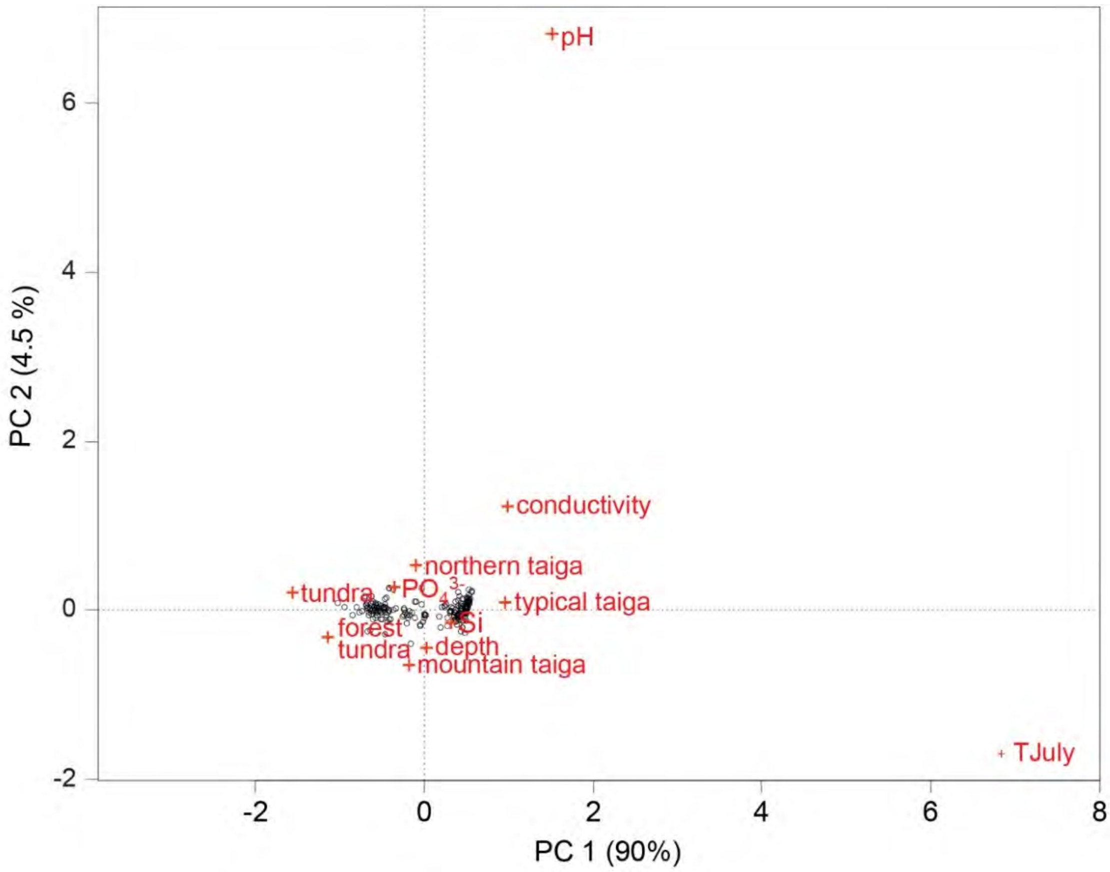
Supplementary material for: Pestryakova L.A., Herzschuh U., Gorodnichev R. & Sebastian Wetterich S. 2018. The sensitivity of diatom taxa from Yakutian lakes (north-eastern Siberia) to electrical conductivity and other environmental variables. *Polar Research 37*. Contact:
Ulrike Herzschuh, Alfred Wegener Institute Helmholtz Center for Polar and Marine Research, Department of Periglacial Research, Telegrafenberg A43, DE-14473 Potsdam, Germany, ulrike.herzschuh@awi.de

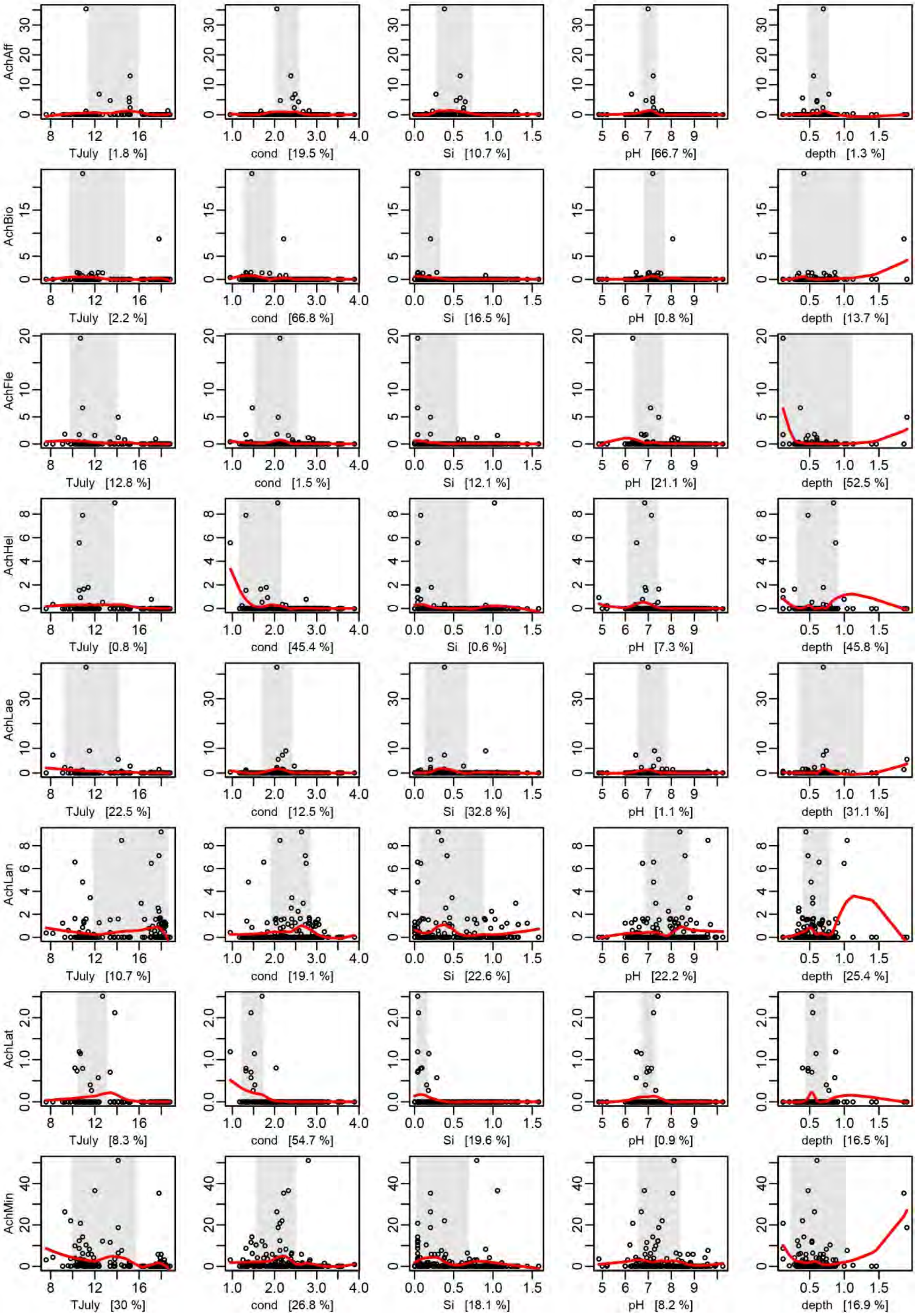


Supplementary Fig. S1. Biplot of the first two axes of a principal component analysis performed on the environmental variables used for the constrained ordination analyses of diatom assemblages from Yakutia. Circles are samples.

Supplementary Fig. S2 (following pages). Abundance plots for all 157 diatom taxa (in alphabetic order of abbreviated names) for each of the five selected environmental variables. Grey shaded area indicates the WA tolerance, red line is a local regression (LOESS) smoother (span: 0.05), and the number below each plot indicates the % of splits in boosted regression tree (BRT) relative to the respective variable.

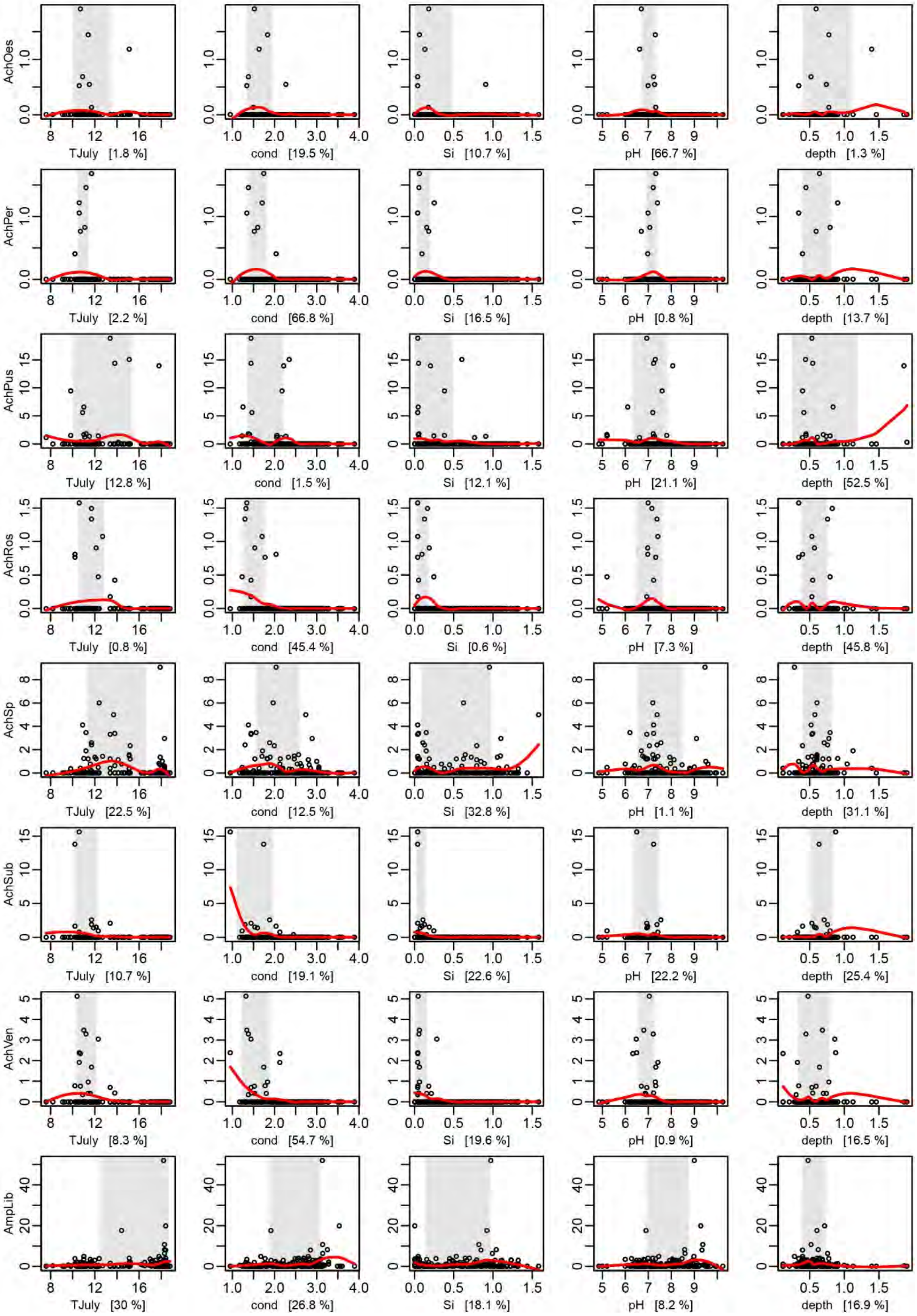
Indicator analysis of diatom species using Boosted Regression Trees

standard parameter settings − part 01/16



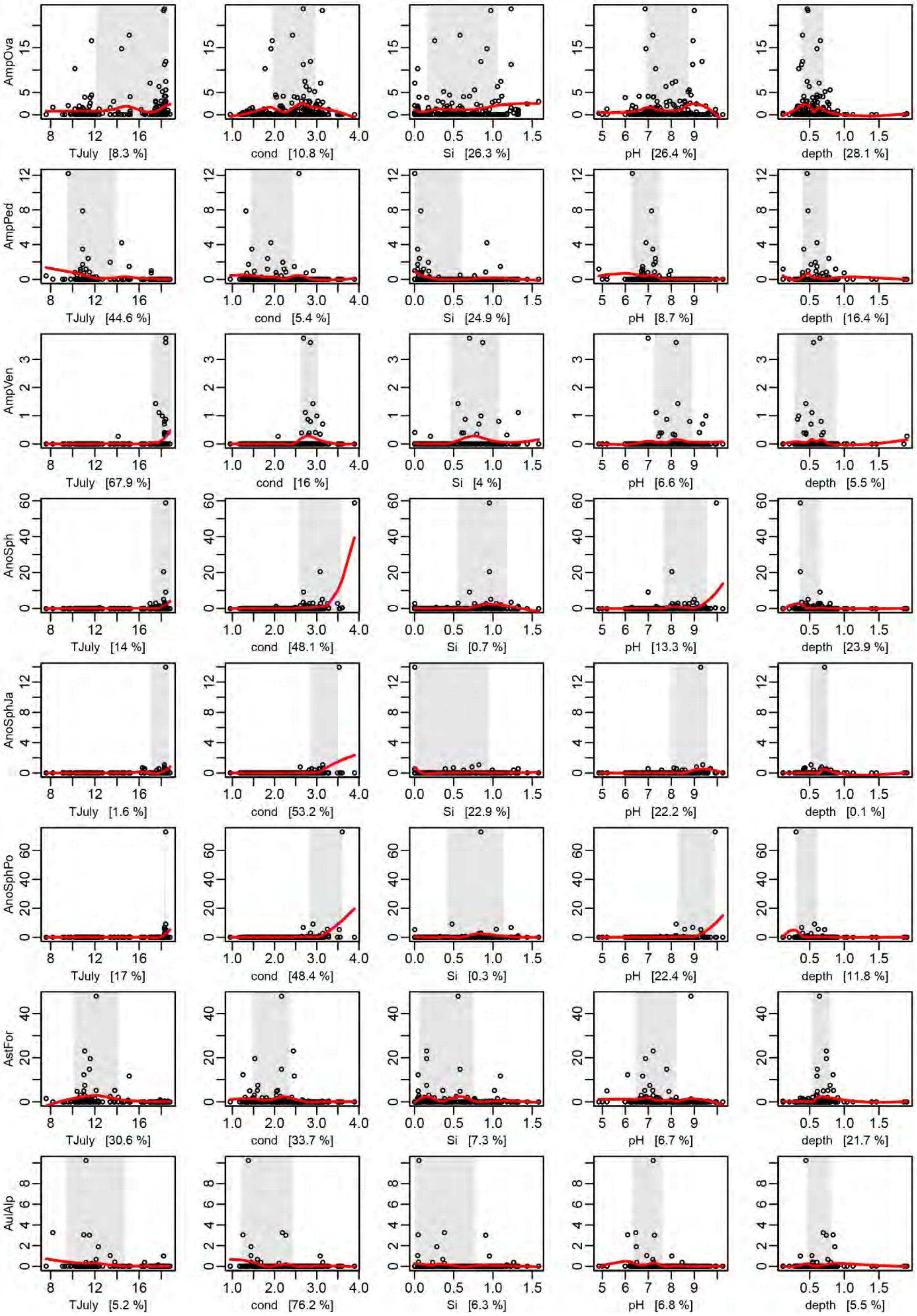
Indicator analysis of diatom species using Boosted Regression Trees

standard parameter settings − part 02/16



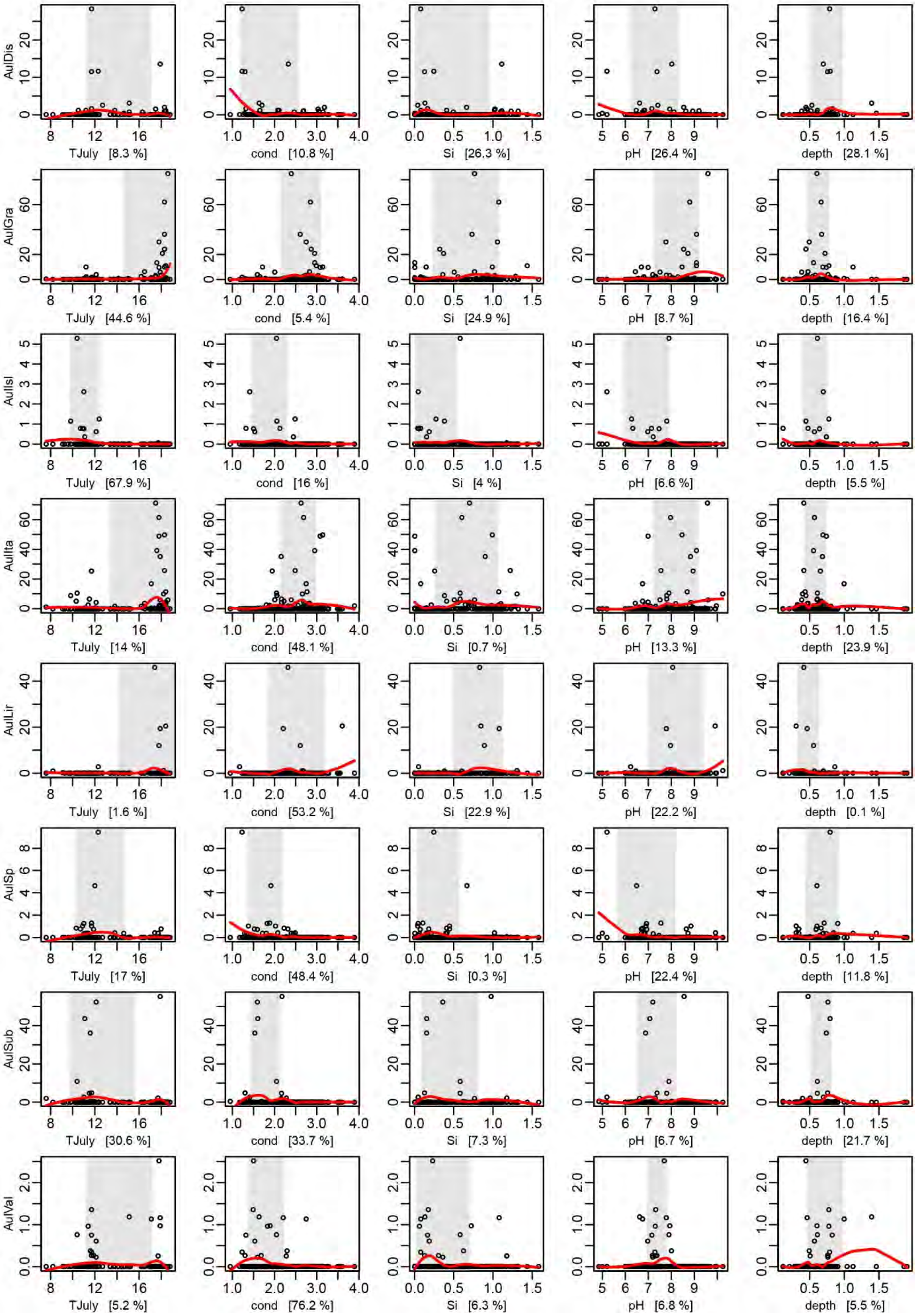
Indicator analysis of diatom species using Boosted Regression Trees

