	0	1	1	1	9.524
Cymbella	3	0.012							10.284

Harmonized_Name	NoSam p	RAsum	Low P			High P			Optima
			Li t	Reg r	TITA N	Li t	Reg r	TIT AN	
Cymbella aspera (Ehrenberg) Cleve	2	0.006							9.260
Cymbella leptoceros (Ehrenberg) Kützing	4	0.028							8.814
Cymbella mexicana (Ehrenberg) Cleve	2	0.010							9.525
Diadlesmis confervacea Kützing	10	0.705	0	0	0	1	1	1	11.057
Diploneis	2	0.003							6.566
Diploneis elliptica (Kützing) Cleve	4	0.008							7.045
Diploneis marginestriata Hustedt	1	0.003							9.402
Diploneis ovalis (Hilse) Cleve	51	0.218			0			1	8.726
Diploneis parva Cleve	46	0.349	1			0			8.424
Diploneis puella (Schumann) Cleve	1	0.012							9.647
Diploneis subovalis Cleve	1	0.003							6.634
Encyonema	5	0.023	1			0			7.473
Encyonema auerswaldii Rabenhorst	61	0.665			0			1	8.337
Encyonema cespitosum	1	0.002							5.922
Encyonema minutum (Hilse) Mann	25	0.264	1	0	0	0	1	1	10.056
Encyonema pergracile Krammer	1	0.002							
Encyonopsis	2	0.006							6.357
Encyonopsis cesatii (Rabenhorst) Krammer	4	0.009	1			0			9.243
Epithemia	2	0.006							
Epithemia adnata (Kützing) Brébisson	1	0.015							9.937
Eunotia	27	0.095		0	0		1	1	9.517
Eunotia arcus Ehrenberg	7	0.029							9.175
Eunotia bilunaris (Ehrenberg) Souza	61	0.842		0	0		1	1	9.981
Eunotia flexuosa (Brébisson ex Kützing) Kützing	26	0.397		0	0		1	1	9.706
Eunotia formica Ehrenberg	10	0.049	0	0	0	1	1	1	10.366
Eunotia glacialis Meister	14	0.074			0			1	9.711
Eunotia implicata Nörpel, Alles and Lange-Bertalot	2	0.006							
Eunotia intermedia (Krasske ex Hustedt) Nörpel and Lange-Bertalot	3	0.014							

Harmonized_Name	NoSam p	RAsum	Low P			High P			Optima
			Li t	Reg r	TITA N	Li t	Reg r	TIT AN	
Eunotia minor (Kützing) Grunow	5	0.025							6.268
Eunotia monodon Ehrenberg	3	0.022	1			0			9.825
Eunotia parallela Ehrenberg	1	0.013							8.614
Eunotia pectinalis (Kützing) Rabenhorst	2	0.008	0			1			
Eunotia pectinalis var. undulata (Ralfs) Rabenhorst	3	0.005	0			1			9.012
Eunotia pirla Carter and Flower	2	0.013							
Eunotia rhomboidea Hustedt	3	0.006							8.809
Eunotia subarcuatoides Alles, Nörpel and Lange-Bertalot	7	0.064							9.961
Fallacia lenzii (Hustedt) Lange-Bertalot	3	0.005							7.813
Fragilaria	13	0.151							7.424
Fragilaria tenera (Smith) Lange-Bertalot	47	0.848	1			0			8.799
Fragilaria vaucheriae (Kützing) Petersen	3	0.008							8.773
Frustulia	1	0.005							9.625
Frustulia crassinervia (Brébisson) Lange-Bertalot and Krammer	1	0.013							
Gomphonema	25	0.149			0			1	9.264
Gomphonema acuminatum Ehrenberg	5	0.079							7.887
Gomphonema affine Kützing	21	0.266		0	0		1	1	10.272
Gomphonema contraturris Lange-Bertalot and Reichardt	11	0.065		0			1		10.539
Gomphonema drutelingense Reichardt	6	0.016							10.136
Gomphonema intricatum Kützing	1	0.002							
Gomphonema minutum (Agardh) Agardh	39	0.503	0	0	0	1	1	1	9.960
Gomphonema pumilum (Grunow) Reichardt and Lange-Bertalot	10	0.043	1			0			8.082
Gomphonema subclavatum (Grunow) Grunow	2	0.004							12.027
Gomphonema truncatum Ehrenberg	1	0.002							9.647
Gyrosigma acuminatum (Kützing) Rabenhorst	1	0.003							
Halamphora veneta (Kützing) Levkov	4	0.047							10.850
Hantzschia amphioxys (Ehrenberg) Grunow	1	0.002	0			1			10.353

Harmonized_Name	NoSam p	RAsum	Low P			High P			Optima
			Li t	Reg r	TITA N	Li t	Reg r	TIT AN	
Hippodonta capitata (Ehrenberg) Lange-Bertalot, Metzeltin and Witkowski	1	0.003							
Hippodonta lueneburgensis (Grunow) Lange-Bertalot, Metzeltin and Witkowski	1	0.014							9.066
Humidophila perpusilla (Grunow) Lowe et al.	1	0.023							7.856
Lemnicola hungarica (Grunow) Round and Basson	1	0.003							
Luticola	2	0.004							9.964
Luticola naviculoides Johansen	1	0.060	1			0			
Navicula	8	0.110							8.462
Navicula aquaeductae (Krasske) Krasske	1	0.002							7.856
Navicula capitatoradiata Germain	1	0.002							9.937
Navicula caterva Hohn and Hellerman	1	0.003							
Navicula contenta var. biceps (Grunow) Van Heurck	1	0.003							
Navicula exilis Kützing	2	0.004							9.570
Navicula lanceolata (Agardh) Kützing	3	0.014	0			1			
Navicula oligotraphenta Lange-Bertalot and Hofmann	2	0.006							7.603
Navicula radiosa Kützing	20	0.119							7.740
Navicula recens (Lange-Bertalot) Lange-Bertalot	5	0.033	0			1			8.592
Navicula trivialis Lange-Bertalot	4	0.013	0			1			8.408
Navicula veneta Kützing	4	0.043							8.835
Neidium	1	0.008							9.066
Neidium affine (Ehrenberg) Pfitzer	2	0.003							
Neidium ampliatus (Ehrenberg) Krammer	3	0.005							9.022
Neidium iridis (Ehrenberg) Cleve	1	0.007							10.627
Nitzschia	32	0.876			0			1	9.554
Nitzschia acicularis (Kützing) Smith	5	0.026	0	0		1	1		11.871
Nitzschia acidoclinata Lange-Bertalot	26	0.725			0			1	9.801
Nitzschia agnita Hustedt	6	0.034		0			1		10.556
Nitzschia archibaldii Lange-Bertalot	21	0.539	0	0	0	1	1	1	10.367

Harmonized_Name	NoSam p	RAsum	Low P			High P			Optima
			Li t	Reg r	TITA N	Li t	Reg r	TIT AN	
Nitzschia brevissima Grunow	1	0.003							
Nitzschia capitellata Hustedt	1	0.003	0			1			
Nitzschia exilis Sovereign	8	0.026							8.928
Nitzschia fonticola (Grunow) Grunow	2	0.005							
Nitzschia frustulum (Kützing) Grunow	1	0.005	0			1			
Nitzschia fruticosa Hustedt	5	0.037		0	0		1	1	10.445
Nitzschia gracilis Hantzsch	52	0.823		0	0		1	1	10.561
Nitzschia hamburgiense Lange-Bertalot	1	0.003							
Nitzschia inconspicua Grunow	2	0.005							9.383
Nitzschia intermedia Hantzsch ex Cleve and Grunow	9	0.038	0			1			8.684
Nitzschia lacuum Lange-Bertalot	1	0.003							8.460
Nitzschia linearis (Agardh) W. Smith	7	0.026		0			1		10.932
Nitzschia nana Grunow ex Van Heurck	40	0.786	0	0	0	1	1	1	9.629
Nitzschia palea var. tenuirostris Grunow	25	0.404		0	0		1	1	10.232
Nitzschia paleacea Grunow	7	0.037							9.402
Nitzschia perminuta (Grunow) Peragallo	11	0.121	0			1			9.316
Nitzschia radícula Hustedt	35	0.523		0	0		1	1	9.326
Nitzschia semirobusta Lange-Bertalot	8	0.056							8.739
Nitzschia sociabilis Hustedt	13	0.080							9.278
Nitzschia subacicularis Hustedt	31	0.340		0	0		1	1	9.105
Nitzschia subtilis (Kützing) Grunow	4	0.016							10.284
Nitzschia wuellerstorffii Lange-Bertalot	6	0.024		0	0		1	1	10.388
Pinnularia	34	0.648		0	0		1	1	10.213
Pinnularia acrosphaeria (Brébisson) Smith	19	0.106		0	0		1	1	10.394
Pinnularia brebissonii (Kützing) Rabenhorst	1	0.003							
Pinnularia gibba var. linearis Hustedt	2	0.022							10.218
Pinnularia microstauron (Ehrenberg) Cleve	37	0.122		0	0		1	1	10.220
Pinnularia obscura Krasske	1	0.003							9.022
Pinnularia subcapitata Gregory	8	0.051		0	0		1	1	9.685

Harmonized_Name	NoSam p	RAsum	Low P			High P			Optima
			Li t	Reg r	TITA N	Li t	Reg r	TIT AN	
Pinnularia subgibba Krammer	1	0.002							
Pinnularia viridiformis Krammer	7	0.015							6.846
Pinnularia viridis (Nitzsch) Ehrenberg	11	0.041		0	0		1	1	10.159
Placoneis clementis (Grunow) Cox	1	0.002							9.647
Placoneis ignorata (Schimanski) Lange-Bertalot	2	0.009							10.162
Placoneis symmetrica (Hustedt) Lange-Bertalot	1	0.006							10.353
Planothidium lanceolatum (Brébisson ex Kützing) Lange-Bertalot	1	0.002							
Psammothidium marginulatum (Grunow) Bukhtiyarova and Round	1	0.002							11.764
Rhopalodia	1	0.003							
Rhopalodia gibba (Ehrenberg) Müller	41	0.429		0	0		1	1	9.406
Sellaphora	7	0.061		0			1		11.818
Sellaphora atomoides (Grunow) Wetzel and Van de Vijver	6	0.024		0			1		10.588
Sellaphora nigri (De Notaris) Wetzel and Ector	3	0.017							10.649
Sellaphora pupula (Kützing) Mereschkowsky	16	0.061	0	0	0	1	1	1	9.388
Sellaphora rectangularis (Gregory) Lange-Bertalot and Metzeltin	11	0.051							8.411
Sellaphora saugerresii (Desmazières) Wetzel and Mann	41	0.550		0	0		1	1	9.414
Sellaphora wallacei (Reimer) Potapova and Ponader	1	0.003							6.762
Stauroneis	4	0.007							9.500
Stauroneis anceps Ehrenberg	2	0.010							9.923
Stauroneis gracilis Ehrenberg	2	0.005							
Stauroneis obtusa Lagerstedt	2	0.012							7.200
Stauroneis phoenicenteron (Nitzsch) Ehrenberg	3	0.008							8.908
Stenopterobia curvula (Smith) Krammer	4	0.030							9.573
Stephanodiscus minutulus (Kützing) Cleve and Möller	1	0.001							
Thalassiosira weissflogii (Grunow) G.A. Fryxell and Hasle	1	0.004							11.044
Ulnaria delicatissima var. angustissima (Grunow) Aboal	34	0.389		0	0		1	1	10.002

Harmonized_Name	NoSam p	RAsum	Low P			High P			Optima
			Li t	Reg r	TITA N	Li t	Reg r	TIT AN	
Ulnaria ulna (Nitzsch) Compère	21	0.338		0	0		1	1	10.209
Unknown (Undetermined pennate)	3	0.020							6.391
Adlafia minuscula (Grunow) Lange-Bertalot	NA	NA	1			0			
Amphora veneta fo. globulosa	NA	NA	0			1			
Brachysira microcephala (Kützing) Compère	NA	NA	1			0			
Cocconeis placentula var. lineata (Ehrenberg) Van Heurck	NA	NA	0			1			
Denticula kuetzingii Grunow	NA	NA	1			0			
Diploneis boldtiana Cleve	NA	NA	1			0			
Encyonopsis falaisensis (Grunow) Krammer	NA	NA	1			0			
Gomphonema angustatum (Kützing) Rabenhorst	NA	NA	0			1			
Gomphonema insigne Gregory	NA	NA	0			1			
Gomphonema olivaceoides Hustedt	NA	NA	1			0			
Melosira varians Agardh	NA	NA	0			1			
Navicula erifuga Lange-Bertalot	NA	NA	0			1			
Navicula germainii Wallace	NA	NA	0			1			
Navicula gregaria Donkin	NA	NA	0			1			
Navicula submuralis Hustedt	NA	NA	0			1			
Nitzschia liebethruthii Rabenhorst	NA	NA	1			0			
Nitzschia tropica Hustedt	NA	NA	0			1			
Placoneis exigua (Gregory) Mereschowsky	NA	NA	0			1			
Sellaphora bacillum (Ehrenberg) Mann	NA	NA	1			0			
Sellaphora laevissima (Kützing) Mann	NA	NA	1			0			
Sellaphora seminulum (Grunow) Mann	NA	NA	0			1			

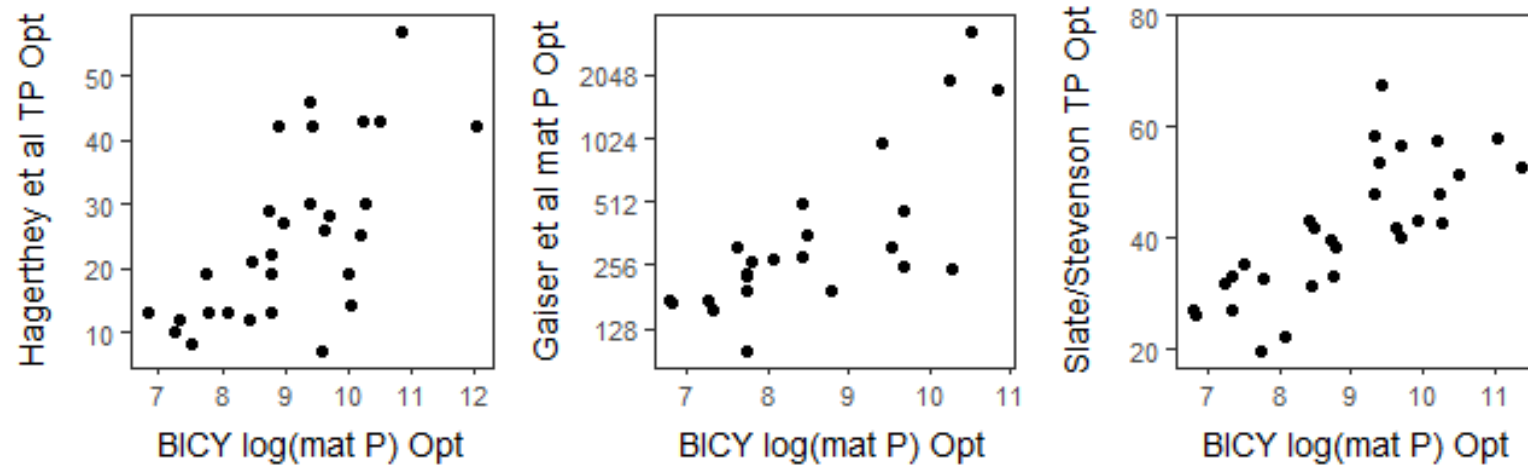


Fig. S5. Comparing mat and TP optimum traits across studies.

