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Results And Discussion of Limnological Study of Ganga River Water of District Haridwar Uttarakhand

Aditi[1*], Dr. Ravi Bhatnagar[2],

ABSTRACT
Haridwar is situated on the bank of river Ganga at the foothills of the Shivalik range of mountains that constitute the outer Himalayas. Haridwar city lies at an elevation of 965ft from the sea level and between latitude 20^0, 58' N and Longitude 78^0, 13' E. The results obtained for the studies made during round the years 2016 and 2017 are presented here (Table 1 to Table 8) A total of 13 physico-chemical parameters were studied as described in the chapter on materials and methods at the selected four sites, namely **Sapta Rishi Ghat, Har Ki Pauri, Prem Nagar Ghat and Jatwada Pul**

Keywords: Physico-chemical parameters, Ganga River, Haridwar, Sapta Rishi Ghat, Har ki Pauri

1. INTRODUCTION

A fresh water body, which fulfils a variety of human needs is full of value only when it is not abused and polluted. Hydrobiology deals with the details of various forms of aquatic life such as algae phytoplankton, periphyton, lithophytes and benthos, zooplankton, fishes and other groups of living organisms. Phytoplankton, periphyton and benthic algae communities represent the major producers in aquatic ecosystems and Diatoms are good indicators of water quality as pointed out by Odum (1971). Hundling (1971) has described the algae as an important producer component of the littoral zone of water bodies. The freshwater limnology plays an important role in the decision-making process for problems like dam construction, pollution control and aquaculture practices. The river catchment from the mountains to the sea is a single ecosystem by itself, linked to other catchment ecosystems through terrestrial corridors, atmospheric corridors and subterranean corridors. Fresh water has been of vital importance to man and animals for the sustenance of life and maintaining the balance of nature. Freshwater constitutes only about three per cent of the total water present on the earth.

Water Quality

The results obtained for the studies made during round the years 2016 and 2017 are presented here (Table 1 to Table 8) A total of 13 physico-chemical parameters were studied as described in the chapter on materials and methods at the selected four sites, namely **Sapta Rishi Ghat, Har Ki Pauri, Prem Nagar Ghat and Jatwada Pul**. The findings of the water quality assessment are described below.

Physico-chemical Parameters

Water temperature

During the first year of the present study i.e. 2016, the overall lowest and highest temperatures were observed as 10.0^0C and 24.80^0C at Site I i.e. Sapta Rishi Ghat and Site IV i.e. Pul Jatwada during January and June, respectively (Table-1 and Table-4).
In the second year of study i.e., 2017, the overall lowest and highest temperatures were observed as 10.2^0C and 24.90^0C at site I i.e. Sapta Rishi Ghat and Site-IV i.e. Pul Jatwada during January and June, respectively (Table-5 and Table-8).

Corresponding Author: Aditi
[1*]Research Scholar, Department of Zoology, School of Science, Sunrise University, Alwar, Rajasthan, India
Email: [1*]04aditiyadav@gmail.com
[2]Department of Zoology, School of Science, Sunrise University, Alwar, Rajasthan, India
Email: [2]srualwar6560@gmail.com

Velocity

During the first year of the present study i.e. 2016, the overall lowest and highest values of velocity were observed at 0.50m/s and 1.95m/s at Site-IV i.e. Pul Jatwada and Site I i.e. Sapta Rishi Ghat during January and June, respectively (Table-1 and Table-4).

In the second year of study i.e., 2017, the overall lowest and highest values of velocity were observed at 0.56m/s and 1.87m/s at site I i.e. Sapta Rishi Ghat and Site-IV i.e. Pul Jatwada during January and June, respectively (Table-5 and Table-8).

pH

During the first year of the present study i.e. 2016, the overall lowest value of pH was observed at 7.1 during January at Site-IV i.e. Pul Jatwada and the highest value of pH was observed at 8.8 at site-I i.e. Sapta Rishi Ghat (Table-1 and Table-4).

During the second year of the present study i.e. 2017, the overall lowest value of pH was observed at 7.1 during January at Site IV i.e. Pul Jatwada and the highest value of pH was observed at 8.7 at site-I i.e. Sapta Rishi Ghat during June (Table-5 and Table-8).

Transparency

During the first year of the present study i.e. 2016, the overall lowest and highest transparency were noted at 3.70cm and 72.64cm at Site-IV i.e. Pul Jatwada and Site I i.e. Sapta Rishi Ghat during July and January, respectively (Table-1 and Table-4).

In the second year of the present study i.e. 2017, the overall lowest and highest transparency was noted at 2.75cm and 72.23cm at Site-IV i.e. Pul Jatwada and the Site I i.e. Sapta Rishi Ghat during July and January, respectively (Table-5 and Table-8).

Turbidity

During the first year of the present study i.e. 2016, the overall lowest and highest turbidity were observed at 1NTU and 586 NTU at site-I i.e. Sapta Rishi Ghat and site-IV i.e. Pul Jatwada during January and July, respectively.

In the second year of the present study i.e. 2017, the overall lowest and highest turbidity were observed at 1NTU and 365NTU the overall lowest and highest turbidity were observed at 1NTU and 542NTU at site-I i.e. Sapta Rishi Ghat and site-IV i.e. Pul Jatwada during January and July, respectively (Table-5 and Table-8).

Total Solids (TS)

In the first year of the present study i.e. 2016, the overall lowest and highest total solids were observed at 142.75mg/l and 2178.00mg/l at the site I i.e. Sapta Rishi Ghat and Site-IV i.e. Pul Jatwada during January and July, respectively (Table-1 and Table-4).

In the second year of study i.e., 2017, the overall lowest and highest total solids were observed at 145.57mg/ and 2199.80mg/l at site I i.e. Sapta Rishi Ghat and Site-IV i.e. Pul Jatwada during January and July, respectively (Table-5 and Table-8).

Total Dissolved Solids (TDS)

During the first year of the present study i.e. 2016, the overall lowest and highest total dissolved solids were observed at 87.80mg/l and 1589.65mg/l at site I i.e. Sapta Rishi Ghat and Site-IV i.e. Pul Jatwada during January and July, respectively (Table-1 and Table-4).

In the second year of study i.e., 2017, the overall lowest and highest total dissolved solids were observed at 90.70mg/l and 1591.00mg/l at site I i.e. Sapta Rishi Ghat and Site-IV i.e. Pul Jatwada during January and July, respectively (Table-5 and Table-8).

Total Suspended Solids (TDS)

During the first year of the present study i.e. 2016, the overall lowest and highest total suspended solids were observed at 39.80mg/l and 588.34mg/l at site II i.e. Har Ki Pauri and Site-IV i.e. Pul Jatwada during October and July, respectively (Table-1 and Table-4).

In the second year of study i.e., 2017, the overall lowest and highest total suspended solids were observed at 47.31 mg/l and 2041.84mg/l at site I i.e. Sapta Rishi Ghat during March and August, respectively (Table-5 and Table-8).

Dissolved Oxygen (DO)

In the first year of the present study i.e. 2016, the overall lowest and highest values of dissolved oxygen were observed at 7.0mg/l and 9.9 mg/l at site-IV i.e. Pul Jatwada and Site-I i.e. Sapta Rishi Ghat during June and January, respectively (Table-1 and Table-4).

In the second year of study i.e., 2017, the overall lowest and highest values of dissolved oxygen were observed at 6.9 mg/l and 9.7mg/l at site-IV i.e. Pul Jatwada and Site-I i.e. Sapta Rishi Ghat during June and January, respectively (Table-5 and Table-8).

Bio-Chemical Oxygen Demand (BOD)

During the first year of the present study i.e. 2016, the overall lowest and highest values of bio-chemical oxygen demand were observed at 1.50 mg and 3.90mg/l at Site-I i.e. Sapta Rishi Ghat and site-IV i.e. Pul Jatwada during January and June, respectively (Table-1 and Table-4).

In the second year of study i.e., 2017, the overall lowest and highest values of bio-chemical oxygen demand were observed at 1.4mg/l and 3.95mg/l at Site-I i.e. Sapta Rishi Ghat and site-IV i.e. Pul Jatwada during January and June, respectively (Table-5 and Table-8).

Chlorides

During the first year of the present study i.e. 2016, the overall lowest and highest chlorides were recorded at 12.40mg/l and 42.30mg/l at Site-I i.e. Sapta Rishi Ghat and site-IV i.e. Pul Jatwada during January and July, respectively (Table-1 and Table-4).

In the second year of the present study i.e. 2017, the overall lowest and highest chlorides were recorded at 14.60mg/l and 44.35mg/l at Site-I i.e. Sapta Rishi Ghat and site-IV i.e. Pul Jatwada during January and July, respectively (Table-5 and Table-8).

Total Hardness

In the first year of the present study i.e. 2016, the overall lowest and highest values of total hardness were observed at 60.80mg/l and 114.5mg/l at Site-I i.e. Sapta Rishi Ghat and site-IV i.e. Pul Jatwada during January and June, respectively (Table-1 and Table-4).

In the second year of the present study i.e. 2017, the overall lowest and highest values of total hardness were observed at 62.2mg/l and 115.9mg/l at Site-I i.e. Sapta Rishi Ghat and site-IV i.e. Pul Jatwada during January and June, respectively (Table-5 and Table-8).

Alkalinity

During the first year of the study period i.e; 2016 the overall mean values of alkalinity at Ganga River, highest value (137 mg/l) and lowest (95 mg/l) at site-III Har Ki Pauri and site-I i.e. Sapta Rishi Ghat during July and January, respectively.

During the second year of the study period i.e.; 2017 the overall mean values of alkalinity at Ganga River, the highest value (145 mg/l) and lowest (97 mg/l) recorded during July and January at site-III and site-I, respectively.

