



Temporal and Spatial Variation in Water Quality of Bagmati River

Binod Chhetri Bhandari & Pramina Nakarmi
Environment and Public Health Organization (ENPHO)
Email: binod.bhandari@enpho.org

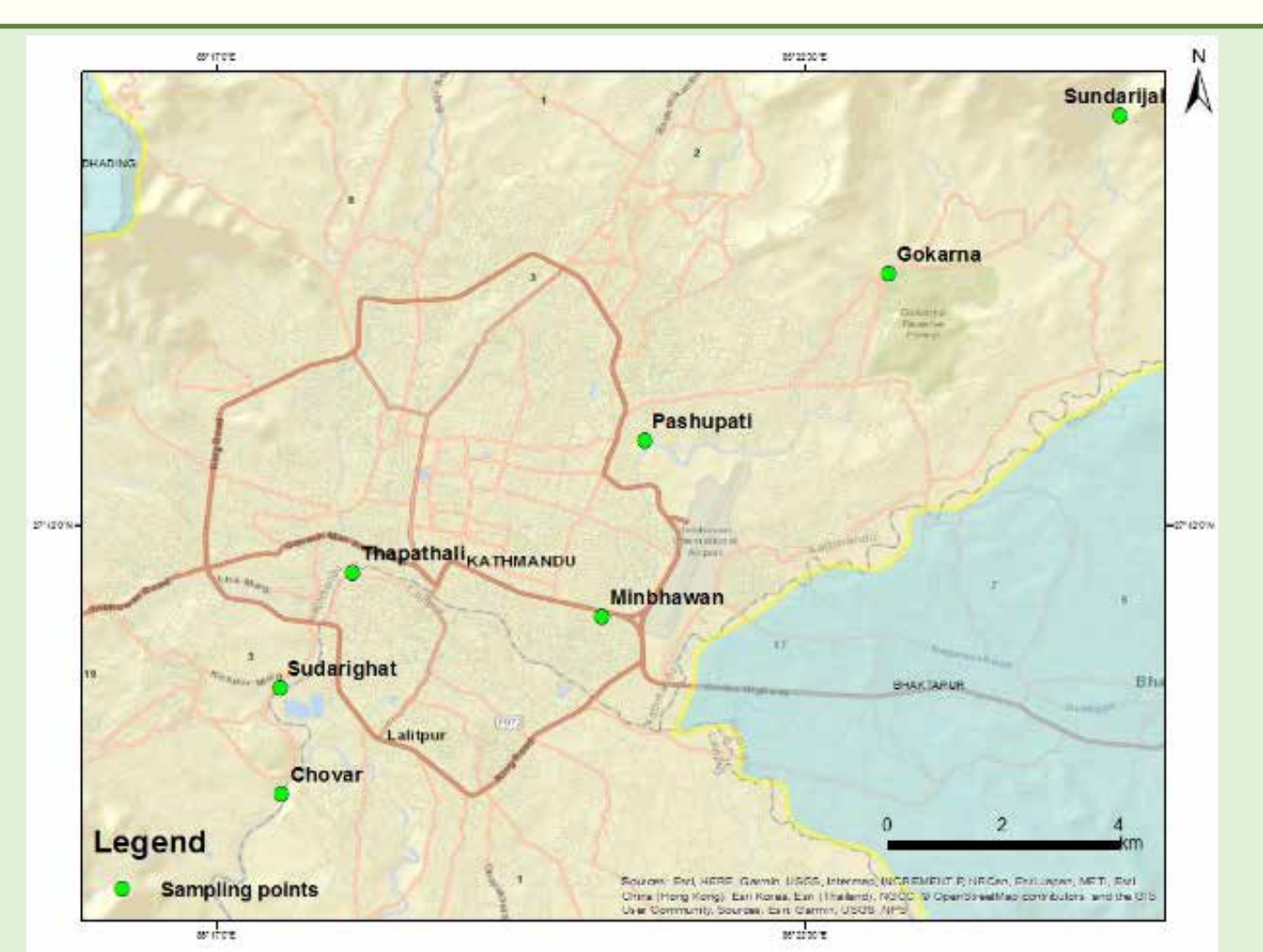
Introduction

Bagmati River (Holy river in capital city of Nepal) is deteriorating day by day and losing its environmental value due to pollution. This in turn has endangered its value for drinking, irrigation and recreation purposes. As in many developing countries in South-east Asia, rapid population growth, urbanization and gaps in proper waste management (domestic and industrial) are the root causes of degradation of Bagmati River. This study aims to analyse spatial and temporal variation in Bagmati River water quality from 2011 to 2014.

Methodology



River water sampling



Study sites along Bagmati River

Study includes 7 different sites (shown in figure) along the stretch of Bagmati River representing different landscapes, mixing of polluted tributaries and population densities. These sites were tested for 9 water quality parameters during pre, post and during monsoon seasons from 2011-2014 for studying temporal and spatial changes in water quality.

S.N.	Studied Parameters
1	pH
2	Electrical Conductivity (EC)
3	Total Suspended Solids (TSS)
4	Chloride (Cl)
5	Ammonia
6	Nitrate (NO ₃)
7	Total Phosphorus (TP)
9	Biological Oxygen Demand (BOD)
10	Chemical Oxygen Demand (COD)