standard parameter settings − part 03/16



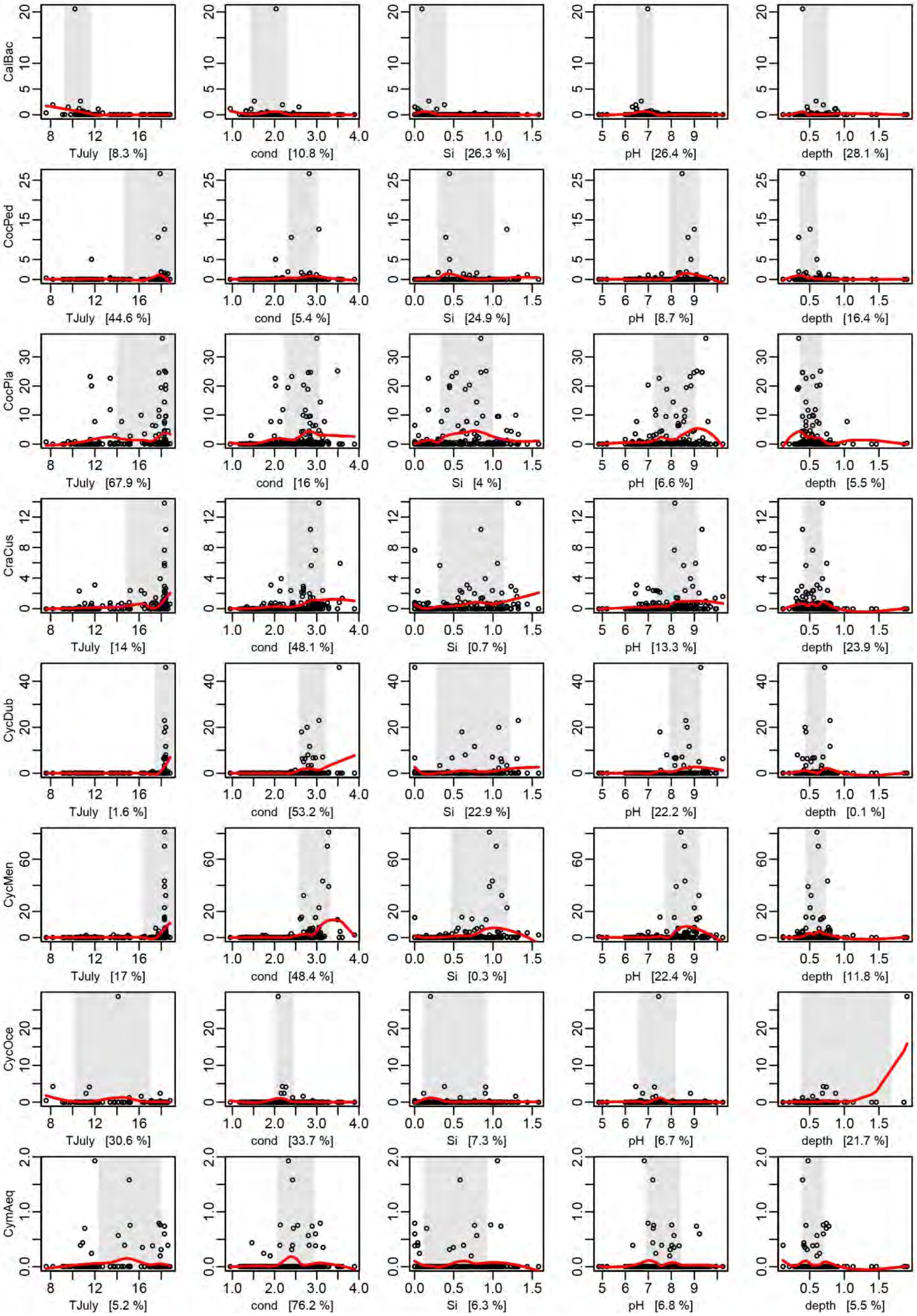
Indicator analysis of diatom species using Boosted Regression Trees

standard parameter settings − part 04/16



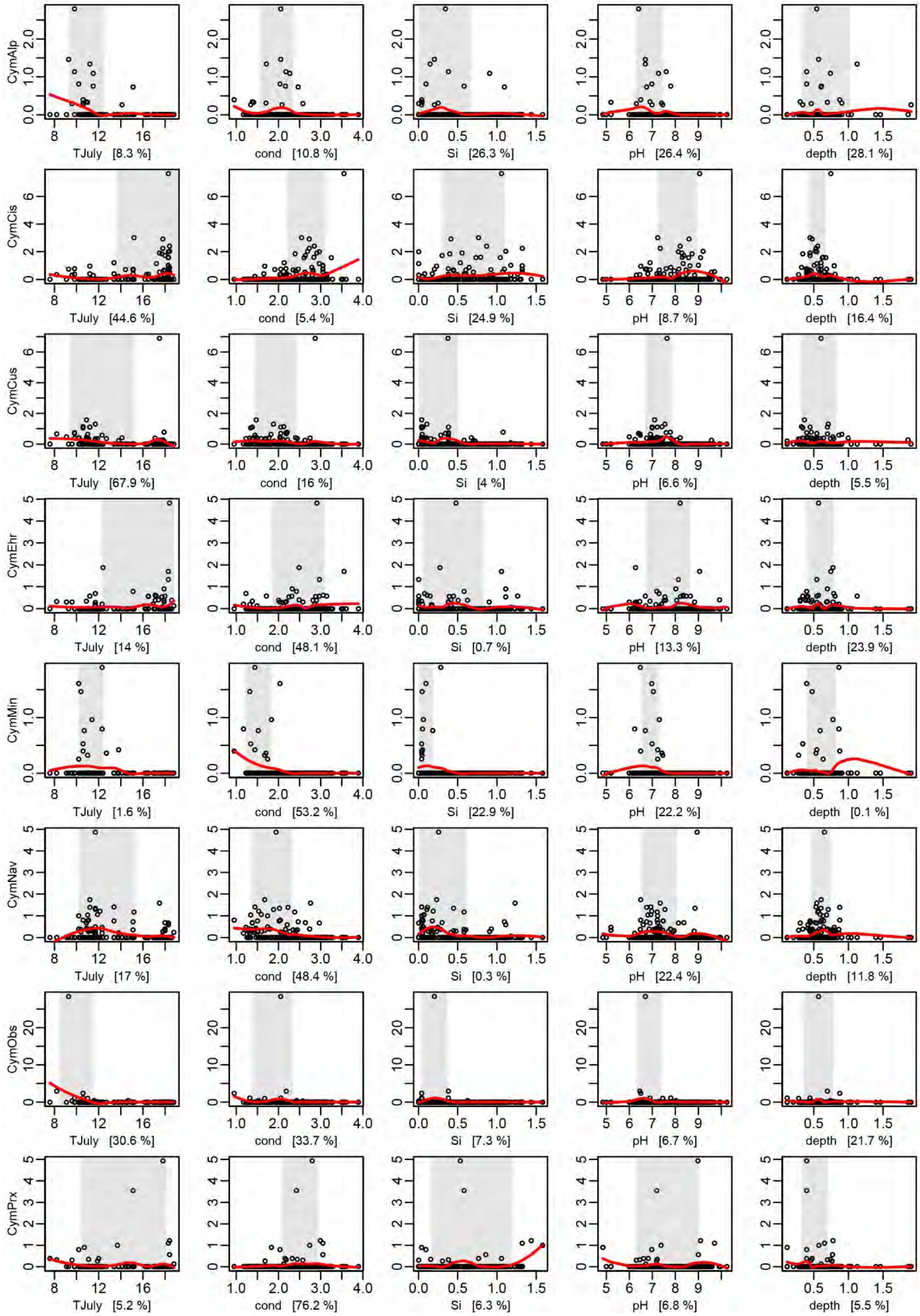
Indicator analysis of diatom species using Boosted Regression Trees

standard parameter settings − part 05/16



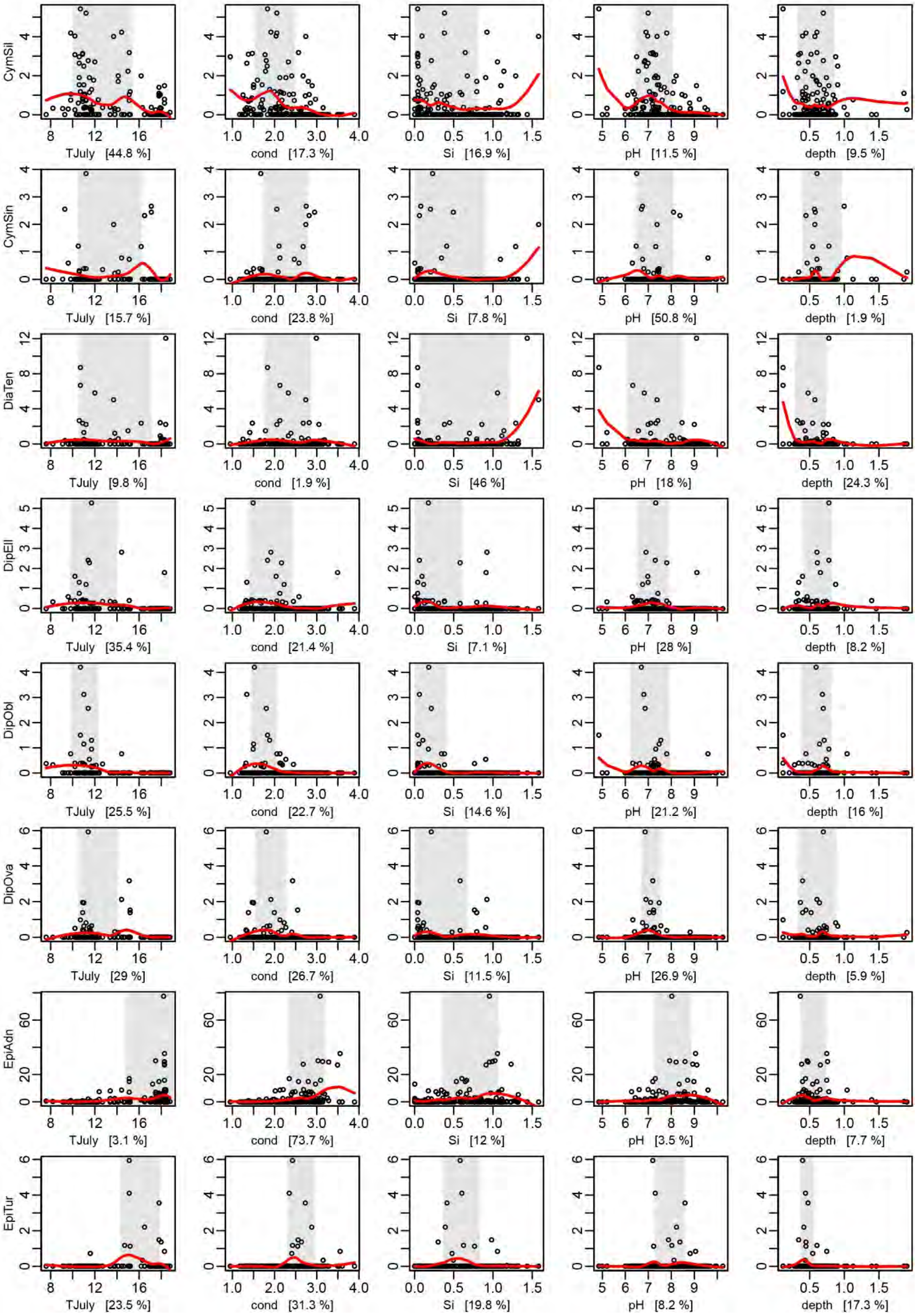
Indicator analysis of diatom species using Boosted Regression Trees

standard parameter settings − part 06/16



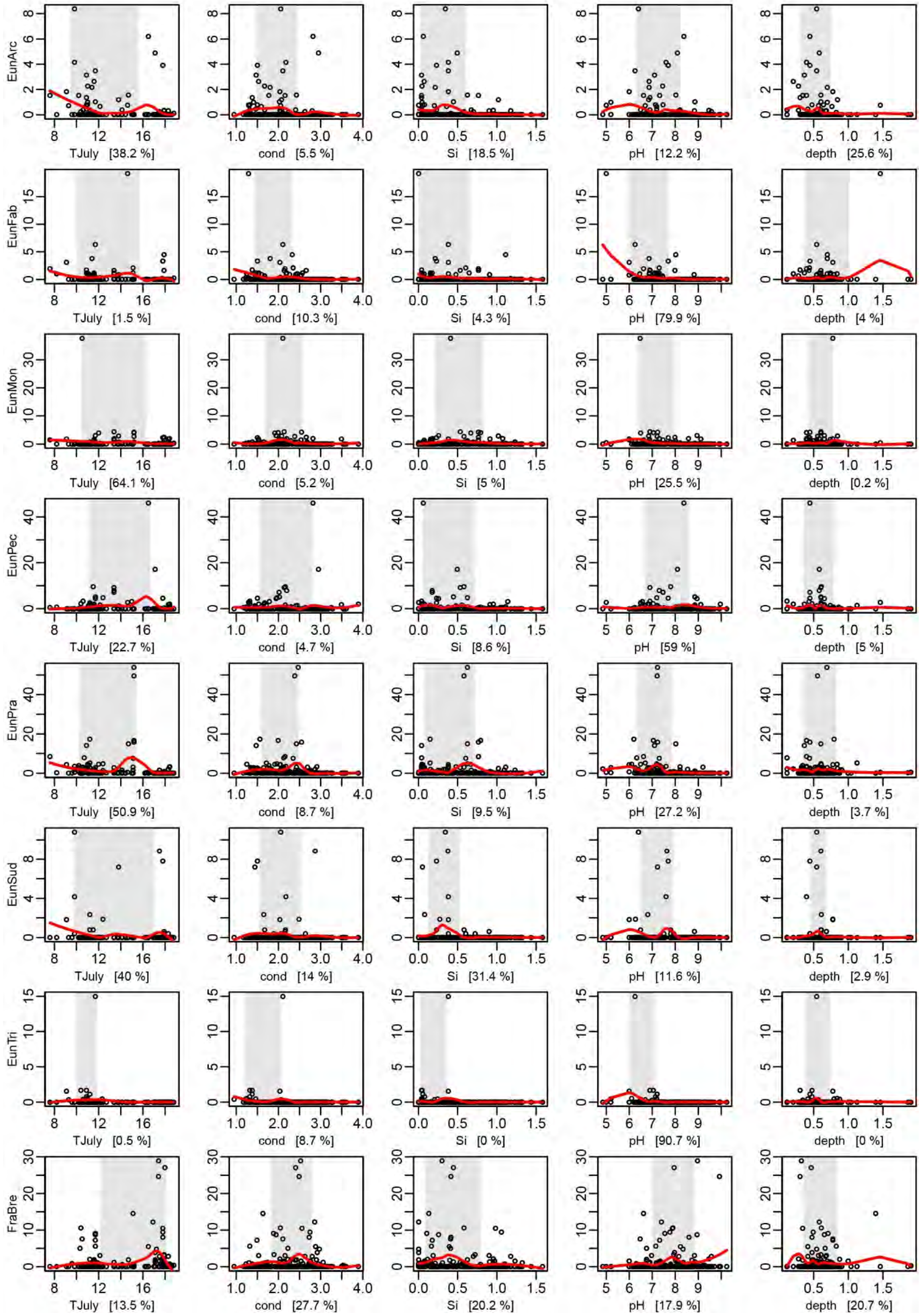
Indicator analysis of diatom species using Boosted Regression Trees

standard parameter settings − part 07/16



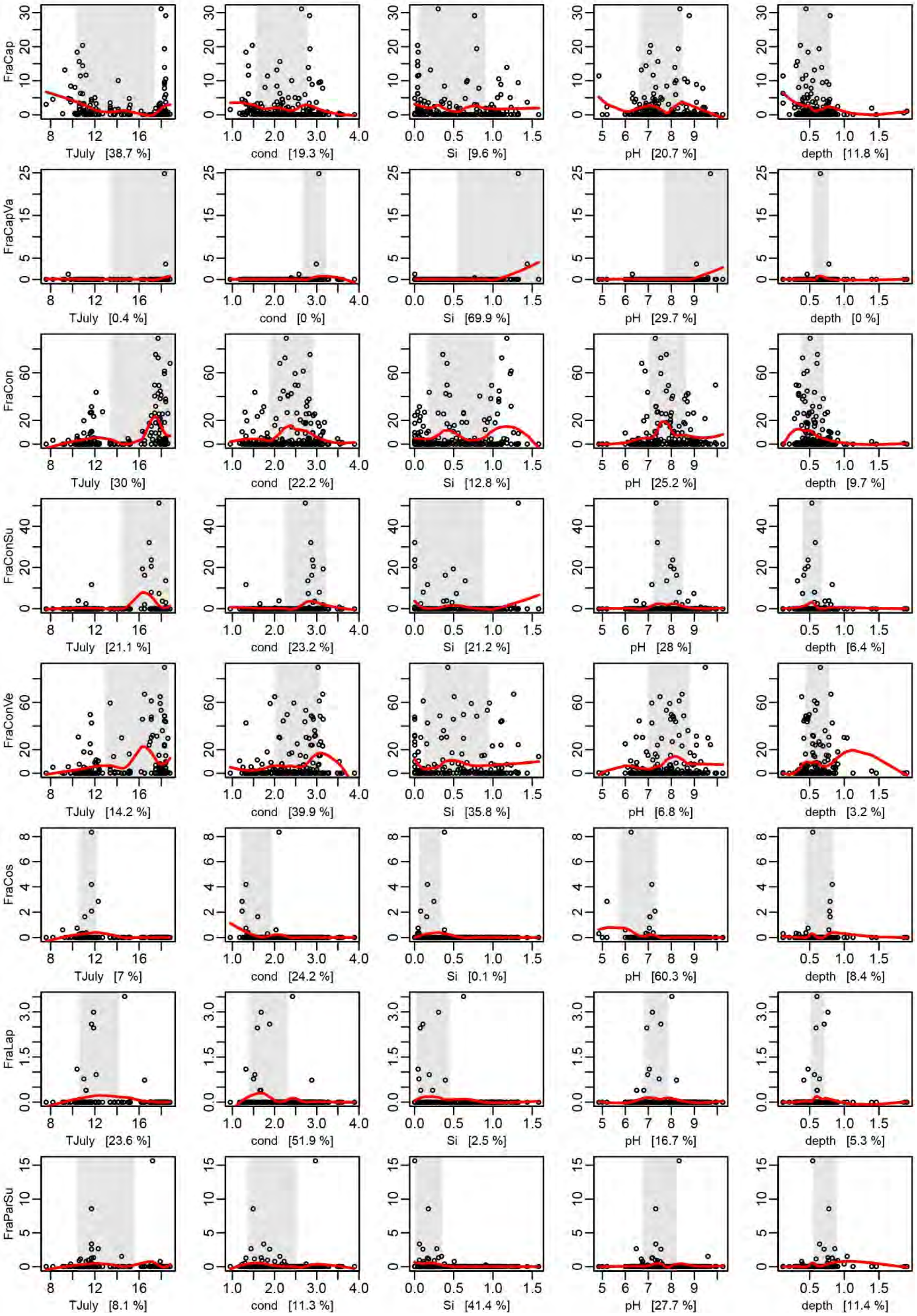
Indicator analysis of diatom species using Boosted Regression Trees

