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Status of River Cauvery – Water Quality and Riverine Environment

By A. K. Das, D. N. Singh, D. S. Krishnarao, S. Manoharan, M. Naskar & J. Canciyal

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Keywords: *cauvery river, ecology, limno-chemistry, productivity, riverine eco-health.*

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Strictly as per the compliance and regulations of:

Status of River Cauvery – Water Quality and Riverine Environment

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I. Introduction

The most vibrant sector under the umbrella of 'Agriculture' is the aquaculture and fisheries sector in India contributing 6.11% to Agriculture GDP and 1.12% of National GDP with annual increment at 7.11% growth achieved in 2018-19 having all time high production of 13.646 million tonne (mt) of Fish, with major share from inland resources (68%) (GOI, 2020). Imbibing with the spectacular rise in this sector that are providing nutritional security (9.5 kg fish consumption per capita per year) to around 60% of 137.44 crores Indian populace with direct involvement of 15 million fishers and fish farming communities, Govt of India has opened up a new Directorate of Fisheries in February, 2019 under Ministry of Agriculture & Farmers' Welfare with an immediate budget layout of more than Rs. 10,000 crores – Rs. 3,000 crores for 'Blue Revolution Schemes' and Rs. 7,322 crores as Fisheries Infrastructure Development Fund (IFDF) and subsequently a separate ministry '*Ministry of Fisheries, Animal Husbandry and Dairying'* as to strengthening the sector in a more pragmatic way.

Though, India is blessed with unique inland open water resources under diversified geographical locations, is in declining trend in capture fisheries from our rivers is obvious with intense anthropogenic interventions resulting in habitat loss, therby many fish species have become highly endangered associated with target species for capture. Habitat destruction (Cuizhang *et al*., 2003), heavy siltation, water demand abstraction for industries, irrigation (Szollosi-Nagy, 2004), faulty river embankment strategies for flood control, rapid urbanization, pollution (Lima-Junior *et al*., 2006)., construction of dams, barrages, anicuts, weirs obstructing migration of fishes coupled with over exploitation and unscrupulous fishing practices, invasion of exotics (Copp *et al*, 2005) gets further aggravated with global climate change (Leveque *et al*., 2005; Mas-Marti *et al*, 2010). The present communication, first of its kind has been explored from origin of R. Cauvery to confluence at BoB (into two stretches) to unravel its eco-physiography, limno-chemical profile, biotic components, pollution scenario. Data thus collected was processed through different statistical tools to have conspicuous relationship with the abiotic and biotic components, productivity, a modest attempt to unravel the present ecology of this important peninsular river having a peep through in assessing the environmental flow to sustain riverine eco-health and fishery.

R. cauvery is fed with more than 15 tributaries, the important ones in Karnataka stretch, joining on the left are Harangi, Hemavathi, Shimsha and Arkavathi while on the right are Lakshmanatirtha, Lokapavani, Kapila, Honnuhole, Suvarnavathi and Kabini; barring Shimsha and Arkavathi, all the tributaries rise in Western Ghats characterized by dense forest and high rainfall and all the tributaries (except Lakshmanathirta) have impoundment constructed on them diverting less water to the main R. Cauvery other than monsoon; while Bhavani, Amaravathi, Noyyal etc. are in Tamil Nadu joining from the left, diverting substantial volume of water into the main river specially in monsoon as almost all the tributaries do have dams and in Cauvery basin there are 96 dams and 11 wiers (CWC, 2020) abstracting huge volume water. Cauvery receives run-off water from its total catchment of 89,600 km^2 and a mean rainfall of 1560 mm, the run-off contribution per unit of catchment is about 0.140 MCM/Km^2.

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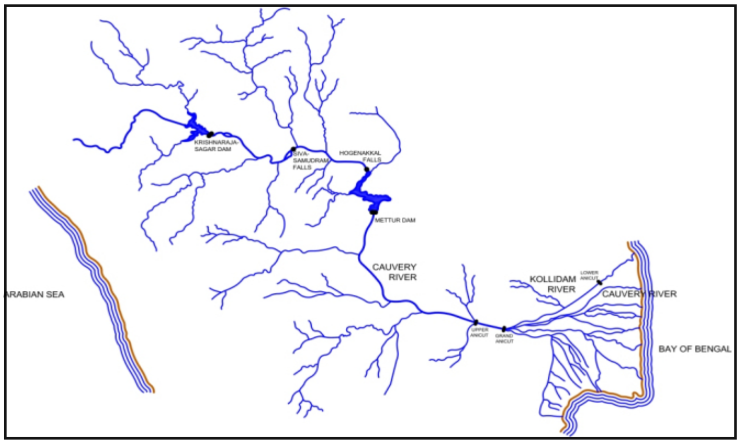
II. Cauvery River Basin



(Source: URL. https://sandrp.in/tag/grand-anicut/)

Fig.1: River Cauvery

a) *Sampling programme and methodology*

River course was divided into two stretches – upper stretch (Karnataka) and lower stretch (Tamil Nadu). In the first stretch R. Cauvery from its origin point at Talacauvery to Arkavathi Sangama near Kanakpura in Karnataka spreading over 300 km in length was chosen with 10 sampling stations viz., Bhagamandala, Kannege, Koodige, Ramnathapuram, K.R.Nagar, Srirangapatnam, T. Narasipur, Muduthere, Talakadu and Mekedatu while in the second stretch the sampling stations (14 nos) in Tamil Nadu were – Hogenakkal, Mettur, Bhavani, Thirumukkudal (Karur), Upper Anicut, Grand Anicut (Thiruvayur), Kumbakonam-Cauvery, Kumbakonam-Coleroon, Kollidam, Grand Anicut Canal, Vettaru, Vennaru, Palaiyar and Poompuhar, selected basically based on domestic, agricultural and industrial activities in the vicinity of river basin, recreation and ritual practices with the river body and also river - tributaries confluence points (Fig 1). Geographical details of the sampling locations and possible sources of contamination are given in Table 1. Samplings were also done in tributaries at the site in the upstream of confluence point. At each centre, sampling was done for various limnological parameters and assessment of phytoplankton primary production.