Table S4. Linear regression relationship of metrics with log transformed mat P. The models include the intercept, estimate of the slope, a standard error of the slope estimate, the p value for the statistical significance of the slope, a code for quick reference of p values (p*), and the adjusted R² for relationships.

Diversity or Trait-Based Metric			Intercept	Slope				adj R2
Trait	Source	Metric.Type		Estimate	SE (est)	p	p*	
High P	Lit	noTaxa	-8.098	1.349	0.215	<0.0001	****	0.470
High P	Lit	PropTaxa	-0.233	0.044	0.008	<0.0001	****	0.398
High P	Lit	PropValves	-0.769	0.106	0.017	<0.0001	****	0.464
High P	Lit	RlogA	-0.429	0.066	0.009	<0.0001	****	0.569
High P	Regr	noTaxa	-19.241	3.427	0.422	<0.0001	****	0.601
High P	Regr	PropTaxa	-0.347	0.095	0.012	<0.0001	****	0.600
High P	Regr	PropValves	-1.088	0.171	0.025	<0.0001	****	0.523
High P	Regr	RlogA	-0.657	0.128	0.015	<0.0001	****	0.638
High P	TITAN	noTaxa	-18.032	3.519	0.464	<0.0001	****	0.568
High P	TITAN	PropTaxa	-0.206	0.090	0.010	<0.0001	****	0.635
High P	TITAN	PropValves	-1.073	0.178	0.023	<0.0001	****	0.574
High P	TITAN	RlogA	-0.596	0.131	0.013	<0.0001	****	0.699
Low P	Lit	noTaxa	8.528	-0.525	0.141	0.0006	***	0.232
Low P	Lit	PropTaxa	0.745	-0.061	0.009	<0.0001	****	0.531
Low P	Lit	PropValves	1.331	-0.105	0.020	<0.0001	****	0.375
Low P	Lit	RlogA	0.971	-0.079	0.010	<0.0001	****	0.607
Low P	Regr	noTaxa	12.919	-0.909	0.153	<0.0001	****	0.444
Low P	Regr	PropTaxa	1.104	-0.095	0.010	<0.0001	****	0.666
Low P	Regr	PropValves	2.078	-0.182	0.024	<0.0001	****	0.572
Low P	Regr	RlogA	1.577	-0.139	0.014	<0.0001	****	0.708
Low P	TITAN	noTaxa	14.111	-1.017	0.160	<0.0001	****	0.477
Low P	TITAN	PropTaxa	1.187	-0.103	0.010	<0.0001	****	0.701
Low P	TITAN	PropValves	2.082	-0.182	0.024	<0.0001	****	0.573
Low P	TITAN	RlogA	1.610	-0.142	0.013	<0.0001	****	0.720
evenness		diversity	0.661	-0.001	0.009	0.8828		-0.023
richness		diversity	-7.171	3.230	0.623	<0.0001	****	0.376

Diversity or Trait-Based Metric			Intercept	Slope				adj R2
Trait	Source	Metric.Type		Estimate	SE (est)	<i>p</i>	<i>p</i> *	
ShannonH		diversity	1.045	0.103	0.040	0.0142	*	0.114
WAM_matP		Inferred mat P	4.744	0.426	0.051	<0.0001	****	0.619
WAM_RlogA.matP		Inferred mat P	5.390	0.375	0.036	<0.0001	****	0.710

Table S5. Linear regression relationship of metrics and mat P with three independent variables (IndepVar): longitude, latitude, and lat*long interaction term. The regression results include an estimate of the intercept and slopes associated with each independent variable, as well as a standard error (SE (est)) of the slope estimate, the p value for the statistical significance of the slope, a code for quick reference of p values (p*), and the adjusted R² for relationships.

Metric or Mat P			IndepVar	Estimate	SE (est)	<i>p</i>	<i>p</i> *	adj R2
Trait	Source	Metric.Type						
High P	Lit	noTaxa	intercept	5.169E+04	1.089E+04	<0.0001	****	
High P	Lit	noTaxa	longitude	1.084E-01	2.292E-02	<0.0001	****	
High P	Lit	noTaxa	latitude	1.791E-02	3.761E-03	<0.0001	****	
High P	Lit	noTaxa	lat*long	-3.760E-08	7.920E-09	<0.0001	****	0.5494
High P	Lit	PropTaxa	intercept	1.612E+03	4.120E+02	0.0003	***	
High P	Lit	PropTaxa	longitude	3.380E-03	8.673E-04	0.0004	***	
High P	Lit	PropTaxa	latitude	5.585E-04	1.423E-04	0.0003	***	
High P	Lit	PropTaxa	lat*long	-1.170E-09	3.000E-10	0.0003	***	0.4925
High P	Lit	PropValves	intercept	3.407E+03	9.309E+02	0.0007	***	
High P	Lit	PropValves	longitude	7.106E-03	1.960E-03	0.0008	***	
High P	Lit	PropValves	latitude	1.180E-03	3.217E-04	0.0007	***	
High P	Lit	PropValves	lat*long	-2.460E-09	6.770E-10	0.0008	***	0.4776
High P	Lit	RlogA	intercept	2.297E+03	4.277E+02	<0.0001	****	
High P	Lit	RlogA	longitude	4.802E-03	9.004E-04	<0.0001	****	
High P	Lit	RlogA	latitude	7.956E-04	1.478E-04	<0.0001	****	
High P	Lit	RlogA	lat*long	-1.660E-09	3.110E-10	<0.0001	****	0.6533
High P	Regr	noTaxa	intercept	1.094E+05	2.423E+04	0.0001	****	
High P	Regr	noTaxa	longitude	2.290E-01	5.102E-02	0.0001	****	

Metric or Mat P			IndepVar	Estimate	SE (est)	<i>p</i>	<i>p</i> *	adj R2
Trait	Source	Metric.Type						
High P	Regr	noTaxa	latitude	3.791E-02	8.373E-03	0.0001	****	
High P	Regr	noTaxa	lat*long	-7.940E-08	1.760E-08	0.0001	****	0.5624
High P	Regr	PropTaxa	intercept	2.514E+03	7.400E+02	0.0016	**	
High P	Regr	PropTaxa	longitude	5.249E-03	1.558E-03	0.0017	**	
High P	Regr	PropTaxa	latitude	8.712E-04	2.557E-04	0.0015	**	
High P	Regr	PropTaxa	lat*long	-1.820E-09	5.380E-10	0.0016	**	0.4690
High P	Regr	PropValves	intercept	5.132E+03	1.296E+03	0.0003	***	
High P	Regr	PropValves	longitude	1.072E-02	2.728E-03	0.0003	***	
High P	Regr	PropValves	latitude	1.779E-03	4.478E-04	0.0003	***	
High P	Regr	PropValves	lat*long	-3.710E-09	9.430E-10	0.0003	***	0.5613
High P	Regr	RlogA	intercept	3.328E+03	8.677E+02	0.0004	***	
High P	Regr	RlogA	longitude	6.942E-03	1.827E-03	0.0005	***	
High P	Regr	RlogA	latitude	1.154E-03	2.998E-04	0.0004	***	
High P	Regr	RlogA	lat*long	-2.410E-09	6.310E-10	0.0005	***	0.5771
High P	TITAN	noTaxa	intercept	1.078E+05	2.668E+04	0.0002	***	
High P	TITAN	noTaxa	longitude	2.258E-01	5.616E-02	0.0003	***	
High P	TITAN	noTaxa	latitude	3.737E-02	9.217E-03	0.0002	***	
High P	TITAN	noTaxa	lat*long	-7.820E-08	1.940E-08	0.0002	***	0.5244
High P	TITAN	PropTaxa	intercept	1.918E+03	6.953E+02	0.0087	**	

Metric or Mat P			IndepVar	Estimate	SE (est)	<i>p</i>	<i>p</i> *	adj R2
Trait	Source	Metric.Type						
High P	TITAN	PropTaxa	longitude	3.998E-03	1.464E-03	0.0093	**	0.4478
High P	TITAN	PropTaxa	latitude	6.654E-04	2.402E-04	0.0085	**	
High P	TITAN	PropTaxa	lat*long	-1.390E-09	5.060E-10	0.0091	**	
High P	TITAN	PropValves	intercept	4.107E+03	1.409E+03	0.0058	**	0.4778
High P	TITAN	PropValves	longitude	8.562E-03	2.967E-03	0.0063	**	
High P	TITAN	PropValves	latitude	1.424E-03	4.870E-04	0.0057	**	
High P	TITAN	PropValves	lat*long	-2.970E-09	1.030E-09	0.0061	**	0.4830
High P	TITAN	RlogA	intercept	2.674E+03	9.391E+02	0.0069	**	
High P	TITAN	RlogA	longitude	5.567E-03	1.977E-03	0.0075	**	
High P	TITAN	RlogA	latitude	9.275E-04	3.245E-04	0.0067	**	0.2322
High P	TITAN	RlogA	lat*long	-1.930E-09	6.830E-10	0.0073	**	
Low P	Lit	noTaxa	intercept	1.642E+04	7.701E+03	0.0391	*	
Low P	Lit	noTaxa	longitude	-3.411E-02	1.621E-02	0.0417	*	0.4361
Low P	Lit	noTaxa	latitude	-5.678E-03	2.661E-03	0.0390	*	
Low P	Lit	noTaxa	lat*long	1.180E-08	5.600E-09	0.0415	*	
Low P	Lit	PropTaxa	intercept	1.783E+03	5.186E+02	0.0014	**	0.4361
Low P	Lit	PropTaxa	longitude	-3.725E-03	1.092E-03	0.0015	**	
Low P	Lit	PropTaxa	latitude	-6.176E-04	1.792E-04	0.0013	**	
Low P	Lit	PropTaxa	lat*long	1.290E-09	3.770E-10	0.0015	**	0.4361
Low P	Lit	PropValves	intercept	3.618E+03	1.085E+03	0.0018	**	

Metric or Mat P			IndepVar	Estimate	SE (est)	<i>p</i>	<i>p</i> *	adj R2
Trait	Source	Metric.Type						
Low P	Lit	PropValves	longitude	-7.575E-03	2.284E-03	0.0019	**	0.4007
Low P	Lit	PropValves	latitude	-1.253E-03	3.748E-04	0.0018	**	
Low P	Lit	PropValves	lat*long	2.620E-09	7.890E-10	0.0019	**	
Low P	Lit	RlogA	intercept	2.399E+03	5.731E+02	0.0002	***	
Low P	Lit	RlogA	longitude	-5.011E-03	1.206E-03	0.0002	***	0.5330
Low P	Lit	RlogA	latitude	-8.308E-04	1.980E-04	0.0001	***	
Low P	Lit	RlogA	lat*long	1.740E-09	4.170E-10	0.0002	***	
Low P	Regr	noTaxa	intercept	2.114E+04	9.400E+03	0.0301	*	
Low P	Regr	noTaxa	longitude	-4.395E-02	1.979E-02	0.0321	*	0.2991
Low P	Regr	noTaxa	latitude	-7.320E-03	3.248E-03	0.0298	*	
Low P	Regr	noTaxa	lat*long	1.520E-08	6.840E-09	0.0317	*	
Low P	Regr	PropTaxa	intercept	2.306E+03	7.250E+02	0.0028	**	
Low P	Regr	PropTaxa	longitude	-4.818E-03	1.526E-03	0.0030	**	0.4399
Low P	Regr	PropTaxa	latitude	-7.991E-04	2.505E-04	0.0028	**	
Low P	Regr	PropTaxa	lat*long	1.670E-09	5.270E-10	0.0029	**	
Low P	Regr	PropValves	intercept	4.072E+03	1.456E+03	0.0079	**	
Low P	Regr	PropValves	longitude	-8.490E-03	3.066E-03	0.0085	**	0.4642
Low P	Regr	PropValves	latitude	-1.412E-03	5.031E-04	0.0077	**	
Low P	Regr	PropValves	lat*long	2.940E-09	1.060E-09	0.0082	**	
Low P	Regr	RlogA	intercept	2.936E+03	9.985E+02	0.0054	**	

