

Supplementary Material

Anthropogenic Impact on Tropical Perennial River in South India: Snapshot of Carbon Dynamics and Bacterial Community Composition

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Table S1. Spearman rank order correlation analysis of measured variables at sampling stations and relative bacterial abundances (%) along Cauvery river basin during January 2019. Distance refers to distance from the source. **Correlation was significant at 0.01 level (two-tailed). *Correlation was significant at 0.05 level (two-tailed). No correlations were found for relative bacterial abundances and T and TOC.

Relative Abundance (%)	Distance	pH	EC	DO	pCO ₂	DIC	pCH ₄
Actinobacteria					-0.51*		
Armatimonadetes							
Bacteroidetes							
Chlamydiae				-0.48*			-0.51*
Chlorobi							
Chloroflexi							
Cyanobacteria	0.50*	0.68**		0.51*	-0.82**	0.60**	
Fusobacteria							
Planctomycetes							
Proteobacteria							
Spirochaetes							
Verrucomicrobia							
Unclassified							
Others		0.56*		0.52*	0.66**		

Table S2. OUT abundance of bacterial phyla at 17 stations along the Cauvery River. The group ‘others’ comprised rare phyla with less than 0.5% of the total bacterial community in a given sample.

Phylum/Stations	S1	S2	S3	S4	S5	S6	S8	S10	S11	S12	S13	S16	S18	S19	S20	S22	S23
Actinobacteria	25,486,500	0	184,788,000	236,356,000	367,421,300	236,753,900	310,643,200	180,614,140	135,460,400	369,695,900	182,248,800	162,105,940	313,116,400	215,834,900	217,265,000	349,055,200	251,169,700
Armatimonadetes	4,758,000	0	6,056,900	0	6,543,200	0	1,926,400	0	0	0	0	4,236,890	0	1,248,200	0	0	1,542,000
Bacteroidetes	37,924,500	2,685,900	125,343,700	56,090,000	140,700,100	58,106,600	100,372,100	26,588,120	28,467,800	81,797,600	193,177,200	21,552,820	19,341,900	34,653,400	69,765,200	62,329,700	81,633,800
Chlamydiae	0	0	2,350,000	0	0	0	15,167,700	0	31,200,900	0	2,151,000	0.84239	0	2,496,400	0	0	0
Chlorobi	0	0	0	0	0	0	12,618,700	0	0	5,844,000	2,440,900	0	2,047,800	0	0	2,976,900	8,320,400
Chloroflexi	0	0	0	0	3,851,400	0	14,037,900	2,616,500	3,726,600	1,599,500	2,151,000	3,897,870	3,379,100	4,265,300	10,983,800	5,126,300	10,354,500
Cyanobacteria	15,016,700	0	24,118,900	37,431,800	88,987,900	111,552,700	117,237,200	37,038,700	33,057,500	8,248,100	42,231,100	10,556,520	60,734,400	159,195,900	161,038,400	100,503,500	113,214,000
Fusobacteria	0	2,685,900	0	4,163,000	0	0	1,926,400	0	0	0	0	0	0	0	1,585,000	0	0
Planctomycetes	0	0	0	0	3,690,900	0	37,799,600	0.89176	5,761,500	4,352,500	0	0.84239	2,047,800	6,102,600	5,491,800	2,149,400	28,417,500
Proteobacteria	938,808,300	169,102,200	873,090,300	993,775,100	1.361 × 10 ⁹	1.04 × 10 ⁹	327,620,300	1.812 × 10 ⁹	772,718,700	1.456 × 10 ⁹	1.085 × 10 ⁹	1.247 × 10 ⁹	750,846,500	1.211 × 10 ⁹	806,590,800	775,860,400	832,425,000
Spirochaetes	0	2,685,900	0	0	0	0	272,3000	0	0	0	0	0	2,861,900	2,496,400	1,585,000	0	3,084,000
Verrucomicrobia	0	0	24,351,100	21,249,400	52,165,800	5,031,300	40,198,400	3,567,040	10,154,700	19,790,300	2,151,000	28,603,350	8,191,200	12,686,500	1,1095,000	8,181,000	59,888,300
Unassigned other:	117,537,400	349,167,000	75,478,700	109,461,600	329,273,000	313,499,600	247,537,000	358,567,360	330,039,100	415,295,800	471,061,600	477,632,090	214,351,500	417,490,200	233,156,800	182,078,800	350,702,700
Firmicutes	0	0	0	0	0	0	0	0.89176	1,503,300	1,010,900	3,226,500	0.84239	0	1,248,200	3,170,000	0	7,710,000
GN02	0	0	0	0	0	0	0	0	0	1,010,900	0	0	0	0	3,170,000	0	0
TM6	0	0	0	0	1,283,800	0	2723,000	0	0	0	0	0	0	0	3,170,000	0	1,542,000
TM7	0	0	0	0	1,283,800	0	7,895,100	0	6,693,800	0	2,760,200	0.84239	0	1,248,200	3,170,000	0	5,022,200
Acidobacteria	2,379,000	0	0	0	1,283,800	0	3,852,800	0	3,006,600	0	2,151,000	6,739,120	0	2,496,400	3,170,000	0	4,626,000
WS3	0	0	0	0	0	0	1,926,400	0	0	0	0	0	0	1,248,200	0	0	0
ZB3	0	0	0	0	0	0	3,852,800	0	0	0	0	0	0	0	0	0	0
LD1	0	0	0	0	0	0	0	0	0	0	1,075,500	0	2,047,800	0	0	0	0
OD1	0	0	2,350,000	0	3,851,400	0	3,852,800	0	0	1,010,900	0	0	0	3,744,600	4,755,000	0	1,542,000
OP3	0	0	0	0	0	0	0	0	0	0	0	0	0	1,248,200	0	0	0
Gemmatimonadetes	0	0	0	0	1,283,800	5,786,000	1,926,400	0	0	0	0	0.84239	0	1,248,200	1,585,000	0	5,022,200

