

Supplementary Material

A snapshot of the limnology of eastern Australian water bodies spanning the tropics to Tasmania: the land-use, climate, limnology nexus

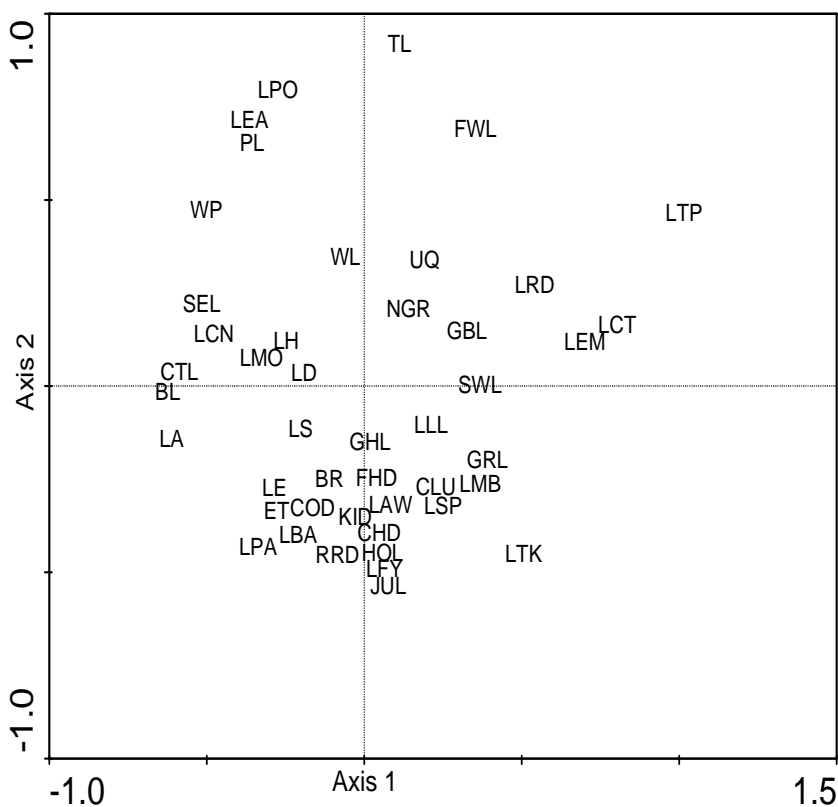
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Fig. S1. Initial principal components analysis (PCA) plot of (a) the 45 water bodies constrained to (b) the 19 environmental variables, with land-use, climate and lake-depth variables entered as passive variables to focus the analysis on in-lake (limnological) variables. The first and second axes of this plot are predominantly specific conductance and pH gradients; it shows a large number of correlated water-conductivity proxies (ion concentrations).

(a)



(b)