Table- 1:-Values of Physico-chemical parameters of Ganga water during the year of 2016 at site-I (Sapta Rishi Ashram)

Parameters	Jan.	Feb.	March	April	May	June	July	August	Sep.	Oct.	Nov.	Dec.
Temp.(^{0}C)	10.0 (10.20-10.40)	12.70 (12.40-12.90)	15.70 (15.50-15.90)	18.76 (17.87-19.21)	19.25 (18.21-20.72)	21.00 (20.60-21.50)	20.65 (20.12-21.67)	20.20 (20.0-21.0)	19.80 (19.50-20.00)	18.90 (18.50-19.20)	15.30 (15.10-15.50)	12.50 (12.20-12.70)
Velocity (m/S)	0.50 (0.46-0.55)	0.85 (0.75-0.96)	0.80 (0.75-0.90)	0.82 (0.75-0.93)	0.85 (0.80-0.90)	1.00 (0.95-1.15)	1.75 (1.65-1.86)	1.60 (1.50-1.70)	1.50 (1.40-1.65)	1.10 (0.95-1.25)	0.89 (0.81-0.87)	(0.91 (0.8-0.99)
pH	8.30 (8.00-8.50)	8.27 (8.00-8.50)	8.10 (8.00-8.30)	7.80 (7.30-8.00)	8.00 (7.80-8.20)	8.80 (8.7-8.9)	7.80 (7.50-8.20)	8.00 (7.80-8.20)	7.70 (7.50-7.90)	7.80 (7.30-8.00)	8.00 (7.80-8.20)	8.20 (8.0-8.30)
Trans. (cm)	72.64 (68.20-74.50)	65.46 (63.40-67.80)	60.87 (59.70-61.20)	50.75 (48.90-51.20)	45.40 (44.40-46.10)	10.45 (8.00-12.80)	8.45 (5.00-9.80)	25.22 (24.20-26.90)	55.94 (54.40-56.10)	59.67 (58.90-61.50)	61.67 (59.21-62.18)	62.32 (58.90-64.50)
Turb. (NTU)	1.00 (0.50-1.50)	2.00 (1.00-2.50)	5.00 (2.00-7.00)	6.00 (3.00-8.00)	18.00 (16.00-20.00)	21.00 (20.00-22.00)	276.0 (275-280)	141.00 (130-165)	15.00 (13-17)	4.00 (2-6)	3.00 (2.00-4.00)	3.00 (2.00-4.00)
TS (mg/l)	142.75 (140-144.	160.60 (155.54-	200.50 (191.87-	470.78 (461.30-	560.32 (530-590.	590.43 (580.71-	1578.67 (1560.88-	1600.87 (1523.67-	194.23 (190.00-	158.10 (145.80-	157.61 (155.21-	155.21 (153.83-

	67)	167.89)	215.56)	476.87)	21)	620.21)	1600.56)	1660.70)	200.87)	169.89)	160.10)	157.74)
TDS (mg/l)	87.80 (94.23-100.28)	110.67 (109.00-112.45)	151.54 (148.62-153.87)	337.5 (334.18-340.40)	454.5 (432-465)	465.45 (455.49-475.67)	1261.50 (1258.48-1264.52)	1275.00 (1217.25-1324.50)	107.78 (104.28-110.20)	101.56 (98.45-104.26)	106.87 (10.4-108.5)	100.67 (98.56-102.98)
TSS (mg/l)	54.95	49.93	48.96	133.28	105.82	124.98	317.17	325.87	86.45	56.54	157.61	54.54
DO (mg/l)	9.9 (9.7-10.1)	9.4 (9.2-9.6)	8.9 (8.8-9.0)	8.7 (8.6-8.8)	8.5 (8.3-8.7)	8.0 (7.8-8.2)	8.1 (8.0-8.2)	8.3 (8.1-8.4)	8.5 (8.3-8.7)	8.7 (8.6-8.8)	8.9 (8.8-9.1)	9.2 (9.1-9.3)
BOD (mg/l)	1.50 (1.35-1.70)	1.68 (1.48-1.85)	2.62 (2.45-2.75)	2.65 (2.60-2.70)	2.68 (2.65-2.71)	2.70 (2.60-2.80)	2.60 (2.50-2.70)	2.55 (2.50-2.60)	2.10 (1.96-2.21)	1.86 (1.72-2.18)	1.78 (1.56-1.82)	1.67 (1.60-1.78)
Chlorides (mg/l)	12.40 (11.30-14.20)	17.80 (17.50-18.40)	19.55 (18.00-20.50)	20.21 (19.80-21.80)	20.65 (20.60-20.70)	20.80 (19.20-21.50)	26.00 (25.40-27.30)	24.55 (23.20-26.50)	22.50 (22.00-23.20)	19.90 (19.40-21.10)	18.78 (17.67-19.23)	16.59 (16.32-17.60)
Total Hardness (mg/l)	60.80 (58.2-62.6)	85.6 (83.7-88.4)	92.7 (91.0-93.8)	70.6 (68.5-72.8)	68.7 (66.5-70.4)	65.8 (63.7-67.4)	69.78 (66.89-76.23)	74.78 (72.67-76.56)	78.6 (77.0-79.5)	86.5 (84.3-87.2)	86.90 (84.59-87.67)	88.45 (87.61-89.39)
Alkalinity (mg/l)	95 (90-105)	98 (92-102)	101 (99-110)	106 (101-109)	128 (120-131)	120 (116-127)	128 (120-135)	124 (120-130)	118 (110-130)	110 (105-115)	103 (100-110)	109 (100-115)

Table- 2:- Physico-chemical parameters of Ganga water during the year of 2016 at site-II (Har Ki Pauri)

Parameters	Jan.	Feb.	March	April	May	June	July	August	Sep.	Oct.	Nov.	Dec.
Temp.(^{0}C)	10.80 (10.50-11.00)	12.90 (12.60-13.50)	16.00 (15.70-16.30)	19.74 (19.50-21.60)	21.40 (21.00-21.60)	22.00 (20.80-23.50)	19.20 (19.00-19.50)	18.80 (16.50-20.00)	16.90 (14.50-18.20)	16.50 (16.00-17.00)	16.00 (15.70-16.30)	12.90 (12.60-13.50)
Velocity (m/S)	0.90 (0.85-1.00)	0.95 (0.85-1.10)	1.00 (0.96-1.20)	1.15 (1.05-1.25)	1.85 (1.75-1.95)	1.75 (1.6-1.90)	1.60 (1.50-1.75)	1.20 (1.05-1.35)	1.00 (0.96-1.20)	1.15 (1.05-1.25)	0.90 (0.85-1.0)	0.95 (0.85-1.10)
pH	7.1 (7.0-7.30)	7.50 (7.30-7.70)	7.40 (7.20-7.60)	7.90 (7.70-8.00)	8.20 (8.00-8.40)	7.80 (7.60-7.90)	8.00 (7.70-8.20)	8.30 (8.10-8.50)	8.40 (8.10-8.60)	7.50 (7.30-7.70)	7.40 (7.20-7.60)	7.90 (7.70-8.00)
Trans. (cm)	64.64 (63.00-66.20)	62.40 (60.40-65.80)	54.85 (52.75-57.25)	45.50 (43.20-48.00)	22.10 (20.10-24.20)	12.40 (10.00-14.50)	3.70 (2.50-3.90)	5.60 (3.10-7.50)	15.55 (13.20-18.00)	24.82 (22.75-28.25)	30.64 (23.00-36.20)	62.00 (61.00-63.00)
Turb. (NTU)	2.00 (1.00-3.00)	4.00 (3.00-7.00)	7.00 (6.00-9.00)	9.00 (8.00-10.00)	286.00 (275.00-	347.00 (344.00-	386.00 (375.00-380.00	306 (300-310)	147.00 (144.00-	9.00 (8.00-10.00)	7.00 (6.00-9.00)	4.00 (3.00-7.00)

					290.00)	349.00)	)		149.00)			
TS (mg/l)	160.80 (155.50-165.67)	172.30 (168.50-175.80)	215.60 (210.75-221.50)	490.85 (470.50-510.70)	529 (520-539)	867.90 (856-879)	1710.85 (1680.60-1730.70)	1610.70 (1590.80-1635.50)	490.85 (470.50-510.70)	210.20 (180.70-235.90)	215.60 (210.75-221.50)	172.30 (168.50-175.80)
TDS (mg/l)	112.60 (108.36-115.20)	116.75 (114.00-118.45)	170.40 (165.60-174.85)	350.20 (340.85-361.80)	450.89 (435-465)	563.78 (540-578)	1350.00 (1330.50-1365.00)	1290.60 (1275.40-1310.50)	350.20 (340.85-361.80)	170.40 (165.60-174.85)	143.60 (138.36-145.20)	116.75 (114.00-118.45)
TSS (mg/l)	48.2	55.55	45.2	140.65	78.11	304.12	360.85	320.1	140.65	39.8	72	55.55
DO (mg/l)	9.0 (8.8-9.2)	8.8 (8.6-9.0)	8.6 (8.4-8.8)	8.4 (8.2-8.6)	8.2 (8.0-8.4)	7.5 (7.6-8.0)	8.1 (8.0-8.3)	7.8 (7.6-8.0)	8.6 (8.5-8.7)	8.8 (8.6-9.0)	8.9 (8.4-9.1)	9.0 (8.8-9.2)
BOD (mg/l)	1.65 (1.56-1.85)	1.78 (1.67-1.86)	2.75 (2.60-2.85)	2.85 (2.75-2.89)	2.70 (2.65-2.77)	2.70 (2.65-2.75)	2.34 (2.25-2.40)	2.85 (2.75-2.89)	2.76 (2.65-2.80)	1.80 (1.60-1.89)	1.95 (1.85-2.10)	1.65 (1.56-1.85)
Chlorides (mg/l)	18.50 (16.70-19.80)	20.40 (19.30-21.70)	21.90 (20.70-22.80)	24.80 (23.00-26.20)	29.20 (28.70-30.50)	28.40 (26.80-29.90)	25.90 (23.80-26.80)	22.60 (20.80-23.90)	23.80 (22.00-24.20)	21.40 (19.30-22.70)	20.90 (20.00-21.80)	19.50 (16.70-19.90)
Total Hardness (mg/l)	75.4 (72.4-77.5)	78.5 (77.6-79.9)	76.3 (74.5-78.3)	95.4 (92.5-96.8)	90.2 (88.5-92.3)	97.4 (95.3-99.5)	85.8 (82.6-88.2)	90.3 (88.6-92.5)	75.4 (72.4-77.5)	78.5 (77.6-79.9)	76.3 (74.5-78.3)	85.4 (92.5-96.8)
Alkalinity (mg/l)	100 (94-102)	102 (96-104)	105 (103-108)	110 (108-117)	136 (124-140)	130 (125-135)	136 (128-140)	130 (120-140)	126 (120-138)	120 (108-124)	116 (108-122)	120 (112-124)

Table 3:- Values of Physico-chemical parameters of Ganga water during the year of 2016 at site-III (Prem Nagar Ghat)

Parameters	Jan.	Feb.	March	April	May	June	July	August	Sep.	Oct.	Nov.	Dec.
Temp.(^{0}C)	11.30 (11.00-11.60)	13.60 (13.30-13.80)	16.90 (16.70-17.50)	17.89 (17.00-18.54)	19.80 (19.0-21.0)	22.80 (22.40-23.00)	21.80 (21.10-22.60)	20.10 (19.50-20.50)	18.00 (17.80-19.60)	17.80 (17.40-17.90)	16.90 (16.70-17.50)	13.50 (13.30-13.60)
Velocity (m/S)	0.77 (0.65-0.82)	0.85 (0.75-0.95)	0.79 (0.70-0.80)	0.90 (0.85-0.95)	1.80 (1.70-1.90)	1.65 (1.55-1.75)	1.50 (1.40-1.60)	1.00 (0.95-1.10)	0.85 (0.75-0.95)	0.70 (0.60-0.80)	0.75 (0.70-0.80)	0.80 (0.75-0.85)
pH	8.50 (8.45-8.60)	7.80 (7.75-8.00)	7.75 (7.60-7.90)	8.00 (7.90-8.20)	8.40 (8.20-8.60)	8.10 (7.90-8.30)	8.20 (8.10-8.40)	8.40 (8.30-8.50)	8.50 (8.45-8.60)	7.82 (7.70-7.90)	7.70 (7.60-7.80)	8.00 (7.90-8.25)
Trans. (cm)	62.80 (61.00-64.00)	61.40 (59.00-62.80)	54.10 (52.10-56.20)	45.10 (43.20-47.30)	12.30 (11.00-14.30)	23.00 (21.20-24.70)	48.50 (45.20-49.10)	54.50 (53.60-55.80)	40.1 (37.20-42.30)	45.90 (40-49)	54.10 (52.10-56.20)	60.00 (59.00-62.80)

