

Table S1. Principal component (gradient) scores for 56 caves on Bohol Island, the Philippines included in this study.

	Code on Fig. 1	PC 1: Landscape disturbance	PC 2: Cave complexity	PC 3: Mining	PC 4: Cave development	PC 5: Resource extraction	PC 6: Bat hunting
Agaw-gaw Cave	1	-1.03	-0.84	-0.85	-0.32	0.28	0.47
Bakongkong Cave	3	0.48	0.62	-2.52	-1.20	1.22	0.46
Batongay Cave	4	1.87	-0.45	-2.10	2.50	-1.32	0.46
Bayang Cave	5	1.14	0.80	-1.94	-1.03	-0.98	-0.13
Benito Cave	6	-1.42	0.11	-0.79	-1.03	0.73	-0.87
Bogtong Park Cave	8	1.86	-1.68	1.40	-1.92	0.01	1.69
Burial Cave	9	-4.28	-2.91	1.38	2.00	0.08	0.59
Calompanan Cave	10	-1.87	1.61	1.53	-0.37	0.96	3.19
Cang Ihong Cave	11	0.62	0.54	1.79	1.23	1.69	0.12
Canlusong Cave	12	-2.14	0.97	0.37	-0.98	0.40	0.20
Cantijong Cave	13	1.53	2.35	0.49	0.05	-0.84	0.64
Cantumocad Cave	14	1.91	-2.00	-0.08	-0.12	-0.82	-1.17
Casampong Cave	15	-2.01	0.61	0.42	-1.65	-1.66	-0.23
Catalina Cave	16	-4.62	2.20	-0.52	0.28	0.07	0.16
Claise Cave	17	0.29	0.57	-0.10	0.40	-0.69	-1.05
Dagohoy Cave	18	1.52	-2.02	-1.43	-2.62	1.42	0.01
Dakong-Buho Cave	19	-2.80	2.08	-1.07	-1.06	-1.34	-0.49
Duguilan Cave	20	-3.73	1.40	-1.02	0.91	0.70	-0.74
Guimba Cave	21	-1.14	3.09	1.01	-1.10	-1.40	0.03
Hinagdanan Cave	22	2.83	-2.16	-0.51	2.55	-1.34	0.17

Inorok Cave	23	-1.04	-1.48	-0.22	-1.10	-0.22	-0.88
Ka Dodong Cave	25	-3.81	2.52	0.19	0.57	-0.25	0.14
Ka Goryo Cave	26	-0.42	-1.41	1.16	-1.64	-0.99	0.01
Ka Iska Cave	27	-3.28	-0.74	0.44	2.46	-0.03	0.21
Kabera Cave	29	-0.89	-0.85	-1.41	-0.66	2.93	-0.26
Kabjawan Cave	30	1.58	2.24	1.31	0.66	0.71	-0.43
Kabyawan Cave	31	0.63	-1.48	1.73	-1.00	-0.31	1.76
Kalanguban Cave	32	-4.01	0.37	0.87	-0.09	-0.41	0.12
Kamagahi Cave	33	-0.60	-1.21	0.18	-0.64	0.43	0.35
Kamira Cave	34	0.99	-1.40	-0.72	1.78	-2.07	-0.36
Kang Mana Cave	35	2.01	-1.02	0.79	0.09	0.51	-0.52
Kasabas Cave	36	-0.71	-2.30	2.40	-0.42	-0.40	-1.11
Kokok Cave	37	-0.21	-0.42	-0.65	-0.97	0.96	1.12
Lagbas Cave	38	1.62	1.36	2.96	-0.45	0.53	0.08
Lahos-Lahos Cave	39	2.13	-0.07	-1.01	-0.33	-0.32	0.96
Lahug Cave	41	1.38	-0.42	1.42	-0.84	-0.11	-0.81
Langgam Cave	42	2.67	3.64	-2.38	0.96	-0.47	-0.54
Loboc Tourist Cave	43	2.61	-1.16	-3.31	0.71	0.98	2.10
Logarita Cave	44	-3.05	0.39	-0.94	-0.54	-0.26	0.34
Lujang Cave	45	-1.26	-0.58	-2.07	0.07	-1.51	0.10
Lungon Cave	46	2.65	-0.77	-0.54	-1.89	0.70	-1.35
Manlawe Cave	47	0.18	-0.95	-0.25	0.50	-1.06	-0.19
Mesias Cave	48	2.27	-2.18	-1.27	1.30	0.32	0.06
Mohon Cave	49	-1.64	-1.36	-0.68	-1.26	-2.38	-0.54