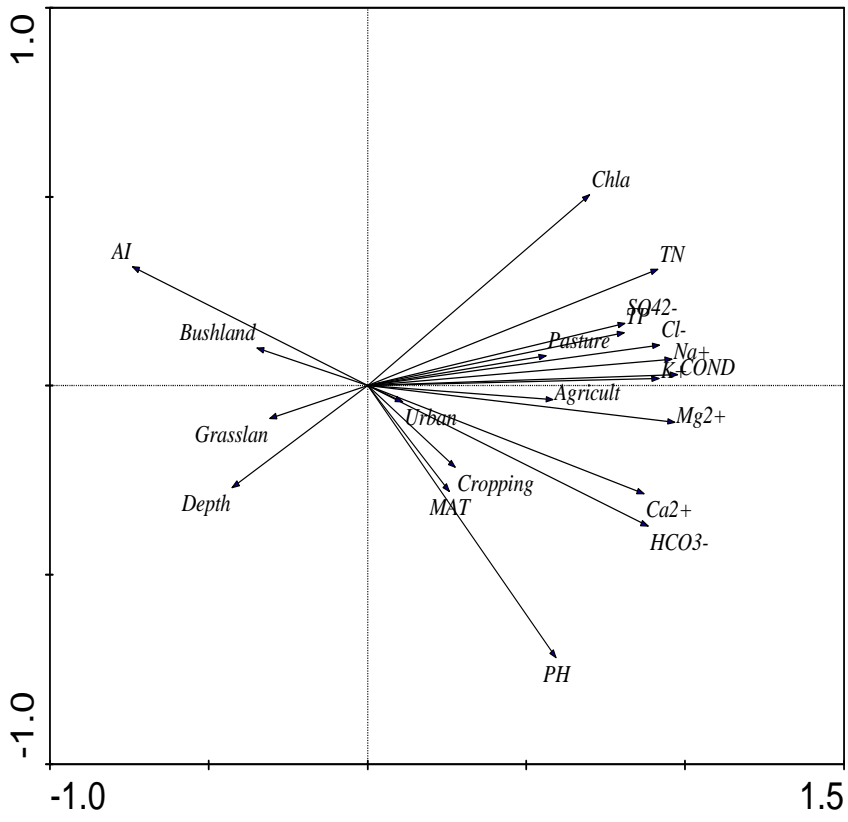
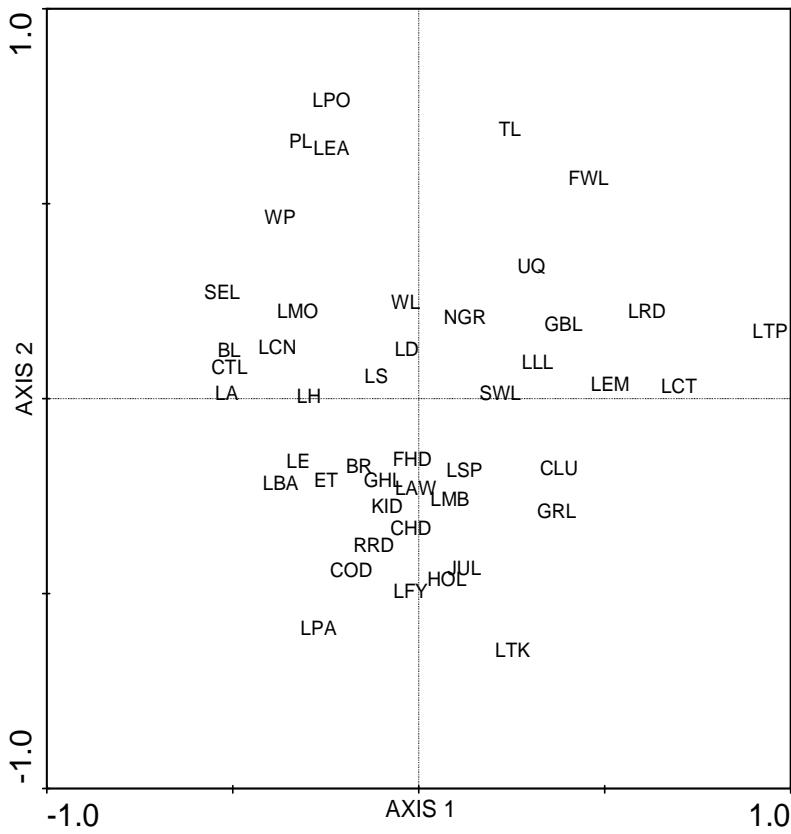


Fig. S2. Revised principal components analysis (PCA) plot of (a) the 45 water bodies constrained to (b) the 12 environmental variables (ionic variables removed), with land-use, climate and lake-depth variables entered as passive variables to focus the analysis on the in-lake (limnological) variables. The first axis is now a nutrient gradient and the second axis is a pH gradient.