Turb. (NTU)	4.00 (3.00-8.00)	8.00 (6.00-10.00)	10.00 (8.00-12.00)	14.00 (12.00-15.00)	124.00 (120-128)	318.00 (311.00-322.00)	373.00 (368.00-380.00)	160.00 (140.00-180.00)	140.00 (120.00-150.00)	10.00 (8.00-12.00)	9.0 (8-10)	8.00 (6.00-10.00)
TS (mg/l)	190.30 (180.60-200.10)	185.40 (180.50-197.80)	300.50 (290.40-321.75)	522.75 (502.60-537.30)	645 (635-655)	1020 (1000-1040)	1830.50 (1810.75-1855.40)	1745.40 (1710.20-1775.50)	522.75 (502.60-537.30)	320.43 (300.20-330.43)	300.50 (290.40-321.75)	260.40 (240.60-280.65)
TDS (mg/l)	127.56 (120.40-130.70)	130.75 (126.70-139.80)	230.43 (221.20-226.40)	382.54 (365.76-390.55)	392.54 (385.76-410.50)	654 (645-670)	1500.70 (1490.20-1520.70)	1360.37 (1340.40-1370.20)	230.43 (221.20-226.40)	196.30 (184.20-203.40)	187.90 (180-193)	130.75 (126.70-139.80)
TSS (mg/l)	62.74	54.65	70.07	140.21	252.46	366	329.8	385.03	292.32	124.13	112.6	129.65
DO (mg/l)	8.7 (8.6-8.8)	8.5 (8.4-8.6)	8.3 (8.2-8.5)	8.2 (8.0-8.4)	8.3 (8.2-8.5)	7.6 (7.5-7.7)	7.8 (7.7-7.9)	7.9 (7.8-8.0)	8.1 (8.0-8.2)	8.4 (8.2-8.6)	8.4 (8.3-8.5)	8.5 (8.4-8.6)
BOD (mg/l)	1.76 (1.72-1.85)	2.00 (1.92-2.10)	2.85 (2.80-2.95)	2.89 (2.85-2.98)	2.95 (2.90-3.0)	3.00 (2.88-3.10)	2.80 (2.75-2.90)	2.76 (2.72-2.82)	2.52 (2.40-2.65)	2.00 (1.92-2.10)	1.98 (1.90-2.00)	1.86 (1.75-1.89)
Chlorides (mg/l)	20.50 (19.80-22.20)	22.70 (21.30-24.20)	24.30 (23.60-25.70)	27.40 (26.20-28.40)	28.40 (27.10-28.90)	29.89 (29.00-30.17)	32.70 (31.30-33.80)	31.10 (30.50-33.30)	28.50 (26.30-30.70)	26.20 (25.40-28.30)	22.50 (20.80-22.90)	21.90 (21.0-22.89)
Total Hardness (mg/l)	80.3 (79.5-82.2)	81.3 (79.9-82.3)	85.1 (83.5-87.5)	98.3 (96.2-101.7)	93.6 (92.0-95.8)	99.7 (98.7-100.8)	91.0 (90.2-92.3)	95.3 (93.4-98.1)	80.3 (79.5-82.2)	81.3 (79.9-82.3)	85.1 (83.5-87.5)	98.3 (96.2-101.7)
Alkalinity (mg/l)	99 (94-107)	102 (95-109)	108 (102-113)	111 (103-115)	132 (125-137)	129 (120-133)	137 (125-145)	130 (124-137)	127 (117-134)	122 (112-130)	112 (107-116)	115 (107-120)

Table-4:- Values of Physico-chemical parameters of Ganga water during the year of 2016 at site-VI (Pul Jatwada)

Parameters	**Jan.**	**Feb.**	**March**	**April**	**May**	**June**	**July**	**August**	**Sep.**	**Oct.**	**Nov.**	**Dec.**
Temp.(^{0}C)	11.70 (11.50-11.80)	13.90 (13.70-14.20)	17.50 (17.30-17.70)	22.70 (22.50-23.00)	23.60 (23.40-23.80)	24.80 (22.00-25.10)	23.70 (23.40-23.90)	22.50 (21.30-23.70)	21.70 (21.50-21.80)	18.90 (18.70-19.20)	17.60 (17.00-18.70)	14.70 (14.50-15.00)
Velocity (m/S)	0.50 (0.45-0.60)	0.60 (0.55-0.65)	0.65 (0.60-0.70)	0.75 (0.70-0.80)	1.55 (1.50-1.65)	1.45 (1.40-1.55)	1.35 (1.30-1.40)	0.95 (0.80-1.00)	0.65 (0.60-0.70)	0.60 (0.55-0.65)	0.65 (0.60-0.70)	0.75 (0.70-0.80)
pH	8.70 (8.60	8.10 (8.00	7.80 (7.60	7.80 (7.60	8.50 (8.40-	8.40 (8.30-	8.50 (8.30-	8.60 (8.50-	8.70 (8.60	8.10 (8.00	7.80 (7.60	7.80 (7.60

	-8.80)	-8.30)	-8.00)	-8.00)	8.60)	8.60)	8.70)	8.70)	-8.80)	-8.30)	-8.00)	-8.00)
Trans. (cm)	56.10 (54.80-59.00)	54.50 (53.50-56.40)	51.00 (49.10-52.00)	40.00 (38.70-41.50)	10.10 (9.60-11.80)	19.10 (18.30-20.70)	45.40 (43.80-47.20)	49.70 (47.80-51.20)	56.10 (54.80-59.00)	54.50 (53.50-56.40)	51.00 (49.10-52.00)	40.00 (38.70-41.50)
Turb. (NTU)	6.00 (5.00-8.00)	11.00 (9.00-13.00)	15.00 (14.00-17.00)	22.00 (20.00-24.00)	195.00 (190.00-205.00)	342.00 (338.00-347.00)	586.00 (580.00-592.00)	416.00 (415.00-417.00)	226.00 (225.00-228.00)	22.00 (20.00-24.00)	15.00 (14.00-17.00)	12.00 (9.00-14.00)
TS (mg/l)	230.70 (210.80-250.60)	270.40 (250.45-293.32)	357.60 (340.20-371.30)	600.10 (590.30-617.85)	1820.70 (1800.40-1844.60)	1970.00 (1930.90-2010.60)	2178.00 (2032.20-2210.20)	1336.10 (1320.50-1357.20)	608.10 (598.30-617.80)	357.60 (340.20-371.30)	270.40 (250.45-293.32)	240.70 (220.80-260.10)
TDS (mg/l)	170.40 (156.45-185.50)	187.50 (175.00-205.30)	280.50 (268.10-292.20)	438.90 (430.56-451.54)	1450.56 (1435.10-1470.80)	1540.70 (1530.25-1560.76)	1589.66 (1241.43-1670.40)	1274.23 (1260.20-1290.10)	438.90 (430.56-451.54)	187.50 (175.00-205.30)	170.50 (268.10-292.20)	178.40 (158.45-189.50)
TSS (mg/l)	60.3	82.9	77.1	161.2	370.14	429.3	588.34	61.87	169.2	170.1	99.9	62.3
DO (mg/l)	8.2 (8.1-8.3)	7.9 (7.8-8.1)	7.7 (7.5-7.9)	7.4 (7.2-7.6)	7.3 (7.1-7.5)	7.0 (6.9-7.1)	7.2 (7.1-7.3)	7.5 (7.3-7.7)	7.7 (7.5-7.9)	7.8 (7.7-7.9)	7.9 (7.7-8.1)	8.0 (7.0-8.3)
BOD (mg/l)	2.00 (1.95-2.10)	2.20 (2.10-2.30)	3.20 (3.10-3.30)	3.50 (3.40-3.60)	3.20 (3.10-3.30)	3.90 (2.90-4.20)	2.80 (2.70-2.90)	2.70 (2.60-2.85)	2.00 (1.95-2.10)	2.20 (2.10-2.30)	3.20 (3.10-3.30)	3.50 (3.40-3.60)
Chlorides (mg/l)	24.63 (23.10-25.70)	28.30 (27.40-30.10)	30.50 (29.10-31.20)	35.10 (33.40-36.80)	36.50 (35.20-37.60)	37.60 (35.60-38.30)	42.30 (40.60-43.50)	36.50 (33.34-39.50)	35.70 (33.20-36.90)	28.30 (27.40-30.10)	26.50 (24.10-28.20)	25.89 (25.10-26.59)
Total Hardness (mg/l)	85.6 (84.3-86.2)	86.3 (84.3-88.6)	89.3 (87.3-90.3)	104.7 (102.3-106.6)	99.8 (98.6-102.5)	114.5 (110.4-118.6)	94.5 (92.3-95.7)	97.2 (96.1-98.3)	85.6 (84.3-86.2)	86.1 (84.2-88.5)	89.3 (87.3-90.3)	103.7 (102.3-105.6)
Alkalinity (mg/l)	97 (92-107)	100 (94-105)	104 (100-108)	110 (105-115)	132 (124-140)	125 (118-129)	130 (122-138)	126 (122-133)	120 (113-130)	118 (107-130)	105 (100-110)	120 (110-125)

Table-5:- Values of Physico-chemical parameters of Ganga water during the year of 2017 at site-I (Sapta Rishi Ashram)

Parameters	Jan.	Feb.	March	April	May	June	July	August	Sep.	Oct.	Nov.	Dec.
Temp.(^{0}C)	10.20 (10.00-	13.00 (12.80-	16.00 (15.80-	21.60 (21.10-	19.00 (18.70-	18.80 (18.60-	15.50 (15.30-	12.10 (12.00-	11.00 (10.80-	13.00 (12.80-	16.00 (15.80-	21.60 (21.10-