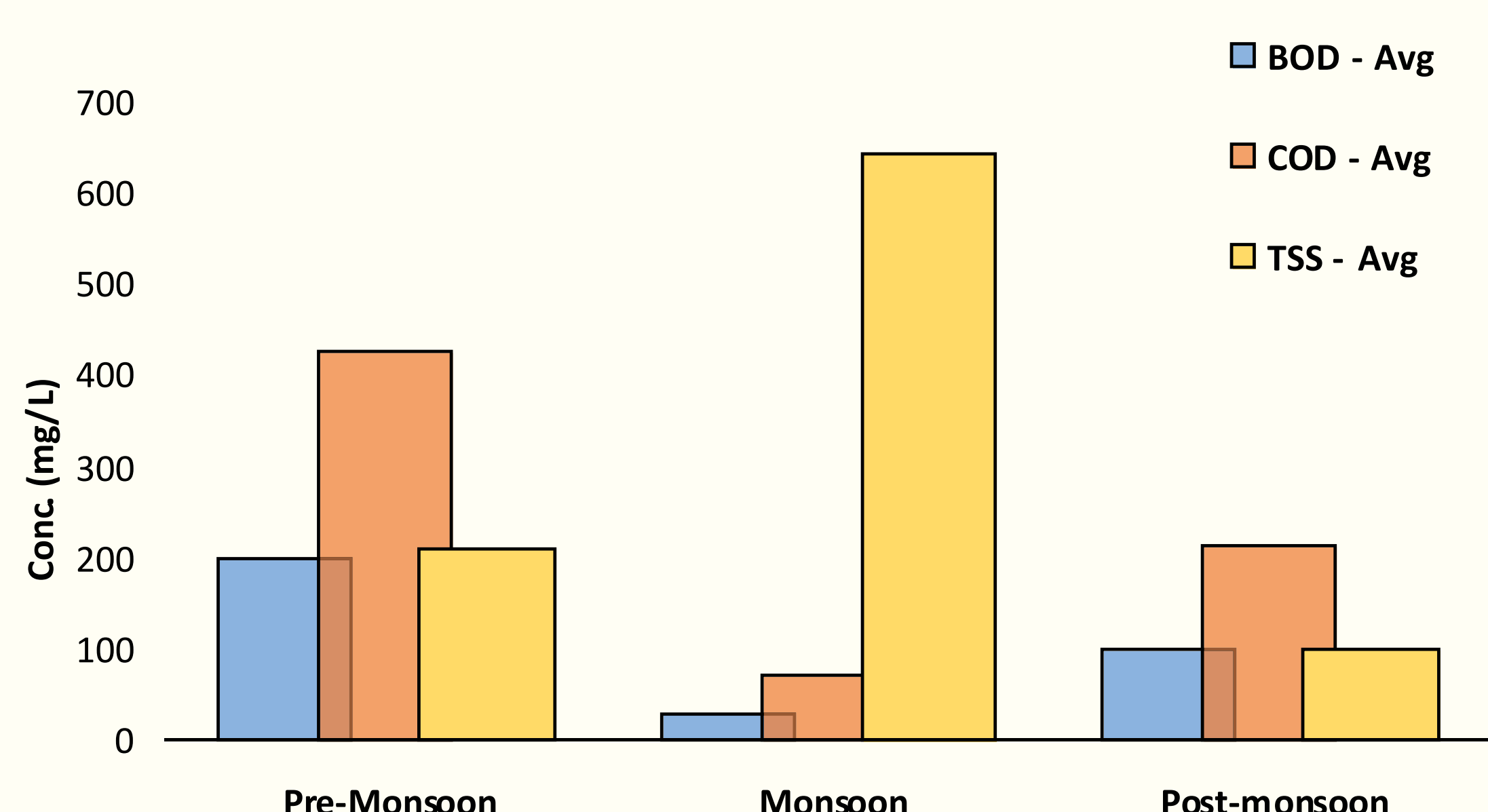
Results

Seasonal variation

Values for monsoon for most studied parameters were significantly lower compared to pre and post-monsoon seasons except for TSS which is likely due to dilution effect of increased flow. Increased TSS possibly due to debris and suspended particles carried with rainwater

	pH		EC (µS/cm)		TSS (mg/L)		Ammonia (mg/L)		Cl (mg/L)	
	Avg.	Max.	Avg.	Max.	Avg.	Max.	Avg.	Max.	Avg.	Max.
Pre-monsoon	7.6	8.7	862	1620	209	776	64.7	127	65.2	147
Monsoon	7.1	7.9	144	413	642	3160	6.6	27	10.7	49
Post-monsoon	7.3	8.3	374	714	99	356	20.5	46	32.3	68