(a)



(b)

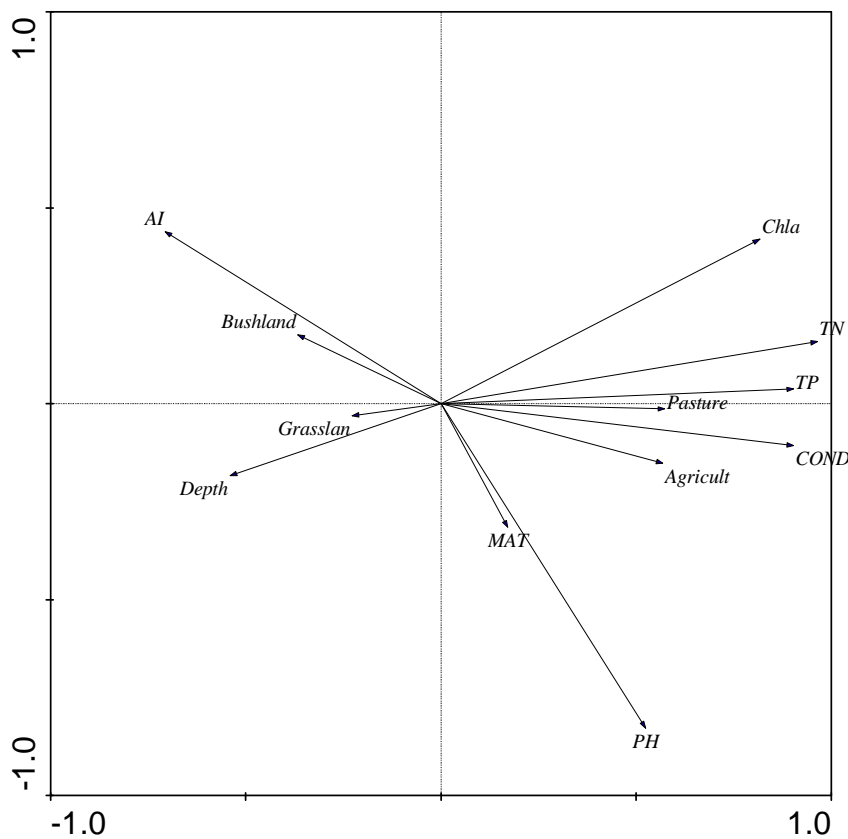


Table S1. List of the 19 variables used, with mean, minimum and maximum values cited and the appropriate units highlighted

Variable	Unit	Abbreviation	Mean	Min	Max
Max. lake water depth	m	Depth	10.4	0.2	65
Mean annual temperature	°C	MAT	14.5	3.7	24.1
Aridity index	ratio	AI	1.2	0.4	3.7
Total nhosphorus	mg L ⁻¹ as P	TP	0.244	0.003	3.6
Total nitrogen	mg L ⁻¹ as N	TN	2.03	0.11	36
Chlorophyll <i>a</i>	µg L ⁻¹	Chl	14	1	90
Sodium	mg L ⁻¹	Na ²⁺	135	1	3000
Potassium	mg L ⁻¹	K ⁺	8.8	0.1	164
Calcium	mg L ⁻¹	Ca ²⁺	11.4	0.1	96
Magnesium	mg L ⁻¹	Mg ²⁺	25.5	0.1	458
Bicarbonate	mg L ⁻¹	HCO ₃ ⁻	107	2	1810
Chloride	mg L ⁻¹	Cl ⁻	224.9	0.1	4800
Sulfate	mg L ⁻¹	SO ₄ ⁻	30	1	418
pH	–	pH	7.3	4.7	9.2
Conductivity	µs cm ⁻¹	COND	846	5	15 700
Bushland	%	Bush	55	0	100
Grassland	%	Grass	21	0	100
Agriculture	%	Agri	21	0	100
Urban	%	Urban	3	0	90

Table S2. Selected limnological and land-use or land-cover variables for the 45 water bodies