standard parameter settings − part 08/16



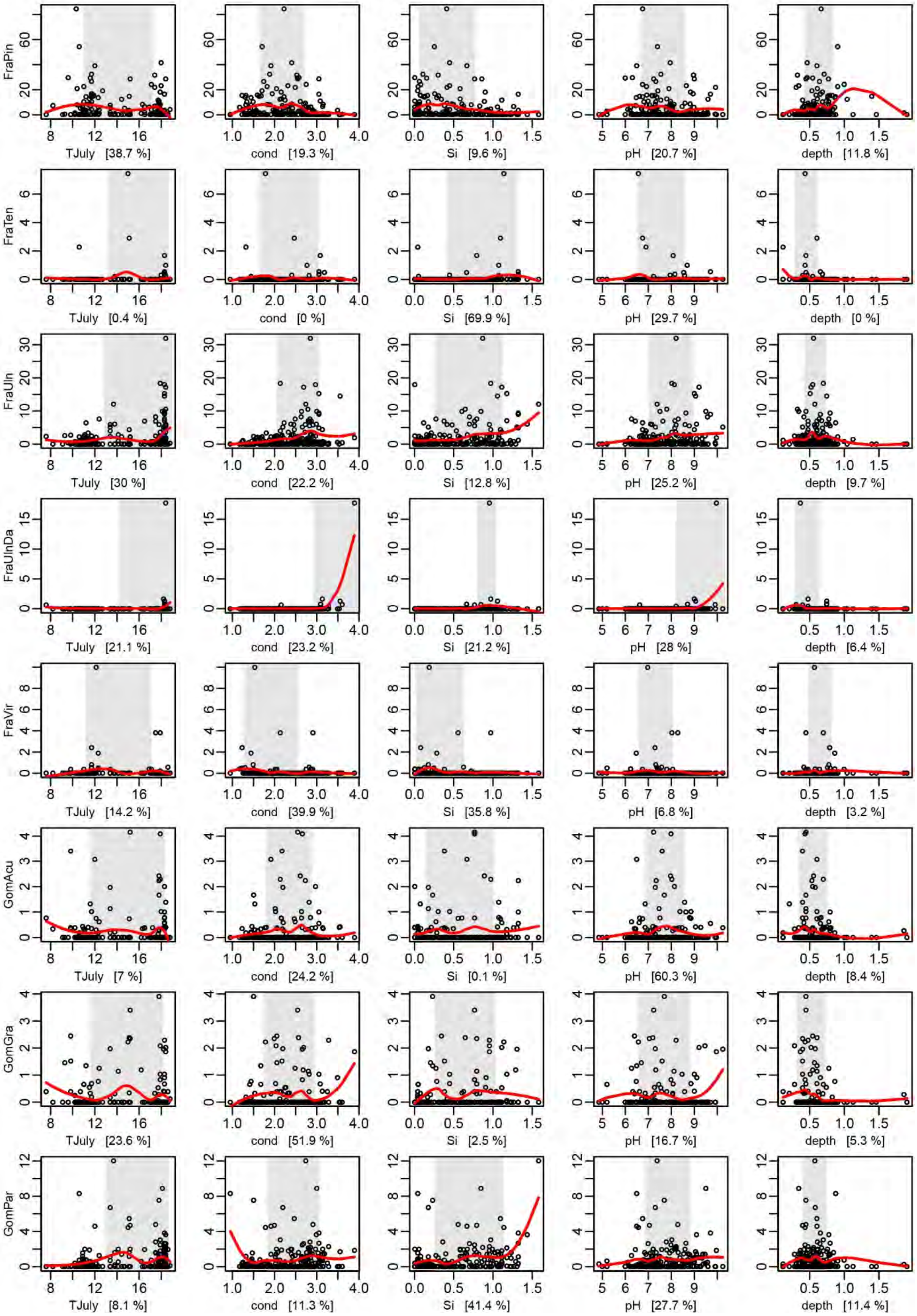
Indicator analysis of diatom species using Boosted Regression Trees

standard parameter settings − part 09/16



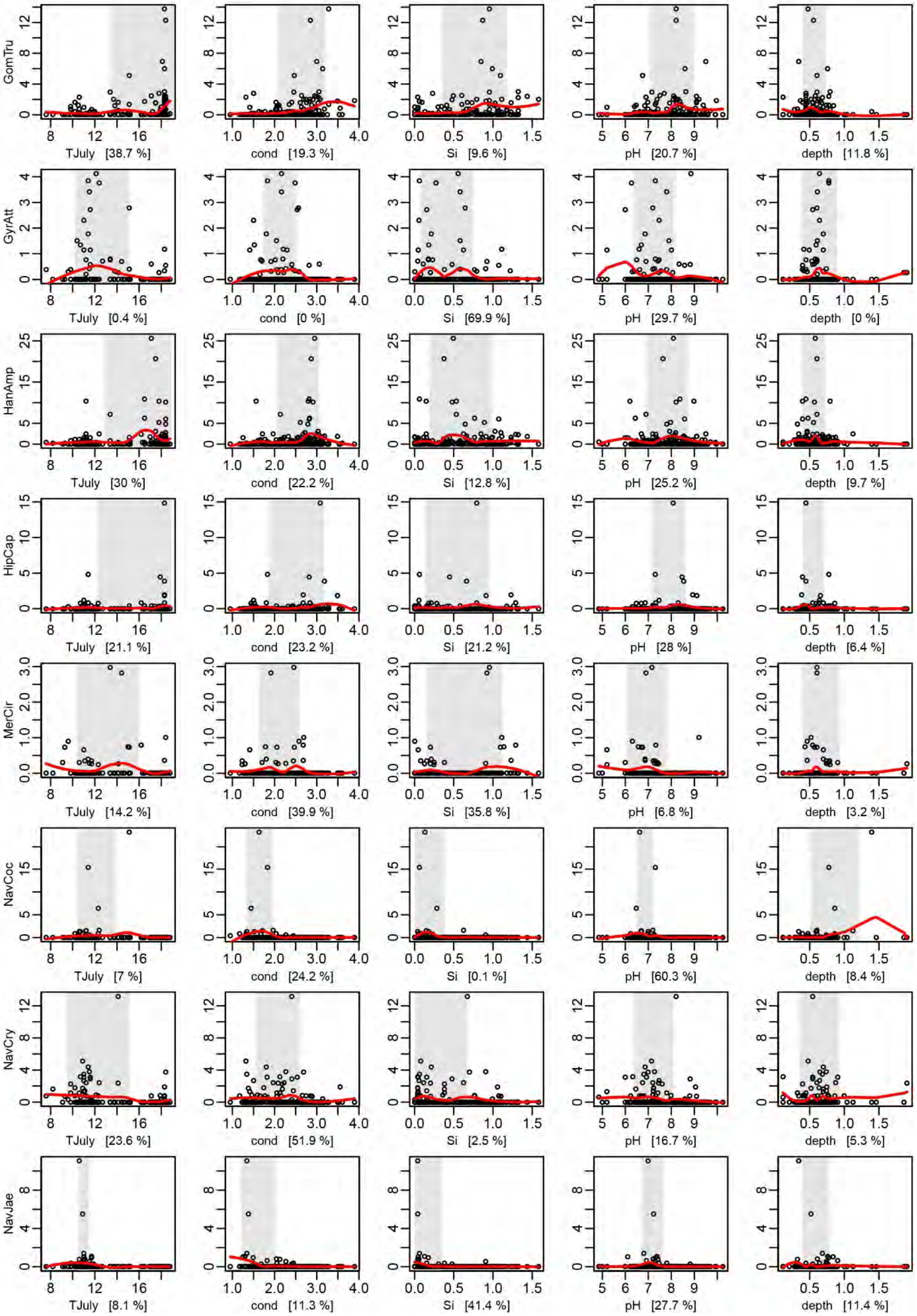
Indicator analysis of diatom species using Boosted Regression Trees

standard parameter settings − part 10/16



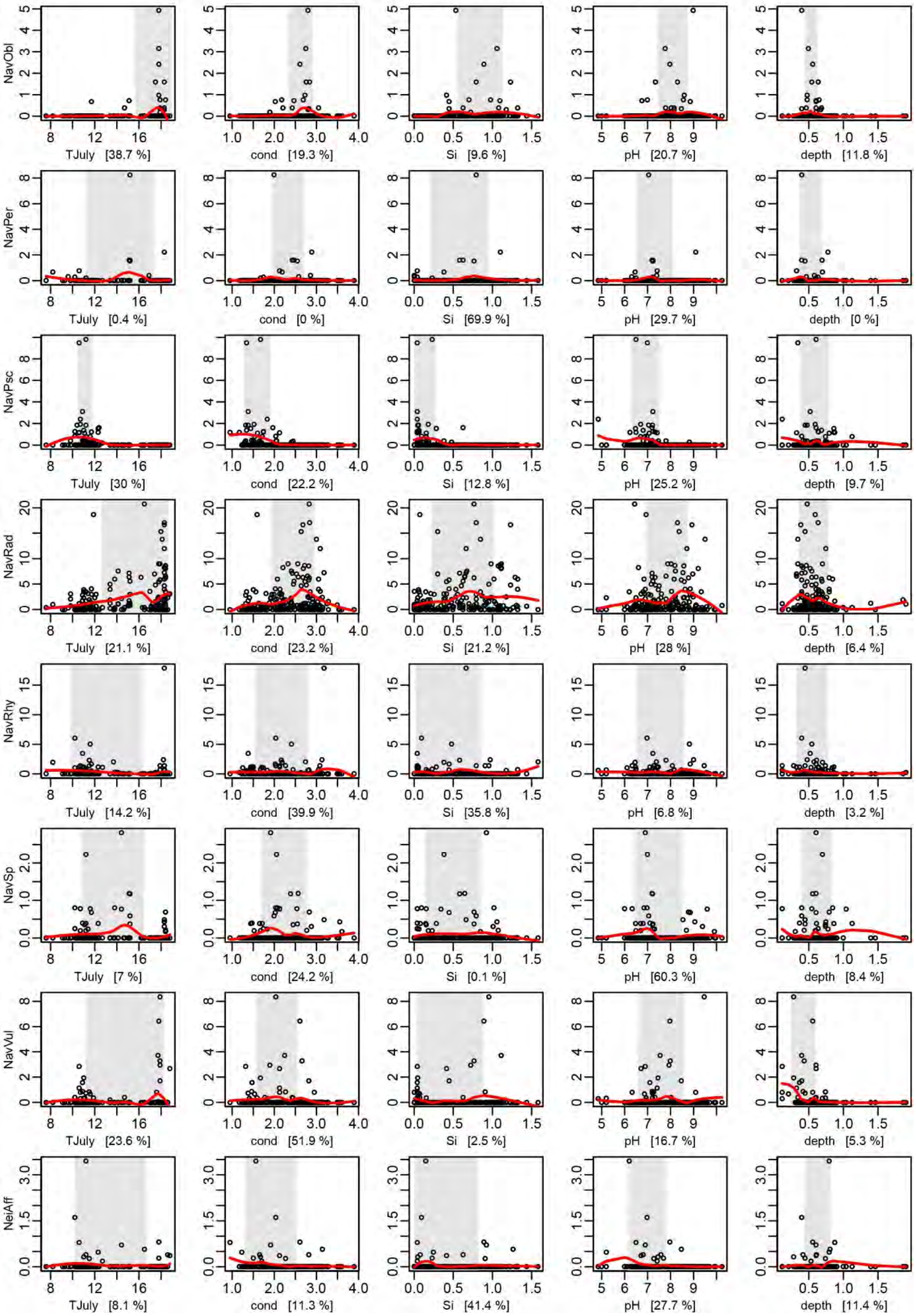
Indicator analysis of diatom species using Boosted Regression Trees

standard parameter settings – part 11/16



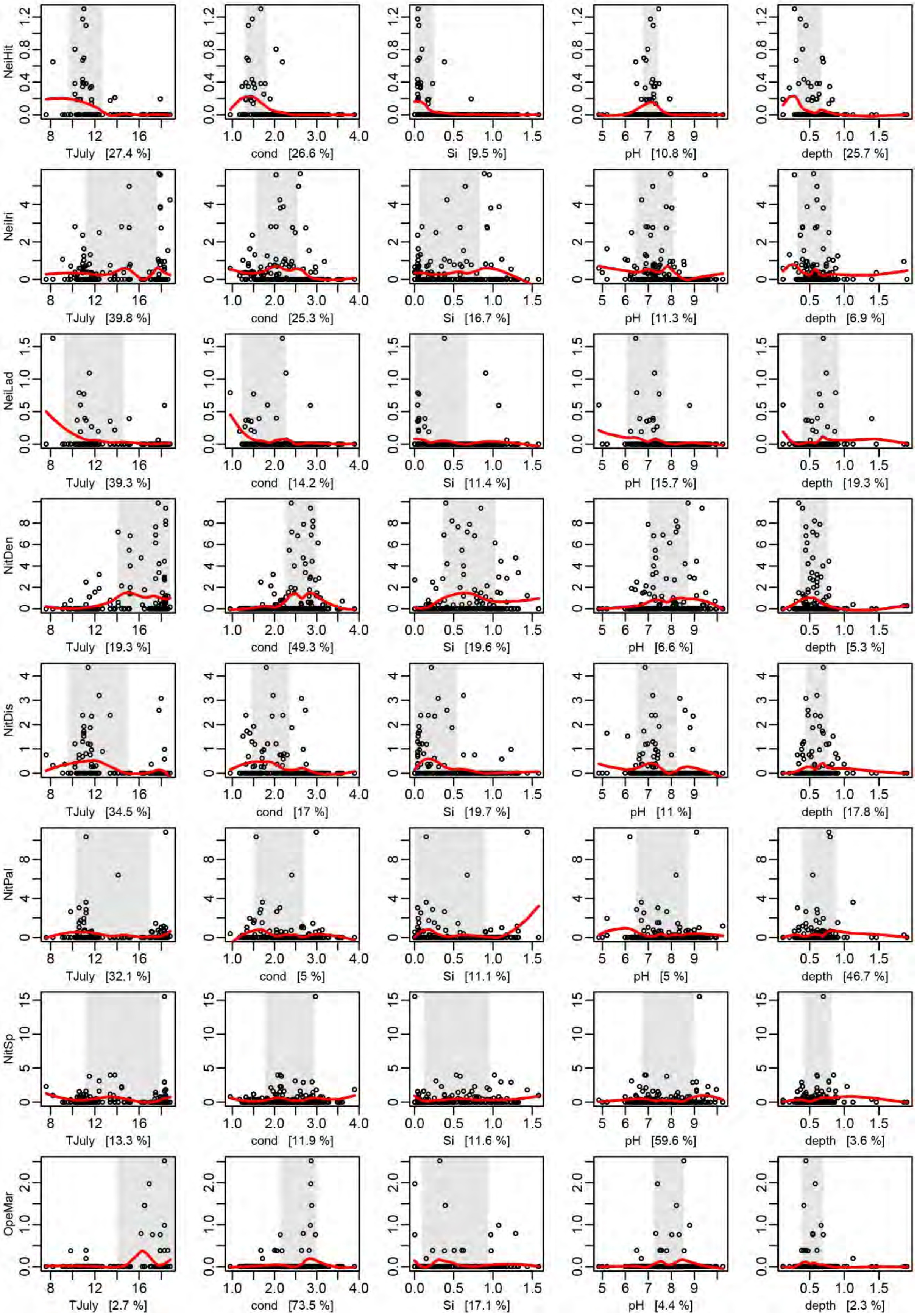
Indicator analysis of diatom species using Boosted Regression Trees

standard parameter settings − part 12/16



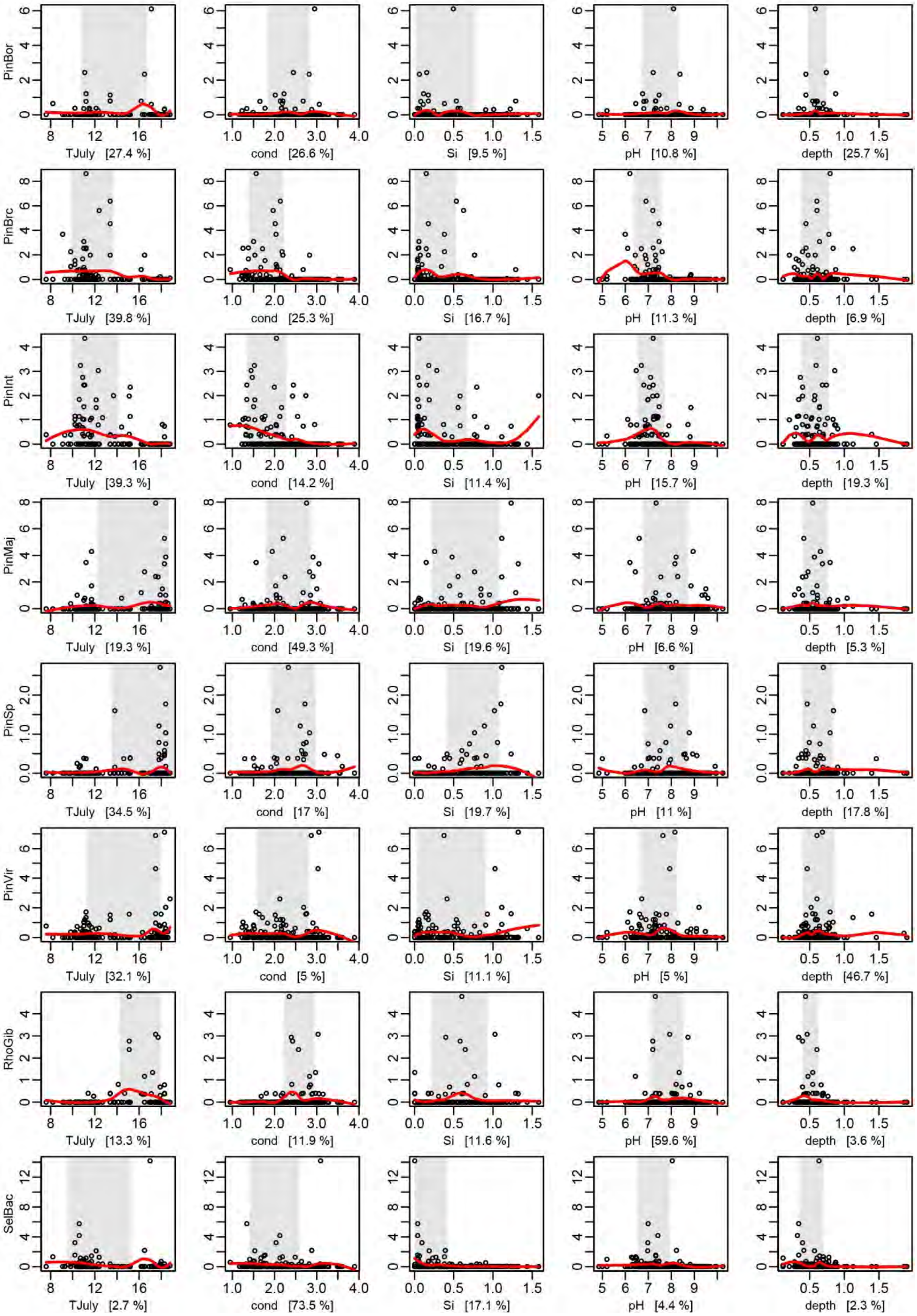
Indicator analysis of diatom species using Boosted Regression Trees