Nangka Cave	50	2.68	-0.29	3.98	0.61	0.44	0.33
Odiong Cave	51	0.45	0.75	0.39	-0.33	-0.06	0.59
Pig-ot Cave	52	3.51	0.20	0.57	-0.66	-1.53	0.60
Polito Cave	53	-3.32	0.39	-0.01	0.96	1.99	-0.71
Popog Cave	54	3.41	2.81	1.35	1.05	-0.44	-0.83
Pou Cave	55	1.26	1.68	-0.07	-0.87	-0.16	-0.77
Seminary Cave	56	4.94	1.51	0.04	0.79	0.53	2.28
Tagjaw Cave	57	0.02	-1.54	0.13	-1.30	1.02	-2.31
Tambo 1 Cave	58	1.94	0.35	0.18	1.34	1.28	-2.11
Tambo 2 Cave	59	2.54	1.00	0.45	1.66	1.37	-1.89
Tangob Cave	61	-4.13	-2.17	1.32	2.16	-0.31	0.42
Tinugdan Cave	62	-2.14	-0.32	-1.77	0.81	1.41	0.57

Table S2. Scientific names and ecological and morphological traits of 19 cave-roosting bat species captured on Bohol Island, Philippines.

Scientific name	Code for Fig. 3	Endemic	Dietary niche	Foraging space	Roost dependence	Colony size	Aspect ratio	Wing loading (N m ⁻²)	Peak frequency (kHz)	Body mass (g)
Pteropodidae										
<i>Eonycteris spelaea</i>	EOSP	No	Phytophagous	Semi-clutter	Obligate	Large	5.6	19.7	N/A	62.1
<i>Ptenochirus jagori</i>	PTJA	Yes	Phytophagous	Semi-clutter	Facultative	Small	6.8	23.8	N/A	74.2
<i>Rousettus amplexicaudatus</i>	ROAM	No	Phytophagous	Semi-clutter	Obligate	Large	7.0	28.7	N/A	83.7
Emballonuridae										
<i>Emballonura alecto</i>	EMAL	No	Insectivorous	Open	Facultative	Small	7.6	6.9	49.4	6.2
<i>Taphozous melanopogon</i>	TAME	No	Insectivorous	Open	Facultative	Medium	8.4	51.5	29.1	23.0
Hipposideridae										
<i>Hipposideros ater</i>	HIAT	No	Insectivorous	Clutter	Facultative	Small	6.1	6.0	138.6	5.2
<i>Hipposideros diadema</i>	HIDI	No	Insectivorous	Clutter	Facultative	Medium	6.2	11.2	69.3	42.8
<i>Hipposideros obscurus</i>	HIOB	Yes	Insectivorous	Clutter	Obligate	Small	6.0	8.9	142.4	9.1
<i>Hipposideros pygmaeus</i>	HIPY	Yes	Insectivorous	Clutter	Obligate	Small	6.3	5.4	95.5	4.0
Megadermatidae										
<i>Megaderma spasma</i>	MESP	No	Insectivorous	Clutter	Facultative	Small	6.3	12.5	N/A	22.9
Miniopteridae										
<i>Miniopterus australis</i>	MIAU	No	Insectivorous	Open	Obligate	Medium	7.5	7.5	65.9	6.0
<i>Miniopterus schreibersii</i>	MISC	No	Insectivorous	Open	Obligate	Medium	7.3	8.4	48.5	9.8
<i>Miniopterus tristis</i>	MITR	No	Insectivorous	Open	Obligate	Medium	7.6	11.6	34.6	18.4

Scientific name	Code for Fig. 3	Endemic	Dietary niche	Foraging space	Roost dependence	Colony size	Aspect ratio	Wing loading (N m ⁻²)	Peak frequency (kHz)	Body mass (g)
Vespertilionidae										
<i>Myotis horsfieldii</i>	MYHO	No	Insectivorous	Clutter	Facultative	Small	5.9	7.1	47.6	6.4
<i>Myotis macrotarsus</i>	MYMA	No	Insectivorous	Clutter	Obligate	Small	6.3	9.0	N/A	12.8
Rhinolophidae										
<i>Rhinolophus arcuatus</i>	RHAR	No	Insectivorous	Clutter	Obligate	Small	5.8	7.4	68.7	7.7
<i>Rhinolophus macrotis</i>	RHMA	No	Insectivorous	Clutter	Obligate	Small	5.9	6.7	50.0	6.7
<i>Rhinolophus philippinensis</i>	RHPH	No	Insectivorous	Clutter	Obligate	Small	5.9	6.8	31.2	10.0
<i>Rhinolophus rufus</i>	RHRU	Yes	Insectivorous	Clutter	Obligate	Small	5.8	11.5	39.5	29.3

See methods section for details regarding the selected ecological and morphological traits.

