

## Supplementary Information

*Species-specific relationships between water transparency and male coloration within and between two closely related Lake Victoria cichlid species*

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Supplementary Table S1: Repeatability for irradiance data: orange ratio															
depth	Luanso			Kissenda			Python			Makobe			Ruti		
	N dates	N spectra	r	N dates	N spectra	r	N dates	N spectra	r	N dates	N spectra	r	N dates	N spectra	r
0.5	2	4	0.96	3	6	0.88	4	9	0.99	3	5	0.70	3	5	0.96
1	2	4	0.71	3	6	0.59	4	8	1.00	4	9	0.82	3	5	0.87
1.5	2	4	0.98	3	6	0.67	4	10	1.00	3	6	0.31	3	8	-0.67
2	2	6	0.71	3	8	0.67	4	10	1.00	3	7	-0.16	3	6	0.77
2.5	2	4	0.99	3	6	0.94	4	10	1.00	3	10	0.59	3	6	0.95
3	2	8	0.93	3	8	0.93	4	10	1.00	4	11	0.92	3	6	0.99
3.5	2	7	0.65	3	10	0.91	4	15	1.00	2	5	0.96	3	5	0.82
4				3	6	0.96	4	8	1.00	4	13	0.81	3	8	0.99
4.5				3	8	0.97	4	8	1.00	2	5	0.98	3	6	1.00
5				3	6	1.00	4	8	1.00	4	9	0.98	3	6	1.00
6				2	6	-0.28	3	6	1.00	4	12	0.86	3	8	1.00
7										4	11	0.96	3	6	1.00
8										4	11	0.37	3	8	0.68
9										4	12	0.99	3	6	1.00
10										4	16	-0.29	2	8	0.97
11										4	9	1.00	2	5	1.00
12										3	6	1.00	2	4	1.00

Supplementary Table S2: Repeatability for reflectance data: chroma													
		light source: lamp						light source: sun					
		<i>P. nyererei</i>			<i>P. pundamilia</i>			<i>P. nyererei</i>			<i>P. pundamilia</i>		
		r	N	N	r	N	N	r	N	N	r	N	N
			fish	spectra		fish	spectra		fish	spectra		fish	spectra
dorsum	Kissenda	NA	1	2	NA	1	2	0.99	5	10	0.63	7	15
	Python	0.91	9	21	0.63	5	13	0.94	7	13	0.71	5	10
	Makobe	0.33	9	22	0.61	5	10	0.82	9	20	0.85	4	8
	Ruti	0.90	11	24	0.57	8	16	0.65	6	15	NA	1	2
	All islands	0.86	30	69	0.64	19	41	0.90	27	58	0.66	17	35
dorsal fin	Kissenda	NA	1	2	NA	1	2	0.97	5	9	0.32	7	14
	Python	0.54	9	20	0.76	4	12	0.74	7	13	0.68	5	10
	Makobe	0.96	9	18	0.87	5	12	0.85	7	15	0.64	5	9
	Ruti	0.95	11	22	0.98	8	16	0.93	6	14	NA	1	2
	All islands	0.94	30	62	0.92	18	42	0.95	25	51	0.58	18	35
dorsal fin lappets	Kissenda	NA	1	2	NA	1	2	0.83	5	9	0.60	7	13
	Python	0.91	8	16	0.90	4	9	0.81	7	14	0.99	5	9
	Makobe	0.88	3	5	0.94	5	10	0.97	8	18	0.92	5	10
	Ruti	NA	1	2	0.81	8	17	0.86	6	11	NA	1	2
	All islands	0.91	13	25	0.86	18	38	0.93	26	52	0.82	18	34
anal fin spot	Kissenda	NA	1	4	NA	1	1	-0.10	5	10	0.64	7	14
	Python	0.94	8	14	0.41	4	8	0.90	7	12	0.36	5	10
	Makobe	0.89	10	19	0.74	5	14	0.93	9	19	0.85	5	10