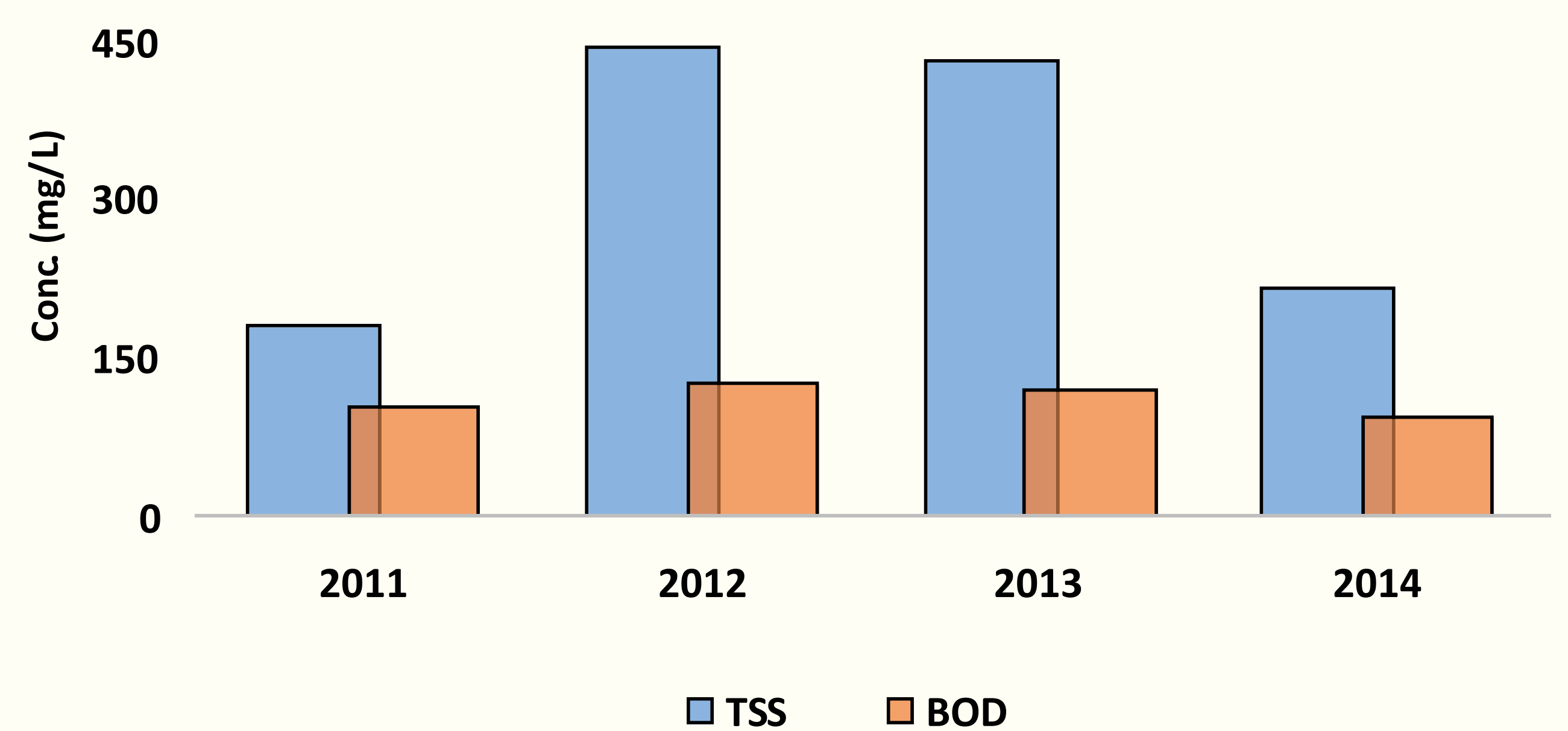
Average values of TSS, BOD and COD in different seasons



Yearly variation

- Statistically significant annual variations were not observed in tested parameters.
- Values for TSS and BOD increased from 2011-2012 