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Supplement of

A comprehensive biogeochemical record and annual flux estimates for the Sabaki River (Kenya)

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Table S1. Bi-weekly monitoring data, Sabaki River: Overview of lower and upper discharge (LDE and UDE, respectively) estimates, surface water temperature (T), pH, percent dissolved oxygen (%), conductivity (Cond.), total alkalinity (TA), concentration of total suspended matter (TSM) and the contribution of particulate organic carbon (POC) to the TSM load (%POC), concentrations and carbon (C) stable isotope signatures of POC ($\delta^{13}C_{POC}$) and dissolved organic C (DOC and $\delta^{13}C_{DOC}$, respectively), concentration and nitrogen (N) stable isotope signature of particulate N (PN and $\delta^{15}N_{PN}$), concentration of total particulate phosphorus (TPP), dissolved methane (CH_4) and nitrous oxide (N_2O) concentrations and % saturation, and concentrations of ammonium (NH_4^+), nitrate (NO_3^-), and phosphate (PO_4^{3-}).

Date	Discharge LDE (m^{-3} s^{-1})	UDE	T (°C)	pH (NBS)	O_2 (%)	Cond. (µS cm^{-1})	TA (mmol kg^{-1})	TSM (mg L^{-1})	%POC (% of TSM)	POC (mg L^{-1})	$\delta^{13}C_{POC}$ (‰)	DOC (mg L^{-1})	$\delta^{13}C_{DOC}$ (‰)	PN (mg L^{-1})	$\delta^{15}N_{PN}$ (‰)	TPP (µg L^{-1})	CH_4 (nmol L^{-1})	CH_4 (%sat)	N_2O (nmol L^{-1})	N_2O (%sat)	NH_4^+-N (µmol L^{-1})	NO_3^--N (µmol L^{-1})	PO_4^{3-}-P (µmol L^{-1})
8/10/2011	21	125	31.2	8.69	100.6	1080	4.461	2658	1.6	43.6	-17.5			6.3	+14.3	204.6	314	15089					
22/10/2011	26	128	31.9	8.29	114.2	859	3.557	512	5.2	26.5	-18.5	4.6	-20.6	2.9	+14.7	123.6	147	7162	10	184			
4/11/2011	91	168	31.3	7.99	83.8	650	3.537	3797	2.0	74.6	-17.7			9.4	+11.0	220.3	249	11992					
19/11/2011	129	190	31.1	7.74	86.8	546	2.144	1603	1.8	29.2	-18.1	4.9	-18.9	3.3	+9.3	114.9	634	30426	22	403			
3/12/2011	115	182	30.3	6.91	96.0	569	2.192	826	4.0	32.7	-18.9	5.9	-22.0	3.4	+8.3	153.9	918	43498	27	463			
17/12/2011	110	179	28.9	7.15	75.0	366	1.713	1303	1.4	18.1	-18.8	3.7	-20.5	1.8	+8.4	133.5	362	16777	22	366			