	10.40)	13.30)	16.20)	21.90)	19.60)	19.00)	15.80)	12.40)	11.30)	13.30)	16.20)	21.90)
Velocity (m/S)	0.90 (0.81 - 1.00)	0.80 (0.77 - 0.89)	0.78 (0.73 - 0.85)	0.97 (0.93 - 1.07)	1.53 (1.49-1.58)	1.87 (1.85-1.92)	1.43 (1.40-1.48)	1.09 (1.07 - 1.14)	0.90 (0.81 - 1.00)	0.80 (0.77 - 0.89)	0.78 (0.73 - 0.85)	0.97 (0.93 - 1.07)
pH	8.50 (8.30 - 8.70)	7.40 (7.20 - 7.50)	7.40 (7.30 - 7.60)	8.00 (7.80 - 8.20)	8.10 (7.90-8.30)	8.70 (8.60-8.90)	7.80 (7.70-8.10)	8.10 (8.00 - 8.20)	8.50 (8.30 - 8.70)	7.40 (7.20 - 7.50)	7.40 (7.30 - 7.60)	8.00 (7.80 - 8.20)
Trans. (cm)	72.23 (70.89-74.00)	63.34 (62.11-65.10)	62.89 (58.53-63.90)	52.59 (48.42-54.30)	17.80 (15.60 - 18.70)	24.59 (23.60 - 25.10)	24.85 (23.10 - 25.50)	53.10 (52.10-55.20)	70.90 (68.89-72.00)	63.34 (62.11-65.10)	62.89 (58.53-63.90)	52.59 (48.42-54.30)
Turb. (NTU)	1.0 (1.00 - 1.00)	4.00 (2.00 - 5.00)	7.00 (5.00 - 9.00)	10.00 (7.00 - 12.00)	34.00 (30-38)	65.00 (60-70)	267.0 (260-273)	145.00 (130-155)	123.0 (112.00-125.00)	4.00 (2.00 - 5.00)	7.00 (5.00 - 9.00)	10.00 (7.00 - 12.00)
TS (mg/l)	145.57 (140.56-150.24)	172.60 (154.34-177.50)	222.54 (205.78-256.76)	482.61 (476.78-512.12)	1613.87 (1610.32-1634.56)	1610.90 (1580.87-1757.43	2109.10 (2094.65-2209.12)	2150.16 (142.08-176.76)	154.12 (148.56-163.24)	172.60 (154.34-177.50)	222.54 (205.78-256.76)	482.61 (476.78-512.12)
TDS (mg/l)	87.80 (86.45-95.30)	110.76 (107.57-114.58)	175.23 (170.76-182.48)	337.78 (331.56-345.40)	1270.67 (1264.87-1282.64)	1370.60 (1364.42-1385.47)	111.89 (106.56-113.50)	108.32 (102.28-114.56)	99.38 (96.45-105.30)	110.76 (107.57-114.58)	175.23 (170.76-182.48)	337.78 (331.56-345.40)
TSS (mg/l)	57.77	61.84	47.31	144.83	343.2	240.3	1997.21	2041.84	54.74	61.84	47.31	144.83
DO (mg/l)	9.7 (9.5-9.9)	9.1 (9.0-9.3)	8.6 (8.3-8.8)	8.3 (8.1-8.5)	8.4 (8.2-8.6)	8.7 (8.6-8.9)	8.9 (8.8-9.1)	9.2 (9.1-9.3)	9.3 (9.1-9.5)	9.1 (9.0-9.3)	8.6 (8.3-8.8)	8.3 (8.1-8.5)
BOD (mg/l)	1.50 (1.40 - 1.60)	1.85 (1.70 - 1.95)	2.80 (2.75 - 2.90)	2.90 (2.80 - 3.10)	2.80 (2.70-2.90)	2.70 (2.60-2.80)	2.40 (2.30-2.50)	2.10 (1.90 - 2.20)	1.70 (1.60 - 1.80)	1.85 (1.70 - 1.95)	2.80 (2.75 - 2.90)	2.90 (2.80 - 3.10)
Chlorides (mg/l)	14.60 (14.00-15.70)	18.80 (18.10-19.80)	21.80 (20.50-23.60)	24.00 (22.80-25.00)	28.70 (27.40 - 29.80)	26.80 (25.70 - 28.00)	24.10 (23.00 - 26.70)	21.20 (20.50-22.90)	16.80 (15.90-18.70)	18.80 (18.10-19.80)	21.80 (20.50-23.60)	24.00 (22.80-25.00)
Total Hardness (mg/l)	62.27 (51.5 - 71.5)	75.0 (72.8 - 77.2)	68.3 (67.2 - 71.0)	87.4 (85.3 - 89.6)	84.2 (82.7-86.2)	89.6 (87.6-93.7)	78.8 (76.3-80.3)	85.4 (83.2 - 87.1)	73.7 (71.5 - 75.5)	75.0 (72.8 - 77.2)	68.3 (67.2 - 71.0)	87.4 (85.3 - 89.6)
Alkalinity (mg/l)	96 (91-107)	100 (94-106)	103 (100-111)	108 (102-110)	130 (122-133)	122 (117-128)	130 (122-137)	126 (122-132)	120 (112-131)	112 (107-116)	105 (102-112)	111 (108-117)

Table 6- Values of Physico-chemical parameters of Ganga water during the year of 2017 at site-II (Har Ki Pauri)

Parameters	Jan.	Feb.	March	April	May	June	July	August	Sep.	Oct.	Nov.	Dec.
Temp.(^{0}C)	11.40 (11.20-11.60)	14.00 (13.80-14.40)	17.00 (16.50-17.30)	22.60 (22.40-22.80)	21.30 (21.00-21.80)	19.70 (19.50-20.20)	16.10 (15.90-16.30)	13.50 (13.30-13.70)	11.40 (11.20-11.60)	14.00 (13.80-14.40)	17.00 (16.50-17.30)	22.60 (22.40-22.80)
Velocity (m/S)	0.90 (0.85-1.00)	0.80 (0.70-0.90)	0.85 (0.75-0.95)	0.95 (0.90-1.05)	1.75 (1.70-1.80)	1.70 (1.65-1.75)	1.65 (1.55-1.70)	1.15 (1.00-1.25)	0.90 (0.85-1.00)	0.80 (0.70-0.90)	0.85 (0.75-0.95)	0.95 (0.90-1.05)
pH	8.50 (8.40-8.65)	7.70 (7.50-7.80)	7.70 (7.40-7.80)	7.90 (7.80-8.00)	8.10 (8.00-8.30)	7.75 (7.65-7.95)	8.15 (7.90-8.30)	8.45 (8.40-8.50)	8.50 (8.40-8.65)	7.70 (7.50-7.80)	7.70 (7.40-7.80)	7.90 (7.80-8.00)
Trans. (cm)	60.30 (58.90-62.40)	58.60 (56.50-61.50)	55.10 (53.50-58.40)	47.90 (45.50-49.50)	14.30 (12.00-16.50)	24.70 (22.70-26.50)	50.80 (49.30-53.90)	55.70 (53.10-57.50)	60.30 (58.90-62.40)	58.60 (56.50-61.50)	55.10 (53.50-58.40)	47.90 (45.50-49.50)
Turb. (NTU)	4.0 (2.00-6.00)	4.00 (3.00-6.00)	6.00 (5.00-9.00)	9.00 (7.00-11.00)	295.00 (289.00-300.00)	160.00 (154.00-170.00)	10.00 (9.00-11.00)	10.00 (9.00-12.00)	4.0 (2.00-6.00)	4.00 (3.00-6.00)	6.00 (5.00-9.00)	9.00 (7.00-11.00)
TS (mg/l)	183.0 (171.5-194.5)	186.95 (180.51-198.45)	280.54 (267.95-281.79)	521.68 (507.91-540.18)	1811.9 (1684.8-1832.56)	1720.92 (1707.1-1732.68)	289.22 (260.8-317.46)	211.19 (190.66-226.64)	183.0 (171.5-194.5)	186.95 (180.51-198.45)	280.54 (267.95-281.79)	521.68 (507.91-540.18)
TDS (mg/l)	123.30 (116.40-128.70)	121.80 (118.61-129.65)	220.42 (210.10-221.50)	368.79 (357.65-378.54)	1476.56 (1369.47-1488.46)	1326.67 (1319.74-1336.48)	157.97 (140.70-171.35)	120.40 (119.26-130.54)	123.30 (116.40-128.70)	121.80 (118.61-129.65)	220.42 (210.10-221.50)	368.79 (357.65-378.54)
TSS (mg/l)	59.7	65.15	60.12	152.89	335.34	394.25	131.25	90.79	59.7	65.15	60.12	152.89
DO (mg/l)	9.0 (8.9-9.1)	8.8 (8.6-8.9)	8.6 (8.4-8.8)	7.8 (7.7-8.1)	8.1 (7.7-8.2)	8.3 (8.1-8.5)	8.5 (8.3-8.6)	8.7 (8.6-8.8)	9.0 (8.9-9.1)	8.8 (8.6-8.9)	8.6 (8.4-8.8)	7.8 (7.7-8.1)
BOD (mg/l)	1.70 (1.63-1.85)	1.80 (1.71-2.00)	2.80 (2.70-3.10)	2.90 (2.80-3.20)	2.70 (2.60-2.80)	2.60 (2.50-2.70)	2.40 (2.30-2.50)	2.00 (2.00-2.10)	1.70 (1.63-1.85)	1.80 (1.71-2.00)	2.80 (2.70-3.10)	2.90 (2.80-3.20)
Chlorides (mg/l)	20.50 (19.50-22.30)	23.60 (22.00-24.80)	24.30 (23.50-25.80)	27.20 (25.90-28.60)	33.10 (31.80-32.80)	31.40 (29.80-33.00)	27.20 (26.40-28.00)	22.10 (21.50-24.50)	20.50 (19.50-22.30)	23.60 (22.00-24.80)	24.30 (23.50-25.80)	27.20 (25.90-28.60)
Total Hardness (mg/l)	87.4 (85.2-92.4)	81.2 (79.5-83.6)	82.0 (80.3-83.6)	84.83 (82.0-86.3)	88.6 (86.7-92.8)	102.3 (100.4-105.6)	102.5 (100.2-104.6)	110.3 (108.3-113.2)	87.4 (85.2-92.4)	81.2 (79.5-83.6)	82.0 (80.3-83.6)	84.83 (82.0-86.3)

Alkalinity (mg/l)	104 (96-110)	110 (102-112)	108 (106-110)	112 (102-120)	140 (128-146)	136 (128-138)	140 (130-148)	136 (124-148)	130 (124-140)	126 (112-130)	120 (114-130)	124 (116-130)

Table- 7:- Values of Physico-chemical parameters of Ganga water during the year 2017 at site-III (Prem Nagar Ghat)