Table S3. Species-specific threshold responses to multiple gradients on Bohol Island, Philippines.

Species	Gradient: Landscape disturbance								
	Change-point analysis						Indicator species analysis		
	+/-	<i>z</i>	Obs.	5%	95%	IndVal	<i>p</i> -value	Purity	Reliability
<i>Emballonura alecto</i>	-	5.57	-1.53	-3.52	-0.80	26.67	0.004	1.00	0.88
<i>Hipposideros pygmaeus</i>	-	3.55	1.06	-3.17	1.55	43.26	0.012	1.00	0.96
<i>Taphozous melanopogon</i>	-	4.69	-3.17	-3.52	1.89	34.46	0.012	0.88	0.73
<i>Rhinolophus arcuatus</i>	-	2.20	-3.52	-3.52	2.63	39.59	0.036	0.74	0.55
<i>Miniopterus australis</i>	-	1.52	-2.14	-3.30	2.68	43.21	0.096	0.47	0.32
<i>Hipposideros ater</i>	-	1.44	1.55	-1.94	1.74	15.79	0.136	0.76	0.28
<i>Rhinolophus rufus</i>	-	1.42	1.98	-3.30	2.20	36.95	0.100	0.88	0.63
<i>Miniopterus tristis</i>	-	0.91	-1.94	-3.17	2.68	16.51	0.124	0.59	0.35
<i>Myotis horsfieldii</i>	-	0.80	1.52	-3.52	1.52	10.81	0.292	0.76	0.30
<i>Myotis macrotarsus</i>	+	9.41	2.68	1.92	2.68	60.00	0.004	0.95	0.82
<i>Rousettus amplexicaudatus</i>	+	3.30	2.63	-1.03	2.68	47.90	0.016	0.94	0.80
<i>Rhinolophus philippinensis</i>	+	2.41	2.66	-3.17	2.68	35.78	0.036	0.67	0.55
<i>Ptenochirus jagori</i>	+	2.01	-0.80	-1.09	2.68	17.14	0.084	0.79	0.46
<i>Miniopterus schreibersii</i>	+	2.00	2.66	-3.31	2.68	57.60	0.048	0.90	0.78
<i>Rhinolophus macrotis</i>	+	1.59	1.20	-2.14	2.68	13.02	0.060	0.86	0.46
<i>Megaderma spasma</i>	+	1.43	-0.66	-1.09	2.20	11.76	0.192	0.88	0.42
<i>Hipposideros diadema</i>	+	1.30	-1.34	-2.92	2.63	49.89	0.120	0.83	0.59
<i>Hipposideros obscurus</i>	+	1.19	-1.09	-1.20	2.63	13.16	0.232	0.59	0.26
<i>Eonycteris spelaea</i>	+	1.09	0.24	-2.47	2.68	20.75	0.152	0.82	0.54