	Ruti	0.88	11	21	0.95	8	16	0.75	6	14	NA	1	2
	All islands	0.89	30	58	0.78	18	39	0.79	27	55	0.82	18	36
flank	Kissenda	NA	1	2	NA	1	1	0.88	5	11	0.49	7	14
	Python	0.96	9	19	0.37	5	19	0.93	7	16	0.99	5	10
	Makobe	0.82	10	20	0.64	5	12	0.93	9	21	0.59	5	12
	Ruti	0.92	11	21	0.77	8	16	0.79	6	16	NA	1	2
	All islands	0.92	31	62	0.71	19	48	0.92	27	64	0.73	18	38

Supplementary Table S3: Repeatability for reflectance data: $\lambda P_{50}$													
		light source: lamp						light source: sun					
		<i>P. nyererei</i>			<i>P. pundamilia</i>			<i>P. nyererei</i>			<i>P. pundamilia</i>		
		r	N	N	r	N	N	r	N	N	r	N	N
		fish	spectra	fish	spectra	fish	spectra	fish	spectra	fish	spectra	fish	spectra
dorsum	Kissenda	NA	1	2	NA	1	2	0.99	5	10	0.76	7	15
	Python	0.95	9	21	0.92	5	13	0.91	7	13	0.18	5	10
	Makobe	0.39	9	22	0.73	5	10	0.91	9	20	0.93	4	8
	Ruti	0.98	11	24	0.90	8	16	0.74	6	15	NA	1	2
	All islands	0.90	30	69	0.85	19	41	0.94	27	58	0.75	17	35
dorsal fin	Kissenda	NA	1	2	NA	1	2	0.73	5	9	0.43	7	14
	Python	0.87	9	20	0.78	4	12	0.72	7	13	0.61	5	10
	Makobe	0.94	9	18	0.89	5	12	0.85	7	15	0.86	5	9
	Ruti	0.92	11	22	0.99	8	16	0.93	6	14	NA	1	2
	All islands	0.97	30	62	0.91	18	42	0.93	25	51	0.71	18	35
dorsal fin lappets	Kissenda	NA	1	2	NA	1	2	0.51	5	9	0.55	7	13
	Python	0.85	8	16	0.85	4	9	0.81	7	14	0.98	5	9
	Makobe	0.93	3	5	0.51	5	10	0.96	8	18	0.92	5	10
	Ruti	NA	1	2	0.84	8	17	0.80	6	11	NA	1	2
	All islands	0.87	13	25	0.76	18	38	0.82	26	52	0.83	18	34
anal fin spot	Kissenda	NA	1	4	NA	1	1	-0.18	5	10	0.82	7	14
	Python	0.99	8	14	-0.60	4	8	0.91	7	12	0.72	5	10
	Makobe	0.93	10	19	0.75	5	14	0.92	9	19	0.91	5	10
	Ruti	0.79	11	21	0.97	8	16	0.83	6	14	NA	1	2
	All islands	0.93	30	58	0.83	18	39	0.83	27	55	0.90	18	36
flank	Kissenda	NA	1	2	NA	1	1	0.88	5	11	0.65	7	14
	Python	0.98	9	19	0.60	5	19	0.93	7	16	0.98	5	10
	Makobe	0.82	10	20	0.75	5	12	0.89	9	21	-0.54	5	12
	Ruti	0.93	11	21	0.91	8	16	0.83	6	16	NA	1	2
	All islands	0.96	31	62	0.85	19	48	0.93	27	64	0.45	18	38

Supplementary Table S4: Spearman correlations between body areas for chroma													
		light source: lamp						light source: sun					
		<i>P. nyererei</i>			<i>P. pundamilia</i>			<i>P. nyererei</i>			<i>P. pundamilia</i>		
		rho	p	N	rho	p	N	rho	p	N	rho	p	N
dorsal fin lappets-anal fin spot	Kissenda	NA	NA	1	NA	NA	1	-0.10	0.95	5	0.64	0.14	7
	Python	0.50	0.22	8	0.50	1.00	3	-0.07	0.91	7	0.50	0.45	5