but dipped down in 2013 and further in 2014 which possibly could be attributed to cleaning efforts made through "Bagmati River Clean-up" campaign in May, 2013.

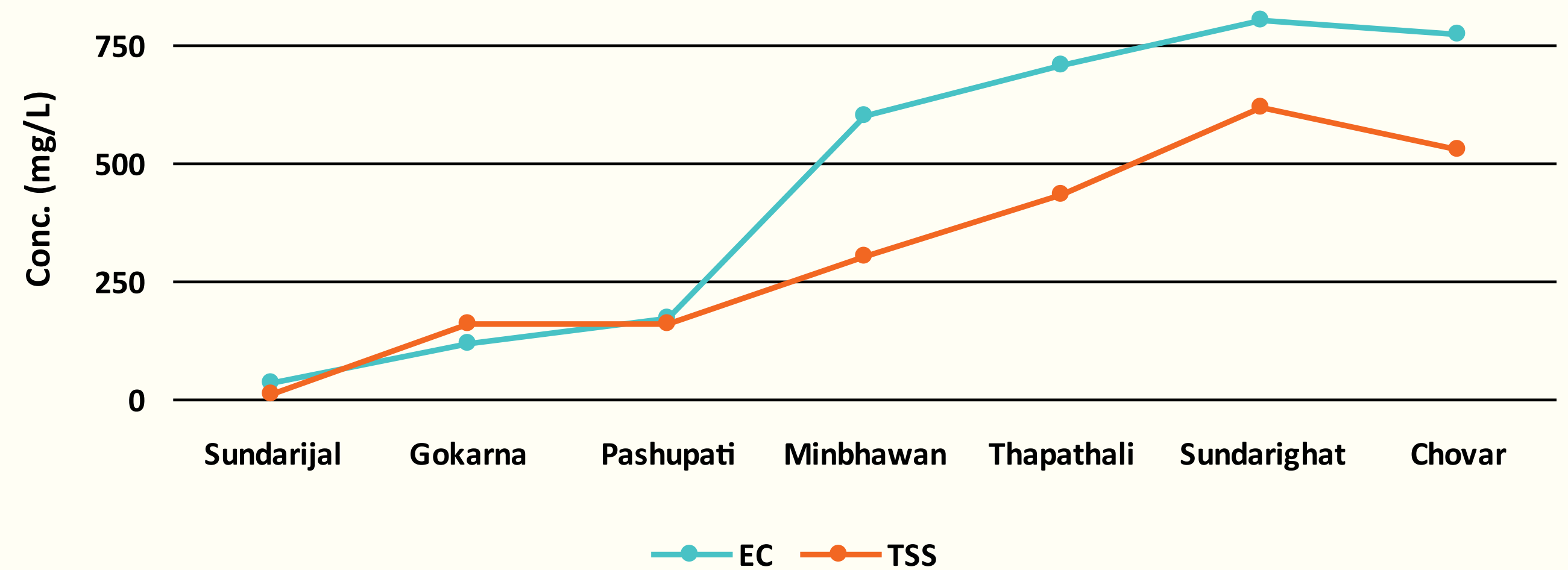
Yearly averages of TSS and BOD from 2011-2014