Samplings were done during 2001-02 covering post-monsoon (POM, Oct-Nov), pre-monsoon (PRM, May-June) and monsoon (MON, September). All samples were collected at 9.00 am. Sediment samples were collected from five to six locations across the river from each sub secotor randomly. Barring nutrients, other physico-chemical features of water were analysed *in situ* subsequently after collections. Water samples were preserved with respective preservatives and analysed in the laboratory without much time lag. Chemical analyses of water were performed following 'Standard Methods' (APHA, 2002) and soil analysis by Standard Methods (Tandon, 1993). The primary production was estimated up to one meter depth using dark and light technique (Vollenweider, 1969) keeping incubation period of 4 hrs (10 to 14 hrs). Plankton samples were collected both from sub-surface and preserved with Lugol's iodine solution. The drop-count method was used (APHA, 2002) for planktonic enumeration. Benthic and periphytic samples were collected following APHA (2002).

III. Statistical Analysis

For statistical analysis, several multivariate analyses (Buyan, 2005) were carried out to characterize the environment, species community structure and their plausible interaction to be reflected in management aspects (Lee et al., 2001; Regunath et al., 2002; Singh et al., 2006; Hayal and Hiilya, 2009; Pejman et al., 2009). The multivariate canonical correlation analysis was carried out to investigate the relationship between water quality and soil quality parameters. The hierarchical cluster analysis based on euclidean distance measure was applied to classify sampling sites according to environmental distance. One of the aims in the present study was to evaluate the influence of soil-water parameters on the productivity. To accomplish this, the immediate choice was to carry out the classical multiple regression. To circumvent this problem, Partial Least Square Regression (PLS) method (Marten, 2001) has been applied. Essentially, all the soil-water quality parameters were designated as predictor variables, and GPP was designated as response variable, to carry out PLS regression. The method quantifies the contribution of soil-water quality on GPP as well as derives latent variables (components) that explains reasonable amount of variability of the soil-water parameters. Selection of optimum number of components is the key to effective implementation of PLS method, and it has been selected by using the Root Mean Square Error of

Prediction (RMSEP) criterion with Leave-One-Out (LOO) cross validation. Thereafter, the PLS was fitted with the selected number of components. Finally, relative contribution of each variable is computed by using following formulae:

$$RC_j = \frac{b_j^2}{\sum_{j=1}^{p} b_j^2};$$

Where, bj is the standardized estimate of the j-th regression coefficients. The 'PLS' package (Mevik et al., 2019) under R software (R Core Team, 2019) environment was used to implement the PLS method.

IV. Physical Features

Depth and width: The catchment of R. Cauvery at Brhamagiri hills (1355m asl) is under Western Ghats (12°25′N) which is covered with evergreen deep forest with forest origin red soil. At Bhagamandala, 19 km down to Talakaveray, the river is 4-6 m width with 2-3 m depth in monsoon with steep gushing of water but in post-monsoon it is narrowed don to 2-3 m width having sheet flow. The river width is maximum in the downstream after Shivasamudram onwards up to Karur. Kannige, the first tributary, however, even with low volume of water being diverted into main river, the tributaries of R. cauvery are exerting tremendous impact on the sediment and water chemistry of the main river which are more vivid during monsoons (Table 1).

Temperature: Ambient water temperature (WT,°C) fluctuated sinusoidally keeping parity with air temperature, varied from a low of 20 & 26°C to a high 30° & 30.5°C in the first and second stretches respectively. However, the mean annual temperature fluctuated over a wide range of 22-29.5°C in the entire river system of Cauvery. Accordingly, higher WT was noticed in PRM (25.0-31.0) followed by MON (21.0-30.5) and POM (20.0-29.4) in the entire river course. More temperature was encounter in the riverine sheet flow compared to deeper waters (lotic of downstream reservoirs, anicuts, barrages etc.) even in the same season. As R. Cauvery basin especially in Karnataka is predominantly covered with forest origin red soil having low heat retentive capacity getting reflected in the ambient water rendering low water temperature unlike other Indian rivers.

Transparency: Maximum water transparency (Secchi-depth, cm) was noticed in PRM with bottom exposed in many occasions followed by POM (22.0-140.0) and lowest in MON (20.5-135.0) in the entire river course. Due to sheet flow of water during summer in some sampling sites both in the up- and down-streams, bottom was viewed (exposed). However, transparency was very high in pre-monsoon months in most of the sampling sites in the entire river course due to quicker sedimentation of red soil (colloid micelles) especially in the up-stream with reduced flow and stable condition. Statistical analysis by the boxplot reflects, temperature and transparency significantly differs from summer than monsoon and post monsoon season.