29/12/2011	91	168	30.4	8.09	59.0	396	1.934	236	6.7	15.7	-19.2	8.0	-20.1	1.7	+8.6	134.1	340	16134	15	256			
17/01/2012	47	142	32.2	8.56	37.6	688	3.425	2175	0.4	8.8	-19.3	4.5	-22.9	0.9	+7.4	103.1	10	499	7	133			
3/02/2012	51	144	31.8	8.08	50.3	529	3.440	128	5.3	6.8	-23.3	5.8	-17.9	0.7	+12.8	133.2	72	3516	6	115			
18/02/2012	34	134	32.6	8.55	53.4	744	4.964	183	4.9	8.9	-23.2	3.5	-21.7	0.9	+10.2	136.8	174	8529	6	120			
3/03/2012	32	132	30.4	8.65	75.3	752	0.725	148	7.2	10.7	-20.2			1.3	+11.8	102.0	60	2851	7	122			
18/03/2012	17	122	33.9	8.41	41.0	861	0.475	972	2.0	19.0	-18.8	4.3	-21.9	1.1	+10.7	123.2	11	536	7	141			
30/03/2012	16	121	32.7	8.21	83.3	836	2.562	1206	0.5	5.6	-20.4	4.3	-21.5	0.6	+10.8	116.3	49	2409					
14/04/2012	104	176	30.6	7.30	76.0	686	1.796	1195	2.4	29.0	-18.7			2.8	+9.6	165.9	689	32807	9	167			
1/05/2012	329	312	28.9	6.60	89.0	481	2.254	880	1.7	15.1	-19.7	4.3	-21.7	1.5	+8.5	81.6	1056	48923	9	150			
15/05/2012	329	312	27.4	5.54	44.1	434	4.476	1141	0.9	10.7	-19.9	6.3	-21.7	1.2	+4.6	139.2	308	13903	8	131			
30/05/2012	72	157	26.3	5.80	73.1	123	2.266	1486	0.6	8.4	-19.8	5.5	-24.7	1.0	+6.0	124.6	301	13341	9	129			
14/06/2012	51	144	28.8	4.64	98.9	123	2.194	1769	1.0	18.3	-15.7	5.8	-24.0	2.8	+12.6	90.7	50	2312	8	134			
26/06/2012	41	138	32.3	6.45	109.7	128	2.241	520	1.3	6.7	-19.7	5.4	-29.3	0.7	+2.2	80.9	37	1789	8	148			
10/07/2012	51	144	29.9	5.65	110.4	123	2.106	477	1.2	5.7	-19.5	6.2	-28.8	0.6	+6.6	84.5	82	3881	9	150			
24/07/2012	51	144	32.3	6.59	110.1	124	2.081	473	1.1	5.1	-19.4	4.7	-22.5	0.5	+4.3	92.2	51	2507	8	154			
6/08/2012	51	144	27.2	6.47	100.7	123	2.096			5.2	-20.2				+8.4	94.4	308	13877	8	126			
20/08/2012	51	144	26.1	6.47	99.9	123	3.745	74	5.2	3.8	-20.0			0.3	-3.1	72.9	293	12954					
2/09/2012	32	132	30.8	9.24	100.6	491	3.764			18.2	-16.0	4.5	-25.0	1.8	+11.6		1819	86891	6	104			
16/09/2012	32	132	28.3	6.33	99.6	469	1.966			4.5	-21.3			0.6	+3.6		1857	85171	6	101			
30/09/2012	23	126	31	7.40	110.6	458	2.287	1217	0.3	3.5	-21.1					91.3	408	19560	6	109			