Species	Gradient: Cave complexity								
	Change-point analysis					Indicator species analysis			
	+/-	<i>z</i>	Obs.	5%	95%	IndVal	<i>p</i> -value	Purity	Reliability
<i>Hipposideros obscurus</i>	-	4.82	-0.90	-1.41	-0.44	27.78	0.008	1.00	0.93
<i>Taphozous melanopogon</i>	-	2.94	-0.18	-2.01	0.27	17.86	0.004	0.99	0.74
<i>Ptenochirus jagori</i>	-	2.45	-1.38	-2.01	0.59	20.14	0.024	0.89	0.60
<i>Megaderma spasma</i>	-	0.99	0.59	-1.38	0.62	10.81	0.312	0.75	0.30
<i>Myotis horsfieldii</i>	-	0.85	-0.42	-1.84	2.22	10.30	0.224	0.67	0.33
<i>Rhinolophus arcuatus</i>	+	7.50	0.77	-0.44	1.88	55.03	0.004	1.00	1.00
<i>Rhinolophus philippinensis</i>	+	6.21	2.30	0.02	2.30	54.46	0.004	1.00	0.99
<i>Rousettus amplexicaudatus</i>	+	5.44	1.46	0.36	2.22	54.95	0.004	1.00	0.98
<i>Rhinolophus rufus</i>	+	4.74	0.27	-0.81	2.14	49.01	0.004	1.00	0.97
<i>Miniopterus tristis</i>	+	4.49	2.22	0.15	2.30	44.40	0.004	1.00	0.96
<i>Eonycteris spelaea</i>	+	3.62	0.47	-0.75	2.22	32.21	0.004	0.98	0.91
<i>Rhinolophus macrotis</i>	+	3.46	1.65	-0.30	2.30	21.30	0.052	0.99	0.75
<i>Hipposideros diadema</i>	+	3.42	-2.01	-2.01	1.88	70.79	0.004	0.99	0.96
<i>Miniopterus australis</i>	+	3.26	0.16	-1.48	2.14	48.06	0.016	0.95	0.87
<i>Myotis macrotarsus</i>	+	2.21	1.38	-0.42	2.30	13.95	0.120	0.94	0.53
<i>Miniopterus schreibersii</i>	+	2.17	2.30	-1.62	2.30	63.54	0.028	0.85	0.70
<i>Hipposideros ater</i>	+	1.30	1.65	-2.01	2.22	17.08	0.132	0.53	0.31
<i>Hipposideros pygmaeus</i>	+	1.24	-1.84	-1.61	2.22	36.73	0.124	0.56	0.25
<i>Emballonura alecto</i>	+	0.20	-1.41	-1.44	2.14	9.09	0.188	0.63	0.23

Species	Gradient: Mining								
	Change-point analysis						Indicator species analysis		
	+/-	<i>z</i>	Obs.	5%	95%	IndVal	<i>p</i> -value	Purity	Reliability
<i>Hipposideros ater</i>	-	3.41	-1.34	-1.85	0.41	28.32	0.016	0.97	0.78
<i>Hipposideros obscurus</i>	-	2.37	0.18	-1.85	0.41	15.62	0.004	0.96	0.62
<i>Miniopterus australis</i>	-	2.25	0.38	-1.85	1.47	43.08	0.040	0.90	0.71
<i>Rhinolophus arcuatus</i>	-	2.07	-1.85	-1.85	1.41	40.11	0.032	0.87	0.66
<i>Miniopterus schreibersii</i>	-	1.99	1.37	-1.85	1.41	52.93	0.072	0.88	0.75
<i>Hipposideros pygmaeus</i>	-	1.94	0.47	-1.34	0.94	33.59	0.052	0.88	0.66
<i>Hipposideros diadema</i>	-	1.68	-1.85	-1.85	1.41	61.88	0.092	0.77	0.62
<i>Emballonura alecto</i>	-	1.43	0.38	-0.67	0.43	11.76	0.204	0.77	0.25
<i>Eonycteris spelaea</i>	-	0.06	-0.82	-1.85	1.41	16.31	0.456	0.57	0.30
<i>Rhinolophus philippinensis</i>	+	3.22	0.15	-1.60	1.24	25.02	0.024	0.94	0.84
<i>Megaderma spasma</i>	+	2.80	0.15	-0.16	1.63	15.38	0.024	0.97	0.60
<i>Ptenochirus jagori</i>	+	2.74	1.63	-0.83	1.63	34.02	0.052	0.77	0.52
<i>Taphozous melanopogon</i>	+	2.74	1.31	-1.85	1.41	20.24	0.032	0.73	0.59
<i>Miniopterus tristis</i>	+	1.89	0.28	-0.90	1.31	18.02	0.051	0.80	0.53
<i>Myotis macrotarsus</i>	+	1.72	-0.04	-0.53	1.34	10.34	0.108	0.90	0.39
<i>Rhinolophus macrotis</i>	+	1.69	-0.07	-0.24	1.24	13.33	0.044	0.78	0.38
<i>Rousettus amplexicaudatus</i>	+	1.02	0.38	-1.85	1.47	22.59	0.140	0.82	0.53
<i>Rhinolophus rufus</i>	+	0.28	1.63	-1.43	1.47	32.67	0.300	0.52	0.30
<i>Myotis horsfieldii</i>	+	0.15	1.41	-1.34	1.47	9.71	0.228	0.48	0.18