Sediment characteristics: Soil in R. Cauvery basin is red in Karnataka stretch while it is alluviam and sandy in Tamil Nadu stretch. River bed is rocky at some parts of Kudige, Ramnathpuram, Srirangapatnam, Sivasamudram, Mekedatu and Hogenakkal in the upper stretch. Soil texture is generally sandy to sandy-loam in the entire river stretch with predominance of sand in the down stretch. Both in stretch I and II, structure of the river bed has been modified due to reservoirs, barrages and weirs. Intense agricultural activities around the riverine catchment have their impact to some extent in modifying the texture of basin soil in both the stretches. Soil reaction was low in the up-stream 5.74-7.8, 5.95-6.95 and 4.08-6.81 while these values were increased gradually towards downstream 7.66-8.32, 7.13-8.28 and 6.25-7.50 in PRM, MON and PRM respectively. Moderate values of specific conductance ($mScm^{-1}$) were also noticed in the entire river course (0.062-1.26), (0.11-1.94) and (0.09-1.51) in PRM, MON and MON respectively. Organic carbon content (%) was fairly rich in MON (0.20-2.26) and POM (0.20-2.05) than PRM (0.02-1.75). More C/N ratio was encountered in MON (3-48) followed by POM (1-40) and PRM (4-36) in the entire stretch with low values in estuarine parts. Available nitrogen was in moderate range (mg/100 g) 3.40-37.50, 2.80-44.80 and 2.50-82.50 in PRM, MON and POM respectively. Available-P (mg/100 g) was fairly moderate in R. cauvery like other Indian rivers and ranged from 0.47-16.97, 0.32-14.75 and 0.38-8.50 in MON, POM and PRM respectively.