Table S3. Relative OUT abundance of bacterial phyla at 17 stations along the Cauvery River. The group ‘others’ comprised rare phyla with less than 0.5% of the total bacterial community in a given sample.

Station	Actinobacteria	Armatimonadetes	Bacteroidetes	Chlamydiae	Chlorobi	Chloroflexi	Cyanobacteria	Fusobacteria	Planctomycetes	Proteobacteria	Spirochaetes	Verrucomicrobia	Unclassified	Others
S1	2.20%	0.40%	3.30%	0.00%	0.00%	0.00%	1.30%	0.00%	0.00%	82.20%	0.00%	0.00%	10.30%	0.20%
S2	0.00%	0.00%	0.50%	0.00%	0.00%	0.00%	0.00%	0.50%	0.00%	32.10%	0.50%	0.00%	66.30%	0.00%
S3	14.00%	0.50%	9.50%	0.20%	0.00%	0.00%	1.80%	0.00%	0.00%	66.20%	0.00%	1.80%	5.70%	0.20%
S4	16.20%	0.00%	3.80%	0.00%	0.00%	0.00%	2.60%	0.30%	0.00%	68.10%	0.00%	1.50%	7.50%	0.00%
S5	15.60%	0.30%	6.00%	0.00%	0.00%	0.20%	3.80%	0.00%	0.20%	57.60%	0.00%	2.20%	13.90%	0.60%
S6	13.40%	0.00%	3.30%	0.00%	0.00%	0.00%	6.30%	0.00%	0.00%	58.70%	0.00%	0.30%	17.70%	0.30%
S8	24.70%	0.20%	8.00%	1.20%	1.00%	1.10%	9.30%	0.20%	3.00%	26.10%	0.20%	3.20%	19.70%	2.10%
S10	7.50%	0.00%	1.10%	0.00%	0.00%	0.10%	1.50%	0.00%	0.00%	74.80%	0.00%	0.10%	14.80%	0.00%
S11	9.90%	0.00%	2.10%	2.30%	0.00%	0.30%	2.40%	0.00%	0.40%	56.70%	0.00%	0.70%	24.20%	0.80%
S12	15.60%	0.00%	3.50%	0.00%	0.20%	0.10%	0.30%	0.00%	0.20%	61.50%	0.00%	0.80%	17.60%	0.00%
S13	9.20%	0.00%	9.70%	0.10%	0.10%	0.10%	2.10%	0.00%	0.00%	54.50%	0.00%	0.10%	23.70%	0.40%
S16	8.20%	0.20%	1.10%	0.00%	0.00%	0.20%	0.50%	0.00%	0.00%	63.40%	0.00%	1.50%	24.30%	0.30%
S18	22.70%	0.00%	1.40%	0.00%	0.10%	0.20%	4.40%	0.00%	0.10%	54.50%	0.20%	0.60%	15.60%	0.00%
S19	10.40%	0.10%	1.70%	0.10%	0.00%	0.20%	7.70%	0.00%	0.30%	58.20%	0.10%	0.60%	20.10%	0.80%
S20	14.10%	0.00%	4.50%	0.00%	0.00%	0.70%	10.50%	0.10%	0.40%	52.40%	0.10%	0.70%	15.10%	1.40%
S22	23.50%	0.00%	4.20%	0.00%	0.20%	0.30%	6.80%	0.00%	0.10%	52.10%	0.00%	0.50%	12.20%	0.00%
S23	14.20%	0.10%	4.60%	0.00%	0.50%	0.60%	6.40%	0.00%	1.60%	47.10%	0.20%	3.40%	19.90%	1.50%