standard parameter settings − part 13/16



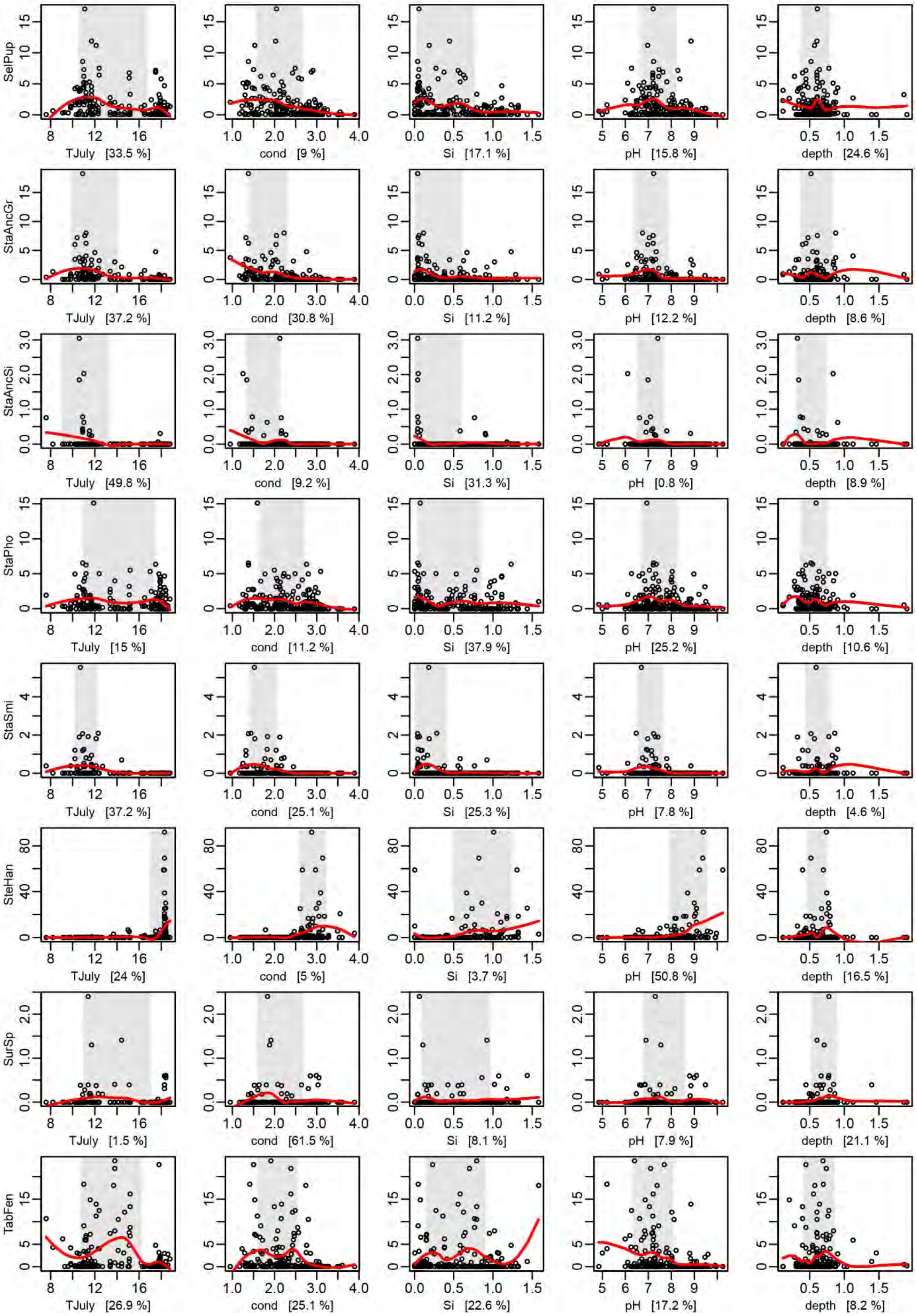
Indicator analysis of diatom species using Boosted Regression Trees

standard parameter settings − part 14/16



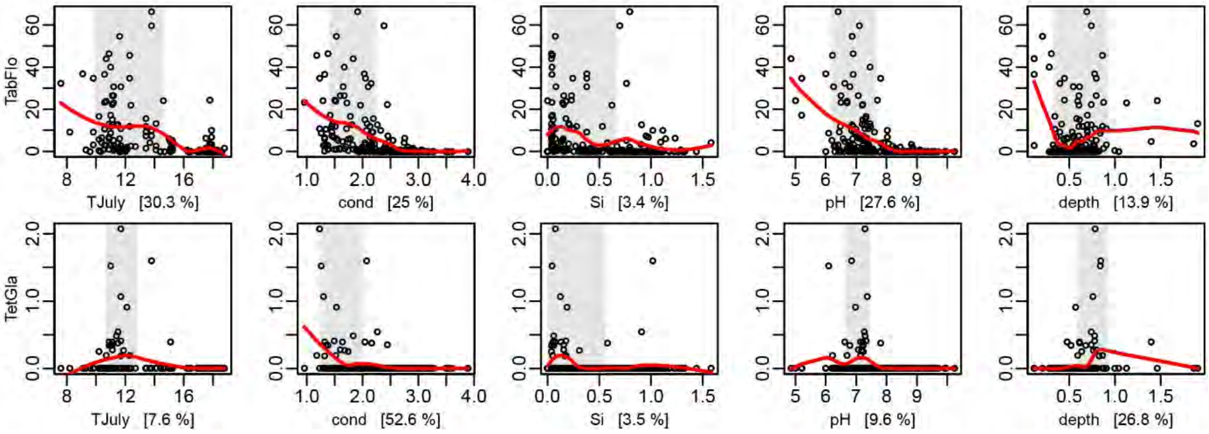
Indicator analysis of diatom species using Boosted Regression Trees

standard parameter settings – part 15/16



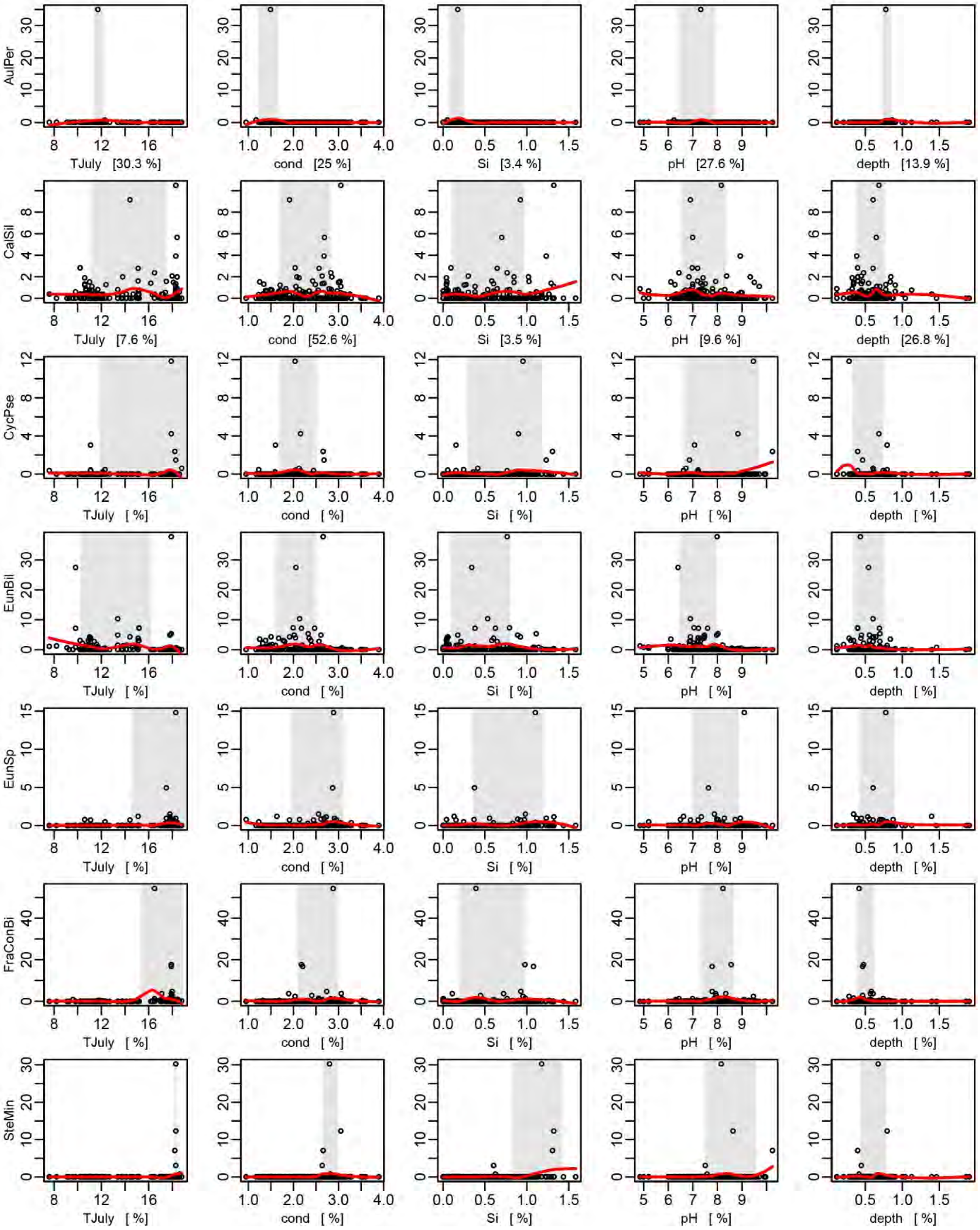
Indicator analysis of diatom species using Boosted Regression Trees

standard parameter settings − part 16/16



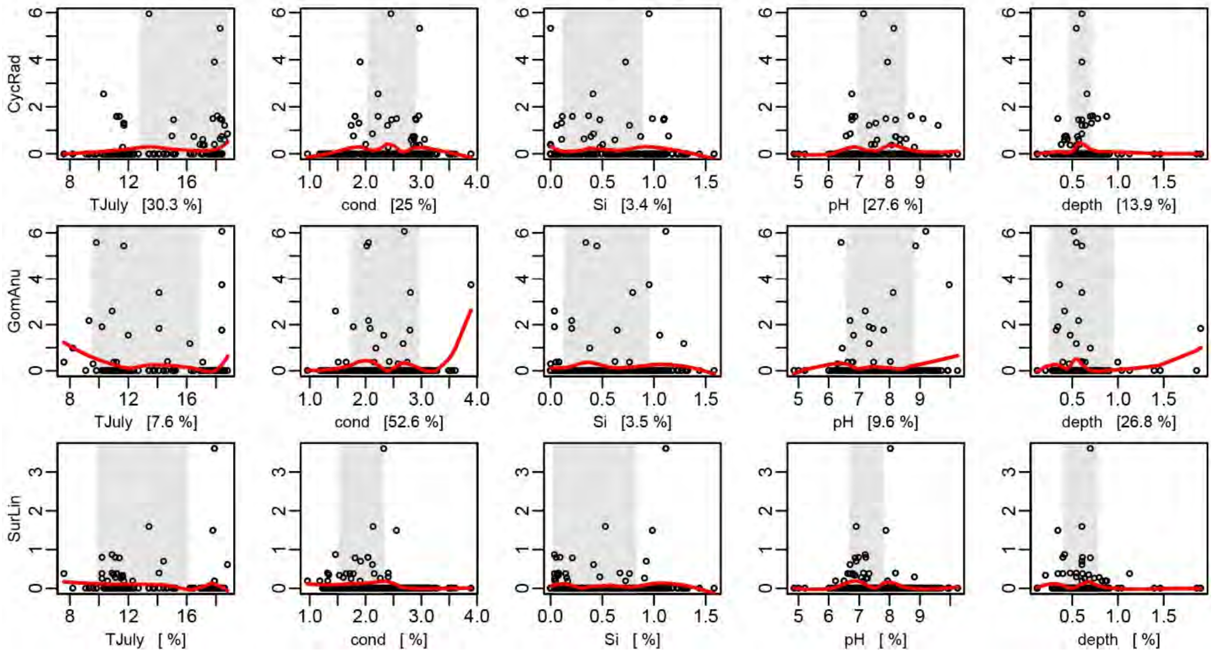
Indicator analysis of diatom species using Boosted Regression Trees

changed parameter settings: tc = 3; lr = 0.000000005; bf = 0.5



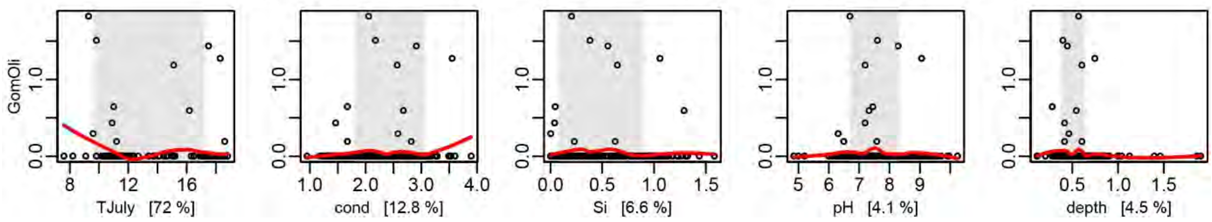
Indicator analysis of diatom species using Boosted Regression Trees

changed parameter settings: tc = 49; lr = 0.000000005; bf = 0.75



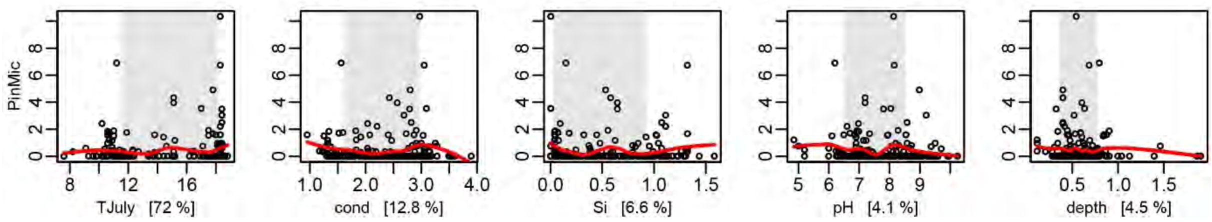
Indicator analysis of diatom species using Boosted Regression Trees

changed parameter settings: tc = 3; lr = 0.000000005; bf = 0.75



Indicator analysis of diatom species using Boosted Regression Trees

changed parameter settings: tc = 49; lr = 0.000000005; bf = 0.5



Supplementary Table S1. Pearson-correlation matrix of non-vegetation environmental variables.

	cond	Ca	Mg	Na+K	HCO_3^{2-}	SO_4	Cl	pH	Si	PO_4	depth
T_{July}	0.75	0.66	0.72	0.56	0.75	0.54	0.49	0.65	0.57	0.32	-0.10
Cond		0.73	0.86	0.85	0.94	0.65	0.82	0.65	0.53	0.45	-0.16
Ca			0.60	0.46	0.73	0.61	0.49	0.45	0.52	0.30	-0.10
Mg				0.66	0.84	0.50	0.67	0.67	0.57	0.39	-0.16
Na+K					0.77	0.59	0.81	0.50	0.30	0.45	-0.13
HCO_3						0.56	0.70	0.69	0.52	0.42	-0.15
SO_4							0.63	0.26	0.35	0.44	-0.07
Cl								0.46	0.38	0.48	-0.13
pH									0.41	0.31	-0.16
Si										0.13	-0.14
PO_4											-0.01

Supplementary Table S2. Detailed results of statistical analyses for each of the 157 diatom taxa. Weighted averaging (WA) optima and tolerances for electrical conductivity, mean July temperature, silica concentration, pH and water depth.

	No.	Conductivity optimum (WA) log(x+1)mS/cm	Conductivity tolerance (WA) log(x+1)mS/cm	TJuly optimum (WA) °C	TJuly tolerance (WA)°C	Si optimum (WA) log(x+1)mg/l	Si tolerance (WA) log(x+1)mg/l	pH optimum (WA)	pH tolerance (WA)	Depth optimum (WA) log(x+1)	Depth tolerance (WA) log(x+1)
Achnanthes spp.	1	2.08	0.52	13.95	2.66	0.53	0.45	7.51	0.97	0.61	0.21
Achnanthidium minutissimum (Kütz.) Czarnecki	2	2.03	0.48	12.83	2.94	0.35	0.34	7.46	0.92	0.62	0.40
Achnanthidium affine (Grun.) Czarnecki	3	2.30	0.30	13.66	2.25	0.51	0.23	7.01	0.36	0.63	0.15
Amphora libyca (Kütz.) Schoeman & Archibald	4	2.49	0.61	15.55	3.12	0.55	0.42	7.82	0.93	0.56	0.17
Amphora ovalis Kütz.	5	2.47	0.51	15.32	3.26	0.61	0.44	7.81	0.94	0.54	0.16
Amphora pediculus (Kütz.) Grun.	6	1.94	0.50	11.73	2.19	0.24	0.35	6.88	0.65	0.57	0.18
Amphora veneta Kütz.	7	2.82	0.21	18.06	0.88	0.76	0.31	8.10	0.82	0.58	0.30
Aneumastus tusculus (Ehr.) Mann & Stickle	8	2.42	0.44	14.81	3.55	0.43	0.31	7.50	0.67	0.64	0.37

	No.	Conductivity optimum (WA) log(x+1)mS/cm	Conductivity tolerance (WA) log(x+1)mS/cm	TJuly optimum (WA) °C	TJuly tolerance (WA)°C	Si optimum (WA) log(x+1)mg/l	Si tolerance (WA) log(x+1)mg/l	pH optimum (WA)	pH tolerance (WA)	Depth optimum (WA) log(x+1)	Depth tolerance (WA) log(x+1)
Anomoeoneis sphaerophora (Ehr.) Pfitzer	9	3.08	0.49	18.04	0.89	0.86	0.31	8.59	0.96	0.50	0.15
Anomoeoneis sphaerophora var. *jakutica* (Kiss.) Zabelina	10	3.17	0.32	17.91	0.84	0.44	0.51	8.80	0.80	0.63	0.14
Anomoeoneis sphaerophora var. *polygramma* (Ehr.) Müller	11	3.22	0.39	18.36	0.05	0.78	0.36	9.08	0.80	0.45	0.16
Asterionella formosa Hass	12	1.93	0.44	12.10	2.01	0.41	0.35	7.28	0.86	0.66	0.13
Aulacoseira alpigena (Grun.) Kram.	13	1.82	0.60	12.09	2.66	0.37	0.41	6.97	0.63	0.64	0.17
Aulacoseira distans (Ehr.) Sim.	14	1.88	0.70	14.14	2.93	0.48	0.48	7.26	1.06	0.74	0.24
Aulacoseira granulata (Ehr.) Sim.	15	2.62	0.49	16.98	2.50	0.66	0.42	8.23	0.97	0.62	0.16
Aulacoseira islandica (O.Müll.) Sim.	16	1.88	0.42	11.11	1.36	0.27	0.27	6.93	1.00	0.58	0.18
Aulacoseira italica (Ehr.) Sim.	17	2.56	0.43	16.33	2.97	0.66	0.41	8.18	0.99	0.58	0.16
Aulacoseira lirata (Ehr.) Ross in Hart.	18	2.52	0.67	16.91	2.80	0.81	0.31	8.19	1.21	0.48	0.16
Aulacoseira perglabra (Oestrup) Haworth	19	1.45	0.22	11.78	0.42	0.16	0.09	7.18	0.77	0.79	0.06
Aulacoseira spp.	20	1.78	0.41	12.49	2.27	0.30	0.27	6.91	1.24	0.68	0.25
Aulacoseira subarctica (O.Müll.) E.Y.Haw.	21	1.78	0.35	12.66	3.01	0.45	0.37	7.34	0.85	0.66	0.15
Aulacoseira valida (Grun.) Kram.	22	1.80	0.43	14.19	3.03	0.36	0.35	7.37	0.43	0.72	0.26
Caloneis baccilum (Grun.) Cleve	23	1.85	0.44	10.43	1.19	0.19	0.22	6.85	0.38	0.59	0.19
Caloneis silicula (Ehr.) Cleve	24	2.25	0.57	14.29	3.21	0.54	0.43	7.43	0.91	0.57	0.20
Cavinula cocconeiformis (Gregory) Mann & Stickle	25	1.65	0.31	12.17	1.73	0.18	0.20	6.85	0.35	0.86	0.35
Cavinula pseudoscutiformis (Hust. ex A.Schm.) Mann & Stickle	26	1.59	0.31	11.12	0.65	0.13	0.14	6.91	0.62	0.58	0.21
Cocconeis pediculus Ehr.	27	2.65	0.35	17.15	2.55	0.66	0.36	8.55	0.67	0.48	0.13
Cocconeis placentula Ehr.	28	2.66	0.41	16.52	2.61	0.66	0.34	8.15	0.91	0.52	0.16
Craticula cuspidata (Kütz.) Mann	29	2.74	0.45	17.06	2.25	0.73	0.42	8.25	0.91	0.55	0.14
Cyclostephanos dubius (Fricke) Round	30	2.90	0.33	18.25	0.82	0.74	0.47	8.59	0.70	0.58	0.15
Cyclotella meneghiniana Kütz.	31	2.94	0.39	17.85	1.54	0.83	0.37	8.47	0.74	0.59	0.15
Cyclotella ocellata Pant.	32	2.23	0.22	13.56	3.46	0.51	0.41	7.38	0.79	1.03	0.66
Cyclotella pseudostelligera Hust.	33	2.10	0.41	15.62	3.77	0.74	0.45	8.15	1.54	0.53	0.21