Metric or Mat P			IndepVar	Estimate	SE (est)	<i>p</i>	<i>p</i> *	adj R2
Trait	Source	Metric.Type						
Low P	Regr	RlogA	longitude	-6.119E-03	2.102E-03	0.0059	**	0.4715
Low P	Regr	RlogA	latitude	-1.018E-03	3.450E-04	0.0053	**	
Low P	Regr	RlogA	lat*long	2.120E-09	7.260E-10	0.0057	**	
Low P	TITAN	noTaxa	intercept	2.340E+04	9.873E+03	0.0227	*	0.3386
Low P	TITAN	noTaxa	longitude	-4.862E-02	2.079E-02	0.0244	*	
Low P	TITAN	noTaxa	latitude	-8.102E-03	3.411E-03	0.0224	*	
Low P	TITAN	noTaxa	lat*long	1.680E-08	7.180E-09	0.0241	*	
Low P	TITAN	PropTaxa	intercept	2.481E+03	7.373E+02	0.0017	**	
Low P	TITAN	PropTaxa	longitude	-5.183E-03	1.552E-03	0.0018	**	0.4825
Low P	TITAN	PropTaxa	latitude	-8.599E-04	2.548E-04	0.0016	**	
Low P	TITAN	PropTaxa	lat*long	1.800E-09	5.360E-10	0.0018	**	
Low P	TITAN	PropValves	intercept	4.086E+03	1.454E+03	0.0076	**	
Low P	TITAN	PropValves	longitude	-8.520E-03	3.062E-03	0.0082	**	0.4661
Low P	TITAN	PropValves	latitude	-1.417E-03	5.025E-04	0.0074	**	
Low P	TITAN	PropValves	lat*long	2.960E-09	1.060E-09	0.0080	**	
Low P	TITAN	RlogA	intercept	3.030E+03	9.975E+02	0.0042	**	
Low P	TITAN	RlogA	longitude	-6.317E-03	2.100E-03	0.0045	**	0.4869
Low P	TITAN	RlogA	latitude	-1.051E-03	3.446E-04	0.0041	**	
Low P	TITAN	RlogA	lat*long	2.190E-09	7.260E-10	0.0044	**	

Metric or Mat P			IndepVar	Estimate	SE (est)	<i>p</i>	<i>p</i> *	adj R2
Trait	Source	Metric.Type						
evenness		diversity	intercept	3.301E+02	5.097E+02	0.5210		
evenness		diversity	longitude	7.072E-04	1.073E-03	0.5137		
evenness		diversity	latitude	1.144E-04	1.761E-04	0.5198		
evenness		diversity	lat*long	-2.450E-10	3.710E-10	0.5133		-0.0279
richness		diversity	intercept	1.109E+05	3.428E+04	0.0024	**	
richness		diversity	longitude	2.328E-01	7.216E-02	0.0025	**	
richness		diversity	latitude	3.843E-02	1.184E-02	0.0024	**	
richness		diversity	lat*long	-8.070E-08	2.490E-08	0.0024	**	0.3700
ShannonH		diversity	intercept	4.311E+03	2.207E+03	0.0578		
ShannonH		diversity	longitude	9.088E-03	4.646E-03	0.0575		
ShannonH		diversity	latitude	1.494E-03	7.626E-04	0.0571		
ShannonH		diversity	lat*long	-3.150E-09	1.610E-09	0.0568		0.1191
WAM_matP		Inferred mat P	intercept	1.116E+04	2.950E+03	0.0005	***	
WAM_matP		Inferred mat P	longitude	2.328E-02	6.210E-03	0.0006	***	
WAM_matP		Inferred mat P	latitude	3.870E-03	1.019E-03	0.0005	***	
WAM_matP		Inferred mat P	lat*long	-8.070E-09	2.150E-09	0.0005	***	0.5696
WAM_RlogA.matP		Inferred mat P	intercept	9.533E+03	2.361E+03	0.0002	***	

Metric or Mat P			IndepVar	Estimate	SE (est)	<i>p</i>	<i>p</i> *	adj R2
Trait	Source	Metric.Type						
WAM_RlogA.matP		Inferred mat						
	P		longitude	1.989E-02	4.970E-03	0.0003	***	
WAM_RlogA.matP		Inferred mat						
	P		latitude	3.306E-03	8.157E-04	0.0002	***	
WAM_RlogA.matP		Inferred mat						
	P		lat*long	-6.890E-09	1.720E-09	0.0003	***	0.5939
mat P			intercept	8.247E+06	2.233E+06	0.0007	***	
mat P			longitude	1.722E+00	4.700E+00	0.0007	***	
mat P			latitude	2.855E+00	7.714E-01	0.0006	***	
mat P			lat*long	-5.960E-06	1.624E-06	0.0007	***	0.4375

Table S6. ANOVA results for effects of BCNP region on metrics. The ANOVA results include an F value as well as the p value for attained statistical significance and a code for quick reference of p values (p*).

Diversity or Trait-Based Metric			F value	p	p*
Trait	Source	Metric.Type			
High P	Lit	noTaxa	20.5	<0.0001	****
High P	Lit	PropTaxa	10.6	<0.0001	****
High P	Lit	PropValves	13.1	<0.0001	****
High P	Lit	RlogA	16.1	<0.0001	****
High P	Regr	noTaxa	22.6	<0.0001	****
High P	Regr	PropTaxa	13.6	<0.0001	****
High P	Regr	PropValves	22.2	<0.0001	****
High P	Regr	RlogA	18.5	<0.0001	****
High P	TITAN	noTaxa	26.8	<0.0001	****
High P	TITAN	PropTaxa	17.5	<0.0001	****
High P	TITAN	PropValves	13.3	<0.0001	****
High P	TITAN	RlogA	19.9	<0.0001	****
Low P	Lit	noTaxa	8.7	<0.0001	****
Low P	Lit	PropTaxa	12.1	<0.0001	****
Low P	Lit	PropValves	10.8	<0.0001	****
Low P	Lit	RlogA	22.0	<0.0001	****
Low P	Regr	noTaxa	22.6	<0.0001	****
Low P	Regr	PropTaxa	17.1	<0.0001	****
Low P	Regr	PropValves	16.5	<0.0001	****
Low P	Regr	RlogA	21.3	<0.0001	****
Low P	TITAN	noTaxa	20.3	<0.0001	****
Low P	TITAN	PropTaxa	18.6	<0.0001	****
Low P	TITAN	PropValves	16.4	<0.0001	****
Low P	TITAN	RlogA	21.1	<0.0001	****
richness		diversity	18.2	<0.0001	****
evenness		diversity	2.4	0.0472	*
ShannonH		diversity	8.3	<0.0001	****
WAM_matP		Inferred mat P	30.5	<0.0001	****

Diversity or Trait-Based Metric			F value	p	p*
Trait	Source	Metric.Type			
WAM	RlogA.matP	Inferred mat P	29.1	<0.0001	****

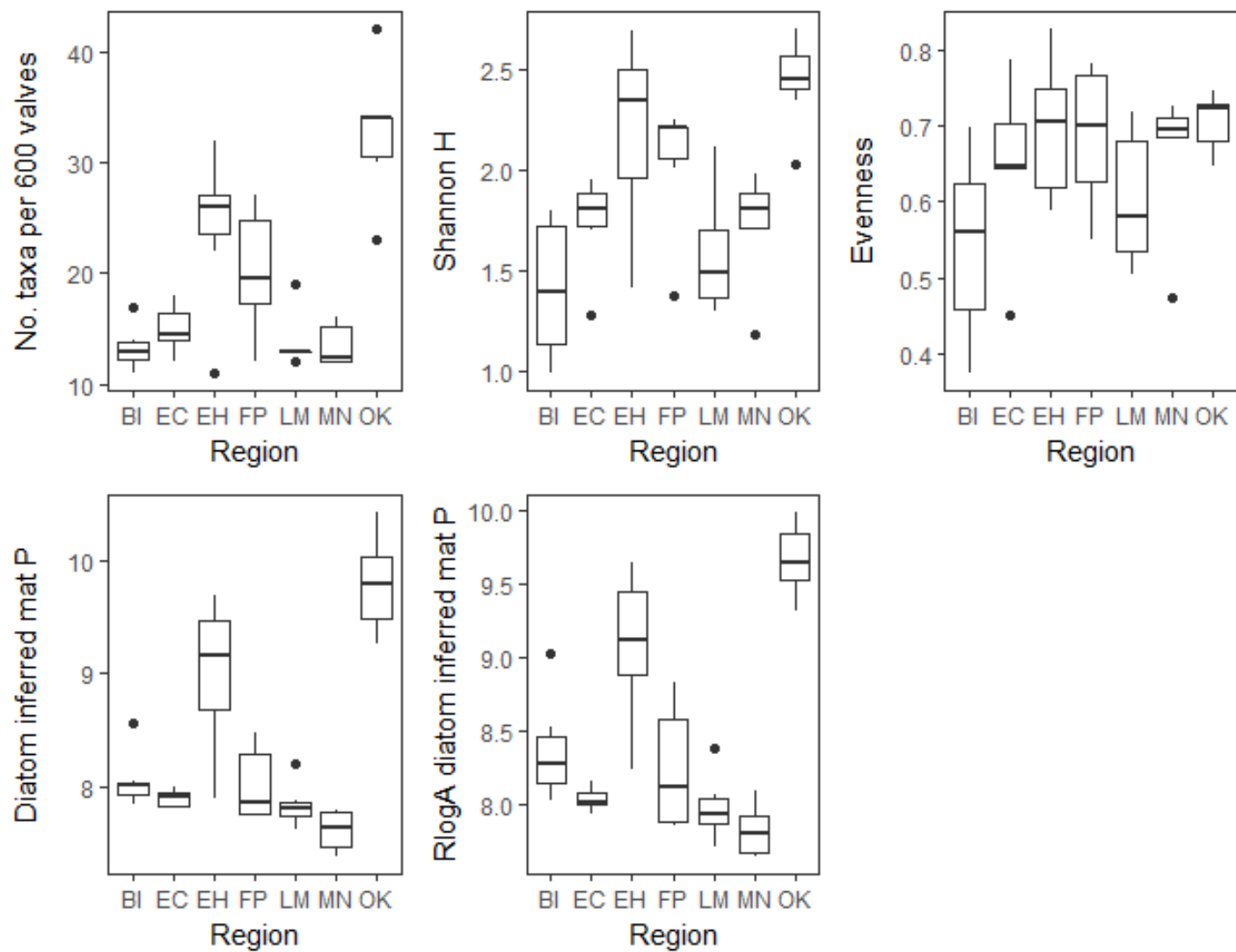


Fig. S6a. Boxplots of diversity and weighted average metrics for regions in BCNP sampling area. BI = Bear Island, EC = East Crossing, EH = East Hinson Marsh, FP = Fire Prairie, LM = Little Marsh, MN = Monument, and OK = Okaloacoochee Slough.

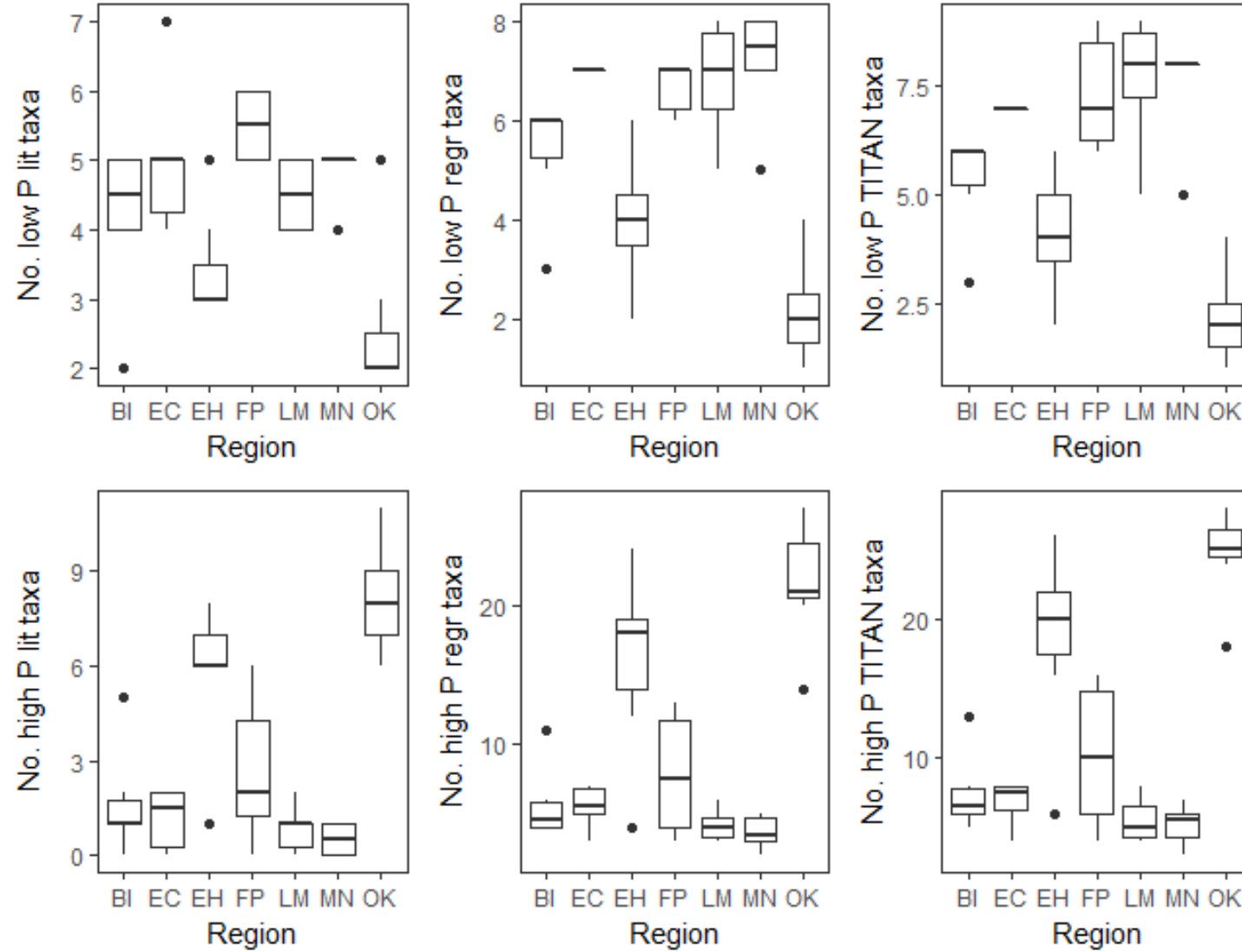


Fig. S6b. Boxplots of metrics based on the number of taxa for regions in BCNP sampling area. Region codes correspond to region names in Fig. S6a.