Table S4. Chemical and geographical coordinates (latitude and longitude), distance (of other stations from Station 1, point of origin), elevation (in m a.s.l.), place of importance, temperature (°C), dissolved inorganic carbon concentration (DIC, mmol L⁻¹), and total organic carbon concentration (TOC, mg L⁻¹), pCH₄, pCO₂, dissolved oxygen DO, and electrical conductivity (EC), pH and elevation of each station along the Cauvery River basin, India, during winter (January 2016). Station no = station number; DfS = Distance from Source (in km); NA = Not available.

Station no	Sampling station	Date/Time	Latitude	Longitude	Distance between Stations (km)	Distance from 1. Station	Elevation (m)	pH	Temperature (°C)	EC (µS)	DO (mg/L)	CO ₂ (umol/L)	pCO ₂ ± SD	DIC (umol/L)	DIC ± SD	CH ₄ (umol/L)	CH ₄ ± SD	TOC (mg/L)
1	Tala Kaveri	19 January 2016 06:17	12.429065	75.778851	0	0	1260	6.74	22.50	63.50	6.50	168,749	35,529	671.9	184.6	0.75	0.25	15.7
2	Bhagamandala	19 January 2016 07:01	12.384406	75.533703	27.11	27	881	7.21	20.70	42.30	7.85	112,659	5185	706.4	94.1	0.56	0.40	11.1
3	Kondangeri	19 January 2016 10:11	12.302576	75.793159	29.64	57	863	7.67	23.70	60.70	7.70	44,728	4613	565.6	160.3	0.32	0.04	10.8
4	Siddapura	19 January 2016 11:32	12.305524	75.868617	8.21	65	849	7.60	23.70	71.90	7.71	34,439	2108	1052.2	80.5	0.21	0.04	8.8
5	Kanive	19 January 2016 12:57	12.508369	75.962233	24.64	90	822	8.20	24.00	119.00	8.27	15,192	4173	1161.7	217.0	0.29	0.22	29.0
6	Yedathore	20 January 2016 04:35	12.468035	76.391969	46.93	137	749	8.29	24.10	377.00	7.76	48,300	4848	2948.5	131.6	0.29	0.01	11.9
7	Hunnavali	20 January 2016 06:06	12.418893	76.480502	11.05	148	751	8.79	25.10	399.00	8.82	24,626	14,237	2891.0	249.1	0.27	0.01	10.7
8	KRS Dam	20 January 2016 07:28	12.424884	76.581608	11.01	159	734	8.52	24.30	296.00	8.56	17,778	3107	2255.2	193.4	0.21	0.01	10.8
9	T. Narasipura	20 January 2016 09:27	12.225215	76.908996	41.9	200	666	8.37	25.60	392.70	7.69	37,334	1884	2885.6	108.9	0.34	0.01	17.2
10	Shivanasamudra	20 January 2016 11:34	12.260447	77.170415	28.71	229	619	8.55	25.70	469.20	8.34	32,617	2045	3462.0	120.8	0.29	0.01	13.6
11	Mettur Dam	21 January 2016 04:57	11.797182	77.807326	86.23	315	198	8.65	26.10	449.00	8.53	23,083	23,631	1347.4	205.3	0.01	0.01	16.7
12	Bhavani	21 January 2016 05:15	11.431789	77.682326	42.66	358	165	7.93	27.80	462.00	4.82	90,880	17,398	1245.4	250.8	0.93	0.06	11.4