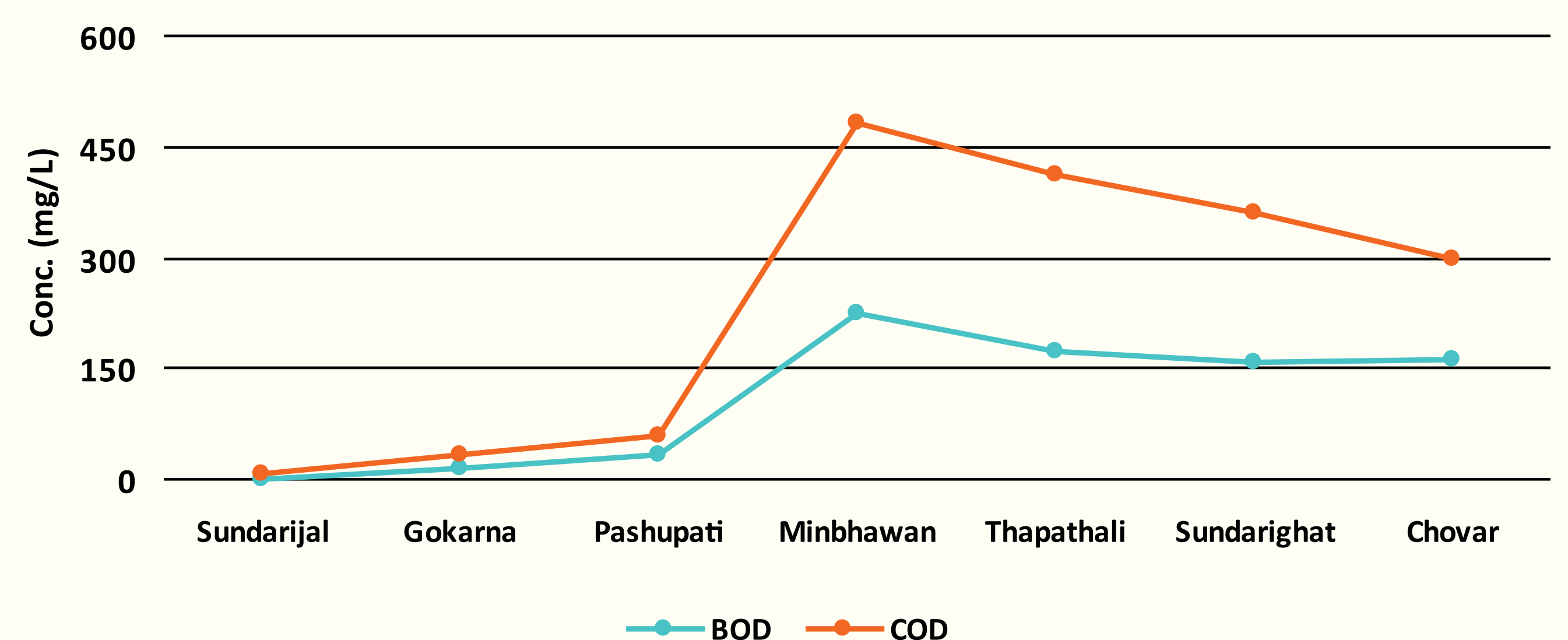
Spatial variation

- General trend indicates rise of contaminants level from upstream (Sundarijal) to downstream (Sundarighat) stretch of the river.
- Steep rise is consistent at Minbhawan for most tested parameters indicating a rapid increase in pollution at this site which can be due to direct dumping of untreated waste, remains of funeral pyres and ashes, bathing, washing, sewage etc.

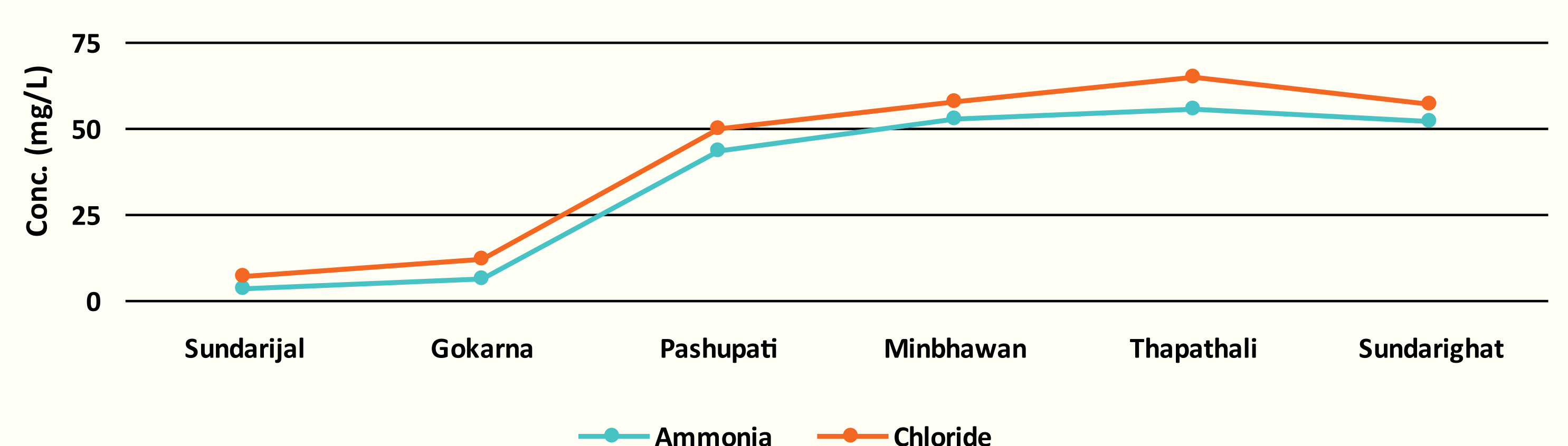
Average EC and TSS values for studied sites



Average BOD and COD values for studied sites



Average ammonia and chloride values for studied sites



Conclusion

Results of tested parameters indicate both seasonal and spatial variation within the stretches of Sundarijal to Chovar, however, changes are not as significant in different years. Pre-monsoon values for most of the tested parameters were higher compared to post-monsoon and monsoon. The significance of variation in parameters along the river, with increase in downstream sites, indicates increasing pollution in those sections. Overall, this study provides convincing evidence of the poor water quality of Bagmati River.