Date	Discharge LDE (m^{-3} s^{-1})	UDE	T (°C)	pH (NBS)	O_2 (%)	Cond. (µS cm^{-1})	TA (mmol kg^{-1})	TSM (mg L^{-1})	%POC (% of TSM)	POC (mg L^{-1})	$\delta^{13}C_{POC}$ (‰)	DOC (mg L^{-1})	$\delta^{13}C_{DOC}$ (‰)	PN (mg L^{-1})	$\delta^{15}N_{PN}$ (‰)	TPP (µg L^{-1})	CH_4 (nmol L^{-1})	CH_4 (%sat)	N_2O (nmol L^{-1})	N_2O (%sat)	NH_4^+-N (µmol L^{-1})	NO_3^--N (µmol L^{-1})	PO_4^{3-}-P (µmol L^{-1})
14/10/2012	123	187	28.9	6.62	96.3	486	2.245	1045	0.7	7.3	-20.7	6.7	-23.9			87.7	266	12340	7	116			
28/10/2012	32	132	30.5	6.69	102.6	446	2.212	1344	0.3	4.4	-21.8	7.2	-24.7			83.0	268	12728	7	129			
11/11/2012	329	312	28.3	6.71	98.8	134	1.816	577	1.2	6.8	-21.4	7.5	-24.0			61.2	321	14736	8	123			
25/11/2012	91	168	29.8	7.86	100.5	127	1.496	379	1.0	3.7	-21.9	7.9	-23.5			65.5	344	16183	9	149			
8/12/2012	123	187	31.6	6.78	96.4	129	2.203	1092	0.6	6.5	-21.3	6.8	-24.2			63.7	378	18289	6	117			
21/12/2012	55	147	30.3	6.66	99.1	147	2.859	1139	0.8	9.3	-19.8	3.8	-21.5	1.1	+9.6	102.0	281	13327	7	119	17.6	277.6	111.6
4/01/2013	217	241	28.6	6.47	98.3	330	2.032	667	0.9	5.8	-20.2	9.2	-24.3	0.6	+11.4	65.1	176	8125	6	103	25.0	0.0	30.2
18/01/2013	97	171	28.9	6.85	96.7	444	2.261					5.6	-20.9				177	8181	6	106	12.8	362.6	83.4
31/01/2013	32	132	32.5	6.90	98.8	476	2.399	537	1.2	6.3	-19.9	5.1	-21.7	0.7	+10.7	81.9	167	8178	6	112	10.7	506.9	89.6
15/02/2013	25	127	29.7	6.60	97.6	139	2.538	273	2.8	7.7	-19.9	6.1	-21.0	0.9	+9.1	100.2	231	10856	6	100	14.1	352.2	98.1
2/03/2013	29	131	30.6	5.82	95.7	868	2.48	233	2.8	6.6	-19.5	5.3	-21.6	0.7	+10.1	75.1	216	10263	6	109	93.8	49.6	6.5
17/03/2013	34	134	30.2	5.83		481	2.957	844	0.7	5.9	-21.1	4.7	-22.5	0.6	+8.1	113.6	154	7288	6	109	192.1	46.5	7.0
2/04/2013	413	370	28.8	6.99		864	2.38	843	1.0	8.2	-21.7	4.7	-23.3	1.1	+9.9	158.0	601	27777	12	196	8.6	58.7	1.1
16/04/2013	1110	1129	30.4	6.44		382	2.384	800	3.0	24.2	-21.7	5.6	-22.8	2.4	+10.3	115.4	600	28456	11	187	7.7	50.1	83.2
30/04/2013	252	263	29.8	6.97		733	2.583	733	0.8	6.1	-21.3	9.3	-22.5	0.6	+9.8	129.8	1057	49700	7	122	10.4	40.3	41.7
14/05/2013	152	203	28.4	7.95	99.4	485	2.638	461	3.9	17.9	-21.0	6.5	-22.1	1.8	+8.8	226.6	593	27263	11	172	16.6	21.9	7.8
30/05/2013	97	171	25.4	7.30	97.4	856	2.397	474	1.1	5.2	-20.7	5.6	-24.0	0.6	+10.4	110.1	482	21021	10	145	10.7	68.4	27.2
18/06/2013	63	152	29.6	7.86	96.0	680	2.280	630	2.5	15.6	-21.2	4.1	-22.9	1.6	+10.0	156.2	478	22388	11	179	11.8	61.5	23.4
30/06/2013	51	144	31.8	8.34	102.3	533	2.316	408	2.4	9.7	-21.9	4.7	-22.7	1.3	+10.0	256.1	660	31988	9	167	309.6	43.4	19.9
13/07/2013	51	144	30.5	6.86	98.9	558	2.408	304	1.9	5.7	-21.4	5.4	-25.0	0.6	+10.8	150.4	735	34954	9	161	12.6	70.1	72.9
31/07/2013	43	139	25.9	7.42	107.1	723	2.411	281	6.2	17.3	-15.9	3.9	-22.7	1.7	+12.4	232.8	524	23071	10	145	11.1	66.2	237.1
16/08/2013	51	144	27.5	10.10	130	419	1.232	472	3.0	14.2	-14.5	3.3	-20.7	1.9	+15.6	169.6	784	35482	9	135	7.1	0.0	4.5
29/08/2013	51	144	30.6	7.55	23.3	402	1.458	50	14.9	7.4	-15.9			1.1	+15.9	135.3	2838	135111	8	137	126.6	0.0	46.1
16/09/2013	47	142	30.9	8.08	46.0	460	1.33	1238	1.3	16.7	-18.1	6.7	-19.1	2.0	+10.7	112.7	1200	57417	7	130	27.4	19.4	222.6
2/10/2013	47	142	24.1	7.10	56.6	113															89.3	86.9	322.6
16/10/2013	43	139	32.1		77.5	696															8.1	73.8	161.3
30/10/2013	17	122	29.8	5.17	95.1	676															82.1	74.7	222.6
15/11/2013	123	187	30.5	5.06	96.3	682															82.9	72.9	245.2
30/11/2013	123	187	28.9	8.06	88.8	736															27.5	24.4	104.5
14/12/2013	1048	1036	28	6.68	89.0	310															86.9	10.6	17.9