13	Pallipalayam	21 January 2016 05:18	11.364104	77.739351	9.74	368	159	8.44	28.00	513.60	4.50	45,748	6716	1127.6	100.6	2.30	0.21	10.6
14	Unjalur	21 January 2016 07:20	11.128925	77.879335	30.17	398	142	8.63	28.40	457.40	8.45	23,384	1784	1216.6	654.3	0.11	0.03	5.9
15	Paramathy Velur	21 January 2016 07:33	11.094799	78.006123	14.36	412	116	8.66	29.50	647.00	9.48	24,024	12,488	918.8	180.7	0.16	0.02	13.1
16	Mohanur	21 January 2016 08:22	11.052458	78.135368	14.88	427	110	8.36	28.60	625.00	7.61	48,893	3658	1083.4	365.7	0.44	0.03	11.0
17	Kulithalai	21 January 2016 10:02	10.58998	78.30654	54.47	482	88	8.42	26.90	550.70	7.70	60,142	10,220	1260.0	849.7	0.27	0.01	7.5
18	Jeeyapuram	22 January 2016 07:02	10.873914	78.613688	45.99	528	74	8.46	28.70	548.60	7.59	36,874	5385	1541.5	179.0	0.26	0.01	12.8
19	Thangaiyan Temple, Trichy	21 January 2016 12:40	10.840277	78.714369	11.62	539	66	8.71	29.60	533.60	9.11	11,761	3044	2970.8	146.0	0.28	0.10	8.8
20	Grand Anaicut	22 January 2016 05:54	10.831584	78.82052	11.65	551	60	8.83	28.60	536.90	8.25	7905	2677	1339.0	270.9	0.06	0.01	17.9
21	Thiruvaiyaru	22 January 2016 09:28	10.879106	79.109731	15.33	566	43	8.72	30.30	555.30	8.28	15,403	2081	1672.2	116.3	0.42	0.04	12.2
22	Melacavery, Kumbakonam	22 January 2016 10:42	10.966264	79.365665	29.59	596	31	8.65	28.60	546.20	8.03	8173	9981	1422.5	82.4	2.76	0.27	6.2
23	Chettimandapam, Kumbakonam	22 January 2016 12:24	10.979208	79.400201	4.04	600	28	8.60	28.20	542.20	7.20	29,811	5544	2009.6	379.0	2.22	0.12	8.6

Table S5. Most abundant pharmaceuticals found in water at five different stations of the Cauvery River. a) Carbamazepine, triclosan, propylparaben (preservatives), and phenol are essential for the production of polycarbonates, detergents, herbicides, and pharmaceutical drugs. b) Pharmaceuticals used as analgesic, antipyretic (Ibuprofen, Paracetamol), anti-inflammatory (Ibuprofen), and nonsteroidal anti-inflammatory drugs (NSAR) for rheumatic, analgesic, and antipyretic treatments (Naproxen) and analgesic and anti-inflammatory application (Diclofenac). Pharmaceuticals of station 1 were below the detection limit and therefore not included in the figure.

Station no	Ibuprofen (ng/L)	Paracetamol (ng/L)	Naproxen (ng/L)	Triclosan (ng/L)	Diclofenac (ng/L)	Carbamazepine (ng/L)	Propylparaben (ng/L)	Nonyl-Phenol (ng/L)	4-Octyl-Phenol (ng/L)
2	199	497	850	492	0	0	0	198	415
9	398	492	1624	0	0	8337	269	170	298
10	142	815	0	0	1280	0	224	176	408
11	140	938	513	0	0	799	0	0	12