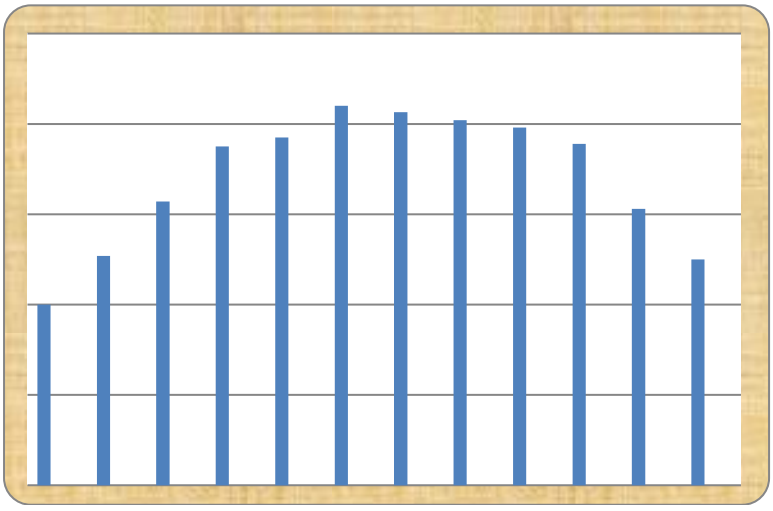
Parameters	Jan.	Feb.	March	April	May	June	July	August	Sep.	Oct.	Nov.	Dec.
Temp.(^{0}C)	11.00 (10.80-11.60)	14.60 (14.30-14.80)	17.90 (17.70-18.50)	22.80 (22.40-23.00)	20.80 (20.50-21.10)	17.90 (17.50-18.10)	16.80 (16.40-17.30)	15.20 (14.80-15.70)	11.00 (10.80-11.60)	14.60 (14.30-14.80)	17.90 (17.70-18.50)	22.80 (22.40-23.00)
Velocity (m/S)	0.80 (0.75-0.95)	0.70 (0.65-0.80)	0.80 (0.70-0.85)	0.85 (0.80-0.90)	1.70 (1.60-1.85)	1.70 (1.55-1.75)	1.45 (1.35-1.55)	1.00 (0.95-1.10)	0.80 (0.75-0.95)	0.70 (0.65-0.80)	0.80 (0.70-0.85)	0.85 (0.80-0.90)
pH	8.65 (8.45-8.80)	7.35 (7.25-7.60)	7.65 (7.50-7.90)	8.20 (7.90-8.30)	8.45 (8.25-8.60)	8.20 (7.90-8.40)	8.15 (8.00-8.40)	8.50 (8.40-8.60)	8.65 (8.45-8.80)	7.35 (7.25-7.60)	7.65 (7.50-7.90)	8.20 (7.90-8.30)
Trans. (cm)	63.80 (61.20-64.00)	61.40 (59.00-62.80)	54.20 (52.30-56.50)	46.10 (44.20-47.30)	12.60 (11.30-14.50)	23.80 (22.20-24.70)	47.50 (46.20-49.10)	54.80 (53.90-55.50)	63.80 (61.20-64.00)	61.40 (59.00-62.80)	54.20 (52.30-56.50)	46.10 (44.20-47.30)
Turb. (NTU)	5.00 (4.00-7.00)	9.00 (8.00-10.00)	14.00 (11.00-16.00)	18.00 (17.00-20.00)	326.00 (321.00-332.00)	185.00 (176.00-190.00)	18.00 (16.00-22.00)	14.00 (11.00-16.00)	5.00 (4.00-7.00)	9.00 (8.00-10.00)	14.00 (11.00-16.00)	18.00 (17.00-20.00)
TS (mg/l)	205.80 (188.90-215.80)	212.40 (198.50-224.70)	323.78 (310.40-337.65)	542.70 (520.60-558.60)	1856.50 (1820.75-1905.40)	1758.70 (1745.60-1798.60)	350.48 (320.60-384.59)	295.00 (278.45-316.90)	205.80 (188.90-215.80)	212.40 (198.50-224.70)	323.78 (310.40-337.65)	542.70 (520.60-558.60)
TDS (mg/l)	137.50 (130.40-143.10)	147.78 (136.70-159.70)	260.89 (250.70-270.90)	456.43 (441.68-469.50)	1510.80 (1490.87-1540.30)	1368.76 (1356.40-1380.10)	220.40 (195.70-232.70)	210.85 (194.50-227.20)	137.50 (130.40-143.10)	147.78 (136.70-159.70)	260.89 (250.70-270.90)	456.43 (441.68-469.50)
TSS (mg/l)	68.3	64.62	62.89	86.27	345.7	389.94	130.08	84.15	68.3	64.62	62.89	86.27
DO (mg/l)	8.6 (8.5-8.7)	8.4 (8.2-8.5)	8.1 (8.0-8.3)	7.4 (7.3-7.5)	7.7 (7.6-7.9)	7.9 (7.8-8.1)	8.0 (7.8-8.2)	8.4 (8.2-8.6)	8.6 (8.5-8.7)	8.4 (8.2-8.5)	8.1 (8.0-8.3)	7.4 (7.3-7.5)
BOD (mg/l)	1.80 (1.70-1.95)	2.00 (1.90-2.10)	2.80 (2.70-2.90)	3.00 (2.80-3.10)	2.70 (2.60-2.80)	2.70 (2.50-2.90)	2.60 (2.40-2.80)	2.20 (2.00-2.40)	1.80 (1.70-1.95)	2.00 (1.90-2.10)	2.80 (2.70-2.90)	3.00 (2.80-3.10)
Chlorides (mg/l)	19.30 (18.80-22.00)	22.80 (21.00-24.00)	25.40 (24.00-26.70)	29.40 (27.70-30.50)	33.80 (32.10-34.30)	31.20 (30.70-32.40)	29.20 (28.10-31.70)	26.20 (25.70-28.50)	19.30 (18.80-22.00)	22.80 (21.00-24.00)	25.40 (24.00-26.70)	29.40 (27.70-30.50)

Total Hardness (mg/l)	81.9 (79.8-83.5)	82.6 (80.0-85.3)	87.5 (86.3-91.8)	85.0 (84.3-87.8)	88.2 (87.0-89.8)	99.8 (97.3-104.7)	102.6 (100.8-105.8)	105.9 (104.7-110.6)	81.9 (79.8-83.5)	82.6 (80.0-85.3)	87.5 (86.3-91.8)	85.0 (84.3-87.8)
Alkalinity (mg/l)	102 (96-109)	106 (100-113)	112 (105-116)	114 (105-118)	134 (127-140)	129 (120-133)	135 (129-150)	136 (128-143)	132 (122-138)	134 (118-139)	117 (114-122)	108 (104-112)

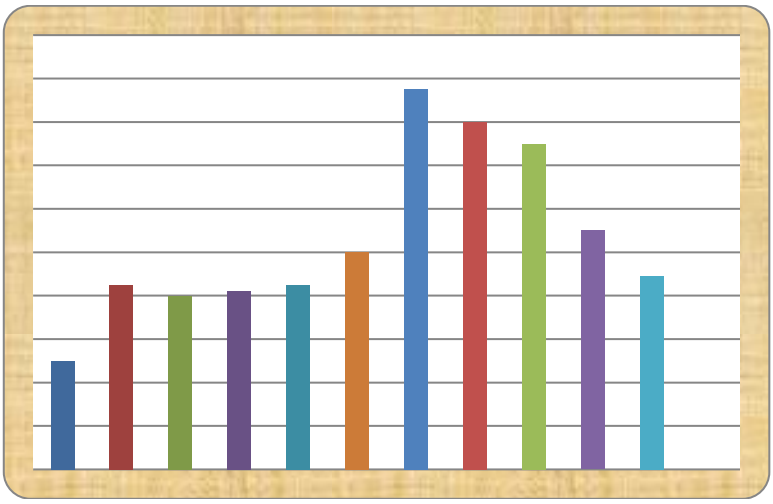
Table- 81:- Values of Physico-chemical parameters of Ganga water during the year 2017 at site-IV (Pul Jatwada)

Parameters	Jan.	Feb.	March	April	May	June	July	August	Sep.	Oct.	Nov.	Dec.
Temp.(^{0}C)	11.85 (11.50-11.95)	13.95 (13.70-14.25)	17.56 (17.30-17.75)	23.75 (23.40-23.95)	22.85 (22.50-23.45)	24.90 (23.00-25.50)	21.75 (21.40-22.85)	17.56 (17.30-17.75)	14.85 (14.50-15.35)	13.95 (13.70-14.25)	12.78 (11.90-13.21)	11.95 (11.50-12.5)
Velocity (m/S)	0.56 (0.50-0.65)	0.65 (0.55-0.75)	0.69 (0.60-0.75)	0.80 (0.70-0.85)	1.59 (1.50-1.65)	1.50 (1.40-1.65)	1.45 (1.30-1.50)	0.97 (0.80-1.15)	0.62 (0.60-0.75)	0.65 (0.55-0.75)	0.69 (0.60-0.75)	0.80 (0.70-0.85)
pH	8.75 (8.60-8.95)	8.15 (8.00-8.36)	7.86 (7.60-8.10)	7.85 (7.60-8.15)	8.65 (8.40-8.90)	8.65 (8.30-8.80)	8.65 (8.30-8.85)	8.68 (8.52-8.75)	8.75 (8.60-8.95)	8.15 (8.00-8.36)	7.86 (7.60-8.10)	7.85 (7.60-8.15)
Trans. (cm)	56.15 (54.80-59.35)	54.75 (53.50-56.45)	51.15 (49.10-52.35)	40.35 (38.75-41.55)	10.25 (9.65-11.95)	9.15 (8.35-10.75)	2.75 (2.5-3.25)	9.85 (7.80-11.26)	16.15 (14.80-19.35)	40.35 (38.75-41.55)	51.15 (49.10-52.35	54.75 (53.50-56.45)
Turb. (NTU)	6.50 (5.00-8.00)	12.00 (10.00-14.00)	16.00 (14.50-17.00)	23.00 (20.00-25.00)	20.00 (18.00-22.00)	196.00 (191.00-206.00)	542.00 (538.00-548.00)	416.00 (415.10-417.00)	6.50 (5.00-8.00)	12.00 (10.00-14.00)	16.00 (14.50-17.00)	23.00 (20.00-25.00)
TS (mg/l)	230.80 (210.85-250.90)	272.68 (250.49-293.35)	358.65 (340.25-371.40)	600.25 (580.35-617.95)	2080.25 (1930.95-2090.65)	1824.75 (1800.45-1844.65)	2199.25 (2032.50-2378.65)	600.25 (580.35-617.95)	358.65 (340.25-371.40)	272.68 (250.49-293.35)	330.80 (210.85-350.90)	337.25 (320.55-357.40)
TDS (mg/l)	170.60 (156.50-185.65)	187.80 (175.50-205.70)	280.65 (268.15-292.40)	439.95 (430.75-451.55)	1541.85 (1530.25-1560.76)	1450.65 (1435.20-1464.95)	1591.00 (1541.55-1570.65)	274.55 (260.25-290.35)	170.60 (156.50-185.65)	187.80 (175.50-205.70)	280.65 (268.15-292.40)	239.95 (230.75-251.55)
TSS (mg/l)	60.2	84.88	78	160.3	538.4	374.1	608.25	325.7	188.05	84.88	50.15	97.3
DO (mg/l)	8.6 (8.2-8.9)	8.0 (7.8-8.2)	7.8 (7.5-8.1)	7.2 (7.0-7.5)	7.5 (7.2-7.8)	6.9 (6.4-7.3)	7.9 (7.7-8.1)	7.8 (7.5-8.1)	8.0 (7.8-8.2)	8.1 (7.7-8.4)	8.2 (7.9-8.5)	8.6 (8.2-8.9)
BOD (mg/l)	2.10 (1.95	2.30 (2.15	3.25 (3.15	3.60 (3.40	3.25 (3.10-	3.90 (3.40-	2.85 (2.70-	2.75 (2.60	3.25 (3.15	2.30 (2.15	2.10 (1.95	2.60 (2.40