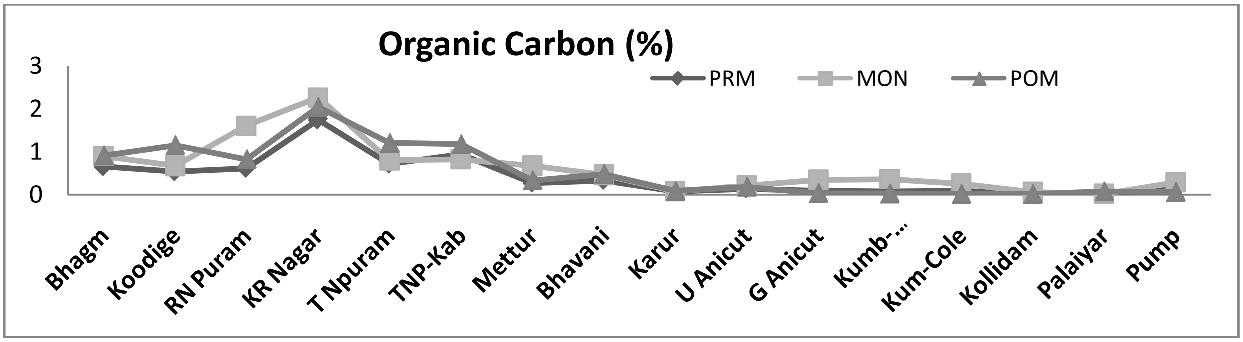


Fig. 2: Organic matter in sediment of R. Cauvery

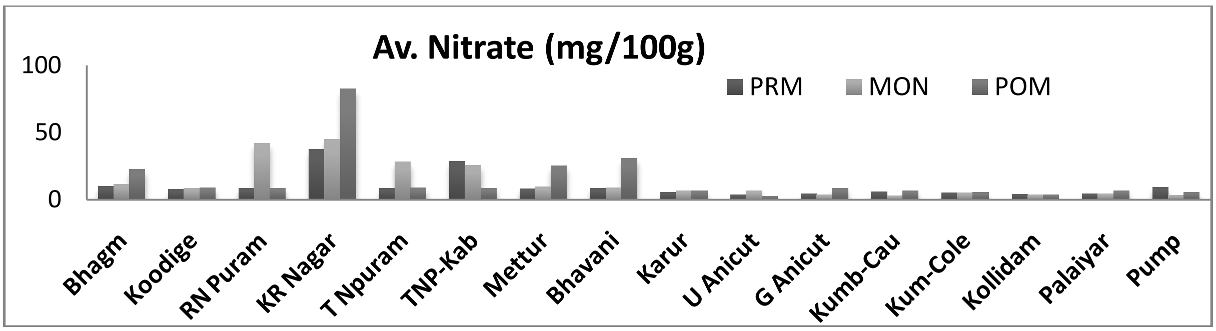


Fig. 3: Available nitrogen in sediment of R. Cauvery

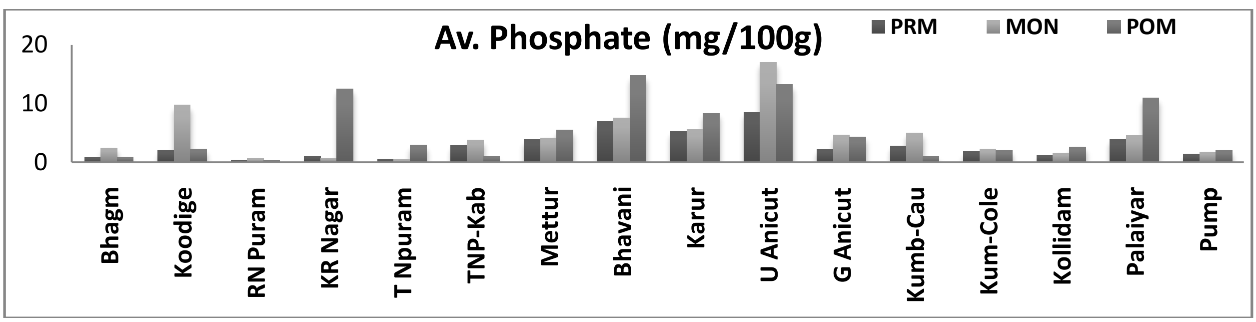


Fig. 4: Available phosphate in sediment of R. Cauvery

V. Limno-Chemical Features of Water

Water reaction was moderately acidic to near neutral in the upper four sampling sites (pH 6.07-7.17) at Coorg district, Karnataka due to innate character of catchment predominatly covered with forest origin red soil. Neutral (pH 6.79) to moderately alkaline (pH 8.6) is followed after that in the entire river stretch. In general, pH was low in MON (6.00-8.50) followed by POM (6.18-8.60) and in slightly higher order during PRM (6.07-8.50). Sp. conductance (μScm^{-1}) was on increasing trend from the origin with higher values noticed in the down-stream and fluctuated widely in tributaries; more in PRM (90-2870) followed by POM (60-2210) and lowest in MON (28-2130). Pumpuhar, the extreme lowest estuarine centre in the south showed highest values of sp. conductance (2870, 2210 & 2130 μScm^{-1} in PRM, POM and MON respectively). Total dissolved salts followed the same trend as observed for specific conductance.

Amongst dissolved gases, DO was moderately rich in R. Cauvery water in many sampling sites. The lowest DO (mgl^{-1}) recorded at Mettur outfall (4.0) in PRM with highest at Hogenakkal (8.7) in POM in this study. Free CO_2 (mgl^{-1}) remained absent in the downstream from Sivasamudram onwards barring Hogenakkal (3.0) in monsoon, in all the seasons; first four sampling sites in Coorg, Karnataka, it was found to the tune of 2.0-8.0 year round due to forest cover in the catchment. Like river Krishna (Das et al, 2017) high total aklinity with predominant presence of carbonates was encountered in the entire Tamil ndu strch of R. Cauvery irresepective ofseasons to the tune of 166-320 mgl^{-1} barring few sampling sites. Very low alkalinity was noticed inthe extreme two stations Bhagamandala and Kannege (6-34 mgl^{-1}) after which it is in increasing order. Total hardness (TH, mgl^{-1}) also follos the same pattern as of total alkalinity, more in the Tamil Nadu stretch (104-237) barring Hogenakkal (60) and Mettur lotic (84) in monsoon. The estuarine sites showed higher values of hardness (680-3670) due to saline water ingress. Calcium content (mgl^{-1}) was moderately rich in Cauvery, like Krishna (Das et al, 2017) registered low values in MON (1.25-25.65) and PRM (4.00-33.14) as compared to PRM (3.38-44.89). Magnesium content (mgl^{-1}) also was moderately rich and ranged from 1.94-48.78 in the entire river stretch during the study period barring Uppar Anicut (PRM 112.22); the estuarine parts recorded highest Ca and Mg content (66.18-917.83 & 74.52-700.00 mgl^{-1}) irrestpective of seasons. In many occasions, the results were in agreement with the findings of Jayaram 2000, Begum 2008, Venkatesharaju et al. 2010, Shivakumar et al. 2014, and Sivakumar et al. 2017.

Local pollution was not well pronounced in R. Cauvery other than Mekedatu, the last sampling station in Karnataka where tributary Arkavathy confluences with R. Cauvery diverting local sewage in the river as getting reflected in chloride content (mgl^{-1}) to the tune of 127.80, 38.89 & 138.00 in PRM, MON & POM seasons. In general moderate values of chloride (mgl^{-1}) were encountered in R. Cauvery more pronounced in POM (14.20-49.40) followed by PRM (10.94-41.40) and MON (12.70-54.80). Palaiyar (120-178) and Pumpuhar (138-166) registered the highest values of chloride) in all the above three seasons respectively due to estuarine parts.

