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# COVID-19 Lockdown phase: A boon for the River Ganga water quality along the city of Kolkata

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## Abstract

We analysed the dissolved oxygen (DO) in 6 sites along the stretch of River Ganga during 2<sup>nd</sup>, 9<sup>th</sup>, 16<sup>th</sup> and 23<sup>rd</sup> April 2020 (COVID-19 lockdown period) and compared with the previous data of 2015 to 2019 during the same time (April). The normal decreasing trend of DO suddenly exhibited a sharp turn during COVID-19 lockdown phase. The DO values hiked significantly in all the stations with the spatial trend 2<sup>nd</sup> Hooghly Bridge (6.90 mg/l) > Botanical Garden (6.78 mg/l) > Ramkrishna Ghat (6.65 mg/l) > Shibpur Ghat (6.51 mg/l) > Princep Ghat (6.35 mg/l) > Babughat (6.24 mg/l). The data clearly confirms an improvement in water quality in context to DO level, which is congenial for aquatic biodiversity.

**Keywords:** Dissolved Oxygen (DO), River Ganga, COVID-19, Water quality

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## Introduction

The DO level, which supports the aquatic biodiversity, is a function of several physical, chemical and biological factors. In the rivers, the physical factor encompasses ripples, tides, wind generated waves etc. through which diffusion of atmospheric oxygen occurs at the air-water

interface. The chemical factor encompasses release of waste from industrial and urban sources, leakage of oil from tankers, shipwrecks etc. The biological factor primarily includes the standing stock of phytoplankton community in the estuarine water. The rate of photosynthesis, respiration and decomposition by microbes regulate the DO level in the aquatic system.

The present study area receives wastes from industries (mainly concentrated along the bank of River Ganga) and municipal and domestic wastes from the city of Kolkata and Howrah .

The oscillation of DO level has a far-reaching impact on the biotic community and hence a baseline data of DO is essential to evaluate the water quality in context to biodiversity of the area, which has been provided by the lockdown effect associated with COVID-19. The lockdown effect, in real sense, started from 25<sup>th</sup> March 2020 to combat the spreading of the pandemic COVID-19. The present paper is an approach to acquire an insight on the water quality depending on the DO values of six sites along the River Ganga.

## Materials and methods

### Site selection

Six ghats/ sites were selected for the present study, which are basically the zones of anthropogenic

influence. Coordinates of all the study sites in the River Ganga are highlighted in Table 1.

**Table 1: Coordinates of all the selected sites/ghats along the River Ganga**

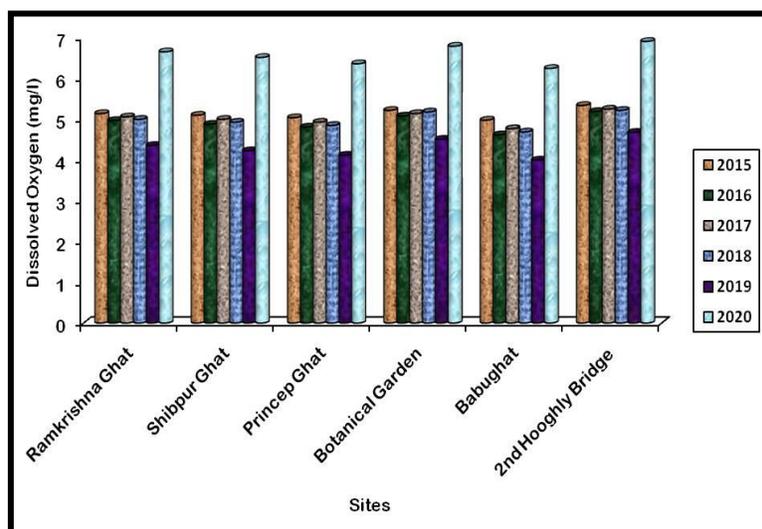
Site Name	Coordinates	View
<b>Ramkrishna Ghat</b>	22°34'19.8"N 88°20'17.0"E	
<b>Shibpur Ghat</b>	22°33'41.2"N 88°19'40.4"E	
<b>Princep Ghat</b>	22°33'30.9"N 88°19'52.5"E	
<b>Botanical Garden</b>	22°33'06.4"N 88°18'06.6"E	
<b>Babughat</b>	22°34'10.3"N 88°20'28.5"E	
<b>2<sup>nd</sup> Hooghly Bridge</b>	22°33'31.4"N 88°19'38.5"E	

## Analysis of DO

The analysis of DO was carried out in the selected sampling stations during the COVID-19 lockdown phase in four different dates (2<sup>nd</sup>, 9<sup>th</sup>, 16<sup>th</sup> and 23<sup>rd</sup> April 2020). For each observation, at least five samples were collected from the study site during high tide condition. Glass bottles of 125 ml were filled to overflow the collected water samples and Winkler titration was performed for the determination of DO. The sampling method did not change since 2015 when DO was estimated by Winkler's method in the same site.