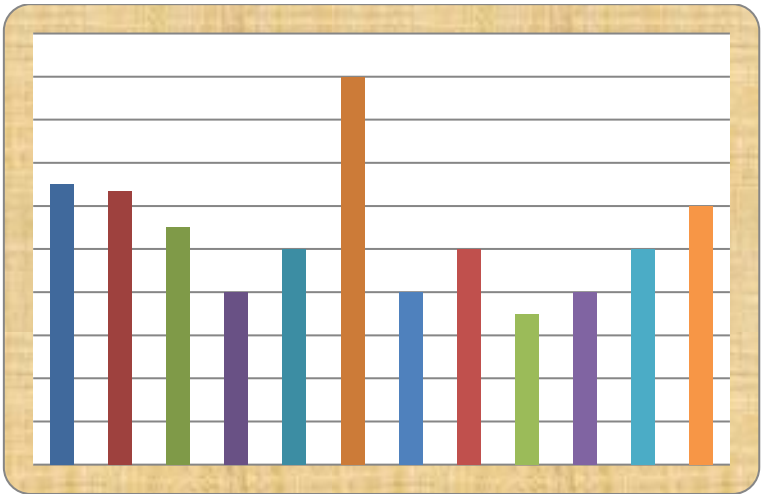
	- 2.20)	- 2.45)	- 3.35)	- 3.85)	3.35)	4.10)	2.95)	- 2.95)	- 3.35)	- 2.45)	- 2.20)	- 2.85)
Chlorides (mg/l)	24.69 (23.15- 25.75)	28.45 (27.40- 30.25)	30.75 (29.10- 31.38)	35.20 (33.40- 36.85)	37.85 (35.65 - 38.75)	36.80 (35.20 - 37.90)	44.35 (40.55 - 46.65)	32.56 (30.35- 34.60)	35.20 (33.40- 36.85)	28.45 (27.40- 30.25)	30.75 (29.10- 31.38)	24.99 (23.50- 25.85)
Total Hardness (mg/l)	85.7 (84.6 - 86.5)	86.7 (84.5 - 88.9)	89.5 (87.2 - 90.6)	103.4 (102.5- 106.7)	99.9 (98.6- 103.5)	114.5 (107.4 - 121.9)	94.9 (92.0- 95.6)	97.8 (96.2 - 98.6)	85.7 (84.6 - 86.5)	86.7 (84.5 - 88.9)	89.5 (87.2 - 90.6)	103.4 (102.5- 106.7)
Alkalinity (mg/l)	98 (92- 108)	100 (95- 106)	104 (102- 114)	110 (108- 112)	132 (124- 135)	124 (119- 130)	132 (124- 139)	128 (124- 134)	122 (114- 133)	114 (109- 118)	108 (104- 114)	114 (110- 120)



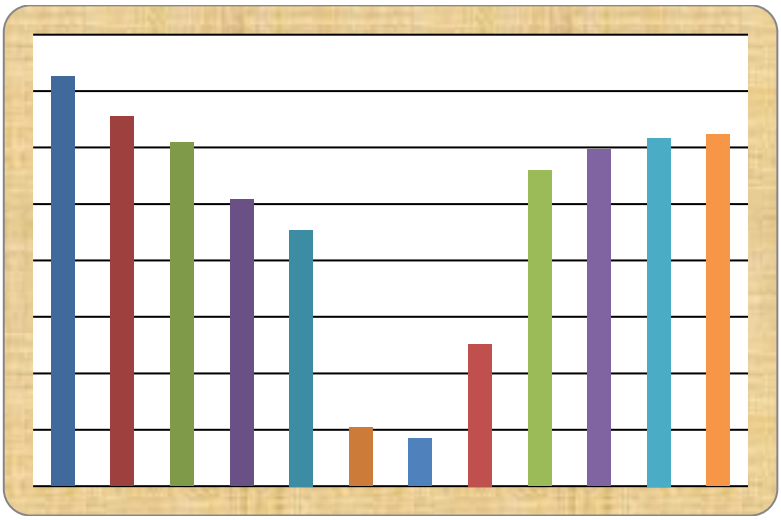
(A) Variation in temperature (^{0}C) in Site-I i.e. Sapta Rishi Ghat



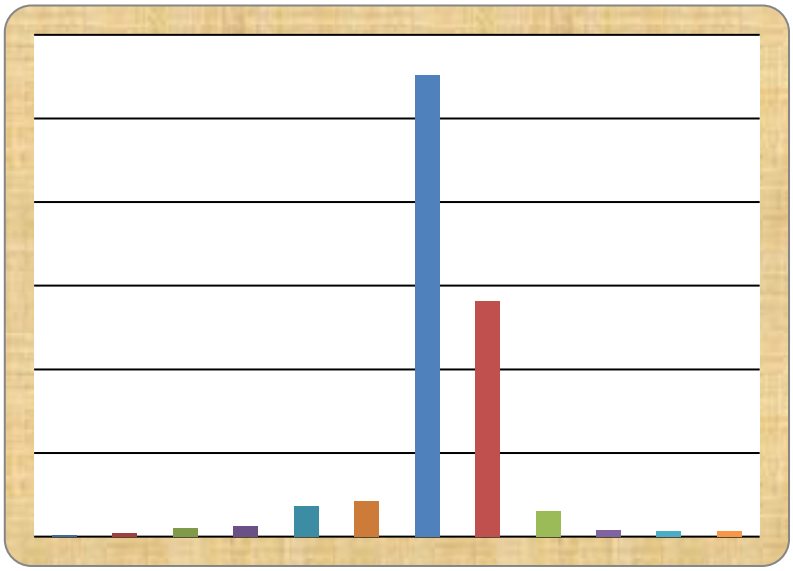
(B) Variation in Velocity (m/s) in Site-I i.e. Sapta Rishi Ghat



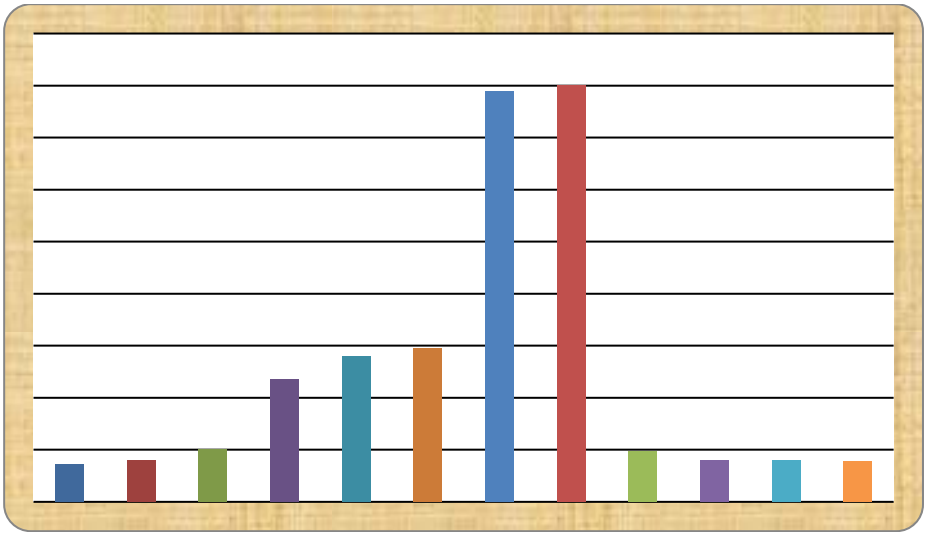
(C) Variation in pH in Site-I i.e. Sapta Rishi Ghat



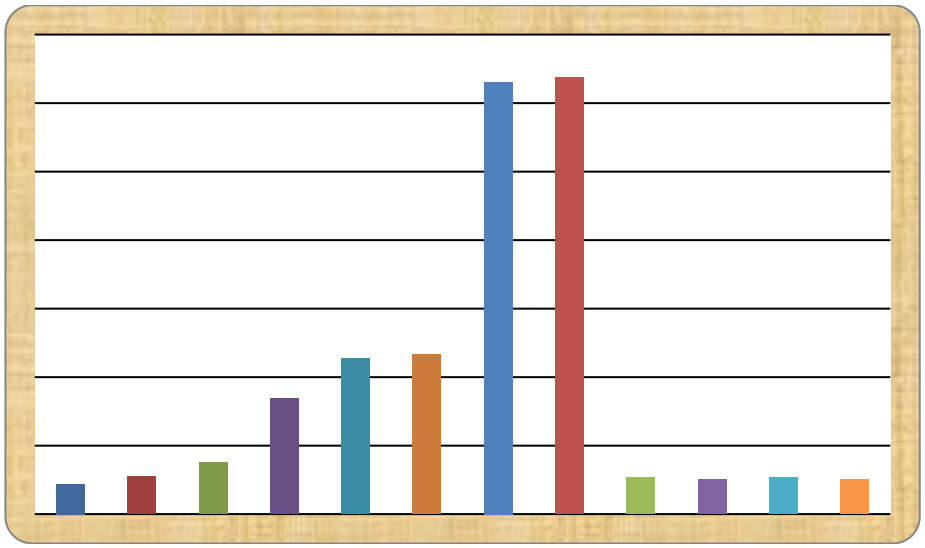
(D) Variation in Transparency (cm) in Site-I i.e. Sapta Rishi Ghat



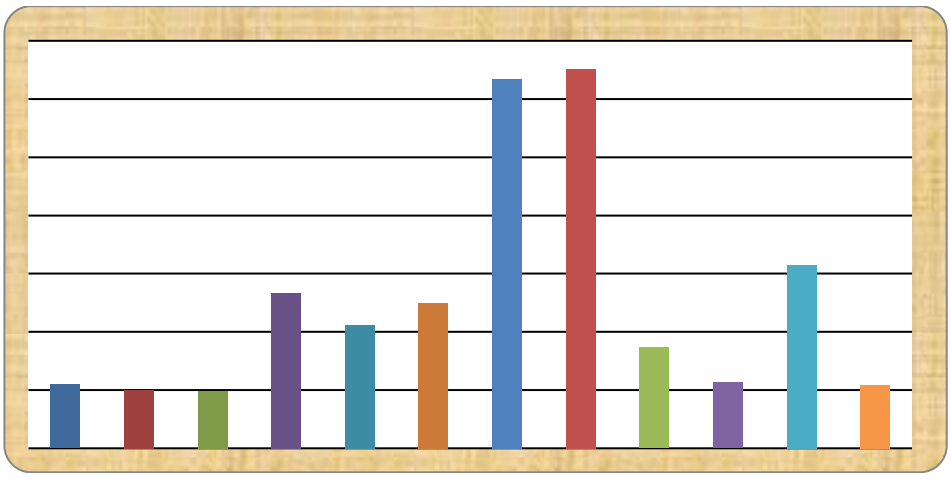
(E) Variation in Turbidity (NTU) in Site-I i.e. Sapta Rishi Ghat