Species	Gradient: Cave development								
	Change-point analysis					Indicator species analysis			
	+/-	<i>z</i>	Obs.	5%	95%	IndVal	<i>p</i> -value	Purity	Reliability
<i>Hipposideros diadema</i>	-	2.40	1.50	-1.28	1.89	62.16	0.024	0.73	0.61
<i>Hipposideros ater</i>	-	2.18	-0.65	-1.28	0.59	18.58	0.032	0.91	0.67
<i>Myotis horsfieldii</i>	-	1.86	-0.65	-1.28	0.45	13.46	0.076	0.91	0.50
<i>Rousettus amplexicaudatus</i>	-	1.21	1.14	-1.28	1.14	28.26	0.096	0.54	0.26
<i>Rhinolophus philippinensis</i>	-	0.72	1.14	-1.28	0.93	17.39	0.336	0.44	0.19
<i>Emballonura alecto</i>	-	0.71	-0.97	-1.28	0.96	10.32	0.172	0.61	0.34
<i>Hipposideros pygmaeus</i>	-	0.69	1.89	-1.28	1.50	35.29	0.132	0.61	0.30
<i>Rhinolophus macrotis</i>	-	0.68	-0.85	-1.01	1.50	10.73	0.160	0.58	0.21
<i>Miniopterus tristis</i>	-	0.52	1.14	-1.28	1.00	15.22	0.120	0.40	0.17
<i>Taphozous melanopogon</i>	+	11.19	1.89	0.75	1.89	79.91	0.004	1.00	0.94
<i>Eonycteris spelaea</i>	+	2.16	-0.35	-1.05	1.51	24.37	0.032	0.82	0.60
<i>Megaderma spasma</i>	+	1.66	1.01	-0.75	1.50	13.45	0.120	0.88	0.42
<i>Miniopterus schreibersii</i>	+	1.62	0.75	-1.28	1.50	44.98	0.084	0.61	0.53
<i>Rhinolophus arcuatus</i>	+	1.18	-1.05	-1.05	1.32	27.50	0.144	0.63	0.34
<i>Myotis macrotarsus</i>	+	0.91	0.75	-1.28	1.14	9.72	0.216	0.73	0.27
<i>Miniopterus australis</i>	+	0.89	0.86	-1.28	1.89	39.12	0.176	0.71	0.52
<i>Rhinolophus rufus</i>	+	0.74	0.54	-1.10	1.32	30.03	0.192	0.63	0.41
<i>Hipposideros obscurus</i>	+	0.50	0.45	-1.10	1.89	10.90	0.260	0.68	0.32
<i>Ptenochirus jagori</i>	+	0.11	1.72	-1.23	1.72	13.99	0.176	0.50	0.22

Species	Gradient: Resource extraction								
	Change-point analysis					Indicator species analysis			
	+/-	<i>z</i>	Obs.	5%	95%	IndVal	<i>p</i> -value	Purity	Reliability
<i>Miniopterus schreibersii</i>	-	1.90	-0.43	-1.33	1.12	46.05	0.056	0.74	0.60
<i>Eonycteris spelaea</i>	-	1.85	0.72	-0.99	0.96	27.91	0.052	0.91	0.73
<i>Miniopterus australis</i>	-	1.52	-0.08	-1.33	1.33	39.07	0.100	0.91	0.68
<i>Rhinolophus arcuatus</i>	-	1.49	0.84	-1.03	0.97	28.26	0.104	0.50	0.23
<i>Myotis macrotarsus</i>	-	1.45	-1.37	-1.37	0.53	14.27	0.092	0.79	0.35
<i>Hipposideros diadema</i>	-	1.39	-0.43	-1.37	1.39	47.92	0.096	0.69	0.50
<i>Rousettus amplexicaudatus</i>	-	1.35	0.97	-0.99	0.96	28.26	0.080	0.83	0.59
<i>Taphozous melanopogon</i>	-	1.29	0.47	-1.19	0.52	13.51	0.196	0.75	0.30
<i>Rhinolophus philippinensis</i>	-	1.13	-1.37	-1.37	0.72	22.51	0.120	0.84	0.54
<i>Emballonura alecto</i>	-	1.01	-1.37	-1.37	1.39	14.91	0.100	0.45	0.25
<i>Miniopterus tristis</i>	-	0.89	0.84	-1.37	0.70	15.91	0.320	0.67	0.35
<i>Hipposideros obscurus</i>	-	0.64	-1.03	-1.37	0.97	13.84	0.180	0.65	0.33
<i>Ptenochirus jadori</i>	-	0.15	-0.36	-1.37	0.97	10.70	0.448	0.68	0.35
<i>Megaderma spasma</i>	+	3.47	0.41	-0.01	1.39	19.05	0.004	0.98	0.76
<i>Hipposideros pygmaeus</i>	+	4.54	1.39	-1.37	1.39	66.25	0.004	0.72	0.69
<i>Hipposideros ater</i>	+	2.59	1.25	-1.33	1.39	24.03	0.056	0.84	0.68
<i>Myotis horsfieldii</i>	+	2.25	1.00	-0.26	1.39	19.68	0.072	0.91	0.60
<i>Rhinolophus macrotis</i>	+	0.73	-0.45	-0.45	1.33	10.00	0.396	0.55	0.20
<i>Rhinolophus rufus</i>	+	0.59	0.53	-1.37	1.25	28.80	0.200	0.64	0.38