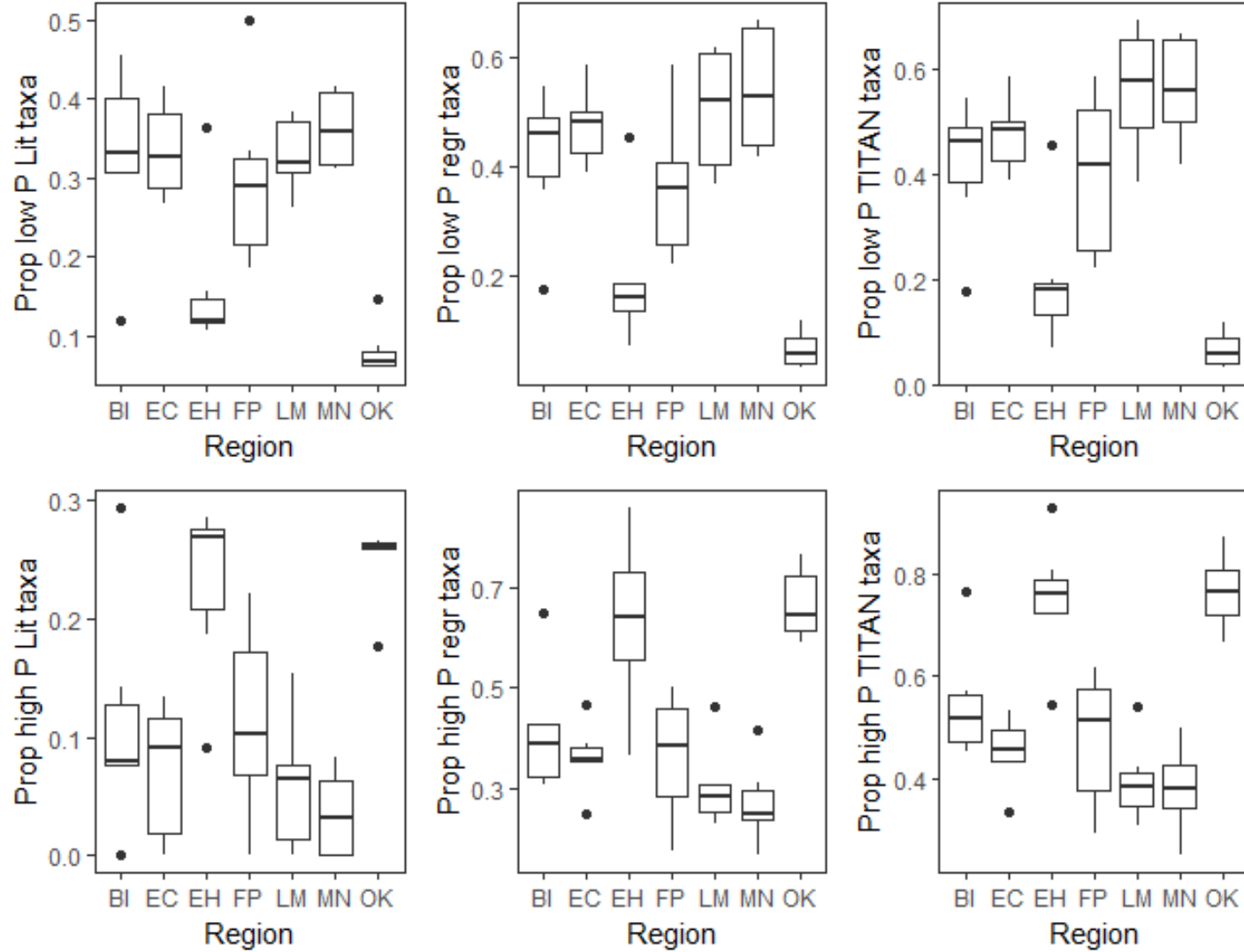


Fig. S6c. Boxplots of metrics based on the proportion of taxa for regions in BCNP sampling area. Region codes correspond to region names in Fig. S6a.

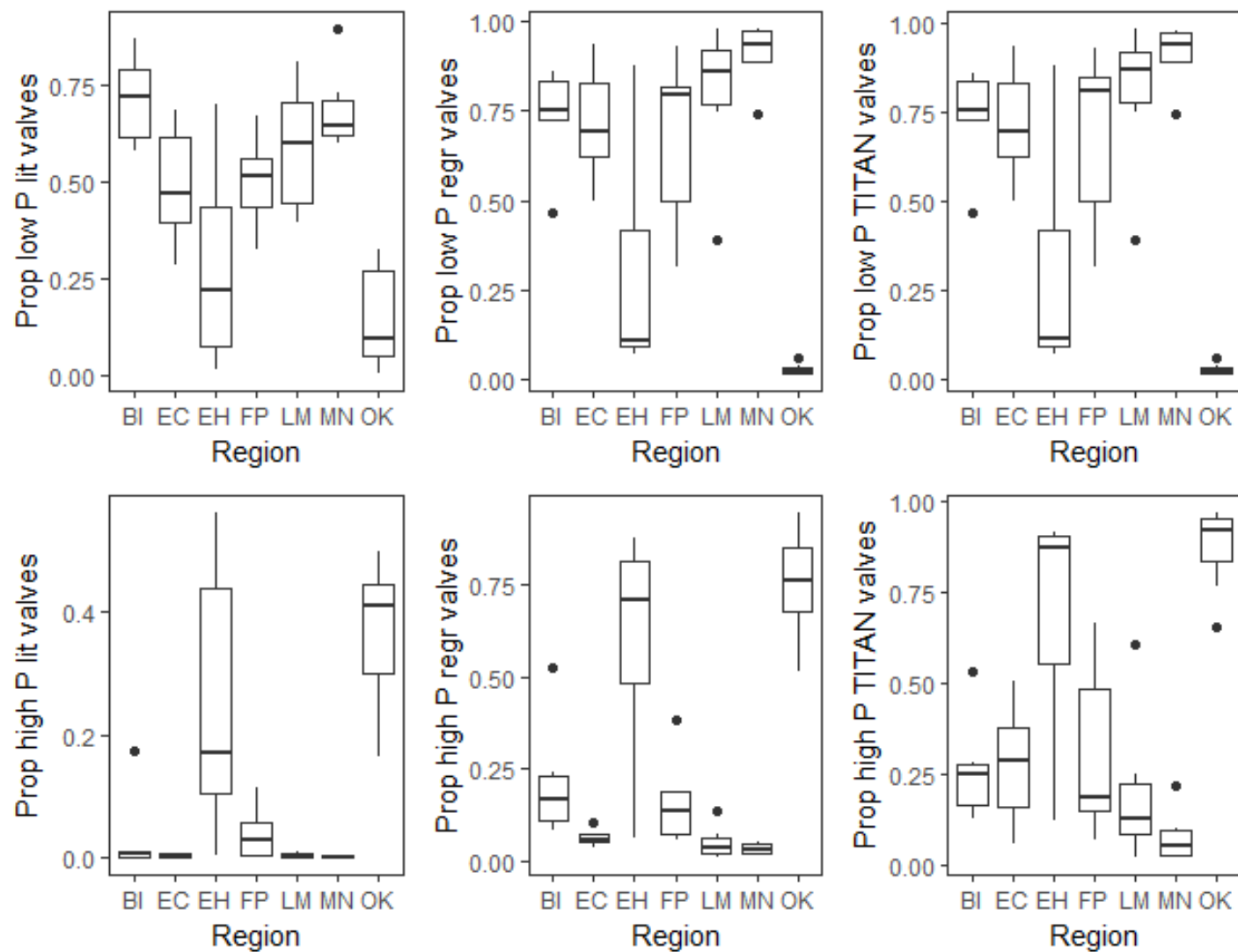


Fig. S6d. Boxplots of metrics based on proportion of valves for regions in BCNP sampling area. Region codes correspond to region names in Fig. S6a.

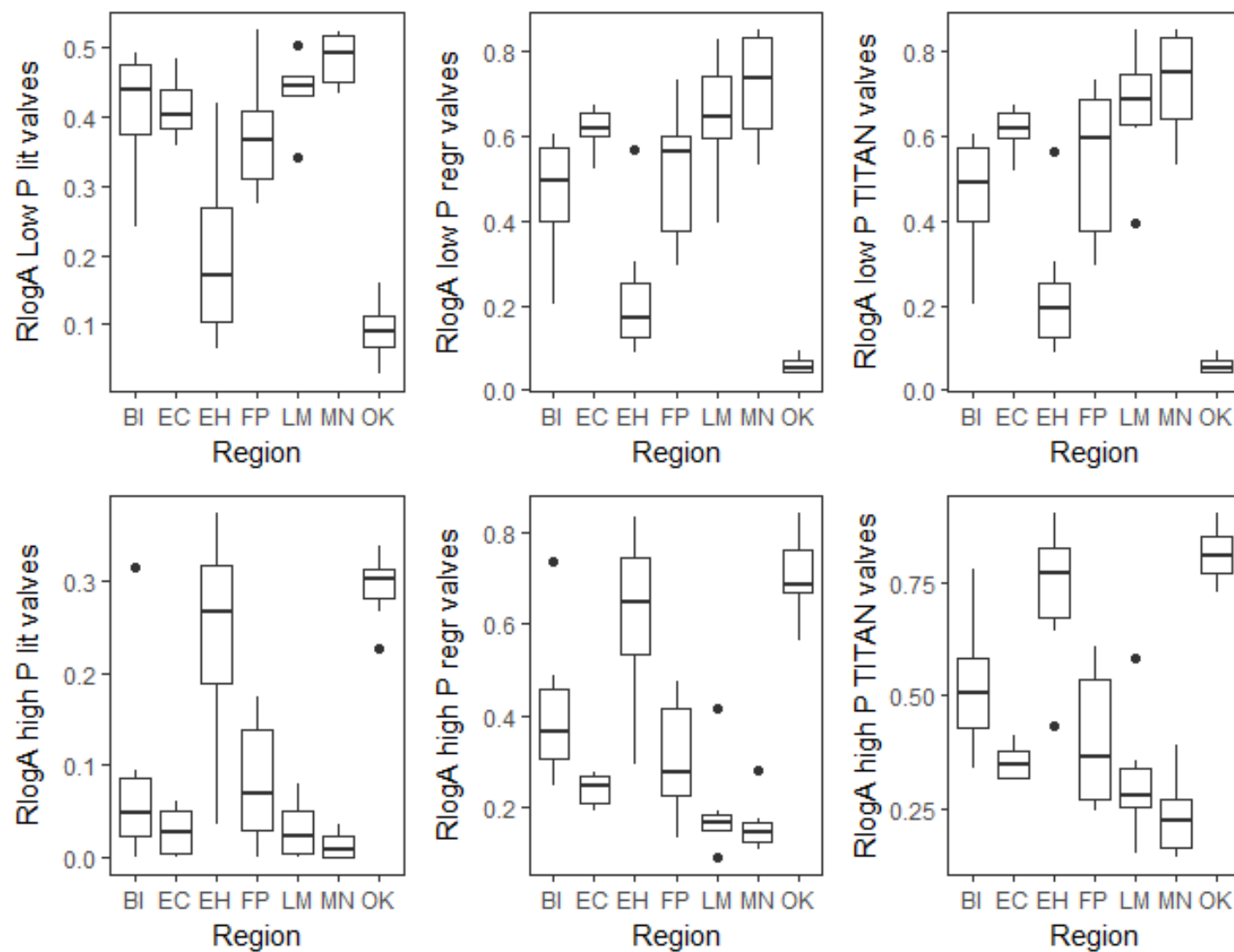


Fig. S6e. Boxplots of metrics based on RlogA valves for regions in BCNP sampling area. Region codes correspond to region names in Fig. S6a.

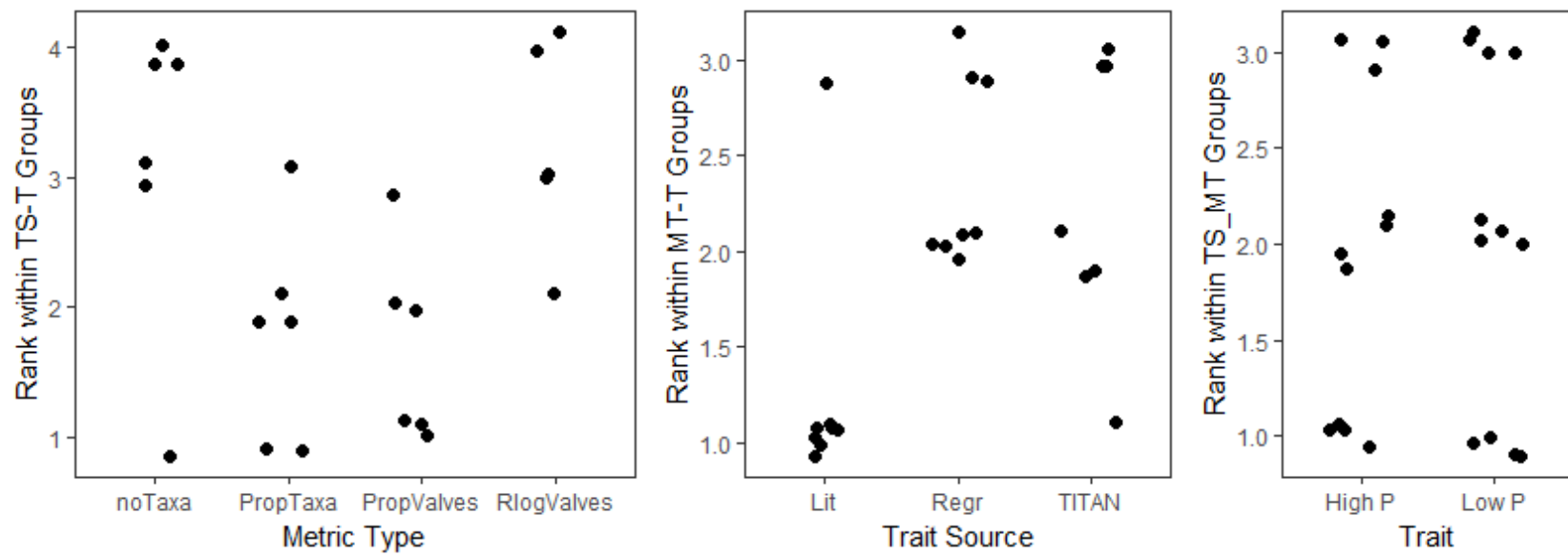


Fig. S7. Plots of the ranks of F statistics for each ANOVA evaluating effects of region on metrics to show effects of metric type, trait source, and trait on assessments of differences in metrics among regions using rank of F values for metric - region ANOVA for metric type (ranks 1-4) within trait-source-trait groups, for trait source (ranks 1-3) within metric type-trait groups, and trait (ranks 1-2) within trait source-metric type groups.