	No.	Conductivity optimum (WA) log(x+1)mS/cm	Conductivity tolerance (WA) log(x+1)mS/cm	TJuly optimum (WA) °C	TJuly tolerance (WA)°C	Si optimum (WA) log(x+1)mg/l	Si tolerance (WA) log(x+1)mg/l	pH optimum (WA)	pH tolerance (WA)	Depth optimum (WA) log(x+1)	Depth tolerance (WA) log(x+1)
Cyclotella radiosa (Grun.) Lemm.	34	2.47	0.44	15.80	3.02	0.50	0.39	7.75	0.81	0.59	0.12
Cyclotella stelligera Cleve & Grun.	35	2.14	0.57	13.88	2.83	0.76	0.59	7.37	0.73	0.64	0.11
Cymatopleura solea (Breb.) W.Sm.	36	2.57	0.56	15.94	2.84	0.60	0.43	7.72	1.09	0.63	0.22
Cymbella cistula (Ehr.) Kirch.	37	2.66	0.46	16.42	2.86	0.70	0.40	8.09	0.86	0.54	0.13
Cymbella cymbiformis Agardh	38	2.45	0.52	15.37	2.41	0.72	0.47	7.78	0.94	0.61	0.17
Cymbella proxima Reimer	39	2.51	0.42	14.31	3.84	0.68	0.52	7.64	1.38	0.51	0.19
Cymbopleura cuspidata Kütz.	40	1.93	0.49	12.32	2.93	0.24	0.26	7.26	0.58	0.57	0.26
Cymbopleura inaequalis (Ehr.) Kram.	41	2.47	0.62	15.55	3.28	0.44	0.39	7.68	0.96	0.60	0.19
Cymbopleura naviculiformis (Auerswald) Kram.	42	1.85	0.48	12.75	2.57	0.28	0.33	7.29	0.77	0.60	0.14
Diatoma tenuis C.A.Agardh	43	2.31	0.56	13.83	3.29	0.63	0.57	7.28	1.21	0.51	0.22
Diploneis elliptica (Kütz.) Cleve	44	1.90	0.52	11.88	2.14	0.29	0.32	7.18	0.68	0.62	0.21
Diploneis oblongella (Naegeli) Cleve-Euler	45	1.75	0.31	11.07	1.24	0.19	0.21	7.07	0.87	0.59	0.22
Diploneis ovalis (Hilse.)	46	1.90	0.37	12.29	1.79	0.34	0.34	7.12	0.43	0.60	0.28
Ellerbeckia arenaria (Moore) Crawford	47	2.20	0.54	14.94	3.25	0.40	0.31	8.10	1.17	0.56	0.23
Encyonema alpinum (Grun.)	48	1.95	0.41	10.90	1.57	0.33	0.33	6.87	0.60	0.67	0.35
Encyonema minutum (Hilse) Mann	49	1.53	0.31	11.31	1.12	0.09	0.09	6.91	0.39	0.61	0.21
Encyonema obscurum (Krasske) Mann	50	1.86	0.49	9.99	1.55	0.21	0.17	6.87	0.52	0.56	0.22
Encyonema silesiacum (Bleisch) Mann	51	2.00	0.49	12.71	2.69	0.40	0.41	7.23	0.83	0.59	0.27
Encyonopsis aequalis (W.Smith) Kram.	52	2.50	0.44	15.20	2.87	0.52	0.41	7.65	0.78	0.55	0.17
Epithemia adnata (Kütz.) Breb.	53	2.77	0.43	16.92	2.17	0.71	0.36	8.07	0.81	0.55	0.19
Epithemia turgida (Ehr.) Kütz.	54	2.63	0.33	16.09	1.79	0.60	0.23	7.94	0.65	0.47	0.10
Eucocconeis flexella (Kütz.) Cleve	55	2.02	0.51	11.87	2.15	0.23	0.32	7.02	0.64	0.56	0.56
Eucocconeis laevis (Oestrup) Lange-Bertalot	56	2.05	0.36	11.72	2.55	0.40	0.28	7.17	0.63	0.81	0.47
Eunotia arcus Ehr.	57	1.97	0.49	12.52	3.08	0.31	0.29	7.24	0.94	0.53	0.22
Eunotia bilunaris (Ehr.) Mills.	58	2.06	0.44	13.23	3.01	0.45	0.35	7.21	0.77	0.55	0.21
Eunotia faba (Ehr.) Grun.	59	1.87	0.45	12.86	2.86	0.33	0.33	6.84	0.89	0.68	0.32
Eunotia monodon Ehr.	60	2.12	0.44	13.38	2.92	0.52	0.31	7.19	0.81	0.60	0.18

	No.	Conductivity optimum (WA) log(x+1)mS/cm	Conductivity tolerance (WA) log(x+1)mS/cm	TJuly optimum (WA) °C	TJuly tolerance (WA)°C	Si optimum (WA) log(x+1)mg/l	Si tolerance (WA) log(x+1)mg/l	pH optimum (WA)	pH tolerance (WA)	Depth optimum (WA) log(x+1)	Depth tolerance (WA) log(x+1)
Eunotia pectinalis (Dillw.) Rabenh.	61	2.18	0.62	13.87	2.80	0.38	0.33	7.64	0.97	0.57	0.22
Eunotia praerupta Ehr.	62	2.04	0.44	12.80	2.58	0.40	0.32	7.10	0.75	0.58	0.24
Eunotia spp.	63	2.53	0.58	16.89	2.37	0.77	0.42	7.92	0.96	0.65	0.24
Eunotia sudetica O.Müller	64	2.04	0.48	13.37	3.62	0.32	0.20	7.18	0.72	0.57	0.11
Eunotia triodon Ehr.	65	1.64	0.42	10.92	0.92	0.19	0.17	6.55	0.57	0.55	0.18
Eunotia veneris (Kütz.) De Toni	66	1.91	0.42	13.00	2.59	0.47	0.46	7.00	0.55	0.72	0.21
Fragilaria capucina Desm.	67	2.17	0.61	13.90	3.57	0.47	0.43	7.55	0.93	0.56	0.24
Fragilaria constricta Ehr.	68	1.57	0.37	11.34	0.82	0.20	0.14	6.53	0.81	0.64	0.21
Fragilaria intermedia Grun.	69	2.29	0.52	15.97	2.63	0.82	0.35	7.47	1.03	0.54	0.23
Fragilaria tenera W.Sm.	70	2.34	0.70	15.92	2.76	0.86	0.45	7.56	1.03	0.45	0.16
Fragilaria vaucheriae (Kütz.) Lange-Bertalot	71	2.93	0.28	17.24	3.78	1.14	0.60	9.13	1.43	0.65	0.12
Fragilariforma virescens (Ralfs) D.M.Williams & Round	72	1.91	0.65	14.15	2.99	0.32	0.31	7.32	0.74	0.65	0.17
Gomphonema acuminatum Ehr.	73	2.34	0.55	14.94	3.38	0.58	0.43	7.71	0.85	0.55	0.21
Gomphonema angustum Ag.	74	2.36	0.62	13.18	3.65	0.54	0.42	7.71	1.14	0.60	0.35
Gomphonema clavatum Ehr.	75	2.32	0.61	15.19	3.02	0.59	0.44	7.54	0.75	0.58	0.28
Gomphonema gracile Ehr.	76	2.35	0.60	14.89	3.30	0.65	0.39	7.69	1.13	0.52	0.21
Gomphonema olivaceum (Horn.) Breb.	77	2.43	0.63	13.42	3.81	0.49	0.41	7.50	0.81	0.51	0.13
Gomphonema parvulum Kütz.	78	2.45	0.61	15.84	2.88	0.69	0.44	7.85	0.99	0.57	0.18
Gomphonema truncatum Ehr.	79	2.65	0.55	16.30	2.90	0.76	0.41	8.02	0.95	0.56	0.17
Gyrosigma attenuatum (Kütz.) Rabenhorst	80	2.12	0.39	12.64	2.46	0.41	0.33	7.25	0.88	0.64	0.26
Hantzschia amphioxys (Ehr.) Grun.	81	2.55	0.50	15.90	2.99	0.59	0.40	7.81	0.91	0.56	0.17
Hippodonta capitata (Ehr.) Lange-Bertalot et al.	82	2.52	0.65	15.55	3.33	0.54	0.41	7.87	0.75	0.56	0.15
Hippodonta hungarica (Grun.) Lange-Bertalot et al.	83	2.32	0.48	14.21	3.65	0.51	0.43	7.72	1.00	0.57	0.20
Karayevia laterostrata (Hust.) Bukhtiyarova	84	1.48	0.27	11.80	1.34	0.09	0.08	6.99	0.33	0.60	0.16
Lemnicola hungarica (Grun.) Round & Basson	85	2.37	0.50	14.79	3.59	0.66	0.43	7.72	1.06	0.65	0.18
Meridion circulare (Greville) Agardh	86	2.11	0.48	13.16	2.79	0.64	0.48	6.94	0.87	0.67	0.27
Navicula cryptocephala Kütz.	87	2.08	0.53	12.30	2.84	0.33	0.34	7.23	0.86	0.64	0.29
Navicula oblonga Kütz.	88	2.62	0.29	17.32	1.66	0.83	0.29	8.09	0.66	0.54	0.09

	No.	Conductivity optimum (WA) log(x+1)mS/cm	Conductivity tolerance (WA) log(x+1)mS/cm	TJuly optimum (WA) °C	TJuly tolerance (WA)°C	Si optimum (WA) log(x+1)mg/l	Si tolerance (WA) log(x+1)mg/l	pH optimum (WA)	pH tolerance (WA)	Depth optimum (WA) log(x+1)	Depth tolerance (WA) log(x+1)
Navicula peregrina (Ehr.) Kütz.	89	2.33	0.38	14.24	3.10	0.57	0.37	7.32	0.79	0.53	0.16
Navicula radiosa Kütz.	90	2.44	0.52	15.65	3.00	0.62	0.40	7.82	0.90	0.57	0.22
Navicula rhynchocephala Kütz.	91	2.17	0.63	13.07	3.27	0.44	0.42	7.55	1.03	0.55	0.23
Navicula spp.	92	2.23	0.53	13.61	2.81	0.50	0.36	7.45	1.05	0.62	0.22
Navicula vulpina Kütz.	93	2.06	0.48	14.71	3.53	0.46	0.42	7.59	0.99	0.42	0.18
Neidium affine (Ehr.) Pfitzer	94	1.91	0.61	13.45	3.27	0.40	0.42	6.97	0.82	0.62	0.18
Neidium ampliatum (Ehr.) Kram.	95	2.04	0.60	13.95	3.49	0.46	0.42	7.57	0.91	0.50	0.18
Neidium bisulcatum (Lager.) Cleve	96	2.04	0.49	13.44	3.58	0.46	0.39	7.23	0.88	0.54	0.18
Neidium hitchcockii (Ehr.) Cleve	97	1.55	0.25	11.14	1.56	0.11	0.14	7.09	0.32	0.49	0.18
Neidium iridis (Ehr.) Cleve	98	2.05	0.49	14.38	3.26	0.45	0.39	7.27	0.86	0.57	0.26
Neidium iridis f. vernales Reichelt	99	2.33	0.50	15.42	3.56	0.66	0.49	7.62	0.92	0.62	0.38
Neidium ladogense (Cleve) Foged	100	1.74	0.52	11.89	2.70	0.28	0.38	6.92	0.86	0.66	0.27
Neidium spp.	101	2.26	0.61	14.53	3.05	0.62	0.41	7.59	0.99	0.62	0.21
Nitzschia amphibia Grun.	102	2.43	0.54	15.04	3.63	0.58	0.50	7.72	0.81	0.68	0.36
Nitzschia amphibia var. *thermalis*	103	1.74	0.47	10.20	2.54	0.04	0.35	7.23	0.81	0.63	0.21
Nitzschia denticula Grun.	104	2.63	0.37	16.40	2.36	0.70	0.33	7.89	0.87	0.56	0.20
Nitzschia dissipata (Kütz.) Grun.	105	1.91	0.45	12.26	2.68	0.26	0.29	7.33	0.85	0.60	0.16
Nitzschia frustulum (Kütz.) Grun.	106	2.38	0.73	14.47	3.76	0.57	0.49	7.39	0.72	0.53	0.15
Nitzschia palea (Kütz). W.Sm.	107	2.10	0.60	13.61	3.40	0.44	0.47	7.59	1.12	0.64	0.24
Nitzschia spp.	108	2.36	0.58	14.53	3.40	0.54	0.42	7.84	1.13	0.61	0.20
Martyana martyi (Heriband-Joseph) Round	109	2.56	0.43	16.60	2.61	0.51	0.42	7.89	0.66	0.54	0.15
Pinnularia borealis Ehr.	110	2.34	0.50	13.75	3.00	0.39	0.38	7.50	0.81	0.61	0.13
Pinnularia brevicostata Cleve	111	1.80	0.41	11.76	1.91	0.25	0.28	6.98	0.60	0.58	0.21
Pinnularia gibba Ehr.	112	2.35	0.55	14.66	3.25	0.50	0.44	7.63	0.78	0.58	0.14
Pinnularia interrupta W.Sm.	113	1.81	0.46	12.01	2.12	0.29	0.38	7.12	0.59	0.57	0.20
Pinnularia major (Kütz.) Rabenh.	114	2.33	0.54	15.44	3.20	0.65	0.43	7.74	0.97	0.58	0.18
Pinnularia microstauron (Ehr.) Cleve	115	2.30	0.68	14.87	3.32	0.48	0.45	7.50	1.01	0.56	0.21
Pinnularia spp.	116	2.44	0.54	16.29	2.80	0.74	0.34	7.78	0.94	0.61	0.22
Pinnularia viridis (Nitzsch.) Ehr.	117	2.20	0.61	14.58	3.36	0.47	0.44	7.45	0.82	0.63	0.24

	No.	Conductivity optimum (WA) log(x+1)mS/cm	Conductivity tolerance (WA) log(x+1)mS/cm	TJuly optimum (WA) °C	TJuly tolerance (WA)°C	Si optimum (WA) log(x+1)mg/l	Si tolerance (WA) log(x+1)mg/l	pH optimum (WA)	pH tolerance (WA)	Depth optimum (WA) log(x+1)	Depth tolerance (WA) log(x+1)
Planothidium lanceolatum (Brebisson) Lange-Bertalot	118	2.38	0.49	15.16	3.33	0.47	0.42	7.81	0.95	0.59	0.20
Planothidium oestrupii (Cleve-Euler) Round & Bukhtiyarova	119	1.65	0.30	11.75	1.71	0.20	0.29	7.01	0.31	0.76	0.35
Planothidium peragallii (Brun & Herib.) Round & Bukhtiyarova	120	1.60	0.22	10.95	0.50	0.12	0.08	7.13	0.24	0.60	0.21
Psammothidium bioretti (Germ.)	121	1.63	0.38	12.18	2.54	0.14	0.19	7.26	0.45	0.74	0.52
Psammothidium helveticum (Hust.) Bukhtiyarova & Round	122	1.66	0.51	11.79	1.95	0.29	0.41	6.76	0.67	0.61	0.29
Psammothidium rossi (Hust.) Bukhtiyarova & Round	123	1.51	0.26	11.69	1.16	0.10	0.07	7.02	0.57	0.57	0.19
Psammothidium subatomoides (Hust.) Bukhtiyarova & Round	124	1.54	0.43	11.19	1.04	0.08	0.06	6.93	0.57	0.67	0.17
Psammothidium ventralis (Krasske) Bukhtiyarova & Round	125	1.55	0.33	11.22	0.92	0.08	0.08	6.93	0.36	0.56	0.23
Pseudostaurosira brevistriata (Grun.) Williams & Round	126	2.30	0.48	15.14	3.01	0.44	0.35	7.91	0.92	0.59	0.24
Pseudostaurosira parasitica var. *subconstricta* (Grun.) Morales	127	1.94	0.58	13.00	2.57	0.18	0.17	7.50	0.74	0.72	0.17
Pseudostaurosira pseudoconstruens (Marciniak) D.M.Williams & Round 1987	128	2.46	0.11	13.67	3.61	0.50	0.44	7.68	1.22	0.57	0.10
Reimeria sinuata (Gregory) Kociolek & Stoermer	129	2.26	0.53	13.38	2.89	0.41	0.50	7.26	0.83	0.68	0.28
Rhoiscophenia curvata (Kütz.) Grun.	130	2.42	0.49	14.25	3.12	0.37	0.31	8.06	0.93	0.55	0.19
Rhopalodia gibba (Ehr.) O.Müll.	131	2.59	0.36	16.10	1.86	0.58	0.35	7.81	0.71	0.51	0.11
Rossithidium pusillum (Grun.) Round & Bukhtiyarova	132	1.77	0.43	12.69	2.64	0.24	0.25	7.07	0.74	0.71	0.47
Sellaphora bacillum (Ehr.) Mann	133	2.00	0.60	12.43	2.88	0.19	0.24	7.24	0.71	0.52	0.18
Sellaphora laevissima (Kütz.) Mann	134	1.62	0.40	11.00	0.48	0.14	0.21	7.17	0.48	0.59	0.20
Sellaphora pupula Kütz.	135	2.11	0.55	13.65	3.11	0.40	0.37	7.41	0.79	0.57	0.22
Stauroneis anceps et f. *gracilis* Rabh.	136	1.84	0.47	11.98	2.13	0.28	0.33	7.12	0.73	0.60	0.23

	No.	Conductivity optimum (WA) log(x+1)mS/cm	Conductivity tolerance (WA) log(x+1)mS/cm	TJuly optimum (WA) °C	TJuly tolerance (WA)°C	Si optimum (WA) log(x+1)mg/l	Si tolerance (WA) log(x+1)mg/l	pH optimum (WA)	pH tolerance (WA)	Depth optimum (WA) log(x+1)	Depth tolerance (WA) log(x+1)
Stauroneis anceps var. *sibirica* Grun.	137	1.73	0.40	11.17	2.16	0.23	0.36	7.10	0.61	0.52	0.22
Stauroneis phoenicenteron (Nitzsch.) Ehr.	138	2.17	0.55	14.19	3.25	0.44	0.41	7.47	0.81	0.56	0.20
Stauroneis smithii Grun.	139	1.72	0.33	11.20	1.04	0.19	0.22	7.08	0.56	0.62	0.19
Staurosira berolinensis (Lemm.) Lange-Bertalot	140	2.54	0.34	15.79	3.69	0.68	0.39	8.01	0.83	0.60	0.18
Staurosira binodis Ehr.	141	2.74	0.49	16.57	2.21	0.42	0.46	7.86	0.64	0.54	0.14
Staurosira construens Ehr.	142	2.54	0.45	17.11	1.77	0.58	0.40	8.00	0.68	0.50	0.12
Staurosira subsalina (Hust.) Lange-Bertalot	143	2.39	0.52	16.20	2.80	0.60	0.42	7.84	0.81	0.54	0.16
Staurosira venter (Ehr.) Cleve & Möller	144	2.54	0.54	15.80	2.89	0.53	0.42	7.88	0.91	0.61	0.18
Staurosirella lapponica (Grun.) Williams & Round	145	1.84	0.46	12.39	1.80	0.24	0.21	7.34	0.52	0.62	0.10
Staurosirella leptostauron (Ehr.)	146	1.98	0.48	11.62	2.53	0.23	0.23	6.95	0.56	0.67	0.18
Staurosirella pinnata Ehr.	147	2.18	0.54	14.13	3.15	0.42	0.36	7.63	0.97	0.63	0.21
Stephanodiscus hantzschii Grun.	148	2.91	0.32	18.00	1.05	0.87	0.38	8.74	0.81	0.60	0.15
Stephanodiscus minutulus (Kütz.) Cleve & Möller	149	2.82	0.17	18.30	0.10	1.13	0.30	8.55	1.03	0.61	0.18
Surirella linearis W.Sm.	150	1.92	0.41	13.01	3.16	0.43	0.41	7.23	0.58	0.59	0.19
Surirella spp.	151	2.14	0.54	14.02	3.06	0.53	0.45	7.70	0.91	0.71	0.19
Tabellaria fenestrata (Lungb.) Kütz.	152	2.08	0.47	13.48	2.79	0.53	0.39	7.22	0.89	0.63	0.23
Tabellaria flocculosa (Roth.) Kütz.	153	1.83	0.43	12.25	2.37	0.32	0.34	6.92	0.76	0.63	0.30
Tetracyclus glans (Ehr.) Mills	154	1.62	0.38	11.74	1.09	0.24	0.32	7.04	0.41	0.75	0.18
Ulnaria ulna (Nitzsch.) P.Compère	155	2.55	0.50	15.90	3.08	0.68	0.43	7.99	0.97	0.58	0.16
Ulnaria ulna var. *acus* (Kütz.) Lange-Bertalot	156	2.64	0.56	16.74	2.94	0.84	0.48	8.06	0.88	0.62	0.14
Ulnaria danica (Kütz.) Compère & Bukhtiyarova	157	3.48	0.57	17.50	3.32	0.92	0.12	9.24	1.10	0.46	0.18

Supplementary Table S3. Detailed results of statistical analyses for each of the 157 diatom taxa. Results and modelling set-up of boosted regression tree (BRT) analyses.