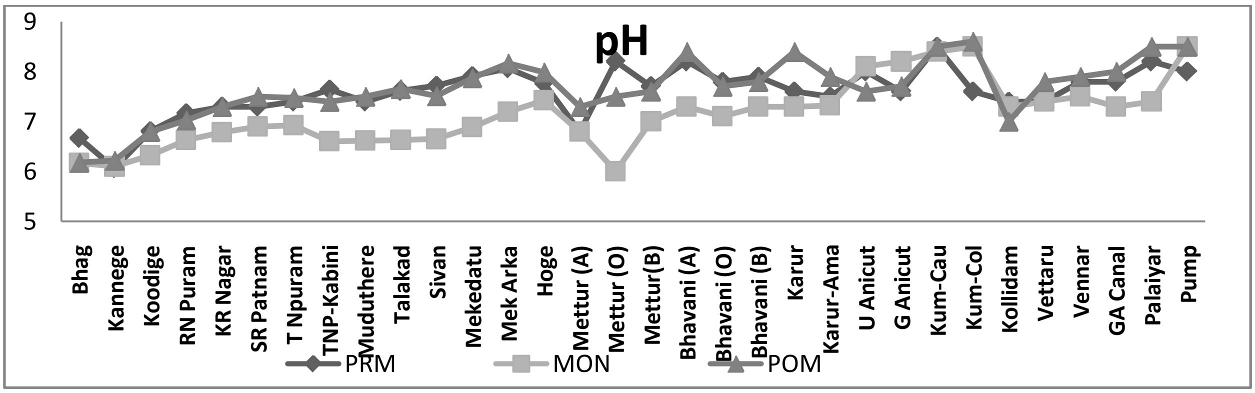


Fig. 5: Water reaction (pH) of R. Cauvery

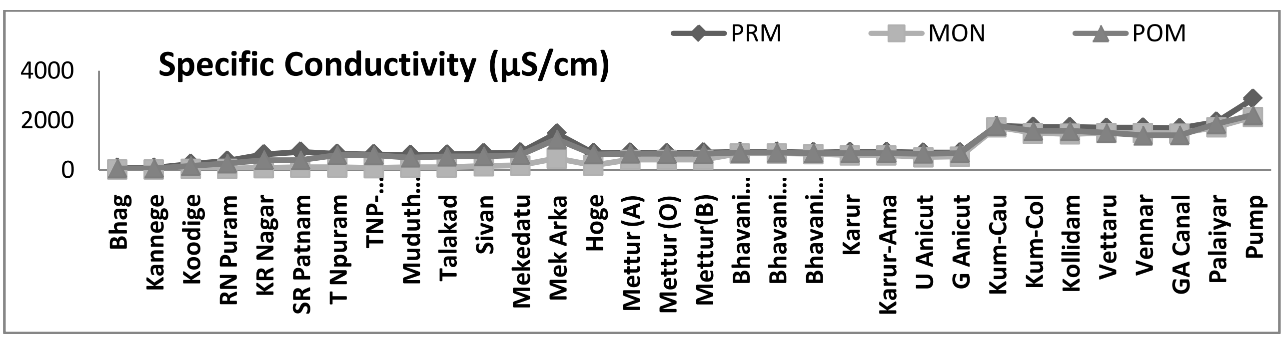


Fig. 6: Specific conductivity of water in R. Cauvery

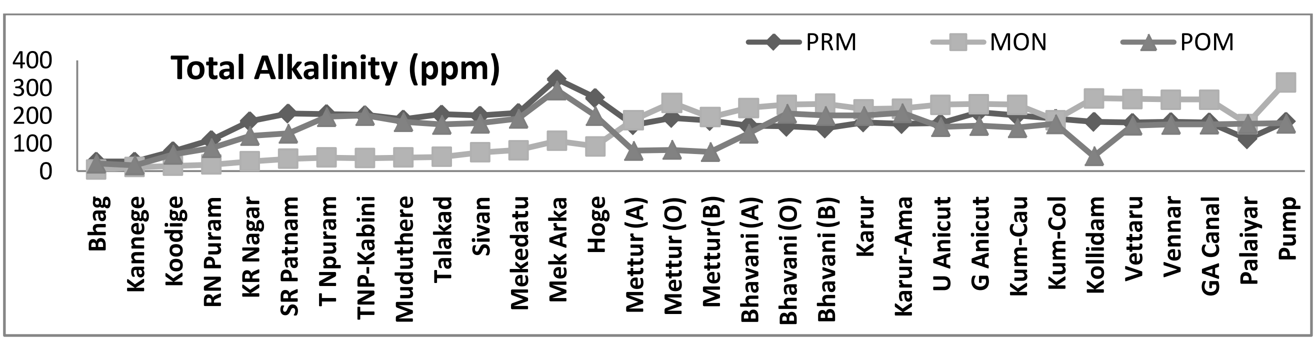


Fig. 7: Total alkalinity of water in R. Cauvery

VI. Nutrient Status of Water

Amongst dissolved nutrients, fluctuation of nitrate – N (μgl^{-1}) was to the tune of 20 -345, 20-312 during MON & POM respectively in the stretch between Mekedatu in upper stretch up to estuarine part in Tamil Nadu with lowest presence or in traces in the entire river system in PRM. The upper stretch beyond Mekedatu in

Karnata represented very low dissolved nitrate in water irrespective of seasons. Soluble reactive phosphorus was evenly distributed in the entire river course with some significant presence in most of the sampling sites in the downstream, more in MON and POM than PRM. It (μgl^{-1}) was in the range 1-390, 10-350 & 1-230 in MON, POM, PRM seasons respectively in the entire river course. Forest origin red soil in the catchment of up-stream prevents its availability in this strectch. Moderate presence of total – P was observed in the entire river system. Silicate – Si maintained a moderate productive range (mgl^{-1}) in the downstream (4.35-9.92, 3.90-10.20 & 3.62-7.51) as compared to up-stream (0.30-5.25, 2.00-5.75 & 0.36-9.99) in MON, POM & PRM seasons respectively; the estuarine parts represented low silicate-silicon content. Overall, the R. Cauvery showed moderate values of dissolved nutrients in water unlike R. Krishna having more dissolved nutrients in its water (Das et al, 2017).