Table S7. Linear regression relationship of residuals from metric-mat P relationships with the independent variables (IndVar) depth and season. The regression results include an estimate of the intercept and slopes associated with each independent variable, as well as a standard error (SE (est)) of the slope estimate, the p value for the statistical significance of the slope, a code for quick reference of p values (p*), and the adjusted R² for relationships.

IndVar	Diversity or Trait-Based Metric			Intercept	Slope				adj R2
	Trait	Source	Metric.Type		Estimate	SE (est)	p	p*	
Depth	High P	Lit	noTaxa	-0.133	0.016	0.023	0.4873		-0.015
Depth	High P	Lit	PropTaxa	-0.025	0.001	0.001	0.1277		0.041
Depth	High P	Lit	PropValves	-0.012	0.001	0.002	0.4778		-0.014
Depth	High P	Lit	RlogA	-0.017	0.001	0.001	0.1943		0.022
Depth	High P	Regr	noTaxa	1.321	-0.035	0.048	0.4715		-0.014
Depth	High P	Regr	PropTaxa	0.012	0.000	0.001	0.8686		-0.029
Depth	High P	Regr	PropValves	0.005	0.001	0.002	0.7806		-0.028
Depth	High P	Regr	RlogA	-0.002	0.001	0.002	0.7589		-0.027
Depth	High P	TITAN	noTaxa	1.198	-0.035	0.053	0.5228		-0.017
Depth	High P	TITAN	PropTaxa	-0.011	0.000	0.001	0.6836		-0.025
Depth	High P	TITAN	PropValves	-0.011	0.001	0.002	0.7339		-0.027
Depth	High P	TITAN	RlogA	-0.023	0.001	0.001	0.4962		-0.016
Depth	Low P	Lit	noTaxa	-0.059	0.000	0.017	0.9771		-0.030
Depth	Low P	Lit	PropTaxa	-0.025	0.001	0.001	0.3859		-0.007
Depth	Low P	Lit	PropValves	0.013	-0.001	0.002	0.6293		-0.023
Depth	Low P	Lit	RlogA	-0.013	0.000	0.001	0.8139		-0.029
Depth	Low P	Regr	noTaxa	0.018	0.000	0.018	0.9885		-0.030
Depth	Low P	Regr	PropTaxa	-0.025	0.001	0.001	0.3221		0.000
Depth	Low P	Regr	PropValves	0.004	0.000	0.002	0.8737		-0.030
Depth	Low P	Regr	RlogA	-0.001	0.000	0.001	0.9108		-0.030
Depth	Low P	TITAN	noTaxa	0.008	0.001	0.019	0.9618		-0.030
Depth	Low P	TITAN	PropTaxa	-0.026	0.001	0.001	0.2769		0.006
Depth	Low P	TITAN	PropValves	0.004	0.000	0.002	0.8784		-0.030

IndVar	Diversity or Trait-Based Metric			Intercept	Slope				adj R2
	Trait	Source	Metric.Type		Estimate	SE (est)	<i>p</i>	<i>p</i> *	
Depth	Low P	TITAN	RlogA	-0.001	0.000	0.001	0.8876		-0.030
Depth	evenness		diversity	2.257	-0.077	0.073	0.3039		0.003
Depth	richness		diversity	0.006	0.000	0.001	0.9033		-0.030
Depth	ShannonH		diversity	0.084	-0.003	0.005	0.5748		-0.020
Depth	WAM_matP		Inferred mat P	-0.062	0.005	0.005	0.3867		-0.007
Depth	WAM_RlogA.matP		Inferred mat P	-0.018	0.002	0.004	0.6362		-0.023
Season	High P	Lit	noTaxa	1.562	-0.486	0.143	0.0015	**	0.197
Season	High P	Lit	PropTaxa	0.027	-0.008	0.006	0.1694		0.022
Season	High P	Lit	PropValves	-0.012	0.004	0.013	0.7787		-0.022
Season	High P	Lit	RlogA	0.024	-0.008	0.006	0.2476		0.009
Season	High P	Regr	noTaxa	2.163	-0.673	0.299	0.0298	*	0.086
Season	High P	Regr	PropTaxa	-0.032	0.010	0.009	0.2618		0.007
Season	High P	Regr	PropValves	0.017	-0.005	0.018	0.7763		-0.022
Season	High P	Regr	RlogA	-0.021	0.006	0.011	0.5576		-0.015
Season	High P	TITAN	noTaxa	2.977	-0.927	0.318	0.0056	**	0.149
Season	High P	TITAN	PropTaxa	-0.022	0.007	0.008	0.3837		-0.005
Season	High P	TITAN	PropValves	-0.032	0.010	0.017	0.5698		-0.016
Season	High P	TITAN	RlogA	-0.028	0.009	0.010	0.3731		-0.004
Season	Low P	Lit	noTaxa	0.620	-0.193	0.101	0.0634		0.058
Season	Low P	Lit	PropTaxa	0.005	-0.001	0.006	0.8295		-0.023
Season	Low P	Lit	PropValves	-0.037	0.012	0.015	0.4470		-0.010
Season	Low P	Lit	RlogA	-0.001	0.000	0.007	0.9592		-0.024
Season	Low P	Regr	noTaxa	0.700	-0.218	0.110	0.0532		0.064
Season	Low P	Regr	PropTaxa	0.008	-0.002	0.008	0.7525		-0.021
Season	Low P	Regr	PropValves	0.032	-0.010	0.018	0.5810		-0.016
Season	Low P	Regr	RlogA	0.022	-0.007	0.010	0.4981		-0.013
Season	Low P	TITAN	noTaxa	0.675	-0.210	0.116	0.0769		0.051
Season	Low P	TITAN	PropTaxa	0.002	-0.001	0.008	0.9336		-0.024
Season	Low P	TITAN	PropValves	0.032	-0.010	0.018	0.5761		-0.016

IndVar	Diversity or Trait-Based Metric			Intercept	Slope				adj R2
	Trait	Source	Metric.Type		Estimate	SE (est)	<i>p</i>	<i>p</i> *	
Season	Low P	TITAN	RlogA	0.021	-0.007	0.010	0.5118		-0.013
Season	evenness		diversity	4.769	-1.484	0.407	0.0007	***	0.222
Season	richness		diversity	0.044	-0.014	0.007	0.0447	*	0.071
Season	ShannonH		diversity	0.263	-0.082	0.028	0.0049	**	0.154
Season	WAM_matP		Inferred mat P	-0.104	0.032	0.038	0.3946		-0.006
Season	WAM_RlogA.matP		Inferred mat P	-0.041	0.013	0.027	0.6422		-0.018

Table S8. ANOVA results for effects of habitat type, substrate location, substrate type, and hydrologic year on residuals in metric-mat P relationships. The ANOVA results include an F value as well as the p value for attained statistical significance and a code for quick reference of p values (p*).

Diversity or Trait-Based Metric			Habitat Type			Substrate Location			Substrate Type			Hydrological Year		
Trait	Source	Metric.Type	F value	p	p*	F value	p	p*	F value	p	p*	F.value	p	p*
High P	Lit	noTaxa	0.6	0.7292		1.4	0.2518		1.1	0.3417		1.4	0.2404	
High P	Lit	PropTaxa	1.2	0.3505		0.3	0.7521		0.9	0.4112		0.0	0.9661	
High P	Lit	PropValves	5.1	0.0011	**	3.1	0.0561		5.9	0.0057	**	0.3	0.5864	
High P	Lit	RlogA	3.0	0.0238	*	2.3	0.1167		2.9	0.0637		0.0	0.8912	
High P	Regr	noTaxa	1.4	0.2586		2.0	0.1473		2.1	0.1379		0.6	0.4363	
High P	Regr	PropTaxa	1.0	0.4239		2.4	0.1071		2.1	0.1303		2.4	0.1313	
High P	Regr	PropValves	2.0	0.098		1.7	0.2045		2.3	0.1105		1.4	0.2354	
High P	Regr	RlogA	1.9	0.1263		2.4	0.1023		2.1	0.1402		2.4	0.1282	
High P	TITAN	noTaxa	1.1	0.3705		1.8	0.1757		0.2	0.8016		1.5	0.2312	
High P	TITAN	PropTaxa	1.0	0.4215		0.3	0.7091		0.0	0.9532		0.4	0.5386	
High P	TITAN	PropValves	1.4	0.2391		0.8	0.4585		1.7	0.2006		1.3	0.2617	
High P	TITAN	RlogA	1.2	0.3504		0.5	0.6182		0.2	0.8003		1.1	0.2956	
Low P	Lit	noTaxa	3.0	0.0232	*	1.3	0.2854		1.9	0.1608		1.5	0.2264	
Low P	Lit	PropTaxa	1.0	0.4477		0.0	0.973		0.1	0.8771		1.3	0.2524	
Low P	Lit	PropValves	1.3	0.2823		0.5	0.6222		4.2	0.022	*	0.0	0.9216	
Low P	Lit	RlogA	1.7	0.1551		0.2	0.8248		1.6	0.2081		0.5	0.5036	
Low P	Regr	noTaxa	2.7	0.0341	*	1.7	0.1965		1.6	0.2184		4.5	0.0397	*
Low P	Regr	PropTaxa	0.4	0.8453		0.3	0.7073		0.2	0.821		4.6	0.0382	*
Low P	Regr	PropValves	1.4	0.2427		0.5	0.6092		1.7	0.192		1.6	0.2181	
Low P	Regr	RlogA	0.9	0.5111		0.0	0.9762		0.4	0.6919		2.5	0.1225	
Low P	TITAN	noTaxa	2.0	0.1086		1.7	0.201		1.2	0.3014		5.6	0.0230	*
Low P	TITAN	PropTaxa	0.3	0.9181		0.1	0.8636		0.2	0.8071		6.0	0.0182	*
Low P	TITAN	PropValves	1.4	0.2444		0.5	0.6045		1.7	0.1915		1.6	0.2128	
Low P	TITAN	RlogA	0.8	0.5624		0.0	0.955		0.4	0.7007		3.0	0.0930	
richness		diversity	1.5	0.2106		2.6	0.0847		0.1	0.949		1.6	0.2146	
evenness		diversity	1.8	0.1374		0.7	0.5047		0.1	0.9356		0.6	0.4597	
ShannonH		diversity	2.0	0.1083		1.2	0.305		0.1	0.9028		1.0	0.3217	

Diversity or Trait-Based Metric		Habitat Type			Substrate Location			Substrate Type			Hydrological Year	
WAM_matP	Inferred mat P	6.0	0.0004	***	3.2	0.0492	*	6.0	0.0053	**	0.3	0.6003
WAM_RlogA.matP	Inferred mat P	3.2	0.0158	*	2.2	0.1191		2.6	0.0896		0.7	0.3965

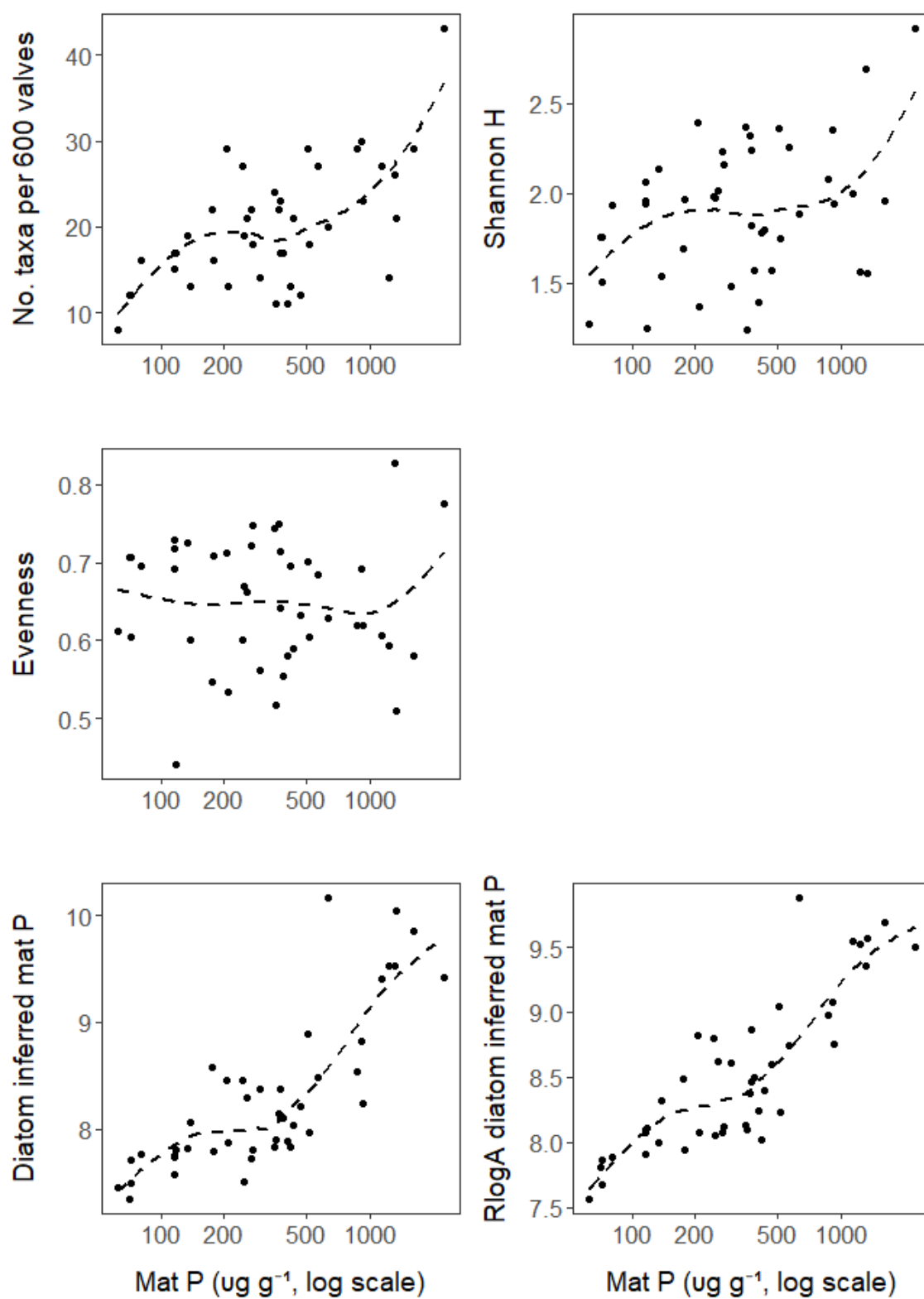


Fig. S8a. Relationships between diversity and weighted average metrics versus log-transformed mat P. The dashed black line represents a lowess fit to the data.