	No.	BRT % TJuly (BRT)	BRT % cond (BRT)	BRT % Si (BRT)	BRT % pH (BRT)	BRT % depth (BRT)	Tree complexity (BRT)	Learning rate (BRT)	Bag fraction (BRT)	Number of fitted trees (BRT)
Achnanthes spp.	1	31.7	31.3	7.9	21.8	7.3	3	0.001	0.50	1600
Achnanthidium minutissimum (Kütz.) Czarnecki	2	31.4	33.6	10.6	12.2	12.2	3	0.001	0.50	2150
Achnanthidium affine (Grun.) Czarnecki	3	9.0	17.4	16.1	51.3	6.3	3	0.001	0.50	1100
Amphora libyca (Kütz.) Schoeman & Archibald	4	2.3	73.7	7.4	13.6	3.1	3	0.001	0.50	2450
Amphora ovalis Kütz.	5	10.0	14.0	26.6	23.4	25.9	3	0.001	0.50	1400
Amphora pediculus (Kütz.) Grun.	6	47.6	13.6	23.7	10.9	4.2	3	0.001	0.50	1700
Amphora veneta Kütz.	7	40.9	29.0	13.0	11.3	5.9	3	0.001	0.50	2050
Aneumastus tusculus (Ehr.) Mann & Stickle	8	NA	NA	NA	NA	NA	NA	NA	NA	NA
Anomoeoneis sphaerophora (Ehr.) Pfitzer	9	13.2	45.7	1.0	12.0	28.1	3	0.001	0.50	6350
Anomoeoneis sphaerophora var. *jakutica* (Kiss.) Zabelina	10	4.8	46.5	18.6	29.9	0.2	3	0.001	0.50	2300
Anomoeoneis sphaerophora var. *polygramma* (Ehr.) O.Müll.	11	25.0	43.5	0.4	19.6	11.4	3	0.001	0.50	1450
Asterionella formosa Hass	12	37.4	17.4	10.1	12.2	22.9	3	0.001	0.50	2850
Aulacoseira alpigena (Grun.) Kram.	13	9.9	70.6	4.9	10.2	4.4	3	0.001	0.50	1500
Aulacoseira distans (Ehr.) Sim.	14	1.7	62.1	7.4	4.4	24.4	3	0.001	0.50	3050
Aulacoseira granulata (Ehr.) Sim.	15	11.5	23.1	6.2	47.2	12.1	3	0.001	0.50	1400
Aulacoseira islandica (O.Müll.) Sim.	16	72.9	4.3	6.8	10.8	5.1	3	0.001	0.50	1550
Aulacoseira italica (Ehr.) Sim.	17	35.7	16.3	9.0	32.1	6.8	3	0.001	0.50	1000
Aulacoseira lirata (Ehr.) Ross in Hart.	18	5.1	17.5	38.5	5.5	33.4	3	0.001	0.50	1150
Aulacoseira perglabra (Oestrup) Haworth.	19	0.0	86.8	0.0	0.0	13.2	3	0.000	0.50	1000

	No.	BRT % TJuly (BRT)	BRT % cond (BRT)	BRT % Si (BRT)	BRT % pH (BRT)	BRT % depth (BRT)	Tree complexity (BRT)	Learning rate (BRT)	Bag fraction (BRT)	Number of fitted trees (BRT)
Aulacoseira spp.	20	4.1	30.1	1.2	51.7	12.9	3	0.001	0.50	1100
Aulacoseira subarctica (O.Müll.) Haworth	21	4.4	46.1	26.5	9.0	13.9	3	0.001	0.50	1800
Aulacoseira valida (Grun.) Kram.	22	11.8	42.1	17.8	17.8	10.5	3	0.001	0.50	8700
Caloneis baccilum (Grun.) Cleve	23	96.9	0.8	0.2	1.5	0.6	3	0.001	0.50	1400
Caloneis silicula (Ehr.) Cleve	24	10.1	7.1	35.4	34.8	12.6	3	0.000	0.50	1000
Cavinula cocconeiformis (Gregory) Mann & Stickle	25	1.9	5.4	2.2	4.6	85.9	3	0.001	0.50	1150
Cavinula pseudoscutiformis (Hust. ex A.Schm.) Mann & Stickle	26	27.4	47.5	5.0	9.7	10.4	3	0.001	0.50	2900
Cocconeis pediculus Ehr.	27	2.9	4.5	7.8	41.0	43.8	3	0.001	0.50	1150
Cocconeis placentula Ehr.	28	14.6	13.2	21.0	31.1	20.1	3	0.001	0.50	2700
Craticula cuspidata(Kütz.) Mann	29	34.8	31.4	15.2	13.3	5.3	3	0.001	0.50	1950
Cyclostephanos dubius (Fricke) Round	30	55.6	12.4	14.1	11.3	6.5	3	0.001	0.50	2400
Cyclotella meneghiniana Kütz.	31	20.8	59.6	7.9	7.1	4.6	3	0.001	0.50	3050
Cyclotella ocellata Pant.	32	1.6	3.6	1.7	1.0	92.1	3	0.001	0.50	1000
Cyclotella pseudostelligera Hust.	33	0.6	3.3	2.7	76.4	17.0	3	0.000	0.50	1000
Cyclotella radiosa (Grun.) Lemm.	34	16.5	20.6	17.8	7.1	38.1	49	0.000	0.75	1000
Cyclotella stelligera Cleve & Grun.	35	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cymatopleura solea (Breb.) W.Sm.	36	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cymbella cistula (Ehr.) Kirch.	37	6.9	27.6	22.5	31.8	11.2	3	0.001	0.50	1100
Cymbella cymbiformis Agardh	38	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cymbella proxima Reimer.	39	3.8	6.1	9.0	28.3	52.8	3	0.001	0.50	1700
Cymbopleura cuspidata Kütz.	40	12.9	7.1	48.2	25.0	6.9	3	0.001	0.50	1850
Cymbopleura inaequalis (Ehr.) Kram.	41	13.2	42.4	10.0	14.8	19.7	3	0.001	0.50	1050

	No.	BRT % TJuly (BRT)	BRT % cond (BRT)	BRT % Si (BRT)	BRT % pH (BRT)	BRT % depth (BRT)	Tree complexity (BRT)	Learning rate (BRT)	Bag fraction (BRT)	Number of fitted trees (BRT)
Cymbopleura naviculiformis (Auerswald) Kram.	42	17.1	27.1	18.4	18.7	18.8	3	0.001	0.50	3350
Diatoma tenuis C.A.Agardh	43	10.7	6.0	45.7	17.6	20.0	3	0.001	0.50	2800
Diploneis elliptica (Kütz.) Cleve	44	30.1	29.2	10.5	21.6	8.6	3	0.001	0.50	1050
Diploneis oblongella (Naegeli) Cleve-Euler	45	32.7	33.6	9.7	14.6	9.5	3	0.001	0.50	2100
Diploneis ovalis (Hilse.)	46	25.9	25.1	8.6	30.3	10.2	3	0.001	0.50	1850
Ellerbeckia arenaria (Moore) Crawford	47	NA	NA	NA	NA	NA	NA	NA	NA	NA
Encyonema alpinum (Grun.)	48	63.2	5.0	14.2	15.3	2.3	3	0.001	0.50	2850
Encyonema minutum (Hilse) Mann	49	24.0	48.1	14.8	7.1	5.9	3	0.001	0.50	2200
Encyonema obscurum (Krasske) Mann	50	91.9	0.2	0.1	7.6	0.1	3	0.001	0.50	1300
Encyonema silesiacum (Bleisch) Mann	51	43.1	19.5	14.1	16.0	7.3	3	0.001	0.50	4300
*Encyonopsis aequalis (*W.Smith) Kram.	52	21.3	30.8	12.4	26.4	9.1	3	0.001	0.50	1000
Epithemia adnata (Kütz.) Breb.	53	3.3	71.1	11.1	6.0	8.5	3	0.001	0.50	2550
Epithemia turgida (Ehr.) Kütz.	54	17.2	29.5	16.4	9.0	27.8	3	0.001	0.50	1550
Eucocconeis flexella (Kütz.) P.T.Cleve	55	21.5	2.7	18.2	16.6	41.0	3	0.001	0.50	2300
Eucocconeis laevis (Oestrup) Lange-Bertalot	56	26.0	18.1	23.0	7.7	25.2	3	0.001	0.50	1950
Eunotia arcus Ehr.	57	28.8	9.2	23.8	15.1	23.1	3	0.001	0.50	1950
Eunotia bilunaris (Ehr.) Mills.	58	18.9	20.6	14.6	20.8	25.1	3	0.000	0.50	1000
Eunotia faba (Ehr.) Grun.	59	3.6	21.7	5.7	65.7	3.3	3	0.001	0.50	1350
Eunotia monodon Ehr.	60	34.0	3.2	4.7	53.4	4.8	3	0.001	0.50	1050
Eunotia pectinalis (Dillw.) Rabenh.	61	23.8	19.7	21.5	24.5	10.5	3	0.001	0.50	1000
Eunotia praerupta Ehr.	62	32.8	9.5	19.0	34.0	4.8	3	0.001	0.50	4400
Eunotia spp.	63	5.9	10.1	57.7	19.8	6.5	3	0.000	0.50	1000
Eunotia sudetica O.Müller	64	21.3	14.6	40.6	15.2	8.3	3	0.001	0.50	1400
Eunotia triodon Ehr.	65	2.0	6.9	0.2	90.9	0.0	3	0.001	0.50	1000
Eunotia veneris (Kütz.) De Toni	66	NA	NA	NA	NA	NA	NA	NA	NA	NA

	No.	BRT % TJuly (BRT)	BRT % cond (BRT)	BRT % Si (BRT)	BRT % pH (BRT)	BRT % depth (BRT)	Tree complexity (BRT)	Learning rate (BRT)	Bag fraction (BRT)	Number of fitted trees (BRT)
Fragilaria capucina Desm.	67	33.1	18.4	15.5	19.0	14.0	3	0.001	0.50	3450
Fragilaria constricta Ehr.	68	17.1	21.1	1.8	50.0	10.0	3	0.001	0.50	1550
Fragilaria intermedia Grun.	69	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fragilaria tenera W.Sm.	70	2.0	6.2	58.9	23.1	9.7	3	0.001	0.50	1800
Fragilaria vaucheriae (Kütz.) Lange-Bertalot	71	0.4	14.6	45.5	39.3	0.3	3	0.001	0.50	1300
Fragilariforma virescens (Ralfs) D.M.Williams & Round	72	6.7	73.6	3.5	8.9	7.3	3	0.001	0.50	1200
Gomphonema acuminatum Ehr.	73	9.1	17.8	19.3	27.2	26.5	3	0.001	0.50	1000
Gomphonema angustum Ag.	74	53.1	7.3	4.3	25.4	9.8	49	0.000	0.75	1000
Gomphonema clavatum Ehr.	75	NA	NA	NA	NA	NA	NA	NA	NA	NA
Gomphonema gracile Ehr.	76	9.3	16.9	29.8	13.1	30.9	3	0.001	0.50	1450
Gomphonema olivaceum (Horn.) Breb.	77	64.2	15.0	9.5	5.0	6.4	3	0.001	0.50	1000
Gomphonema parvulum Kütz.	78	16.3	20.4	47.9	8.8	6.6	3	0.001	0.50	1450
Gomphonema truncatum Ehr.	79	15.2	28.8	33.9	13.5	8.6	3	0.001	0.50	2700
Gyrosigma attenuatum (Kütz.) Rabenhorst	80	39.5	18.7	9.6	18.7	13.5	3	0.001	0.50	5200
Hantzschia amphioxys (Ehr.) Grun.	81	9.3	63.4	12.3	9.9	5.0	3	0.001	0.50	1000
Hippodonta capitata (Ehr.) Lange-Bertalot et al.	82	3.1	81.3	3.2	6.0	6.4	3	0.001	0.50	1250
Hippodonta hungarica (Grun.) Lange-Bertalot et al.	83	NA	NA	NA	NA	NA	NA	NA	NA	NA
Karayevia laterostrata (Hust.) Bukhtiyarova	84	6.0	63.0	19.1	1.5	10.4	3	0.001	0.50	2000
Lemnicola hungarica (Grun.) Round & Basson	85	NA	NA	NA	NA	NA	NA	NA	NA	NA
Meridion circulare (Greville) Agardh	86	13.0	25.5	28.1	22.6	10.9	3	0.001	0.50	6300
Navicula cryptocephala Kütz.	87	47.5	27.8	4.9	10.4	9.3	3	0.001	0.50	1800
Navicula oblonga Kütz.	88	34.2	39.7	9.7	10.4	6.1	3	0.001	0.50	3500

	No.	BRT % TJuly (BRT)	BRT % cond (BRT)	BRT % Si (BRT)	BRT % pH (BRT)	BRT % depth (BRT)	Tree complexity (BRT)	Learning rate (BRT)	Bag fraction (BRT)	Number of fitted trees (BRT)
Navicula peregrina (Ehr.) Kütz.	89	10.4	8.5	11.2	15.4	54.5	3	0.001	0.50	1000
Navicula radiosa Kütz.	90	12.2	33.3	23.3	18.5	12.7	3	0.001	0.50	2250
Navicula rhynchocephala Kütz.	91	24.2	60.5	1.8	10.9	2.6	3	0.001	0.50	1000
Navicula spp.	92	16.2	23.7	13.8	39.4	6.9	3	0.001	0.50	1850
Navicula vulpina Kütz.	93	20.7	17.1	11.7	13.4	37.1	3	0.001	0.50	2650
Neidium affine (Ehr.) Pfitzer	94	16.1	9.4	9.1	33.0	32.4	3	0.001	0.50	1150
Neidium ampliatum (Ehr.) Kram.	95	NA	NA	NA	NA	NA	NA	NA	NA	NA
Neidium bisulcatum (Lager.) Cleve	96	NA	NA	NA	NA	NA	NA	NA	NA	NA
Neidium hitchcockii (Ehr.) Cleve	97	32.1	30.4	14.4	7.9	15.2	3	0.001	0.50	8150
Neidium iridis (Ehr.) Cleve	98	32.2	25.7	19.7	14.3	8.2	3	0.001	0.50	2350
Neidium iridis f. *vernales* Reichelt	99	NA	NA	NA	NA	NA	NA	NA	NA	NA
Neidium ladogense (Cleve) Foged	100	37.6	16.2	11.4	17.1	17.7	3	0.001	0.50	1900
Neidium spp.	101	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitzschia amphibia Grun.	102	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitzschia amphibia var. *thermalis*	103	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitzschia denticula Grun.	104	19.2	37.9	22.8	11.4	8.7	3	0.001	0.50	3800
Nitzschia dissipata (Kütz.) Grun.	105	29.0	18.9	22.4	15.0	14.8	3	0.001	0.50	2650
Nitzschia frustulum (Kütz.) Grun.	106	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitzschia palea (Kütz.) W.Sm.	107	29.6	4.3	7.9	14.5	43.6	3	0.001	0.50	1800
Nitzschia spp.	108	12.5	13.9	12.9	56.4	4.3	3	0.001	0.50	1250
Martyana martyi (Heriband-Joseph) Round	109	4.3	79.7	11.6	2.7	1.8	3	0.001	0.50	2800
Pinnularia borealis Ehr.	110	41.5	26.2	15.4	14.6	2.2	3	0.001	0.50	1000
Pinnularia brevicostata Cleve	111	60.0	13.5	6.2	9.0	11.3	3	0.001	0.50	2300
Pinnularia gibba Ehr.	112	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pinnularia interrupta W.Sm.	113	40.3	27.7	6.6	15.8	9.6	3	0.001	0.50	3700
Pinnularia major (Kütz.) Rabenh.	114	3.9	13.2	55.9	22.0	5.0	3	0.001	0.50	1550
Pinnularia microstauron (Ehr.) Cleve	115	7.4	28.4	25.5	21.4	17.3	49	0.000	0.50	1000

	No.	BRT % TJuly (BRT)	BRT % cond (BRT)	BRT % Si (BRT)	BRT % pH (BRT)	BRT % depth (BRT)	Tree complexity (BRT)	Learning rate (BRT)	Bag fraction (BRT)	Number of fitted trees (BRT)
Pinnularia spp.	116	15.5	25.8	43.5	6.7	8.4	3	0.001	0.50	1000
Pinnularia viridis (Nitzsch.) Ehr.	117	15.9	31.1	16.8	32.0	4.2	3	0.001	0.50	1450
Planothidium lanceolatum (Brebisson) Lange-Bertalot	118	12.8	24.4	24.2	21.8	16.7	3	0.001	0.50	2250
Planothidium oestrupii (Cleve-Euler) Round & Bukhtiyarova	119	20.2	50.6	12.4	6.4	10.4	3	0.001	0.50	1000
Planothidium peragallii (Brun & Herib.) Round & Bukhtiyarova	120	19.2	47.2	10.7	19.5	3.4	3	0.001	0.50	1750
Psammothidium bioretti (Germ.)	121	4.9	63.2	20.8	0.5	10.6	3	0.001	0.50	1050
Psammothidium helveticum (Hust.) Bukhtiyarova & Round	122	7.8	28.7	3.9	26.7	32.9	3	0.001	0.50	1900
Psammothidium rossi (Hust.) Bukhtiyarova & Round	123	12.4	59.3	10.7	12.5	5.0	3	0.001	0.50	2900
Psammothidium subatomoides (Hust.) Bukhtiyarova & Round	124	49.9	15.2	24.9	2.5	7.5	3	0.001	0.50	4300
Psammothidium ventralis (Krasske) Bukhtiyarova & Round	125	14.7	55.2	23.2	4.4	2.5	3	0.001	0.50	3150
Pseudostaurosira brevistriata (Grun.) Williams & Round	126	17.1	18.8	21.4	22.6	20.1	3	0.001	0.50	8250
Pseudostaurosira parasitica var. *subconstricta* (Grun.) Morales	127	8.7	14.1	35.6	31.7	9.9	3	0.001	0.50	1350
Pseudostaurosira pseudoconstruens (Marciniak) D.M.Williams & Round 1987	128	NA	NA	NA	NA	NA	NA	NA	NA	NA
Reimeria sinuata (Gregory) Kociolek & Stoermer	129	23.1	24.5	9.3	36.1	7.0	3	0.001	0.50	1400