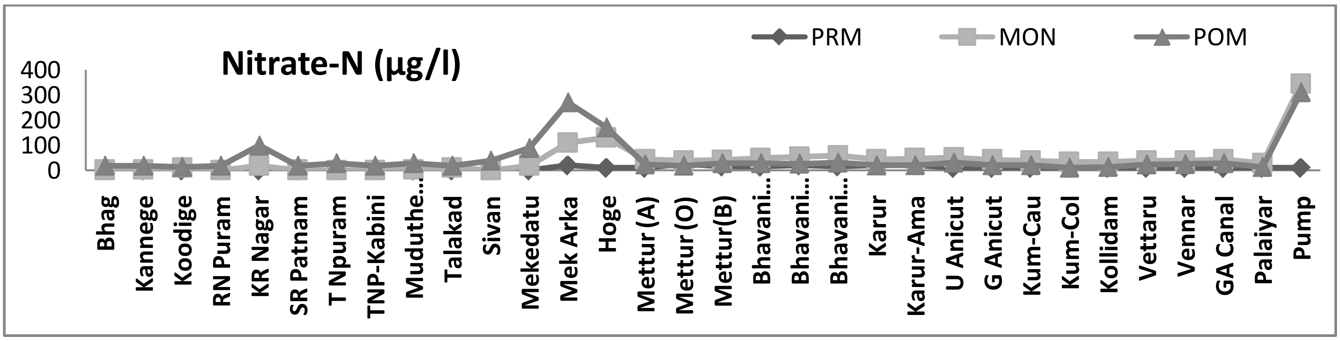


Fig. 8: Nitrate nitrogen in water of R. Cauvery

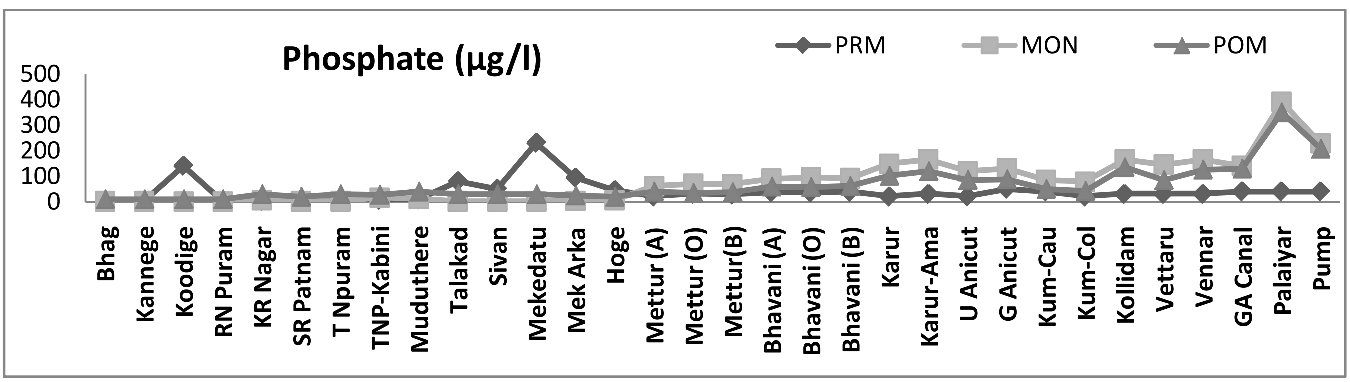


Fig. 9: Phosphate-P in water of R. Cauvery

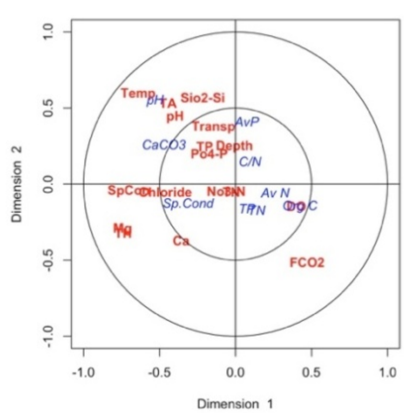


Fig. 11: Relationship between water and sediment qualities. Blue colour denoted sediment qualities

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VII. Association between Water and Sediment Qualities

The dimension 1 separates most of the water quality parameters. Considering 0.5 as the threshold contribution, sediment pH and $CaCO_3$ of sediment were positively associated with temperature TA, SiO_2-Si and pH of water. Though weakly related dissolved nutrients, especially SiO_2-Si was negatively related to the sediment nutrients.

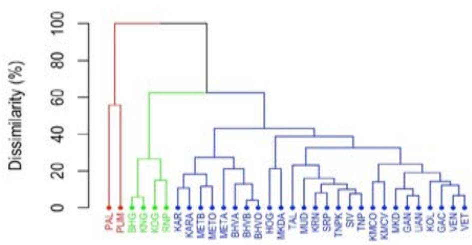

Fig. 12: Dendogram tree of sites according to environmental dissimilarity. Three different colours denoted the three clusters at 60% dissimilarity

VIII. Environmental Classification of Sites

The results of hierarchical cluster analysis have been depicted in Fig.12. It indicates that environment comprising physical, limno-chemical features of water distinguishingly divides the river into three stretches with 60% dissimilarity in the envrionement. The three distinct environmental site-groups were as follows: Group1 of two sites (Palaiyar and Pumpuhar); Group 2 of four sites (Bhagamandala, Kannege, Koodige and Ramnathapuram) and Group 3 of 26 sampling sites (KRNagar, Srirangapatnam, TNarasipur, TNarasipur-Kabini, Muduthere, Talakadu, Mekedatu, Mekedatu-Arkavathy, Shivasamudram, Hogenakkal, Mettur-Above, Metture-Outfall, Mettur-Below outfall, Bhavani-Above, Bhavani –Outfall, Bhavani-Below out fall, Karur, Karur-Amaravathy, Upper Anicut, Grand Anicut Kumbakonam-Cauvery, Kumbakonam-Coleroon, Kollidam, Grand Anicut Canal, Vettaru, Vennaru), which is obvious from the fact that the Gr 1 is comprising the extreme estuarine parts unlike any other sampling stations. Group 2 covers the upstream four sampling sites in the serene hilly terrains with red cover forest soils. Rest of the 26 samplings sites under Group 3 are more or less homogeneous in respect of limnological parameters existing between upstream hilly terrain and extreme estuarine sectors with deep pools, flattened river basins with influence of reservoirs and weirs/anicuts.