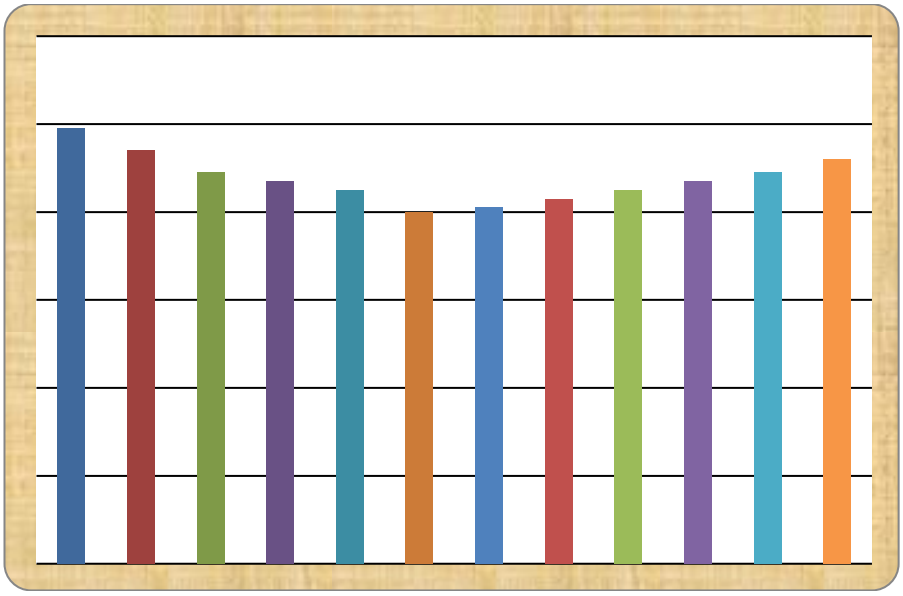
(F)Variation in Total Solids (mg/l in Site-I i.e. Sapta Rishi Ghat



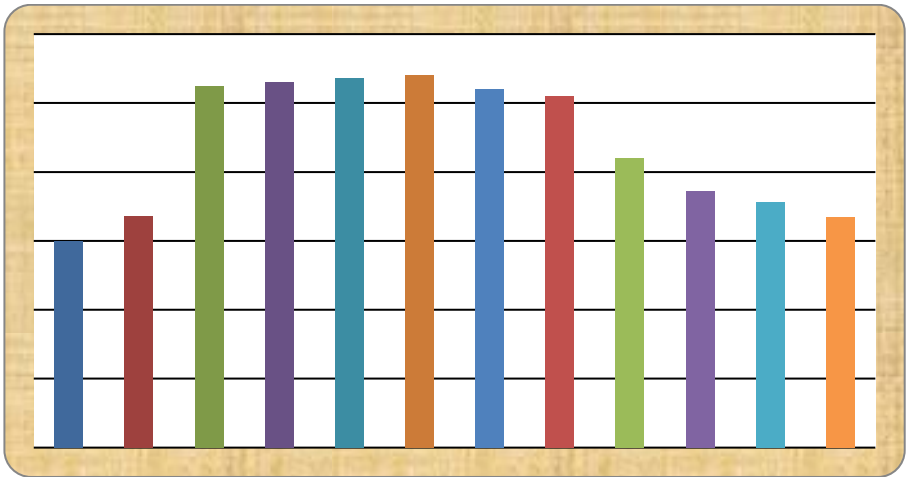
(F) Variations in Total Dissolved Solids (mg/l) in Site-I i.e. Sapta Rishi Ghat



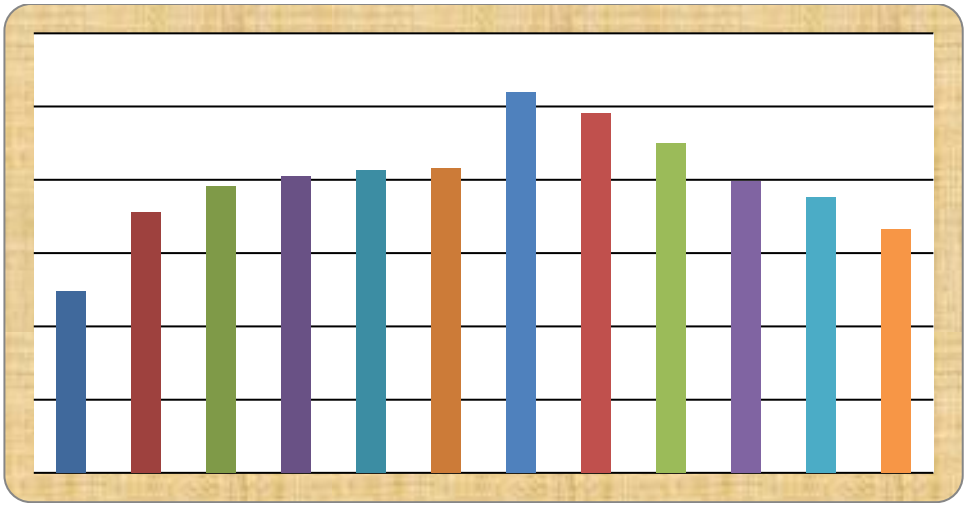
(H) Variations in Total Suspended Solids (mg/l) in Site-I i.e. Sapta Rishi Ghat



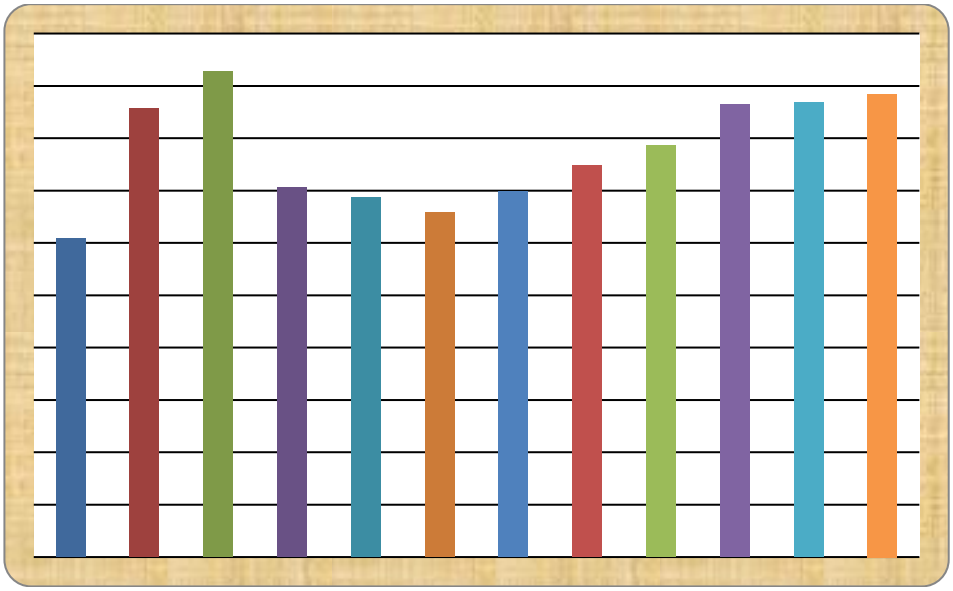
(I) Variations in Dissolved Oxygen (mg/l) in Site-I i.e. Sapta Rishi Ghat



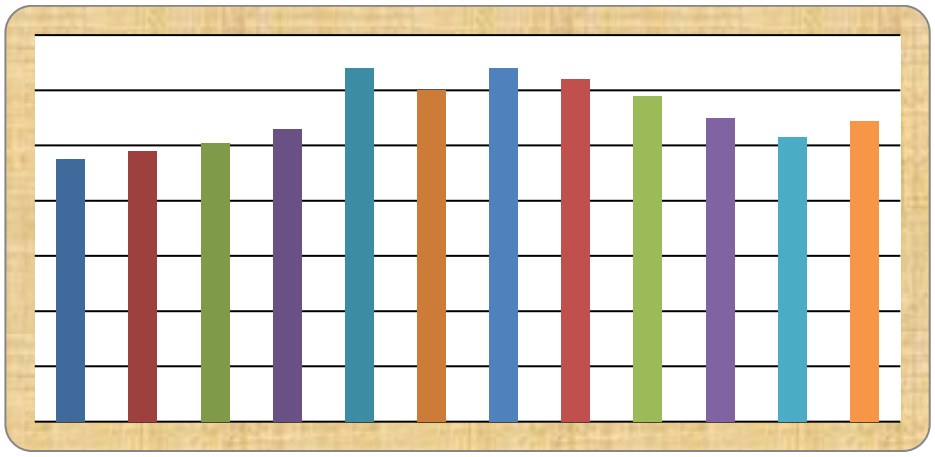
(J) Variations in Bio-chemical Oxygen Demand (mg/l) in Site-I i.e. Sapta Rishi Ghat