	No.	BRT % TJuly (BRT)	BRT % cond (BRT)	BRT % Si (BRT)	BRT % pH (BRT)	BRT % depth (BRT)	Tree complexity (BRT)	Learning rate (BRT)	Bag fraction (BRT)	Number of fitted trees (BRT)
Rhoiscophenia curvata (Kütz.) Grun.	130	NA	NA	NA	NA	NA	NA	NA	NA	NA
Rhopalodia gibba (Ehr.) O.Müll.	131	35.2	27.2	14.5	5.9	17.3	3	0.001	0.50	1600
Rossithidium pusillum (Grun.) Round & Bukhtiyarova	132	15.0	60.9	5.3	6.8	12.0	3	0.001	0.50	2150
Sellaphora bacillum (Ehr.) Mann	133	14.9	11.9	67.7	1.5	4.0	3	0.001	0.50	1950
Sellaphora laevissima (Kütz.) Mann	134	9.3	64.3	17.0	1.1	8.3	3	0.001	0.50	2700
Sellaphora pupula Kütz.	135	30.4	12.9	18.5	17.7	20.4	3	0.001	0.50	4350
Stauroneis anceps et f. *gracilis* Rabh.	136	37.6	31.3	12.5	11.9	6.8	3	0.001	0.50	7600
Stauroneis anceps var. *sibirica* Grun.	137	35.5	14.1	34.2	1.7	14.6	3	0.001	0.50	3950
Stauroneis phoenicenteron (Nitzsch.) Ehr.	138	14.4	15.8	35.6	19.9	14.3	3	0.001	0.50	1850
Stauroneis smithii Grun.	139	36.2	38.6	11.1	8.5	5.6	3	0.001	0.50	2650
Staurosira berolinensis (Lemm.) Lange-Bertalot	140	NA	NA	NA	NA	NA	NA	NA	NA	NA
Staurosira binodis Ehr.	141	16.7	29.5	19.1	28.0	6.6	3	0.001	0.50	1750
Staurosira construens Ehr.	142	13.2	14.1	11.0	36.5	25.2	3	0.000	0.50	1000
Staurosira subsalina (Hust.) Lange-Bertalot	143	30.9	20.0	16.0	24.0	9.1	3	0.001	0.50	6350
Staurosira venter (Ehr.) Cleve & Möller	144	11.9	39.3	26.6	15.6	6.5	3	0.001	0.50	1850
Staurosirella lapponica (Grun.) Williams & Round	145	28.1	36.5	5.6	22.2	7.7	3	0.001	0.50	1000
Staurosirella leptostauron (Ehr.)	146	NA	NA	NA	NA	NA	NA	NA	NA	NA
Staurosirella pinnata Ehr.	147	28.2	25.6	15.0	14.4	16.9	3	0.001	0.50	3150
Stephanodiscus hantzschii Grun.	148	20.9	10.4	6.2	54.7	7.8	3	0.001	0.50	4200
Stephanodiscus minutulus (Kütz.) Cleve & Möller	149	0.5	0.2	98.0	0.6	0.7	3	0.001	0.50	1000
Surirella linearis W.Sm.	150	10.4	32.3	29.6	23.3	4.4	49	0.000	0.75	1000
Surirella spp.	151	2.8	49.2	10.5	8.9	28.6	3	0.001	0.50	1100
Tabellaria fenestrata (Lungb.) Kütz.	152	31.5	21.2	23.7	17.3	6.3	3	0.001	0.50	4150

	No.	BRT % TJuly (BRT)	BRT % cond (BRT)	BRT % Si (BRT)	BRT % pH (BRT)	BRT % depth (BRT)	Tree complexity (BRT)	Learning rate (BRT)	Bag fraction (BRT)	Number of fitted trees (BRT)
Tabellaria flocculosa (Roth.) Kütz.	153	25.8	26.7	4.9	30.8	11.8	3	0.001	0.50	5400
Tetracyclus glans (Ehr.) Mills	154	9.9	38.1	4.7	8.1	39.2	3	0.001	0.50	4650
Ulnaria ulna (Nitzsch.) P.Compère	155	28.5	19.1	23.7	12.4	16.3	3	0.001	0.50	1700
Ulnaria ulna var. *acus* (Kütz.) Lange-Bertalot	156	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ulnaria danica (Kütz.) Compère & Bukhtiyarova	157	6.3	62.6	0.1	20.0	11.1	3	0.001	0.50	1700

Supplementary Table S4. Detailed results of statistical analyses for each of the 157 diatom taxa. Quality evaluation of boosted regression tree (BRT) analyses.

	No.	Mean total deviance (BRT)	Mean residual deviance (BRT)	Estimated cv deviance (BRT)	SE estimated cv deviance (BRT)	Training data correlation (BRT)	Cv correlation (BRT)	SE cv correlation (BRT)	Correlation with vegetation type	*P* value (indicspecies)
Achnanthes spp.	1	1.09	0.97	1.08	0.57	0.502	0.171	0.073	0.618	0.001
Achnanthidium minutissimum (Kütz.) Czarnecki	2	37.43	31.54	36.75	13.05	0.516	0.309	0.079	0.782	0.001
Achnanthidium affine (Grun.) Czarnecki	3	7.37	7.04	7.27	5.78	0.410	0.209	0.104	0.338	0.048
Amphora libyca (Kütz.) Schoeman & Archibald	4	17.84	15.66	17.67	11.97	0.405	0.239	0.111		
Amphora ovalis Kütz.	5	11.60	10.75	11.64	4.01	0.447	0.066	0.088		
Amphora pediculus (Kütz.) Grun.	6	1.23	1.13	1.21	0.69	0.379	0.269	0.112	0.440	0.007
Amphora veneta Kütz.	7	0.16	0.14	0.16	0.08	0.468	0.285	0.051	0.352	0.034
Aneumastus tusculus (Ehr.) Mann & Stickle	8	NA	NA	NA	NA	NA	NA	NA		

	No.	Mean total deviance (BRT)	Mean residual deviance (BRT)	Estimated cv deviance (BRT)	SE estimated cv deviance (BRT)	Training data correlation (BRT)	Cv correlation (BRT)	SE cv correlation (BRT)	Correlation with vegetation type	*P* value (indicspecies)
Anomoeoneis sphaerophora (Ehr.) Pfitzer	9	19.34	15.07	18.87	15.72	0.566	0.346	0.103	0.482	0.005
Anomoeoneis sphaerophora var. *jakutica* (Kiss.) Zabelina	10	0.95	0.86	0.98	0.95	0.430	0.422	0.113		
Anomoeoneis sphaerophora var. *polygramma* (Ehr.) Müller	11	26.62	24.79	27.59	26.81	0.423	0.454	0.104	0.338	0.046
Asterionella formosa Hass	12	18.17	15.07	17.67	12.36	0.523	0.448	0.066	0.641	0.001
Aulacoseira alpigena (Grun.) Kram.	13	0.66	0.62	0.65	0.48	0.328	0.164	0.087	0.334	0.040
Aulacoseira distans (Ehr.) Sim.	14	6.06	5.16	5.82	3.41	0.453	0.315	0.109	0.453	0.003
Aulacoseira granulata (Ehr.) Sim.	15	69.71	65.02	68.54	34.82	0.384	0.156	0.090		
Aulacoseira islandica (O.Müll.) Sim.	16	0.19	0.18	0.19	0.13	0.313	0.275	0.034	0.350	0.020
Aulacoseira italica (Ehr.) Sim.	17	85.46	84.05	86.82	36.77	0.421	0.101	0.065		
Aulacoseira lirata (Ehr.) Ross in Hart.	18	14.60	13.92	14.54	10.40	0.409	0.166	0.103		
Aulacoseira perglabra (Oestrup) Haworth.	19	5.91	5.91	6.14	6.11	0.217	0.326	0.100		
Aulacoseira spp.	20	0.57	0.54	0.56	0.42	0.339	0.043	0.043	0.399	0.016
Aulacoseira subarctica (O.Müll.) Haworth	21	43.54	39.85	42.76	18.07	0.434	0.294	0.081	0.357	0.049
Aulacoseira valida (Grun.) Kram.	22	0.07	0.04	0.07	0.03	0.755	0.411	0.065	0.353	0.033
Caloneis baccilum (Grun.) Cleve	23	2.12	2.02	2.17	2.08	0.280	0.379	0.096	0.445	0.003
Caloneis silicula (Ehr.) Cleve	24	1.34	1.34	1.36	0.59	0.412	0.092	0.092	0.696	0.001
Cavinula cocconeiformis (Gregory) Mann & Stickle	25	3.95	3.82	3.90	2.79	0.306	0.125	0.103	0.483	0.001
Cavinula pseudoscutiformis (Hust. ex A.Schm.) Mann & Stickle	26	1.06	0.86	0.98	0.53	0.500	0.506	0.052	0.705	0.001
Cocconeis pediculus Ehr.	27	4.87	4.65	4.96	3.44	0.372	0.095	0.074		
Cocconeis placentula Ehr.	28	30.37	23.97	28.99	9.78	0.560	0.261	0.063	0.688	0.001

	No.	Mean total deviance (BRT)	Mean residual deviance (BRT)	Estimated cv deviance (BRT)	SE estimated cv deviance (BRT)	Training data correlation (BRT)	Cv correlation (BRT)	SE cv correlation (BRT)	Correlation with vegetation type	*P* value (indicspecies)
Craticula cuspidata (Kütz.) Mann	29	2.30	2.02	2.25	0.92	0.451	0.303	0.049	0.644	0.001
Cyclostephanos dubius (Fricke) Round	30	17.90	15.17	17.38	9.99	0.471	0.432	0.085	0.462	0.004
Cyclotella meneghiniana Kütz.	31	82.09	60.64	71.79	33.46	0.565	0.424	0.063	0.654	0.001
Cyclotella ocellata Pant.	32	4.20	4.17	4.17	3.97	0.239	0.079	0.139		
Cyclotella pseudostelligera Hust.	33	0.84	0.84	0.83	0.65	0.295	0.065	0.120		
Cyclotella radiosa (Grun.) Lemm.	34	0.50	0.50	0.50	0.19	0.541	0.058	0.085		
Cyclotella stelligera Cleve & Grun.	35	NA	NA	NA	NA	NA	NA	NA		
Cymatopleura solea (Breb.) W.Sm.	36	NA	NA	NA	NA	NA	NA	NA		
Cymbella cistula (Ehr.) Kirch.	38	0.55	0.52	0.56	0.29	0.416	0.086	0.083	0.480	0.035
Cymbella cymbiformis Agardh	39	NA	NA	NA	NA	NA	NA	NA		
Cymbella proxima Reimer.	40	0.20	0.19	0.21	0.13	0.350	0.144	0.049		
Cymbopleura cuspidata Kütz.	41	0.29	0.25	0.29	0.24	0.455	0.422	0.074	0.619	0.001
Cymbopleura inaequalis (Ehr.) Kram.	42	0.17	0.16	0.17	0.11	0.352	0.097	0.076		
Cymbopleura naviculiformis (Auerswald) Kram.	43	0.22	0.16	0.20	0.11	0.579	0.397	0.063	0.660	0.001
Diatoma tenuis C.A.Agardh	44	1.68	1.46	1.68	0.72	0.468	0.141	0.081	0.450	0.008
Diploneis elliptica (Kütz.) Cleve	45	0.27	0.26	0.27	0.13	0.422	0.243	0.058	0.502	0.002
Diploneis oblongella (Naegeli) Cleve-Euler	46	0.20	0.17	0.19	0.09	0.515	0.327	0.058	0.537	0.001
Diploneis ovalis (Hilse.)	47	0.31	0.27	0.31	0.21	0.499	0.212	0.068	0.484	0.002
Ellerbeckia arenaria (Moore) Crawford	48	NA	NA	NA	NA	NA	NA	NA		
Encyonema alpinum (Grun.)	66	0.08	0.06	0.07	0.03	0.501	0.405	0.066	0.365	0.012
Encyonema minutum (Hilse) Mann	49	0.05	0.05	0.05	0.03	0.468	0.278	0.072	0.447	0.003
Encyonema obscurum (Krasske) Mann	50	3.97	3.81	3.90	3.80	0.283	0.358	0.107		
Encyonema silesiacum (Bleisch) Mann	51	1.00	0.62	0.84	0.13	0.665	0.443	0.032	0.759	0.001

	No.	Mean total deviance (BRT)	Mean residual deviance (BRT)	Estimated cv deviance (BRT)	SE estimated cv deviance (BRT)	Training data correlation (BRT)	Cv correlation (BRT)	SE cv correlation (BRT)	Correlation with vegetation type	*P* value (indicspecies)
Encyonopsis aequalis (W.Smith) Kram.	37	0.05	0.05	0.05	0.02	0.495	0.161	0.093		
Epithemia adnata (Kütz.) Breb.	52	58.91	48.12	54.85	30.14	0.485	0.262	0.063	0.726	0.001
Epithemia turgida (Ehr.) Kütz.	53	0.36	0.32	0.37	0.24	0.558	0.227	0.084	0.403	0.003
Eucocconeis flexella (Kütz.) Cleve	54	2.21	2.01	2.16	1.72	0.393	0.153	0.113	0.373	0.016
Eucocconeis laevis (Oestrup) Lange-Bertalot	55	9.62	8.80	9.50	8.86	0.443	0.238	0.062	0.337	0.043
Eunotia arcus Ehr.	56	1.00	0.87	0.99	0.36	0.475	0.206	0.083	0.465	0.005
Eunotia bilunaris (Ehr.) Mills.	57	12.26	12.26	12.65	7.20	0.358	0.146	0.082	0.726	0.001
Eunotia faba (Ehr.) Grun.	58	2.29	2.17	2.25	1.70	0.362	0.144	0.068	0.523	0.002
Eunotia monodon Ehr.	59	7.34	7.08	7.25	6.55	0.311	0.192	0.094	0.592	0.001
Eunotia pectinalis (Dillw.) Rabenh.	60	13.34	12.96	13.31	9.77	0.468	0.139	0.063	0.515	0.005
Eunotia praerupta Ehr.	61	32.08	22.02	30.59	22.68	0.664	0.310	0.079	0.835	0.001
Eunotia spp.	62	1.21	1.21	1.21	1.04	0.269	0.137	0.088		
Eunotia sudetica O.Müll.	63	1.60	1.48	1.61	0.61	0.477	0.066	0.072	0.436	0.004
Eunotia triodon Ehr.	64	1.13	1.11	1.12	1.06	0.260	0.313	0.104	0.407	0.001
Eunotia veneris (Kütz.) De Toni	65	NA	NA	NA	NA	NA	NA	NA		
Fragilaria capucina Desm.	67	20.91	15.29	19.84	6.32	0.593	0.341	0.090	0.746	0.001
Fragilaria constricta Ehr.	68	0.49	0.46	0.49	0.32	0.376	0.353	0.115	0.387	0.005
Fragilaria intermedia Grun.	70	NA	NA	NA	NA	NA	NA	NA		
Fragilaria tenera W.Sm.	71	0.35	0.33	0.36	0.29	0.387	0.158	0.069		
Fragilaria vaucheriae (Kütz.) Lange-Bertalot	75	3.03	2.89	3.00	2.90	0.391	0.339	0.108		
*Fragilariforma virescens (*Ralfs) D.M.Williams & Round	76	0.67	0.64	0.69	0.55	0.276	0.279	0.103	0.522	0.001
Gomphonema acuminatum Ehr.	77	0.42	0.41	0.42	0.12	0.478	0.069	0.077		
Gomphonema angustum Ag.	78	0.69	0.69	0.72	0.33	0.454	0.138	0.079		
Gomphonema clavatum Ehr.	79	NA	NA	NA	NA	NA	NA	NA		
Gomphonema gracile Ehr.	80	0.39	0.36	0.39	0.13	0.539	0.110	0.067		
Gomphonema olivaceum (Horn.) Breb.	81	0.06	0.06	0.06	0.02	0.351	0.100	0.118		

	No.	Mean total deviance (BRT)	Mean residual deviance (BRT)	Estimated cv deviance (BRT)	SE estimated cv deviance (BRT)	Training data correlation (BRT)	Cv correlation (BRT)	SE cv correlation (BRT)	Correlation with vegetation type	*P* value (indicspecies)
Gomphonema parvulum Kütz.	82	2.64	2.42	2.59	0.71	0.420	0.150	0.071		
Gomphonema truncatum Ehr.	83	2.44	1.95	2.30	1.02	0.529	0.217	0.072		
Gyrosigma attenuatum (Kütz.) Rabenhorst	84	0.42	0.28	0.39	0.10	0.665	0.269	0.058	0.485	0.004
Hantzschia amphioxys (Ehr.) Grun.	85	7.92	7.59	8.21	5.36	0.450	0.140	0.056		
Hippodonta capitata (Ehr.) Lange-Bertalot et al.	86	1.38	1.31	1.42	1.15	0.290	0.071	0.086		
Hippodonta hungarica (Grun.) Lange-Bertalot et al.	87	NA	NA	NA	NA	NA	NA	NA		
Karayevia laterostrata (Hust.) Bukhtiyarova	88	0.08	0.07	0.07	0.03	0.443	0.361	0.102	0.428	0.001
Lemnicola hungarica (Grun.) Round & Basson	89	NA	NA	NA	NA	NA	NA	NA		
Meridion circulare (Greville) Agardh	90	0.10	0.07	0.10	0.05	0.685	0.342	0.107		
Navicula cryptocephala Kütz.	91	1.56	1.37	1.50	0.76	0.447	0.323	0.063	0.558	0.001
Navicula oblonga Kütz.	92	0.23	0.18	0.22	0.12	0.606	0.280	0.052		
Navicula peregrina (Ehr.) Kütz.	93	0.39	0.38	0.39	0.32	0.299	0.133	0.081	0.356	0.017
Navicula radiosa Kütz.	94	12.06	10.15	11.69	3.33	0.525	0.262	0.072		
Navicula rhynchocephala Kütz.	95	2.01	1.97	2.09	1.54	0.284	0.133	0.056	0.500	0.004
Navicula spp.	96	0.10	0.09	0.10	0.04	0.507	0.132	0.082	0.484	0.002
Navicula vulpina Kütz.	97	0.80	0.67	0.77	0.31	0.503	0.269	0.071	0.412	0.028
Neidium affine (Ehr.) Pfitzer	98	0.08	0.08	0.09	0.06	0.346	0.028	0.079		
Neidium ampliatum (Ehr.) Kram.	99	NA	NA	NA	NA	NA	NA	NA	0.421	0.019
Neidium bisulcatum (Lager.) Cleve	101	NA	NA	NA	NA	NA	NA	NA	0.468	0.004
Neidium hitchcockii (Ehr.) Cleve	102	0.04	0.02	0.03	0.01	0.762	0.530	0.068	0.603	0.001
Neidium iridis (Ehr.) Cleve	100	0.85	0.70	0.83	0.20	0.555	0.224	0.042	0.603	0.003
Neidium iridis f. *vernales* Reichelt	103	NA	NA	NA	NA	NA	NA	NA		
Neidium ladogense (Cleve) Foged	104	0.03	0.03	0.03	0.01	0.426	0.210	0.084	0.420	0.001