IX. Primary Productivity

The gross primary production (GPP, $mgCm^{-3}h^{-1}$) increased progressively with the river flowing downwards. Significantly, higher production was registered in the downstream of the river in PRM months followed by MON and POM. The overall range of GPP in PRM, MON and POM seasons were 20-306, 28-296 and 27-250 respectively in the entire river stretch. Down-stretch of river zone is always more productive due to accumulation of more nutrients and ions as reflected this study also.

Net production (NPP, $mgCm^{-3}h^{-1}$) also, in most centres, followed the same trend as observed for GPP and attained the value of around 60-65% of GPP in most occasions irrespective of seasons. Community respiration (CR, $mgCm^{-3}h^{-1}$) varied widely amongst the sampling stations and ranged from 16-85, 17-125 & 9-75 mg in PRM, MON and POM seasons respectively. P:R ratio (GPP:CR), an indicator of organic pollution, registered moderate amplitude of variation (1.30-3.66, 1.27-1.51 & 1.47-5.20) in up-stream and higher values (2.25-6.65, 1.50-7.00 & 1.39-5.30) in downstream during PRM, MON & POM periods respectively, reflecting that contribution to respiration component was predominantly by phytoplankton biomass.

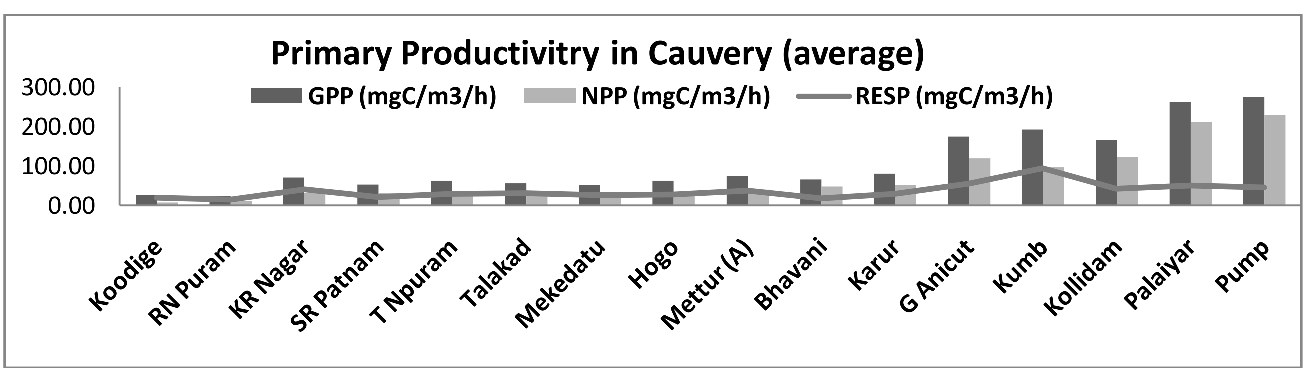

Fig. 10: Primary productivity of R. Cauvery

X. Influence of Soil-Water Qualities on GPP

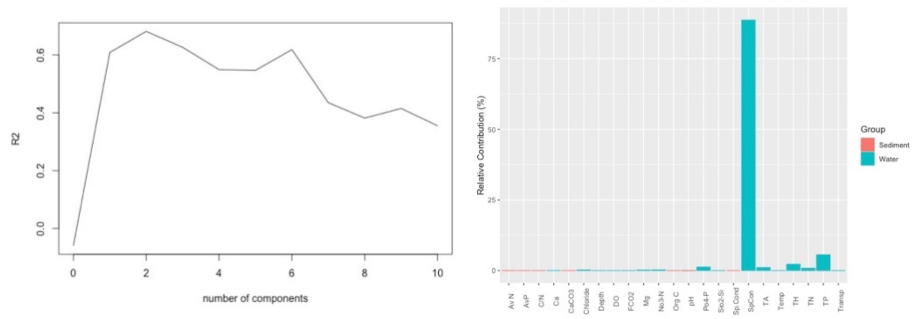

Fig. 13: R^2 against the number of components for latent variable selections (Left panel). Relative contribution of soil-water quality on GPP in R. Cauvery

The PLS with two components resulted in maximum R^2 (Fig. 13), suggesting two components suffice to explain GPP. These two components explain 95.8% variability in the soil-water qualities and 76.6% variability in GPP, which are quite good for data interpretation. The relative contribution of soil-water quality variables to the GPP revealed that specific conductivity of water has the highest influence as compared to other parameters (Fig13; Right panel). In order of relative magnitude, the top five influential variables on GPP are as follows: specific conductivity (88.7%)> TP (5.5%) >TH (2.2%) >PO_4-P(1.2%) > TA (1%), all of which represent the water qualities. This implies that water quality parameters precisely specific conductivity is more influential to GPP than the soil quality parameters.