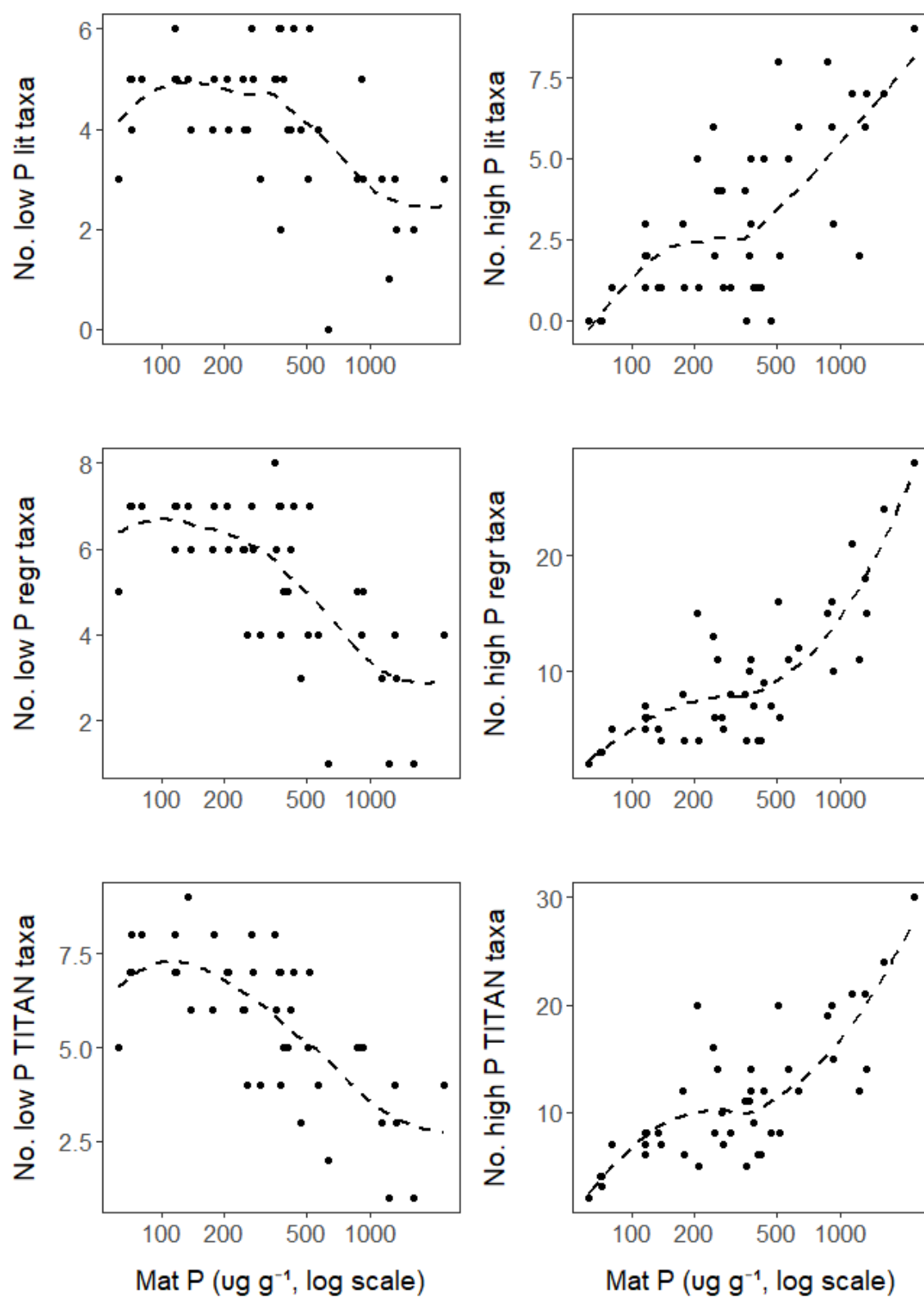


Fig. S8b. Relationships between metrics based on number of taxa versus log-transformed mat P. The dashed black line represents a lowess fit to the data.

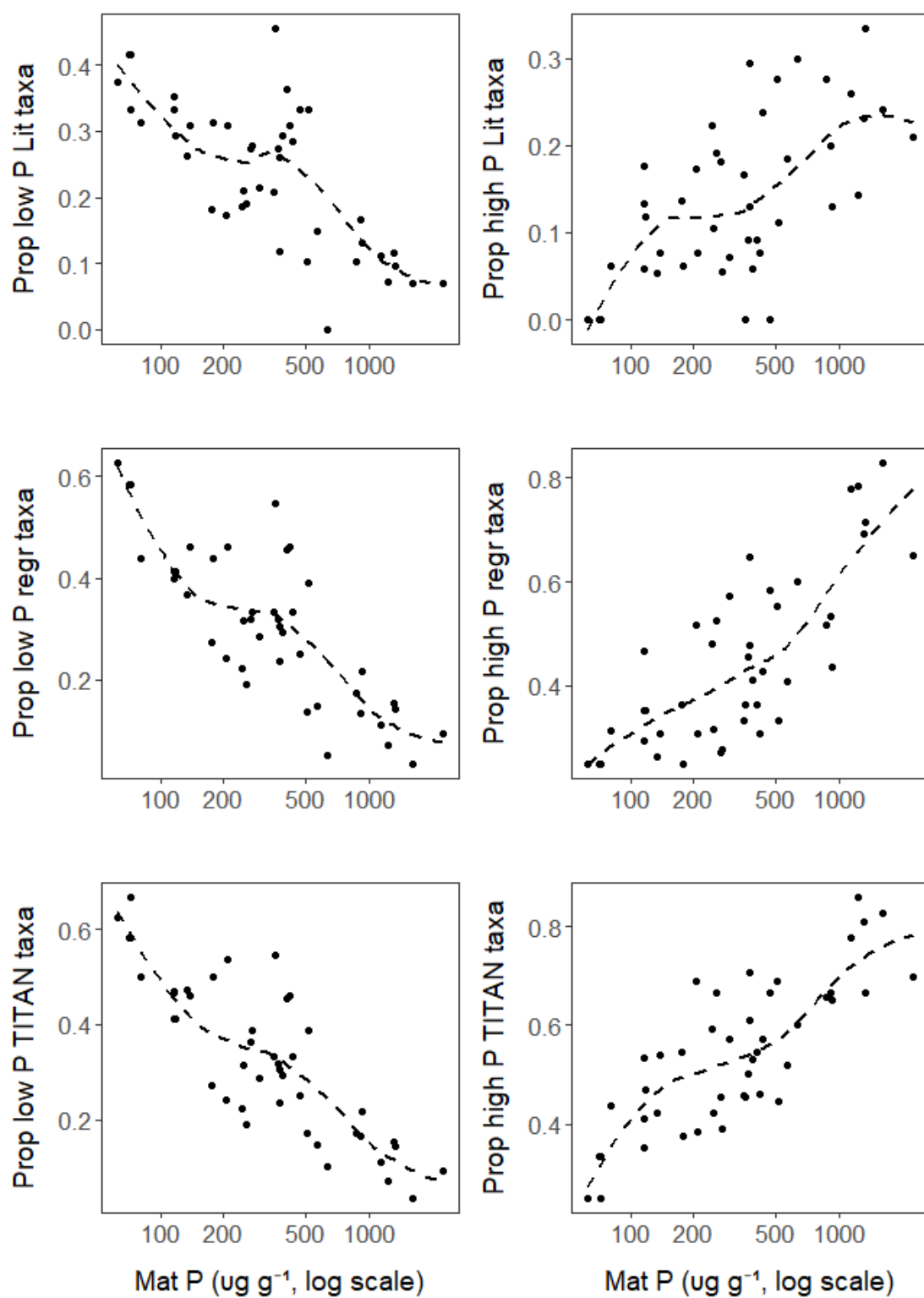


Fig. S8c. Relationships between metrics based on the proportion of taxa versus log-transformed mat P. The dashed black line represents a lowess fit to the data.

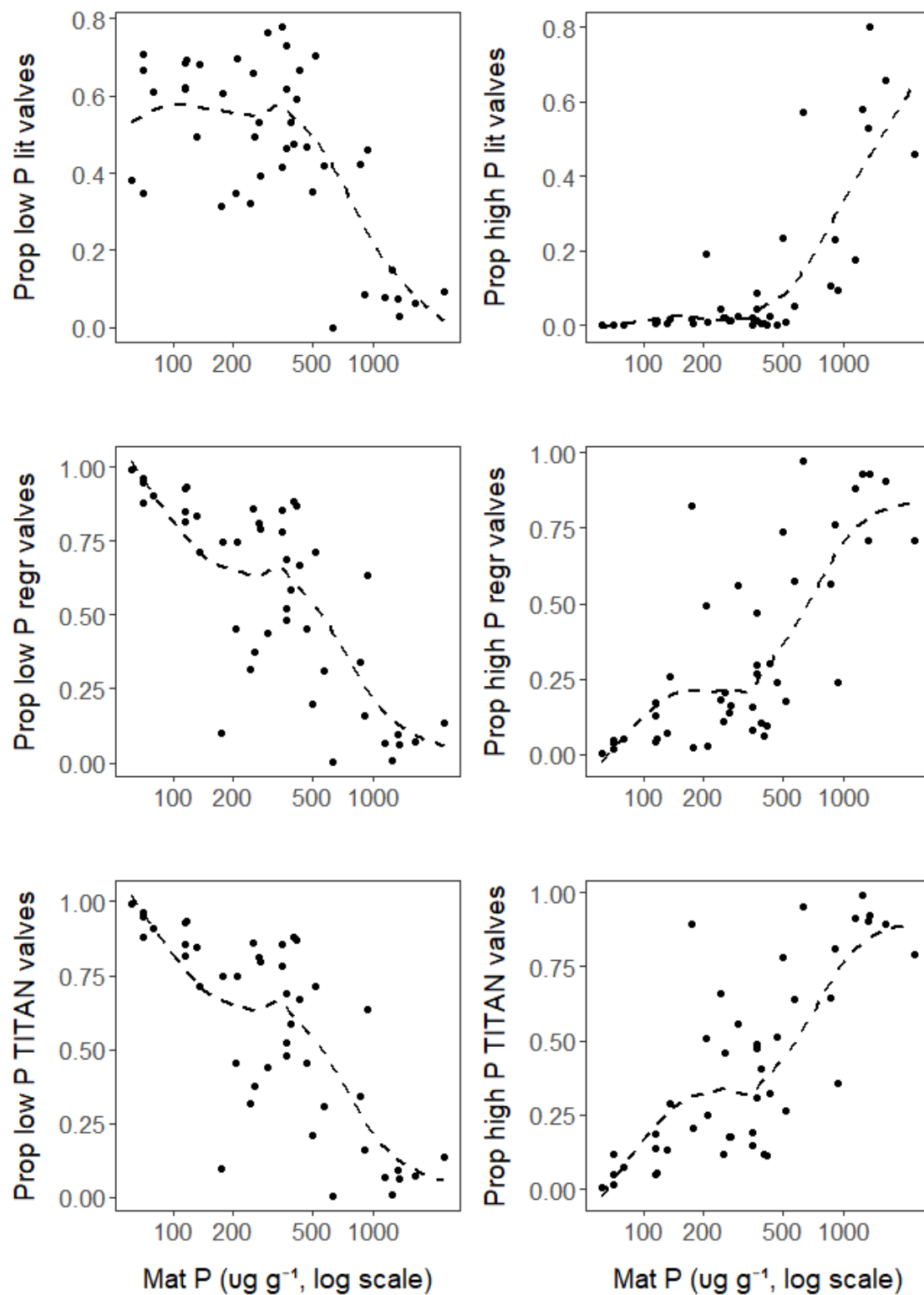


Fig. S8d. Relationships between metrics based on proportion of valves versus log-transformed mat P. The dashed black line represents a lowess fit to the data.