	No.	Mean total deviance (BRT)	Mean residual deviance (BRT)	Estimated cv deviance (BRT)	SE estimated cv deviance (BRT)	Training data correlation (BRT)	Cv correlation (BRT)	SE cv correlation (BRT)	Correlation with vegetation type	*P* value (indicspecies)
Neidium spp.	105	NA	NA	NA	NA	NA	NA	NA	0.470	0.008
Nitzschia amphibia Grun.	106	NA	NA	NA	NA	NA	NA	NA		
Nitzschia amphibia var. thermalis	107	NA	NA	NA	NA	NA	NA	NA		
Nitzschia denticula Grun.	108	3.21	2.29	3.03	0.58	0.622	0.279	0.063	0.554	0.011
Nitzschia dissipata (Kütz.) Grun.	109	0.39	0.31	0.38	0.12	0.559	0.279	0.067	0.559	0.001
Nitzschia frustulum (Kütz.) Grun.	110	NA	NA	NA	NA	NA	NA	NA		
Nitzschia palea (Kütz). W.Sm.	111	1.52	1.40	1.55	1.08	0.414	0.201	0.051	0.488	0.014
Nitzschia spp.	112	1.63	1.53	1.67	1.21	0.372	0.148	0.094	0.566	0.026
Martyana martyi (Heriband-Joseph) Round	113	0.08	0.06	0.07	0.03	0.566	0.170	0.107		
Pinnularia borealis Ehr.	114	0.26	0.25	0.27	0.18	0.456	0.138	0.085		
Pinnularia brevicostata Cleve	115	1.07	0.88	1.03	0.37	0.513	0.307	0.065	0.615	0.001
Pinnularia gibba Ehr.	116	NA	NA	NA	NA	NA	NA	NA		
Pinnularia interrupta W.Sm.	117	0.42	0.28	0.35	0.10	0.617	0.467	0.060	0.679	0.001
Pinnularia major (Kütz.) Rabenh.	118	0.81	0.75	0.83	0.38	0.392	0.071	0.083		
Pinnularia microstauron (Ehr.) Cleve	119	1.52	1.52	1.55	0.49	0.426	0.108	0.070		
Pinnularia spp.	120	0.09	0.08	0.09	0.04	0.409	0.038	0.086		
Pinnularia viridis (Nitzsch.) Ehr.	121	0.71	0.65	0.72	0.44	0.545	0.128	0.058	0.556	0.031
Planothidium lanceolatum (Brebisson) Lange-Bertalot	122	1.71	1.46	1.74	0.62	0.542	0.191	0.083		
Planothidium oestrupii (Cleve-Euler) Round & Bukhtiyarova	123	0.04	0.04	0.04	0.02	0.362	0.119	0.056	0.289	0.041
Planothidium peragallii (Brun & Herib.) Round & Bukhtiyarova	124	0.04	0.04	0.04	0.02	0.477	0.296	0.089	0.342	0.015
Psammothidium bioretti (Germ.)	125	2.94	2.85	3.05	2.57	0.272	0.346	0.087	0.471	0.001
Psammothidium helveticum (Hust.) Bukhtiyarova & Round	126	0.87	0.80	0.89	0.70	0.392	0.288	0.050	0.361	0.014

	No.	Mean total deviance (BRT)	Mean residual deviance (BRT)	Estimated cv deviance (BRT)	SE estimated cv deviance (BRT)	Training data correlation (BRT)	Cv correlation (BRT)	SE cv correlation (BRT)	Correlation with vegetation type	*P* value (indicspecies)
Psammothidium rossi (Hust.) Bukhtiyarova & Round	127	0.05	0.04	0.05	0.02	0.525	0.449	0.102	0.528	0.001
Psammothidium subatomoides (Hust.) Bukhtiyarova & Round	128	2.18	1.85	2.12	1.28	0.466	0.221	0.085	0.428	0.003
Psammothidium ventralis (Krasske) Bukhtiyarova & Round	129	0.37	0.28	0.33	0.18	0.546	0.389	0.084	0.516	0.001
Pseudostaurosira brevistriata (Grun.) Williams & Round	130	14.94	9.00	13.94	3.90	0.713	0.223	0.096		
Pseudostaurosira parasitica var. *subconstricta* (Grun.) Morales	131	1.67	1.56	1.66	1.17	0.380	0.276	0.070	0.531	0.001
Pseudostaurosira pseudoconstruens (Marciniak) D.M.Williams & Round 1987	132	NA	NA	NA	NA	NA	NA	NA		
Reimeria sinuata (Gregory) Kociolek & Stoermer	133	0.23	0.21	0.23	0.07	0.442	0.195	0.061		
Rhoiscophenia curvata (Kütz.) Grun.	134	NA	NA	NA	NA	NA	NA	NA	0.355	0.016
Rhopalodia gibba (Ehr.) O.Müll.	135	0.28	0.25	0.29	0.14	0.538	0.136	0.071	0.482	0.002
Rossithidium pusillum (Grun.) Round & Bukhtiyarova	136	5.44	4.81	5.43	2.37	0.435	0.366	0.090	0.474	0.001
Sellaphora bacillum (Ehr.) Mann	137	1.34	1.21	1.34	0.97	0.380	0.338	0.082	0.625	0.001
Sellaphora laevissima (Kütz.) Mann	138	0.76	0.66	0.72	0.54	0.446	0.396	0.088	0.426	0.002
Sellaphora pupula Kütz.	139	5.40	3.40	4.73	1.45	0.661	0.474	0.059	0.877	0.001
Stauroneis anceps et f. *gracilis* Rabh.	140	3.39	1.87	2.64	1.33	0.697	0.574	0.060	0.838	0.001
Stauroneis anceps var. *sibirica* Grun.	141	0.09	0.07	0.08	0.04	0.496	0.393	0.114	0.426	0.002
Stauroneis phoenicenteron (Nitzsch.) Ehr.	142	2.98	2.64	2.94	1.34	0.463	0.198	0.065		
Stauroneis smithii Grun.	143	0.27	0.22	0.25	0.12	0.480	0.343	0.072	0.618	0.001

	No.	Mean total deviance (BRT)	Mean residual deviance (BRT)	Estimated cv deviance (BRT)	SE estimated cv deviance (BRT)	Training data correlation (BRT)	Cv correlation (BRT)	SE cv correlation (BRT)	Correlation with vegetation type	*P* value (indicspecies)
Staurosira berolinensis (Lemm.) Lange-Bertalot	144	NA	NA	NA	NA	NA	NA	NA		
Staurosira binodis Ehr.	145	26.91	23.48	27.54	19.67	0.515	0.228	0.101		
Staurosira construens Ehr.	69	17.22	17.22	17.75	14.37	0.389	0.135	0.059	0.462	0.018
Staurosira subsalina (Hust.) Lange-Bertalot	146	241.56	122.25	192.27	49.72	0.735	0.450	0.097		
Staurosira venter (Ehr.) Cleve & Möller	147	248.99	215.97	240.26	40.32	0.500	0.203	0.095		
Staurosirella lapponica (Grun.) Williams & Round	148	0.18	0.17	0.18	0.09	0.446	0.193	0.068	0.323	0.038
Staurosirella leptostauron (Ehr.)	149	NA	NA	NA	NA	NA	NA	NA		
Staurosirella pinnata Ehr.	150	105.65	83.48	101.60	30.23	0.570	0.232	0.067		
Stephanodiscus hantzschii Grun.	151	120.00	77.05	95.46	34.22	0.630	0.548	0.062	0.669	0.001
Stephanodiscus minutulus (Kütz.) Cleve & Möller	152	5.39	5.39	5.40	5.28	0.330	0.050	0.068		
Surirella linearis W.Sm.	153	0.11	0.11	0.10	0.06	0.453	0.083	0.081	0.474	0.006
Surirella spp.	154	0.06	0.05	0.05	0.03	0.444	0.071	0.082	0.384	0.045
Tabellaria fenestrata (Lungb.) Kütz.	155	18.43	11.69	15.90	2.83	0.671	0.386	0.065	0.779	0.001
Tabellaria flocculosa (Roth.) Kütz.	156	137.66	69.20	101.64	15.59	0.731	0.542	0.080	0.915	0.001
Tetracyclus glans (Ehr.) Mills	157	0.06	0.04	0.05	0.02	0.579	0.495	0.065	0.491	0.001
Ulnaria ulna (Nitzsch.) P.Compère	72	15.36	13.18	14.99	5.46	0.517	0.252	0.096		
Ulnaria ulna var. *acus* (Kütz.) Lange-Bertalot	73	NA	NA	NA	NA	NA	NA	NA		
Ulnaria danica (Kütz.) Compère & Bukhtiyarova	74	1.55	1.43	1.60	1.56	0.391	0.584	0.020		

Supplementary Table S5. The total number of occurrences (N), maximum percent abundance (maximum %), mean percentage in all samples in which the species occurs (average %), and summary of indicator taxa per environmental factor (I) and vegetation type (D). EC – electrical conductivity.

Diatom taxon	N	Maximum (%)	Average (%)	EC low (<100 µS/cm)	EC intermediate (100-500 µS/cm)	EC high (>500 µS/cm)	Si low (<1 mg/l)	Si intermediate (1-10 mg/l)	Si high (>10 ml/l)	pH low (<7)	pH intermediate (7-8)	pH high (>8)	Depth low (<1 m)	Depth intermediate (1-5m)	Depth high (>5m)	Tundra	Forest-tundra	Northern taiga	Typical taiga
Achnanthes spp.	43	9.1	0.3																
Achnanthidium minutissimum	82	51.0	2.1															I	I
Achnanthidium affine	11	35.3	0.4								I							I	
Amphora pediculus	23	12.2	0.2													I		I	
Amphora veneta	14	3.8	0.1																I
Anomoeoneis sphaerophora	28	58.9	0.6																I
Anomoeoneis sph. var. *jakutica*	11	13.9	0.1			I													
Anomoeoneis sph. var. *polygramma*	12	73.0	0.5			I													I
Asterionella formosa	48	47.9	0.9													I	I	I	
Aulacoseira alpigena	13	10.2	0.1														I		
Aulacoseira distans	20	28.3	0.4														I		
Aulacoseira islandica	10	5.3	0.1													I	I		
Aulacoseira lirata	11	45.9	0.5					I											
Aulacoseira perglabra	2	35.0	0.2	I															
Aulacoseira spp.	20	9.5	0.1													I	I	I	
Aulacoseira subarctica	15	55.3	1.0	I												I	I	I	
Aulacoseira valida	16	2.5	0.1	I													I		
Caloneis baccilum	16	20.6	0.2													I	I	I	
Caloneis silicula	81	10.5	0.4													I	I	I	
Cavinula cocconeiformis	16	23.2	0.3													I	I		
Cavinula pseudoscutiformis	33	9.8	0.2	I															
Cocconeis pediculus	17	26.7	0.3											I					
Cocconeis placentula	78	36.5	2.1															I	I
Craticula cuspidata	68	13.9	0.5															I	I
Cyclostephanos dubius	24	46.0	0.9																I
Cyclotella meneghiniana	62	81.0	2.3			I													I
Cyclotella radiosa	26	5.9	0.2											I					

Diatom taxon	N	Maximum (%)	Average (%)	EC low (<100 µS/cm)	EC intermediate (100-500 µS/cm)	EC high (>500 µS/cm)	Si low (<1 mg/l)	Si intermediate (1-10 mg/l)	Si high (>10 ml/l)	pH low (<7)	pH intermediate (7-8)	pH high (>8)	Depth low (<1 m)	Depth intermediate (1-5m)	Depth high (>5m)	Tundra	Forest-tundra	Northern taiga	Typical taiga
Cymbella cistula	44	7.6	0.2														I	I	I
Cymbopleura cuspidata	38	6.9	0.1				I									I	I		
Cymbopleura naviculiformis	51	4.9	0.2													I	I	I	
Diatoma tenuis	32	12.0	0.3													I		I	
Diploneis elliptica	29	5.3	0.1													I	I	I	
Diploneis oblongella	23	4.2	0.1	I												I	I		
Diploneis ovalis	22	5.9	0.1								I					I	I		
Encyonema minutum	12	1.9	0.0	I												I	I		
Encyonema silesiacum	78	5.4	0.5													I	I	I	
Epithemia adnata	89	77.5	2.4			I											I	I	I
Epithemia turgida	12	5.9	0.1		I													I	
Eucocconeis flexella	15	19.6	0.2													I		I	
Eucocconeis laevis	17	42.8	0.4													I	I	I	
Eunotia arcus	34	8.4	0.3													I	I		
Eunotia bilunaris	70	37.7	0.9													I	I	I	
Eunotia faba	35	19.2	0.3													I	I	I	
Eunotia monodon	46	37.7	0.5															I	
Eunotia pectinalis	41	46.1	0.7														I	I	
Eunotia praerupta	81	53.8	1.6													I	I	I	
Eunotia sudetica	14	10.8	0.2				I										I		
Eunotia triodon	12	15.0	0.1							I						I			
Encyonema alpinum	15	2.8	0.1													I	I		
Fragilaria capucina	100	31.1	2.1													I	I	I	
Fragilaria constricta	11	8.4	0.1													I	I		
Staurosira construens	19	54.4	0.6								I						I		I
Fragilariforma virescens	17	10.0	0.1														I		
Gyrosigma attenuatum	31	4.1	0.2													I	I	I	
Karayevia laterostrata	11	2.5	0.1	I												I	I		
Navicula cryptocephala	41	13.2	0.4													I	I	I	
Navicula oblonga	16	4.9	0.1		I														
Navicula peregrina	11	8.2	0.1											I					
Navicula rhynchocephala	38	17.8	0.3													I	I	I	
Navicula spp.	27	2.8	0.1													I		I	
Navicula vulpina	25	8.4	0.2													I			

Diatom taxon	N	Maximum (%)	Average (%)	EC low (<100 µS/cm)	EC intermediate (100-500 µS/cm)	EC high (>500 µS/cm)	Si low (<1 mg/l)	Si intermediate (1-10 mg/l)	Si high (>10 ml/l)	pH low (<7)	pH intermediate (7-8)	pH high (>8)	Depth low (<1 m)	Depth intermediate (1-5m)	Depth high (>5m)	Tundra	Forest-tundra	Northern taiga	Typical taiga
Neidium ampliatum	25	4.8	0.1													I	I		
Neidium iridis	63	5.6	0.4													I	I	I	
Neidium bisulcatum	30	17.2	0.2													I	I	I	
Neidium hitchcockii	24	1.3	0.1													I	I		
Neidium ladogense	16	1.6	0.0													I	I		
Neidium spp.	31	4.0	0.1														I	I	
Nitzschia denticula	54	9.9	0.7		I												I	I	I
Nitzschia dissipata	35	4.4	0.2													I	I	I	
Nitzschia palea	37	10.8	0.3													I	I		
Nitzschia spp.	64	15.6	0.4													I	I	I	
Pinnularia brevicostata	39	8.6	0.3													I	I	I	
Pinnularia interrupta	48	4.4	0.3													I	I	I	
Pinnularia viridis	58	7.1	0.3													I	I	I	
Planothidium oestrupii	7	1.9	0.0	I												I	I		
Planothidium peragallii	7	1.7	0.0	I												I	I		
Psammothidium bioretti	16	22.9	0.2	I												I	I		
Psammothidium helveticum	12	9.0	0.1													I	I		
Psammothidium rossi	10	1.6	0.0	I	I												I		
Psammothidium subatomoides	11	15.6	0.2													I	I		
Psammothidium ventralis	16	5.1	0.1	I												I	I		
Pseudostaurosira par. var. *subcon.*	19	15.6	0.2				I										I		
Rhoiscophenia curvata	11	15.2	0.1															I	
Rhopalodia gibba	23	4.8	0.1															I	
Rossithidium pussillum	18	18.9	0.5	I													I		
Sellaphora bacillum	41	14.2	0.3				I									I	I		
Sellaphora laevissima	15	0.5	0.0	I												I	I		
Sellaphora pupula	133	17.1	1.5													I	I	I	
Stauroneis anceps et f. *gracilis*	78	18.2	0.7													I	I	I	
Stauroneis sibirica	14	3.0	0.1													I			
Stauroneis smithii	31	5.5	0.1	I												I	I		

Diatom taxon	N	Maximum (%)	Average (%)	EC low (<100 µS/cm)	EC intermediate (100-500 µS/cm)	EC high (>500 µS/cm)	Si low (<1 mg/l)	Si intermediate (1-10 mg/l)	Si high (>10 ml/l)	pH low (<7)	pH intermediate (7-8)	pH high (>8)	Depth low (<1 m)	Depth intermediate (1-5m)	Depth high (>5m)	Tundra	Forest-tundra	Northern taiga	Typical taiga
Staurosirella lapponica	10	3.5	0.1													I	I	I	
Stephanodiscus hantzschii	54	92.0	3.1																I
Stephanodiscus minutulus	5	30.2	0.3						I										
Surirella linearis	25	3.6	0.1	I												I		I	
Surirella spp.	23	2.4	0.1													I	I	I	
Tabellaria fenestrata	96	23.5	2.0													I	I	I	
Tabellaria flocculosa	109	66.1	5.9													I	I	I	
Tetracyclus glans	21	2.1	0.1													I	I		

Supplementary Table S6. Comparison of estimated conductivity optima and tolerances of indicator taxa from this study with those from other regions. (Abbreviations: AmpLib – *Amphora libyca*, AnoSph – *Anomoeoneis sphaerophora*, CycMen – *Cyclotella meneghiniana*; EpiAdn –*Epithemia adnata*, EpiTur – *Epithemia turgida*, NavObl – *Navicula oblonga*, HipCap –*Hippodonta capitata*, EncMin – *Encyonema minutum*, SelLae – *Sellaphora laevissima*). In addition, the number of lakes (N), as well as minima and maxima of the studied electrical conductivity (EC) range of the cited studies are indicated (Mongolia, Shinneman et al. 2009; Spain, Reed et al. 1998; Turkey, Reed et al. 2012, Tibetan Plateau, Yang et al. 2003).

	AmpLib	AnoSph	CycMen	EpiAdn	EpiTur	NavObl	HipCap	EncMin	SelLae
This study; N=206, min EC: 8 µS/cm, max EC: 7761 µS/cm									
WA optimum (µS/cm)	308	1209	866	586	424	415	329	33	40
WA optimum ([log+1]µS/cm)	2.49	3.08	2.94	2.77	2.63	2.62	2.52	1.53	1.62
WA tolerance ([log+1]µS/cm)	0.61	0.49	0.39	0.43	0.33	0.29	0.65	0.31	0.40

Mongolia; N=54, min EC: 41 µS/cm, max EC: 3200 µS/cm									
WA optimum (µS/cm)	1737	12341		979		4228	1932		
WA optimum ([log+1]µS/cm)	3.24	4.09		2.99		3.63	3.29		
WA tolerance ([log+1]µS/cm)	0.59	0.52		0.43		0.44	0.23		
Spain; N=74, min EC: 140 µS/cm, max EC: 338000 µS/cm									
WA optimum (µS/cm)		13700	8640				8340	9700	
WA lower tolerance limit (µS/cm)		7360	5050				4400	4920	
WA upper tolerance limit (µS/cm)		25590	147900				158300	191500	
Turkey; N=30, min EC: 1421 µS/cm, max EC: 125000 µS/cm									
WA optimum (µS/cm)		12588	1994	630	388	4466	1174		
WA optimum ([log+1]µS/cm)		4.1	3.3	2.8	2.59	3.65	3.07		
WA tolerance ([log+1]µS/cm)		0.53	0.49	0.41	0.34	0.54	0.41		
Tibetan Plateau; N=40, min EC: 119 µS/cm, max EC: 116500 µS/cm									
WA optimum (µS/cm)	523	5672				784	810		
WA optimum ([log+1]µS/cm)	2.72	3.75				2.89	2.91		

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