	Makobe	0.50	1.00	3	-0.14	0.80	6	-0.05	0.93	8	0.70	0.23	5
	Ruti	NA	NA	1	0.12	0.79	8	0.54	0.30	6	NA	NA	1
dorsal fin lappets-flank	Kissenda	NA	NA	1	NA	NA	1	-0.40	0.52	5	-0.68	0.11	7
	Python	-0.29	0.50	8	-0.40	0.75	4	-0.32	0.50	7	-0.30	0.68	5
	Makobe	0.50	1.00	3	-0.09	0.92	6	-0.26	0.54	8	0.50	0.45	5
	Ruti	NA	NA	1	-0.17	0.70	8	-0.09	0.92	6	NA	NA	1
dorsal fin-dorsal fin lappets	Kissenda	NA	NA	1	NA	NA	1	-0.90	0.08	5	-0.32	0.50	7
	Python	0.33	0.43	8	-0.80	0.33	4	0.07	0.91	7	0.30	0.68	5
	Makobe	-1.00	1.00	2	-0.26	0.66	6	-0.32	0.50	7	0.20	0.78	5
	Ruti	NA	NA	1	0.33	0.43	8	0.66	0.18	6	NA	NA	1
dorsal fin-dorsum	Kissenda	NA	NA	1	NA	NA	1	0.80	0.13	5	0.00	1.00	7
	Python	0.20	0.61	9	-0.20	0.92	4	0.07	0.91	7	0.60	0.35	5
	Makobe	0.52	0.20	8	0.60	0.24	6	-0.25	0.59	7	0.40	0.75	4
	Ruti	0.72	<b>0.04</b>	9	0.45	0.27	8	0.26	0.66	6	NA	NA	1
dorsal fin-anal fin spot	Kissenda	NA	NA	1	NA	NA	1	0.00	1.00	5	-0.25	0.59	7
	Python	0.36	0.39	8	-1.00	0.33	3	0.75	0.07	7	0.90	0.08	5
	Makobe	-0.65	0.07	9	-0.20	0.71	6	-0.68	0.11	7	-0.30	0.68	5
	Ruti	0.36	0.27	11	-0.40	0.33	8	0.71	0.14	6	NA	NA	1
dorsal fin-flank	Kissenda	NA	NA	1	NA	NA	1	0.30	0.68	5	0.32	0.50	7
	Python	-0.07	0.88	9	0.80	0.33	4	-0.14	0.78	7	0.50	0.45	5
	Makobe	0.22	0.58	9	0.83	0.06	6	0.04	0.96	7	0.90	0.08	5
	Ruti	0.67	<b>0.03</b>	11	0.40	0.33	8	-0.09	0.92	6	NA	NA	1
dorsum-dorsal fin lappets	Kissenda	NA	NA	1	NA	NA	1	-0.50	0.45	5	-0.61	0.17	7
	Python	0.14	0.75	8	0.40	0.75	4	-0.61	0.17	7	-0.10	0.95	5
	Makobe	1.00	1.00	2	-0.43	0.42	6	0.19	0.66	8	-0.40	0.75	4
	Ruti	NA	NA	1	0.19	0.66	8	0.26	0.66	6	NA	NA	1
dorsum-anal fin spot	Kissenda	NA	NA	1	NA	NA	1	-0.30	0.68	5	-0.61	0.17	7
	Python	-0.50	0.22	8	-0.80	0.33	4	-0.07	0.91	7	0.70	0.23	5
	Makobe	-0.82	<b>0.01</b>	9	0.43	0.42	6	-0.35	0.36	9	-0.40	0.75	4
	Ruti	0.33	0.39	9	-0.40	0.33	8	-0.09	0.92	6	NA	NA	1
dorsum-flank	Kissenda	NA	NA	1	NA	NA	1	0.30	0.68	5	0.50	0.27	7
	Python	0.20	0.61	9	0.50	0.45	5	0.43	0.35	7	0.90	0.08	5
	Makobe	0.07	0.88	9	0.20	0.71	6	0.17	0.68	9	-0.20	0.92	4
	Ruti	0.27	0.49	9	0.00	1.00	8	0.77	0.10	6	NA	NA	1
anal fin spot-flank	Kissenda	NA	NA	1	NA	NA	1	0.20	0.78	5	-0.57	0.20	7
	Python	-0.26	0.54	8	-1.00	0.08	4	0.14	0.78	7	0.60	0.35	5
	Makobe	0.07	0.86	10	-0.66	0.18	6	-0.45	0.23	9	-0.10	0.95	5
	Ruti	0.54	0.09	11	-0.86	<b>0.01</b>	8	0.03	1.00	6	NA	NA	1

Supplementary Table S5: Spearman correlations between body areas for $\lambda P_{50}$													