See Table S1 for definition of symbols

Lake name	Lake	Depth (m)	AI	MAT (°C)	TP (mg L ⁻¹)	TN (mg L ⁻¹)	Chl (µg L ⁻¹)	Na ⁺ (mg L ⁻¹)	K ⁺ (mg L ⁻¹)	Ca ²⁺ (mg L ⁻¹)	Mg ²⁺ (mg L ⁻¹)	HCO ₃ ⁻ (mg L ⁻¹)	Cl ⁻ (mg L ⁻¹)	SO ₄ ²⁻ (mg L ⁻¹)	PH	COND (µs cm ⁻¹)	Bush (%)	Grass (%)	Agri (%)	Urban (%)
Lake Cootaptamba	CTL	3	2.51	3.7	0.011	0.15	1	1	0.1	0.1	0.1	7	0.2	1	6.47	5	0	100	0	0
Lake Albina	LA	9	2.33	4.4	0.007	0.12	1	1	0.1	0.4	0.1	6	0.1	1	6.6	6	0	100	0	0
Blue Lake	BL	28	2.36	3.9	0.007	0.11	2	1	0.1	0.2	0.1	6	0.1	1	6.44	5	0	100	0	0
Little Llangothlin Lagoon	LLL	3	0.83	11.6	0.16	1.5	31	9	5	15	11	109	9.1	1	8.11	212	0	32	68	0
Lake Catani	LCN	1.6	1.53	7.9	0.015	0.28	2	2	0.3	0.4	0.2	6	2	1	6.53	12	18	65	17	0
Eagle Tarn	ET	0.2	1.99	6.3	0.021	0.41	1	3	0.1	3.4	1.7	25	4.4	1	7.39	47	68	21	10	0
Lake Lila	WP	13	3.07	6.7	0.019	0.29	1	2	0.2	0.3	0.4	2	3.7	1	4.91	23	80	12	8	0
Lake Lea Pond	LEA	0.75	2.77	7.4	0.028	0.44	5	4	0.3	0.2	0.5	2	6.5	1	4.83	33	96	4	0	0
Lakes Samuel	LS	1.2	1.26	7.5	0.024	0.47	8	6	0.1	3.8	2.2	27	8.9	1	7.38	68	74	24	2	0
Highland Waters	LD	1.2	1.26	7.6	0.043	0.57	9	6	0	3.4	2.1	26	9.6	1	7.22	67	74	24	2	0
Jubilee Lake	JUL	1.3	0.82	11.9	0.11	0.78	5	21	1.1	6.2	8.5	81	19	1.2	8.95	194	51	10	39	0
Lake Selina	SEL	7.3	3.41	8.9	0.003	0.16	1	3	0.1	0.6	0.5	3	5.9	1	5.5	29	88	11	1	0
Lake Plimsoll Pond	PL	1.3	3.7	9	0.01	0.38	6	5	0.2	0.4	0.7	2	8.9	1	4.8	44	94	6	0	0
Thirlmere Lakes	TL	1.8	0.83	15	0.051	3.2	65	32	3.9	1.6	2.9	6	48	28	6.17	249	82	7	11	0
Freshwater Lake	FWL	2.1	0.58	13.2	0.56	5.1	60	77	13	9	12	41	130	22	6.74	564	10	0	90	0
Nuggety Gully Resrvoir	NGR	1.2	0.43	14.1	0.041	1.6	11	44	14	8	9.2	26	100	1	7.02	400	55	41	5	0
Lake Fyans	LFY	2.7	0.49	13.8	0.019	0.64	3	24	2.6	6.4	5.2	49	36	6.3	8.79	206	30	39	31	0
Lake Tooliorook	LTK	3	0.53	13.4	0.12	2.2	1	353	11	16	85	124	690	62	9.17	2470	0	0	100	0
Green Lake	GRL	2.1	0.39	14.3	0.18	1.5	16	75	9.6	14	12	112	100	13.2	8.97	553	0	5	95	0
Lake Elingamite	LEM	1.2	0.84	13.3	0.11	4.4	22	976	41	65	197	259	2000	223	7.98	6420	10	0	90	0
Reedy Lake	LRD	0.5	0.45	14.8	0.52	5.3	80	147	21	22	17	246	170	8.5	8.23	959	35	53	13	0
Lake Terangpom	LTP	0.5	0.59	13.5	3.6	36	90	3000	164	10	458	1810	4800	418	8.68	15 700	0	81	19	0
Lake Surprise	LSP	6	0.72	13.3	0.031	0.88	9	85	9.6	18	26	235	100	2.3	8.08	698	74	0	26	0
Bamrang Reservoir	BR	25	1.08	16.2	0.011	0.3	4	8	1.1	3.8	2.5	24	12	2.9	7.7	91	68	32	0	0