Table S2. Annual fluxes and yields for lower and upper discharge estimates (LDE and UDE, respectively) from the Athi-Galana-Sabaki river basin. Mean annual discharge rates are presented with median values in closed brackets. Measured parameters include total suspended matter (TSM), particulate and dissolved organic carbon (POC and DOC, respectively), particulate nitrogen and organic phosphate (PN and POP, respectively), dissolved nutrient fractions of ammonium (NH_4^+), nitrate (NO_3^-), and phosphorus (PO_4^{3-}), as well as the proportional contribution of POC to the TSM pool, and likewise DOC to the total organic carbon pool, and the ratio of POC to PN.

	2011 – 2012		2012 – 2013	
	LDE	UDE	LDE	UDE
Discharge ($m^3\ s^{-1}$)[a]	140 (51)	228 (144)	138 (55)	218 (147)
Discharge ($m^3\ s^{-1}$)[b]			161 (51)	237 (144)
Flux		($Tg\ yr^{-1}$)		
TSM	4.7	7.5	3.2	4.9
		($Gg\ yr^{-1}$)		
POC	85.51	129.85	55.72	81.26
DOC	21.79	35.51	26.49	40.51
PN	9.01	13.96	6.03	8.96
POP	0.53	0.86	0.53	0.84
NH_4^+			2.31	4.11
NO_3^-			4.33	7.74
PO_4^{3-}			11.15	18.66
%POC (of TSM)	1.8	1.7	1.7	1.7
POC:PN	9.5	9.3	9.2	9.1
%DOC (of TOC)	20	21	32	33
Yield		($Mg\ km^{-2}\ yr^{-1}$)		
TSM	100.70	159.73	68.44	104.11
POC	1.83	2.78	1.19	1.74
DOC	0.47	0.76	0.57	0.87
		($kg\ km^{-2}\ yr^{-1}$)		
PN	192.6	298.7	129.0	191.6
POP	11.4	18.4	11.4	18.0
NH_4^+			49.4	87.8
NO_3^-			92.7	165.6
PO_4^{3-}			238.5	399.2

[a] All fractions except dissolved N and P: hydrological years 1st October 2011 to 30th September 2012 and 1st October 2012 to 30th September 2013.
[b] Dissolved N and P only: hydrological year 21st December 2012 to 14th December 2013.