		light source: lamp						light source: sun					
		<i>P. nyererei</i>			<i>P. pundamilia</i>			<i>P. nyererei</i>			<i>P. pundamilia</i>		
		rho	p	N	rho	p	N	rho	p	N	rho	p	N
dorsal fin lappets-anal fin spot	Kissenda	NA	NA	1	NA	NA	1	-0.10	0.95	5	0.63	0.13	7
	Python	0.36	0.39	8	0.50	1.00	3	-0.07	0.91	7	0.50	0.45	5
	Makobe	0.87	0.33	3	0.03	1.00	6	-0.06	0.89	8	0.70	0.23	5
	Ruti	NA	NA	1	-0.02	0.95	8	0.54	0.30	6	NA	NA	1
dorsal fin lappets-flank	Kissenda	NA	NA	1	NA	NA	1	-0.20	0.78	5	-0.04	0.96	7
	Python	0.00	1.00	8	0.40	0.75	4	-0.32	0.50	7	0.30	0.68	5
	Makobe	0.87	0.33	3	-0.37	0.50	6	-0.24	0.57	8	-0.41	0.49	5
	Ruti	NA	NA	1	-0.61	0.11	8	-0.09	0.92	6	NA	NA	1
dorsal fin-dorsal fin edge	Kissenda	NA	NA	1	NA	NA	1	-0.70	0.23	5	0.29	0.56	7
	Python	-0.19	0.66	8	0.40	0.75	4	0.34	0.45	7	-0.30	0.68	5
	Makobe	-1.00	1.00	2	-0.12	0.83	6	-0.32	0.50	7	0.40	0.52	5
	Ruti	NA	NA	1	-0.30	0.47	8	0.66	0.18	6	NA	NA	1
dorsal fin-dorsum	Kissenda	NA	NA	1	NA	NA	1	0.90	0.08	5	0.89	0.01	7
	Python	0.57	0.12	9	-0.40	0.75	4	-0.27	0.56	7	0.90	0.08	5
	Makobe	0.48	0.24	8	0.67	0.15	6	-0.25	0.59	7	0.80	0.33	4
	Ruti	0.67	<b>0.05</b>	9	0.86	0.01	8	0.26	0.66	6	NA	NA	1
dorsal fin-anal fin spot	Kissenda	NA	NA	1	NA	NA	1	0.10	0.95	5	0.31	0.50	7
	Python	-0.55	0.17	8	0.50	1.00	3	0.49	0.27	7	-0.90	0.08	5
	Makobe	-0.58	0.11	9	0.52	0.29	6	-0.65	0.11	7	0.10	0.95	5
	Ruti	0.50	0.12	11	0.59	0.13	8	0.71	0.14	6	NA	NA	1
dorsal fin-flank	Kissenda	NA	NA	1	NA	NA	1	0.20	0.78	5	0.46	0.30	7
	Python	0.25	0.52	9	0.60	0.42	4	0.23	0.61	7	0.50	0.45	5
	Makobe	-0.08	0.85	9	0.90	0.01	6	0.05	0.91	7	0.41	0.49	5
	Ruti	0.21	<b>0.54</b>	11	0.60	0.13	8	-0.09	0.92	6	NA	NA	1
dorsum-dorsal fin lappets	Kissenda	NA	NA	1	NA	NA	1	-0.50	0.45	5	0.04	0.96	7
	Python	-0.38	0.36	8	-0.40	0.75	4	-0.61	0.17	7	0.10	0.95	5
	Makobe	NA	NA	2	-0.09	0.92	6	0.24	0.57	8	0.20	0.92	4
	Ruti	NA	NA	1	-0.19	0.65	8	0.26	0.66	6	NA	NA	1
dorsum-anal fin spot	Kissenda	NA	NA	1	NA	NA	1	-0.30	0.68	5	0.41	0.36	7
	Python	-0.36	0.39	8	0.40	0.75	4	-0.07	0.91	7	-0.70	0.23	5
	Makobe	-0.92	<b>0.00</b>	9	-0.20	0.71	6	-0.44	0.24	9	0.20	0.92	4
	Ruti	0.54	0.13	9	0.54	0.17	8	-0.09	0.92	6	NA	NA	1
dorsum-flank	Kissenda	NA	NA	1	NA	NA	1	-0.10	0.95	5	0.71	0.09	7
	Python	0.67	0.06	9	0.36	0.55	5	0.43	0.35	7	0.60	0.35	5
	Makobe	0.11	0.78	9	0.83	0.06	6	-0.03	0.93	9	0.80	0.33	4
	Ruti	0.10	0.80	9	0.42	0.30	8	0.77	0.10	6	NA	NA	1