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Table 1: Sampling Stations in R. Cauvery with GIS locations and their habitats

No.	Stations	Lat (N)	Long (E)	State	Habitat
1	BHG	12°23′4.7″	75°32'4.4″	Karnataka	Very narrow, sheet flow in summer
2	KNG	12°17'50.6"	75°47'54.4"	Karnataka	Kannige confluence, narrow sheet flow
3	KOG	12°27'28.7"	75°57'34.41"	Karnataka	Flowing through gorgy site, sheet flow
4	RNP	12°36'23.07"	76°5'21.18"	Karnataka	A sanctuary, deep pool
5	KRN	12°28'7.62"	76°23'54.15"	Karnataka	Backwaters of KRS reservoir
6	SRP	12°24'12.26"	76°43'26.26"	Karnataka	Deep pool, gorgy sporadic pool
7	TNP	12°12'5.19"	76°54'53.06"	Karnataka	Deep pool, river flattened
8	TNPK	12°6'32"	76°20'17"	Karnataka	Kabini confluence point with R. cauvery
9	MUD	12°13'32.07"	77°02'10.11"	Karnataka	A deep pool, year round water, fish hub
10	TAL	12°11'27.08"	77°1'42.88"	Karnataka	Deep pool type with low depth
11	SIV	12°17'38.40"	77°10'4.80"	Karnataka	Rocky widened gorgy falls
12	MKD	12°16'20"	77°26'25"	Karnataka	Gorgy river basin, fish sanctuary
13	MKDA	12°17'19.48"	77°25'54.67"	Karnataka	Arkavathy confluences diverting sewage
14	HOG	12°06' 54.0"	77°46'42.5"	T Nadu	Flattened river, rocky bad, falls, fish hub
15	META	11°48'58"	77°48'38"	T Nadu	Lotic of Mettur reservoir, falattened, rocky
16	METO	11°47'10.51"	77°48'2.81"	T Nadu	Meettur reservoir outfall point
17	METB	11°47'59.99"	77°47'59.99"	T Nadu	One km down to Mettur outfall, flattened
18	BHVA	11°28′15″	77°6′50″	T Nadu	Bhavani reservoir lotic, flattened
19	BHVO	11°28'44.95"	77°8'2.89"	T Nadu	Bhavani outfall point in R. cauvery
20	BHVB	11°30'39″	77°12'57"	T Nadu	One Km down to out fall point of Bhavani
21	KAR	10°57'27.76"	78°4'51.42"	T Nadu	Out fall point of R. Noyyal at Cauvery
22	KARA	10°24'38.39"	77°15'36"	T Nadu	Amaravathy confluence point, flattened
23	UAN	10°52'58"	78°34'58"	T Nadu	Upperanicut, flattened, mixed terrain
24	GAN	10°49'54.5"	78°49'22.2"	T Nadu	Grandanicut, flattened, mixed terrain
25	KMCV	10°57'35.33"	79°22'51.23"	T Nadu	Kumbokonam Cauvery alluuvial basin
26	KMCO	10°57'43.52"	79°23'28.46"	T Nadu	Kumbokonam Coleroon alluuvial basin
27	KOL	10°58'5.7"	79°22'41.5"	T Nadu	Kollidam fertile basin flattened

28	VET	10°48'41.41"	79°48'35.39"	T Nadu	Vettaru-narrow flattened fertile basin
29	VEN	11°48′58″	77°48'38"	T Nadu	Vennaru-narrow flattened fertile basin
30	GAC	10°49'43.3"	78°49' 2.6"	T Nadu	Grandanicut canal-narrow, fertile basin
31	PAL	11°2'12.41"	79°32'49.75"	T Nadu	Eastuarine, sandy basin Palaiyar
32	PUM	11°8'36.60"	79°51'25.29"	T Nadu	Eastuarine, sandy basin Pumpuhar

Table 2: Pre-monsoon physical characteristics of R. Cauvery

Sampling stations	Width (m)	Depth (m)	Flow (cm/sec.)	Temp. (A/W) (ºC)	Transp. (cm)
Bhagamandala	3.0-3.5	0.25-0.50	15	30/25	Bottom
Kannige T	2.0-2.5	0.25-0.50	10	30/25.5	Bottom
Koodige	30-40	0.8-1.0	35		Bottom
R.N. Puram	100-150	0.5-0.7	30	32/28.5	Bottom
K.R. Nagar	80-100	0.25-3.0	25	33/30	100
S.R. Patnam	70-90	0.5-2.0	35	32/29	85
T.Narasipura	80-100	0.5-1.5	20	32/29	100
TNP Kabini T	50-70	0.5-2.0	25	32/28	80
Muduthere	60-80	3-5	20	32/28	130
Talakadu	70-90	0.5-2.5	25	31/28.5	200
Mekedatu	15-20	0.5-0.8	40	31/29	bottom
Arkavathy T	15-18	0.3-0.4	30	31/29.5	bottom
Hogennakal	100-150	1-1.5	40	32/30	90
Mettur (A)	500-550	2.0	50	29.5/26.2	200
Mettur (O).	500-560	0.5-0.8	60	29.5/26.8	25
Mettur (B)	520-570	2.0	50	29.5/26.4	140
Bhavani (A)	350-400	1.0	50	31.5/29	100
Bhavani (O)	400-450	1.3	60	31.5/29.1	95
Bhavani (B)	400-480	1.5	45	31.5/29.0	97
Karur	500	0.7-0.8	70	30.4/29.1	70
Upper Anicut	20-25	0.5	nil	30.2/27	50
Grand Anicut	75	0.5	60	30.5/26.2	30
Kumbokonam-Cauvery	Dry				
Kumbokonam-Coleroon	100	1.0	35	30.7/26.2	30
Kollidam	200	1.0-1.5	35	30.5/27	40
Palaiyar	650	7-7.5	Sheet flow	30.8/30	500

A=Air, W=Water