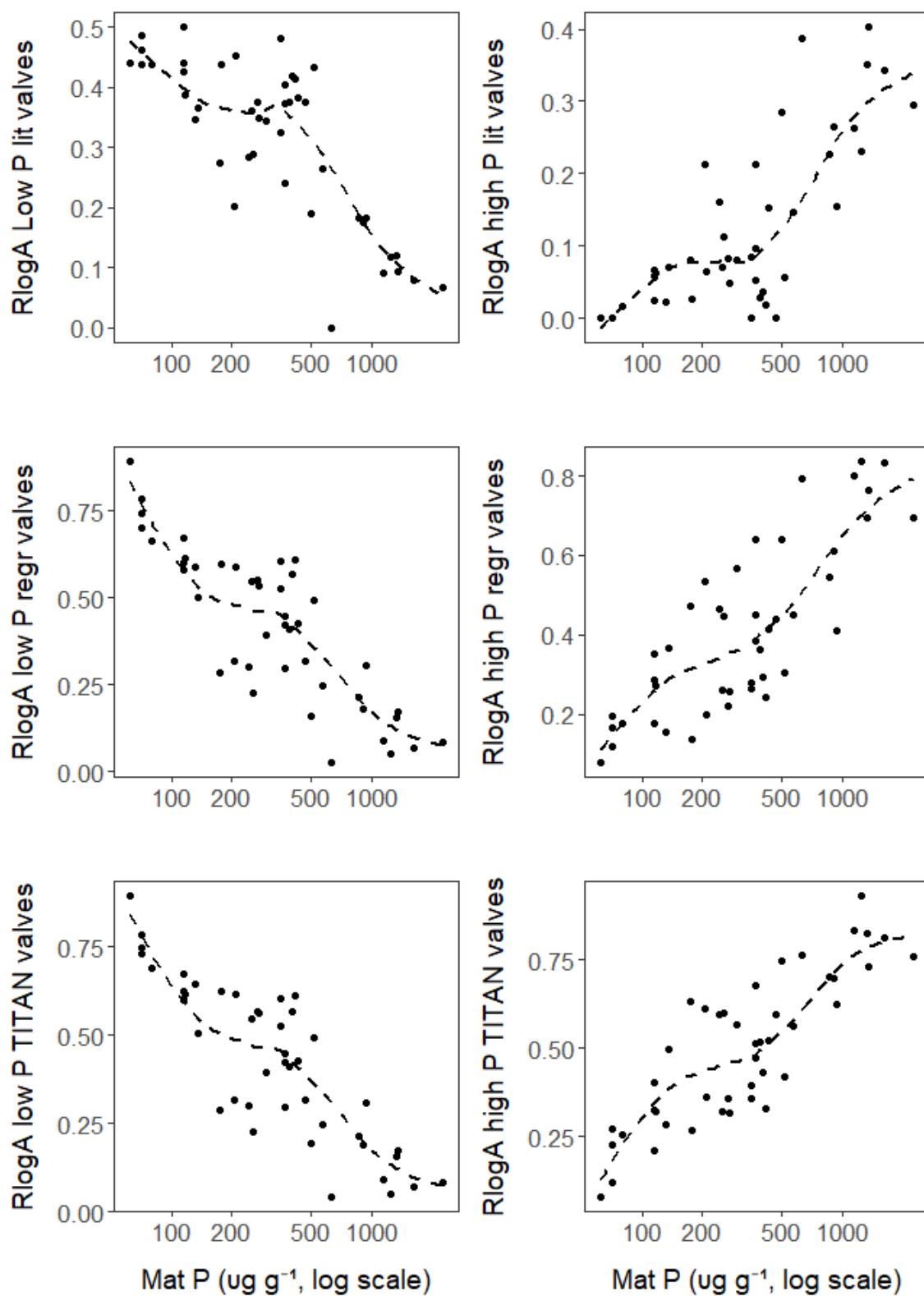


Fig. S8e. Relationships between metrics based on RlogA valves versus log-transformed mat P. The dashed black line represents a lowess fit to the data.

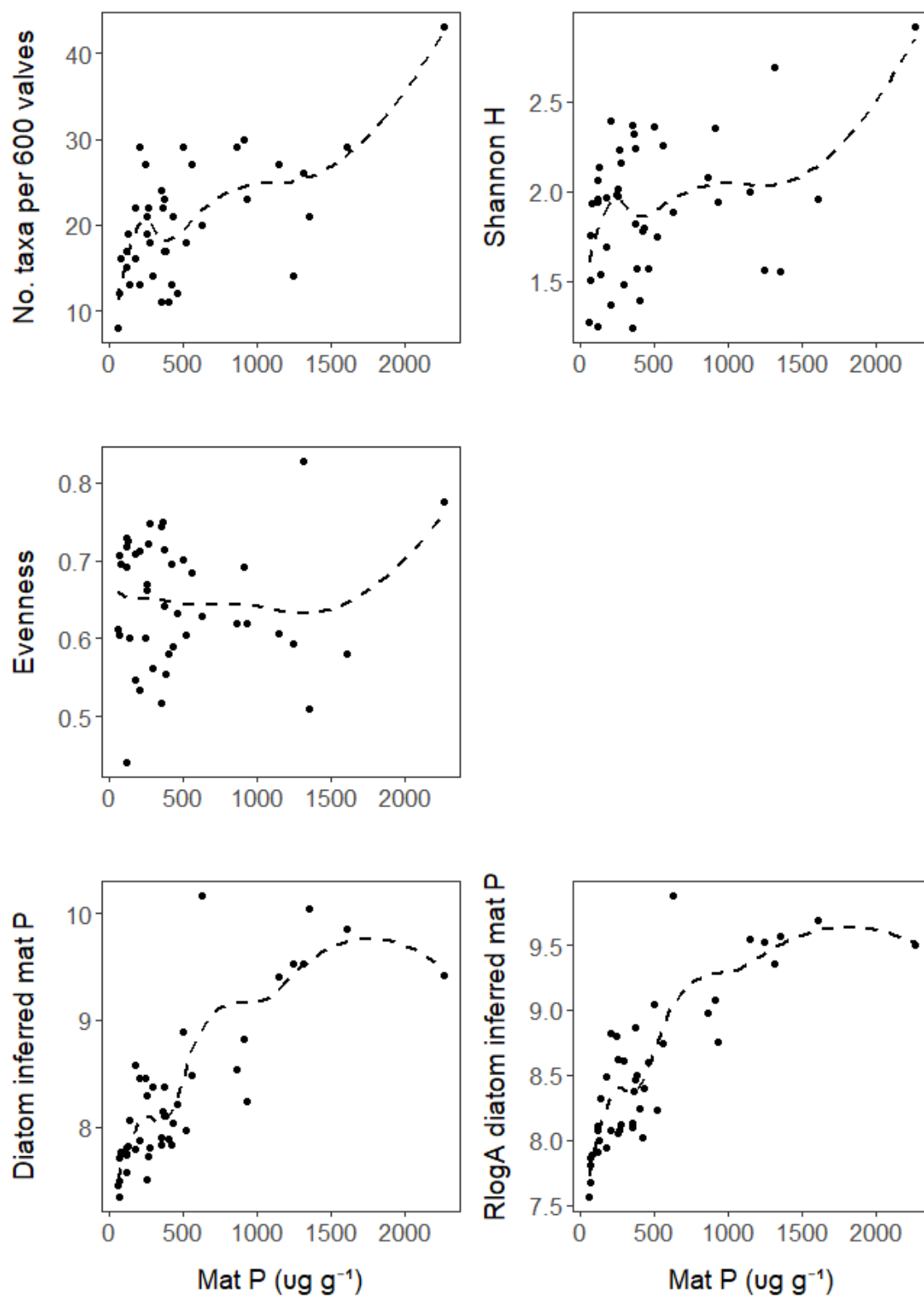


Fig. S9a. Relationships between diversity and weighted average metrics versus mat P without log transformation. The dashed black line represents a lowest fit to the data.

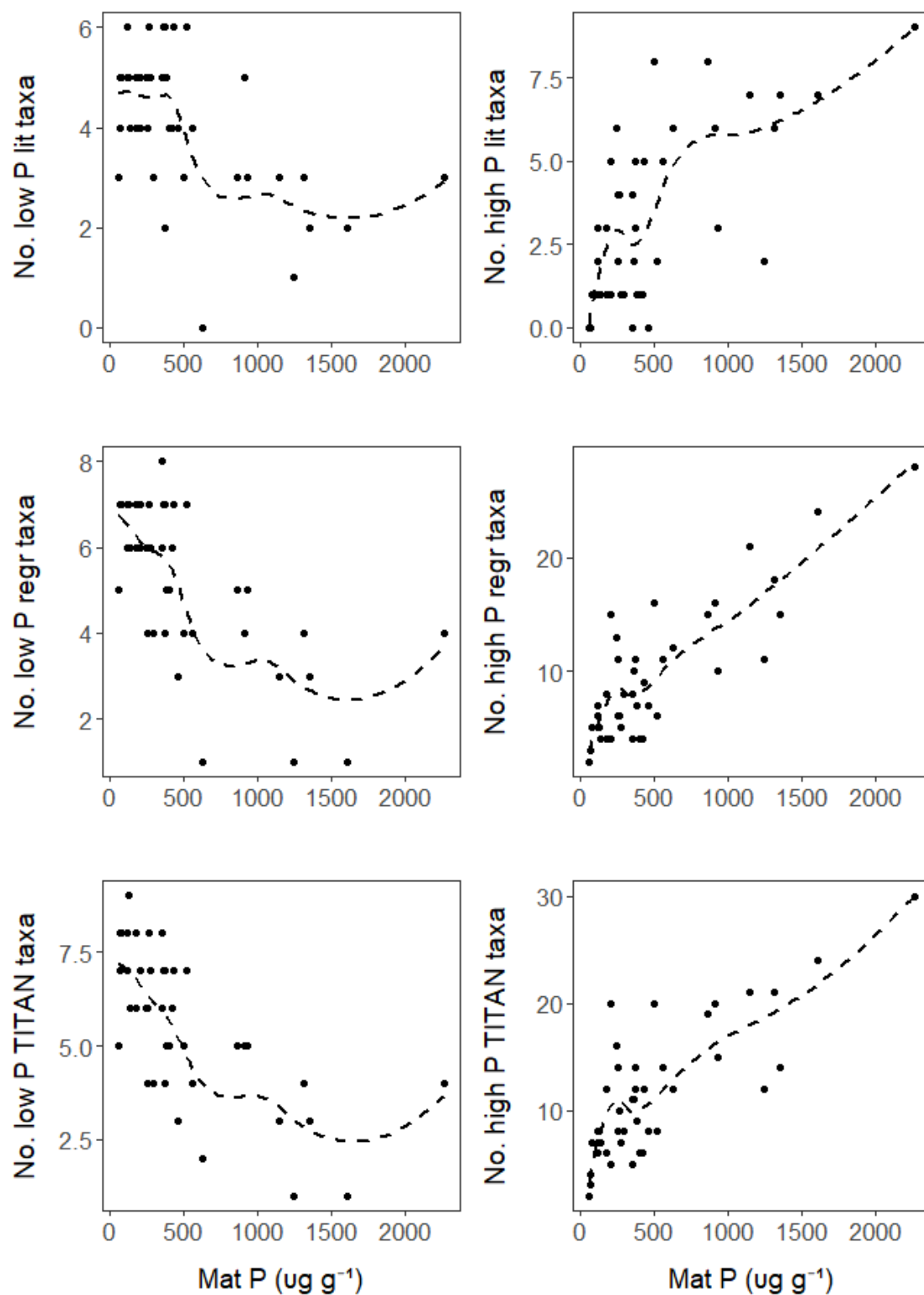


Fig. S9b. Relationships between metrics based on number of taxa versus mat P without log transformation. The dashed black line represents a lowess fit to the data.

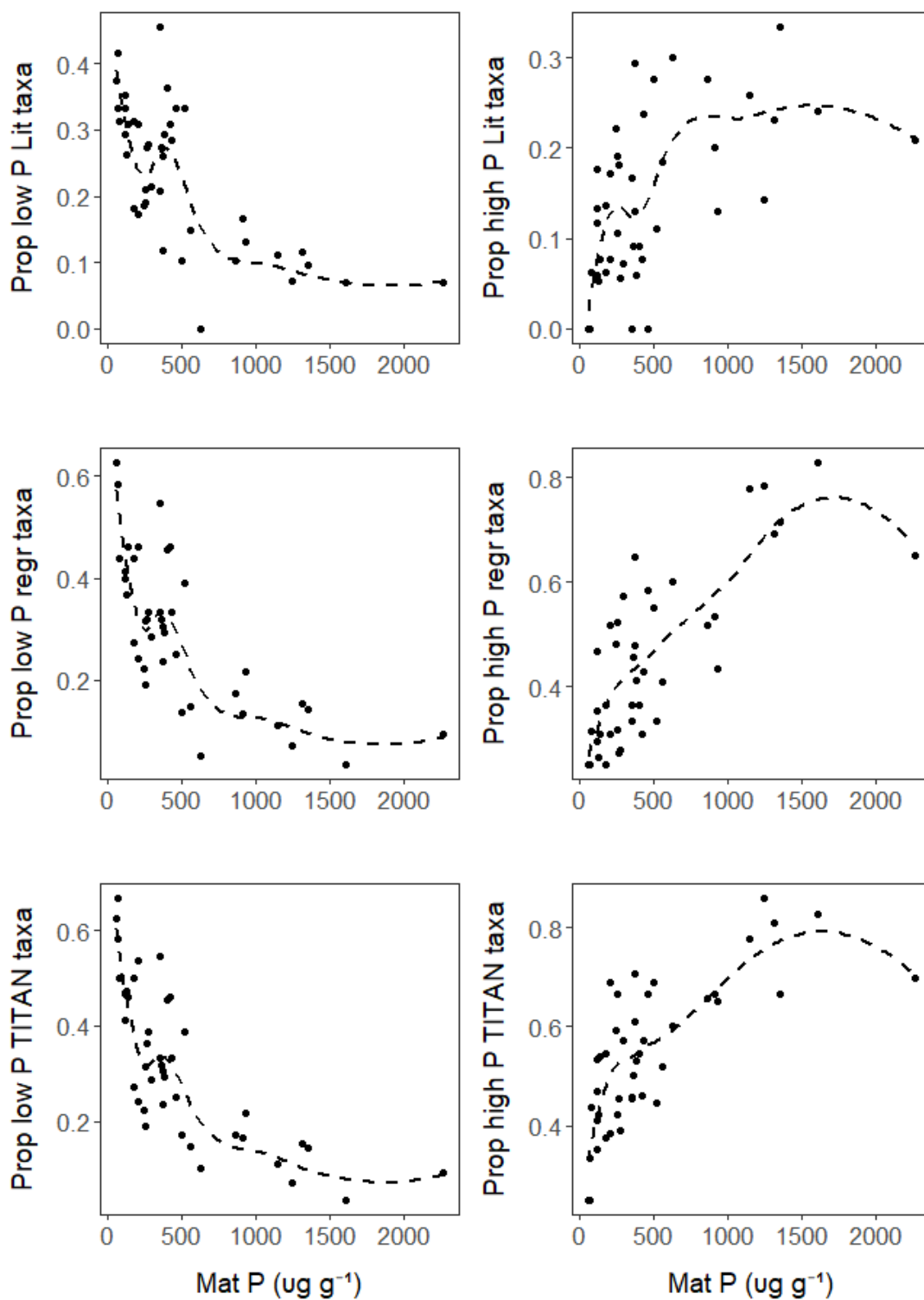


Fig. S9c. Relationships between metrics based on proportion of taxa versus mat P without log transformation. The dashed black line represents a lowest fit to the data.