anal fin spot-flank	Kissenda	NA	NA	1	NA	NA	1	0.50	0.45	5	0.45	0.31	7
	Python	0.12	0.79	8	0.95	0.05	4	-0.21	0.66	7	-0.60	0.35	5
	Makobe	0.41	0.24	10	0.20	0.71	6	-0.36	0.34	9	-0.67	0.22	5
	Ruti	0.38	0.25	11	0.12	<b>0.78</b>	8	0.03	1.00	6	NA	NA	1

Supplementary Table S6: descriptive statistics for the effect of using different light sources				
colour metric	species	body area	light source	
			lamp (mean $\pm$ se, N)	sunlight (mean $\pm$ se, N)
Brightness	<i>P. nyererei</i>	dorsum	646.08 $\pm$ 67.85 (28)	2897.22 $\pm$ 402.58 (27)
		dorsal fin	1982.62 $\pm$ 157.26 (32)	6265.16 $\pm$ 759.82 (25)
		dorsal fin lappets	1141.35 $\pm$ 163.4 (13)	5770.37 $\pm$ 920.09 (26)
		anal fin spot	2401.1 $\pm$ 159.56 (30)	5963.13 $\pm$ 810.37 (27)
		flank	1934.79 $\pm$ 150.32 (31)	5903.28 $\pm$ 685.93 (27)
	<i>P. pundamilia</i>	dorsum	642.07 $\pm$ 156.46 (20)	2253.07 $\pm$ 359.62 (17)
		dorsal fin	1611.3 $\pm$ 142.9 (19)	4402.05 $\pm$ 734.25 (18)
		dorsal fin lappets	767.62 $\pm$ 141.32 (19)	4282.96 $\pm$ 933.16 (18)
		anal fin spot	1498.26 $\pm$ 134.5 (19)	6187.43 $\pm$ 824.95 (18)
		flank	1796.6 $\pm$ 222.97 (20)	5082.14 $\pm$ 563.47 (18)
Chroma	<i>P. nyererei</i>	dorsum	0.3 $\pm$ 0.03 (28)	0.28 $\pm$ 0.03 (27)
		dorsal fin	0.4 $\pm$ 0.04 (32)	0.24 $\pm$ 0.04 (25)
		dorsal fin lappets	0.42 $\pm$ 0.04 (13)	0.27 $\pm$ 0.03 (26)
		anal fin spot	0.33 $\pm$ 0.02 (30)	0.15 $\pm$ 0.02 (27)
		flank	0.24 $\pm$ 0.02 (31)	0.19 $\pm$ 0.02 (27)
	<i>P. pundamilia</i>	dorsum	0.11 $\pm$ 0.02 (20)	0.09 $\pm$ 0.01 (17)
		dorsal fin	0.17 $\pm$ 0.02 (19)	0.1 $\pm$ 0.02 (18)
		dorsal fin lappets	0.38 $\pm$ 0.04 (19)	0.2 $\pm$ 0.02 (18)
		anal fin spot	0.39 $\pm$ 0.02 (19)	0.2 $\pm$ 0.02 (18)
		flank	0.17 $\pm$ 0.02 (20)	0.07 $\pm$ 0.01 (18)
$\lambda P_{50}$	<i>P. nyererei</i>	dorsum	588.29 $\pm$ 8.26 (28)	603.37 $\pm$ 5.15 (27)
		dorsal fin	596.06 $\pm$ 9.36 (32)	591.04 $\pm$ 6.14 (25)
		dorsal fin lappets	617.62 $\pm$ 4.6 (13)	599.65 $\pm$ 4.36 (26)
		anal fin spot	605.17 $\pm$ 2.93 (30)	577.59 $\pm$ 3.35 (27)
		flank	572.19 $\pm$ 3.83 (31)	578.52 $\pm$ 3.73 (27)
	<i>P. pundamilia</i>	dorsum	536.95 $\pm$ 5.03 (20)	553.94 $\pm$ 4.51 (17)
		dorsal fin	527.37 $\pm$ 4.24 (19)	535.72 $\pm$ 4.69 (18)
		dorsal fin lappets	613.74 $\pm$ 7.15 (19)	589.5 $\pm$ 5.07 (18)
		anal fin spot	615.32 $\pm$ 2.59 (19)	585.83 $\pm$ 4.33 (18)
		flank	531.5 $\pm$ 5.23 (20)	544.72 $\pm$ 3.93 (18)