Species	Gradient: Bat hunting								
	Change-point analysis					Indicator species analysis			
	+/-	<i>z</i>	Obs.	5%	95%	IndVal	<i>p</i> -value	Purity	Reliability
<i>Miniopterus australis</i>	-	2.45	-0.53	-0.85	0.80	46.55	0.028	0.96	0.88
<i>Rhinolophus arcuatus</i>	-	2.26	0.46	-0.79	0.58	32.56	0.016	0.94	0.79
<i>Rhinolophus macrotis</i>	-	3.99	-0.75	-1.08	0.13	24.51	0.020	0.94	0.71
<i>Ptenochirus jagori</i>	-	2.47	-1.08	-1.08	0.34	25.73	0.060	0.82	0.45
<i>Myotis horsfieldii</i>	-	2.15	-0.79	-1.08	0.18	16.92	0.048	0.93	0.55
<i>Rhinolophus rufus</i>	-	1.42	0.59	-1.08	0.62	34.57	0.084	0.80	0.55
<i>Rhinolophus philippinensis</i>	-	1.34	0.21	-0.54	0.46	17.00	0.092	0.63	0.28
<i>Emballonura alecto</i>	-	1.33	-0.54	-0.82	0.27	12.40	0.104	0.83	0.35
<i>Hipposideros pygmaeus</i>	-	1.12	0.27	-1.08	0.46	29.38	0.136	0.70	0.45
<i>Miniopterus tristis</i>	-	1.00	-0.21	-0.79	0.58	14.74	0.168	0.61	0.35
<i>Hipposideros ater</i>	-	0.88	0.15	-0.79	1.04	13.24	0.224	0.56	0.22
<i>Megaderma spasma</i>	-	0.66	0.38	-1.08	0.34	10.00	0.320	0.75	0.29
<i>Miniopterus schreibersii</i>	-	0.57	-0.53	-1.08	0.60	39.16	0.280	0.58	0.31
<i>Taphozous melanopogon</i>	+	4.98	0.21	0.09	0.46	25.00	0.004	0.99	0.89
<i>Myotis macrotarsus</i>	+	3.66	0.60	-1.08	1.40	21.37	0.028	0.79	0.58
<i>Eonycteris spelaea</i>	+	3.74	0.46	-0.54	1.40	35.28	0.004	0.84	0.76
<i>Rousettus amplexicaudatus</i>	+	3.59	0.46	-0.25	1.40	39.27	0.008	0.89	0.85
<i>Hipposideros diadema</i>	+	1.76	0.60	-1.08	0.80	56.33	0.064	0.78	0.55
<i>Hipposideros obscurus</i>	+	0.51	1.40	-0.96	1.40	16.69	0.144	0.50	0.27

Change-point analysis: +/- indicates the direction of each species response (positive/negative) to a gradient, standardized *z*-scores, observed change points (Obs.) with bootstrap confidence intervals (5 and 95%) based on 500 bootstrap replicates. Indicator species analysis: indicator value scores (IndVal) with corresponding *p*-values and estimates of purity (i.e., mean proportion of correct response

direction (z- or z+) assignments) and reliability (i.e., mean proportion of $p \leq 0.05$) based on 500 replicates. Species in bold are credible indicator species with purity > 0.90 and reliability > 0.75 for the respective gradient.