Lake Cartcarrong	LCT	1.1	0.82	13.4	1.1	11	24	705	21	96	185	565	1100	378	8.33	4700	6	0	94	0
Grubbed Lake	GBL	1.7	0.64	13.7	0.12	3.2	36	36	13	15	9.3	107	50	1.5	7.89	345	89	0	11	0
Swan Lake	SWL	1.1	0.83	13.7	0.044	1.3	10	85	4.8	40	13	91	150	45	7.61	744	41	2	57	0
UQ lake	UQ	1.3	0.81	20.3	0.27	1.1	69	17	3.2	14	4.7	55	19	13	7.5	210	9	1	0	90
Lake Mombeong	LMB	4.8	0.80	13.8	0.021	0.79	5	143	3.6	46	20	91	280	52	8.03	1140	100	0	0	0
Lake Hiawatha	LH	16.8	1.19	19.1	0.006	0.2	3	17	0.8	0.6	1.9	6	28	2.6	6.84	117	95	3	2	0
Grahamstown Lake	GHL	11.4	0.91	17.8	0.013	0.4	4	23	2.5	4.5	4.7	27	32	15	7.74	197	48	1	1	50
Wellums Lake	WL	3	0.73	17.5	0.025	0.56	11	18	2.7	1.2	2.6	9	30	3	6.75	134	99	1	0	0
Chaffey Dam	LPO	9.7	1.25	20.3	0.009	0.44	12	8	0.9	0.5	1	2	13	2	4.7	45	100	0	0	0
Poona Lake	CHD	28	0.57	15.6	0.031	0.46	4	14	1.6	6.7	11	89	6.4	8.5	8.3	185	59	7	34	0
Lake Morris	LMO	30	1.61	22.4	0.015	0.27	3	8	0.3	1.7	1	14	5.7	1.5	6.2	41	92	2	1	5
Lake Barrine	LBA	65	1.49	20.6	0.012	0.12	1	4	1.3	3.2	3.1	30	5.9	1	7.14	67	80	20	0	0
Lake Eacham	LE	63	1.46	20.5	0.012	0.26	1	3	1.1	1.6	2.3	20	4.5	1	7.09	44	100	0	0	0
Lake Paluma	LPA	14	0.68	19.8	0.012	0.2	2	3	0.7	0.3	0.3	7	3.9	1	9.14	9	95	1	4	0
Horseshoe Lagoon	HOL	3.5	0.64	24.1	0.059	0.61	6	15	2.3	7.4	4.6	50	19	2.4	9.12	139	20	71	8	0
Ross River Dam	RRD	13	0.62	24.1	0.021	0.3	3	12	1.7	5.2	2.5	43	9.8	1.2	8.33	86	70	23	2	5
Kinchant Dam	KID	13	0.74	20.8	0.011	0.32	7	14	1.6	8.2	5	60	19	1.3	8.25	135	41	0	59	0
Coffee Dam	COD	4.3	0.80	22.4	0.012	0.29	2	13	1.1	0.7	1.3	15	17	1.9	8.44	61	75	3	22	0
Lake Awoonga	LAW	35	0.63	22.3	0.023	0.39	8	18	2.2	16	6.8	89	25	6.7	8.12	216	59	39	2	0
Coalstoun Lake	CLU	0.7	0.59	19.6	3.4	1.5	5	12	28	23	7.6	139	15	1	8.14	229	100	0	0	0
Fred Haigh Dam	FHD	31	0.69	21.3	0.061	0.83	2	17	3.2	11	5.4	67	23	1.6	7.45	159	73	25	2	0

Table S3. Guideline used to determine lake trophic status in this study (Carlson 1977)

Trophic class	Chl ($\mu\text{g L}^{-1}$)	TP ($\mu\text{g L}^{-1}$)
Oligotrophic	0–2.6	0–12
Mesotrophic	2.6–20	12–24
Eutrophic	20–56	24–96
Hypereutrophic	56–155+	96–384+