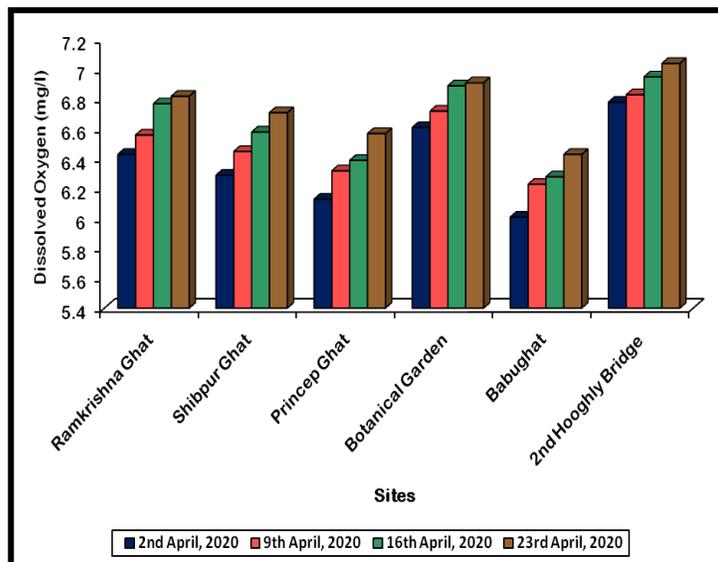
## Results

The spatial variation of DO exhibits a unique trend as per the order 2<sup>nd</sup> Hooghly Bridge (5.42 mg/l) > Botanical Garden (5.31 mg/l) > Ramkrishna Ghat (5.19 mg/l) > Shibpur Ghat (5.10 mg/l) > Princep Ghat (5.01 mg/l) > Babughat (4.87 mg/l) (Fig. 1). The values within the brackets indicate the mean values of DO during 2015 – 2020.



**Fig. 1. Spatial variation of DO level (in mg/l) in River Ganga**

It is interesting to note that the DO values have hiked up during the COVID-19 lockdown phase and this rising trend is observed with the passage of time (Fig. 2).



**Fig. 2. DO level (in mg/l) in the study sites during lockdown phase**

### Discussion

It is clear from the data sets that there has been considerable increase in the levels of DO after the implementation of strict lockdown in the city of Kolkata (Mitra et al., 2020). Compared to the earlier DO levels (mean of 2015 to 2019), the value has increased by 35.71%, 35.06%, 33.97%, 35.06%, 35.65% and 34.50% at Ramakrishna Ghat, Shibpur Ghat, Princep Ghat, Botanical Ghat, Babughat and 2<sup>nd</sup> Hooghly Bridge respectively during April, 2020 (mean of four sampling dates). Almost similar type of works in the same sampling sites were also carried out by earlier workers (Zaman et al., 2018) on heavy metals Pb, Cr and Cd, which also exhibited similar spatial trend. Owing to the presence of several industries coupled with

movements of vessels and trawlers, the Gangetic stretch is basically a stressed zone (Mitra, 2013; Mitra and Zaman, 2014; Mitra and Zaman, 2016; Mitra, 2019) hence DO values were not up to the mark during 2015 to 2019. The lockdown associated with COVID-19, however, brought a radical change in water quality, preferably with respect to DO as reflected through the data sets of 2<sup>nd</sup> April to 23<sup>rd</sup> April, 2020. This upgradation of water quality is congenial for the survival and growth of aquatic lives preferably fishes (Butler et al., 2010; Tran-Duy et al., 2012; Abdel-Tawwab et al., 2015; Makori et al., 2017; Nyanti et al., 2018).

ANOVA carried out with the DO data showed significant spatio-temporal variations between two periods (pre-COVID-19 and COVID-19 periods) at  $p < 0.05$ , which clearly points towards the upgradation of Ganga water quality along the city of Kolkata due to almost zero anthropogenic disturbances during the COVID-19 lockdown phase (Table 2).

**Table 2: ANOVA for DO between stations and between pre-COVID-19 and COVID-19**

"Source of Variation"	"SS"	"df"	"MS"	"F"	"P-value"	"F crit"
Between Stations	0.4922	5	0.09844	43.3020	0.00040	5.05032
Between pre-COVID-19 and COVID-19 phase	8.70403	1	8.70403	3828.75	2.09E-08	6.60789
Error	0.01136	5	0.00227			
Total	9.2076	11				

It is a fact that with the number of COVID-19 cases leaning dangerously more than 3,059,081 and the worldwide death toll crossing more than 2,11,202, ([https://www.worldometers.info/coronavirus/?utm\\_campaign=homeAdvegas1?%22%20%5C1%20%22](https://www.worldometers.info/coronavirus/?utm_campaign=homeAdvegas1?%22%20%5C1%20%22) countries; data downloaded on 28<sup>th</sup> April 2020), the World Health Organization (WHO) declared the virus outbreak a pandemic in the second week of March 2020, four months after the novel virus first made headlines. Nearly 162 countries have steadily gone to lockdown, and businesses across the globe are presently operating in fear of an impending collapse of global financial markets. This situation, clubbed with sluggish economic growth in the previous year, especially in a developing country like India, the pandemic is leading to an extremely volatile market condition. With major cities on lockdown, organizations have no choice but to dig into their business continuity and contingency plans. Ever since the first COVID-19 case was confirmed in India, numerous companies have instituted a ‘work from home’ drill using critical resources to understand whether remote working conditions are feasible. We have observed that remote working also has its limitations and cannot be carried out by other sectors like agriculture, fishery, retail, hospitality, or manufacturing, leaving them no choice but to face business/occupation interruption, leading to an adverse impact on the economy spinning around these sectors .

However, “*every crisis has a silver lining around the dark cloud and serves as a learning opportunity*”, and this silver lining is definitely the upgradation of environment as observed in the

present study. The authors feel that the COVID-19 lockdown phase has great probability to meet the objectives of Namami Ganga Programme that is an Integrated Conservation Mission, approved as “*Flagship Programme*” by the Government of India in June 2014 with budget outlay of Rs. 20,000 Crore to accomplish the twin objectives of effective abatement of pollution, conservation and rejuvenation of the National River Ganga (<https://nmcg.nic.in/NamamiGanga.aspx>).

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