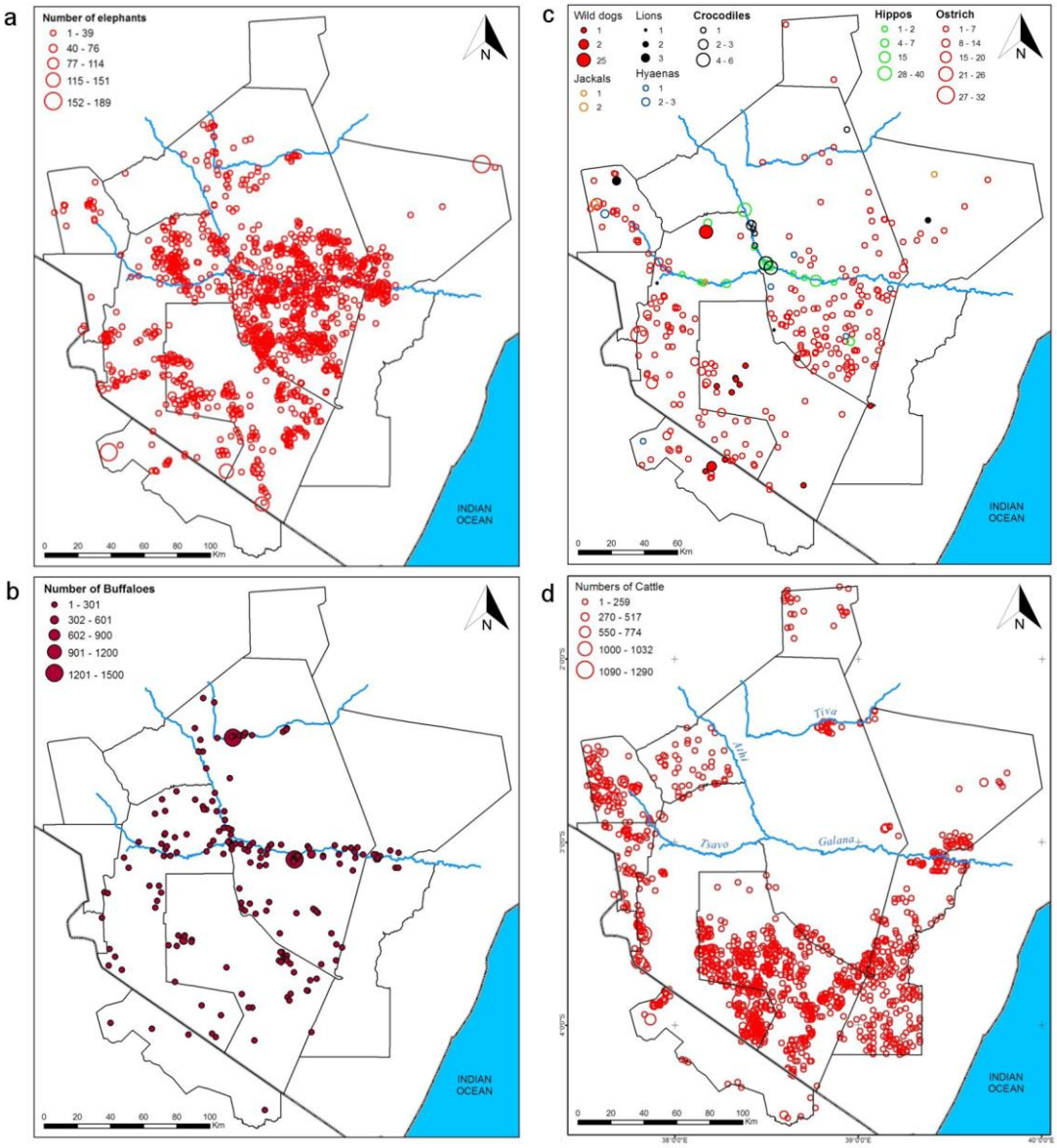

Figure S1. Aerial census results for large mammals in the Tsavo-Mkomazi ecosystem, including (a) elephants, (b) buffalo, (c) hippopotami and other wildlife, and (d) cattle. The blue line represents rivers, with the Athi, Tsavo, and Galana rivers labelled in (d). (adapted from Ngene et al. (2011)).