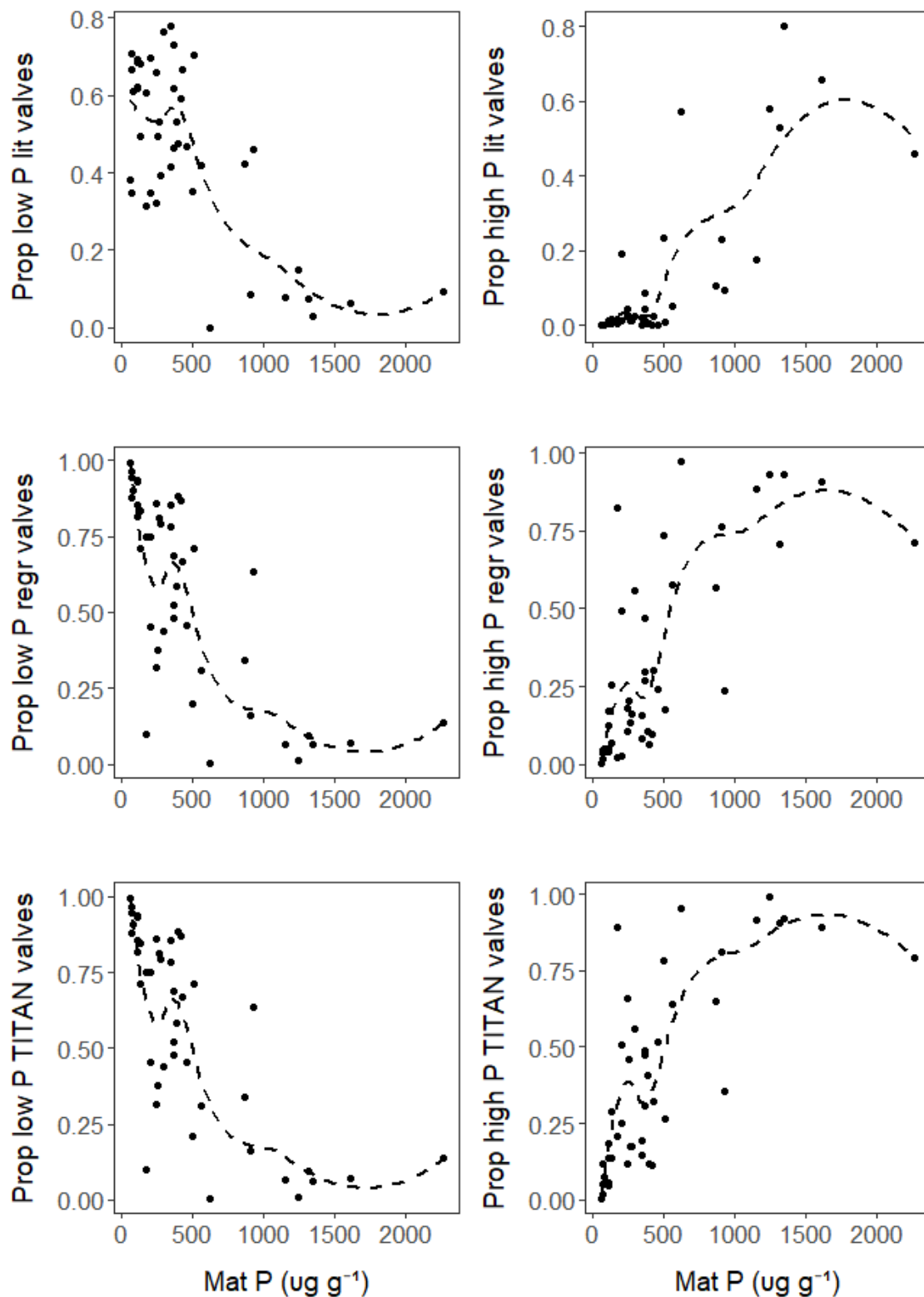


Fig. S9d. Relationships between metrics based on proportion of valves versus mat P without log transformation. The dashed black line represents a lowess fit to the data.

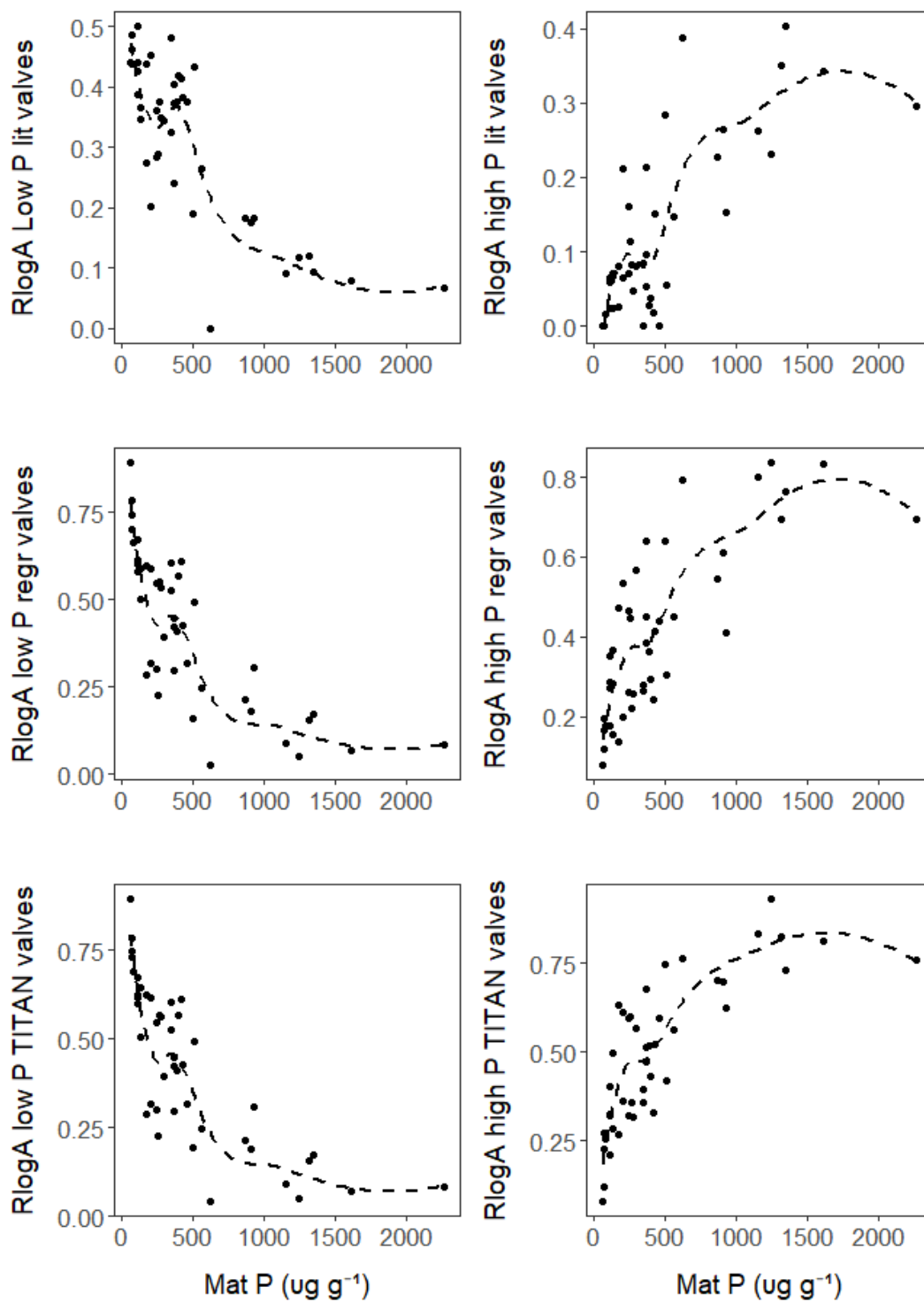


Fig. S9e. Relationships between metrics based on RlogA valves versus mat P without log transformation. The dashed black line represents a lowess fit to the data.

Table S9. Significant changepoints in metric-mat P relationships. Bold numbers indicate especially low probability of occurring by chance.

Diversity or Trait-Based Metric			<100	100-150	150-250	250-350	350-450	450-750	>750
Trait	Source	Metric.Type							
High P	TITAN	noTaxa	71.000	137.000				464, 627	1246
High P	TITAN	PropTaxa							
High P	TITAN	PropValves							
High P	TITAN	RlogValves							
Low P	TITAN	noTaxa					427		
Low P	TITAN	PropTaxa							
Low P	TITAN	PropValves							
Low P	TITAN	RlogValves							
evenness		diversity							
richness		diversity	71.000	137.000				464,627	1246
ShannonH		diversity							
WAM_matP		Inferred mat P						564	
WAM_RlogA.matP		Inferred mat P							

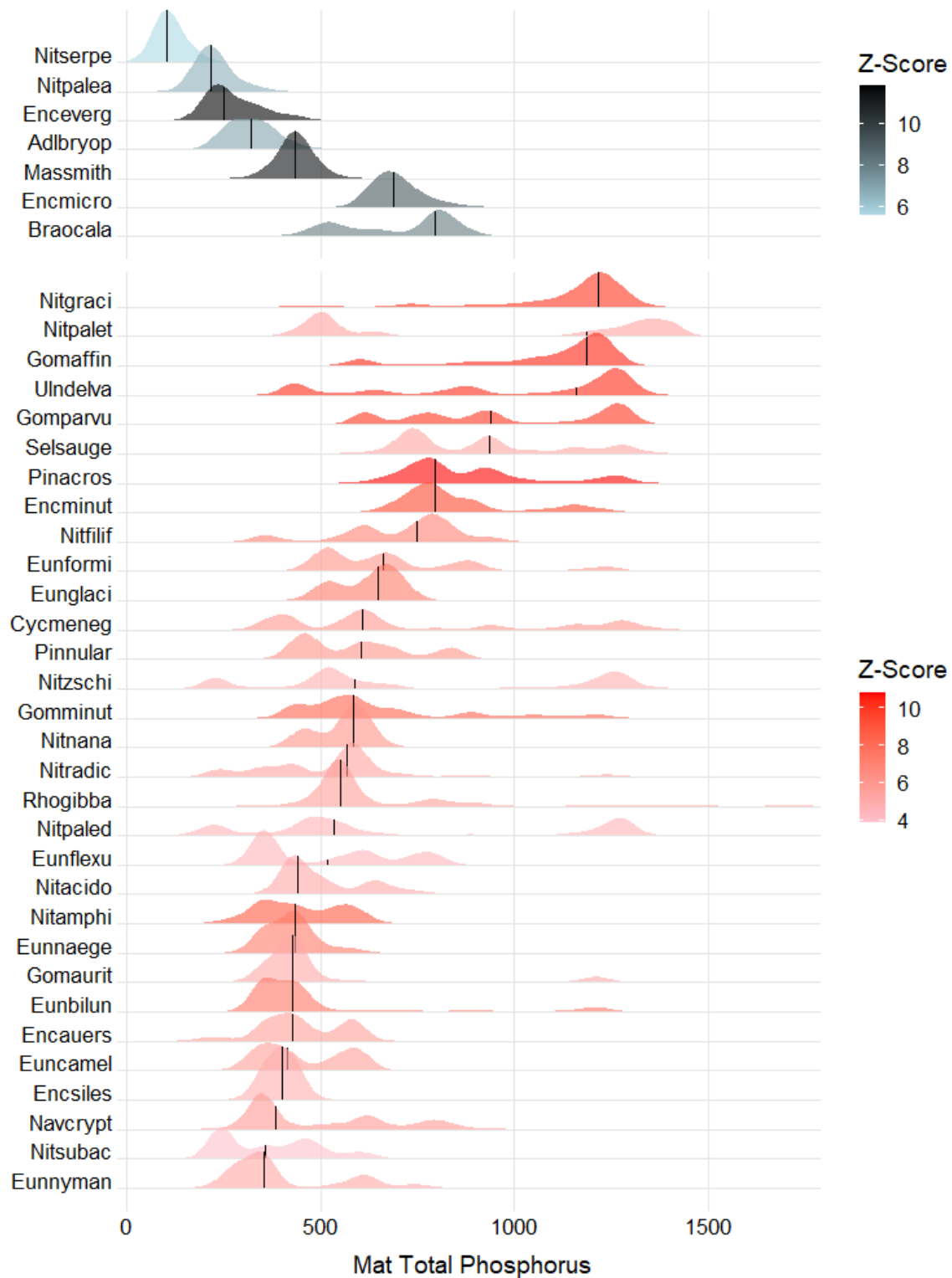


Fig. S10. Frequency distributions of likely change points for low P (gray) and high P (red) taxa determined by TITAN. Shading indicates TITAN Z-scores. Metric codes are based on the first three letters of the genus name and first five letters of the species names, which can be found in Table S3.