(K) Variations in Chlorides (mg/l) in Site-I i.e. Sapta Rishi Ghat

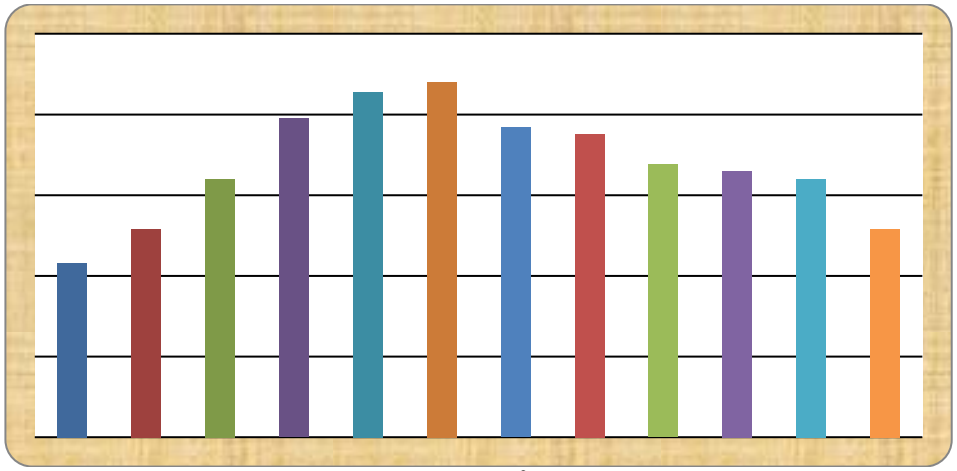


(L) Variations in Total Hardness (mg/l) in Site-I i.e. Sapta Rishi Ghat

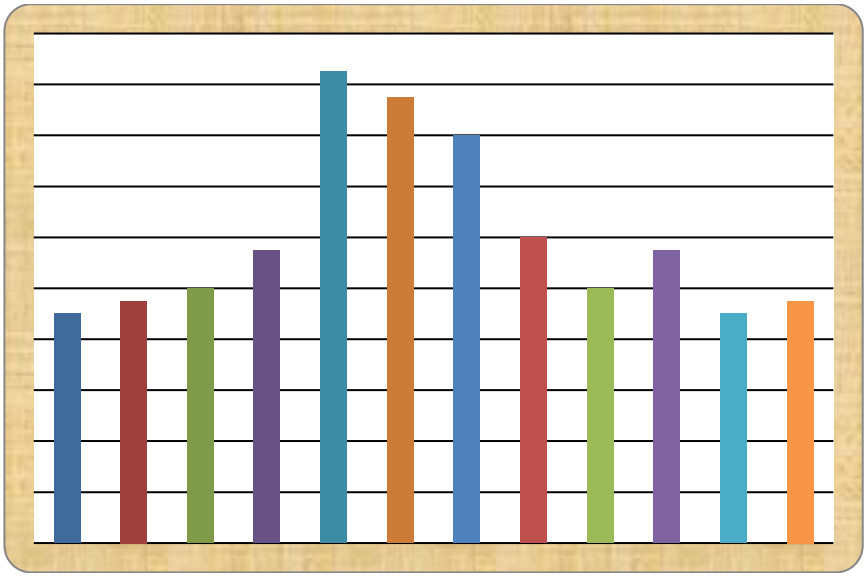


(M) Variations in Alkalinity (mg/l) in Site-I i.e. Sapta Rishi Ghat

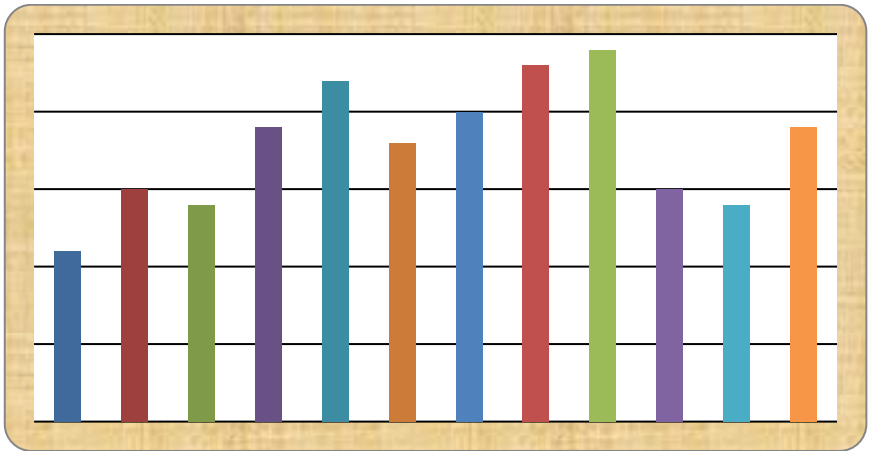
(Graphs A to M) Showing physicochemical variations at site-I i.e. Sapta Rishi Ghat during the first year of study i.e. 2016



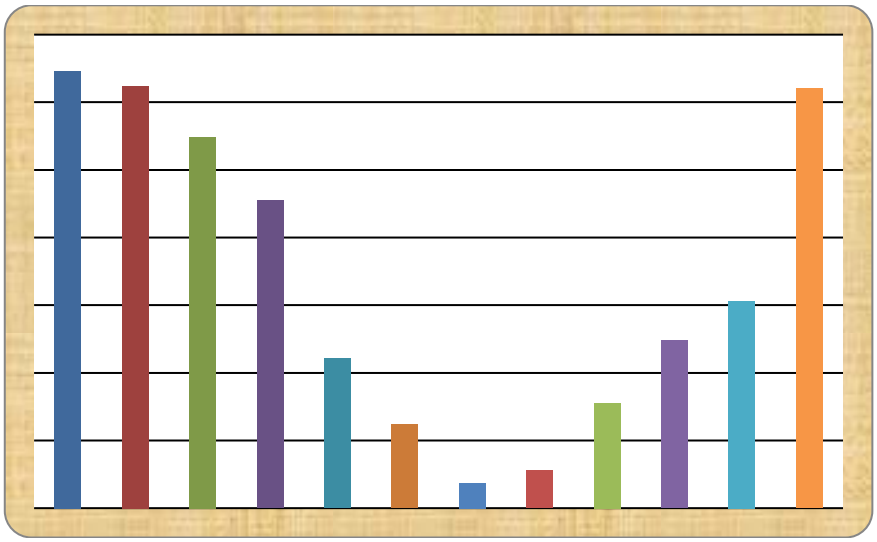
(a) Variations in Temperature (^{0}C) in site-II i.e. Har Ki Pauri



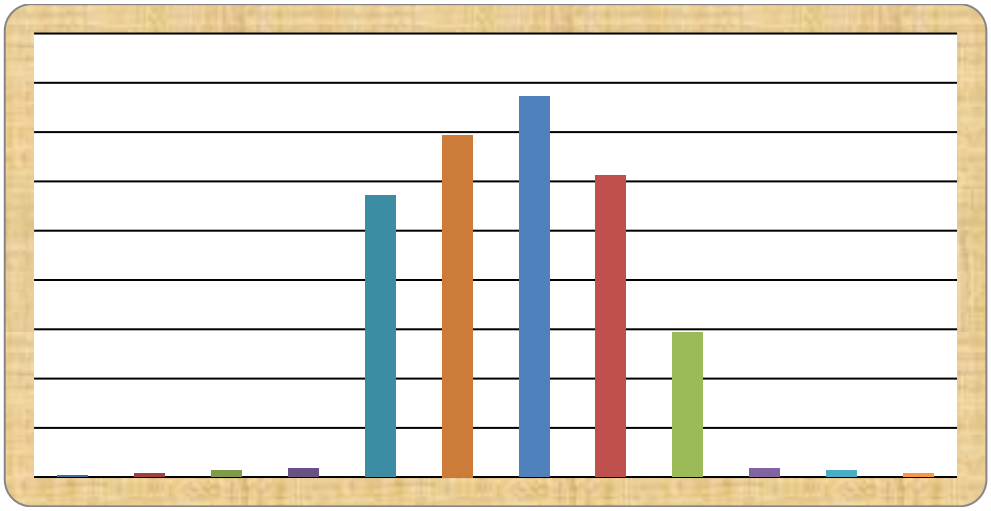
(b) Variations in Velocity (m/s) in site-II i.e. Har Ki Pauri



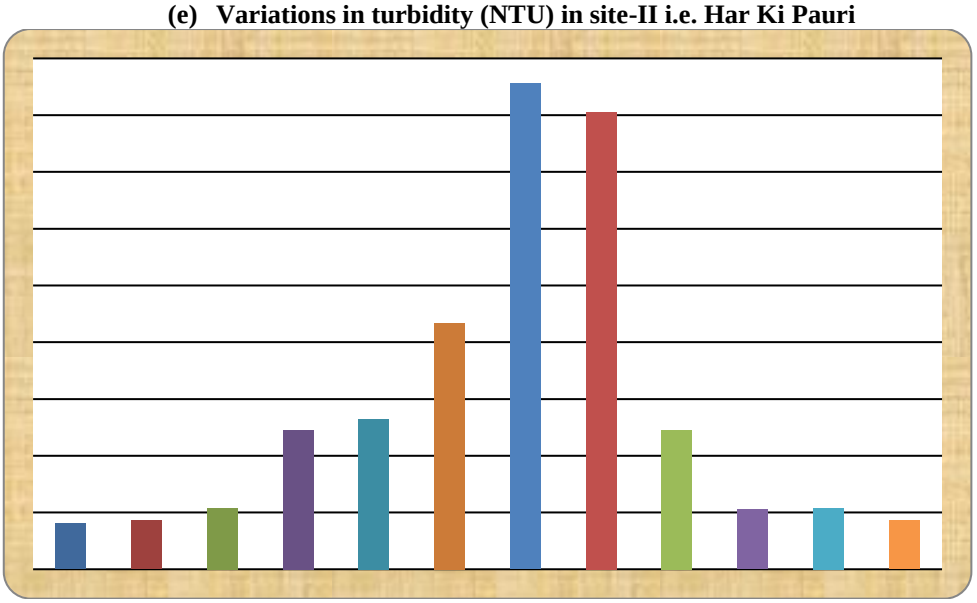
(c) Variations in pH in site-II i.e. Har Ki Pauri



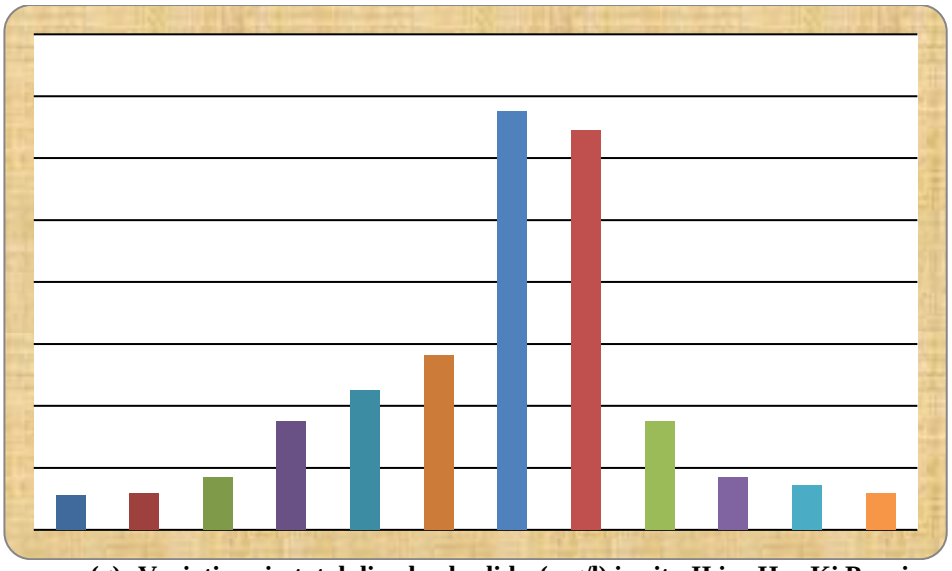
(d) Variations in transparency (cm) in site-II i.e. Har Ki Pauri



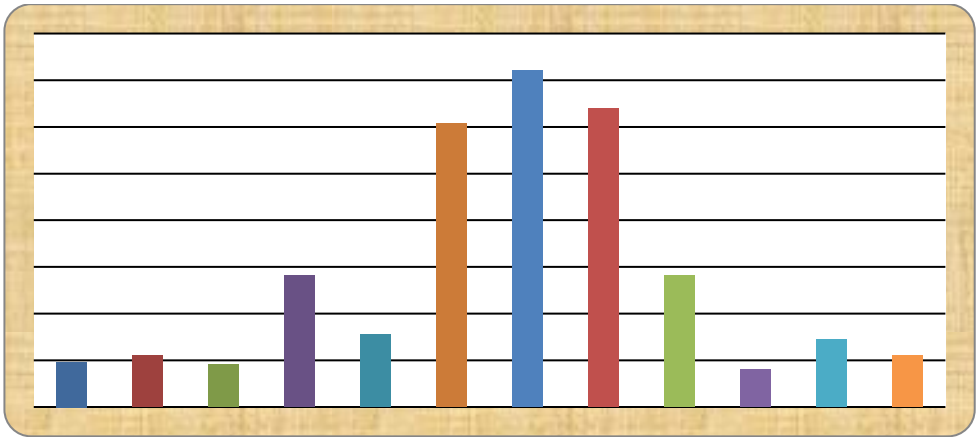
(e) Variations in turbidity (NTU) in site-II i.e. Har Ki Pauri



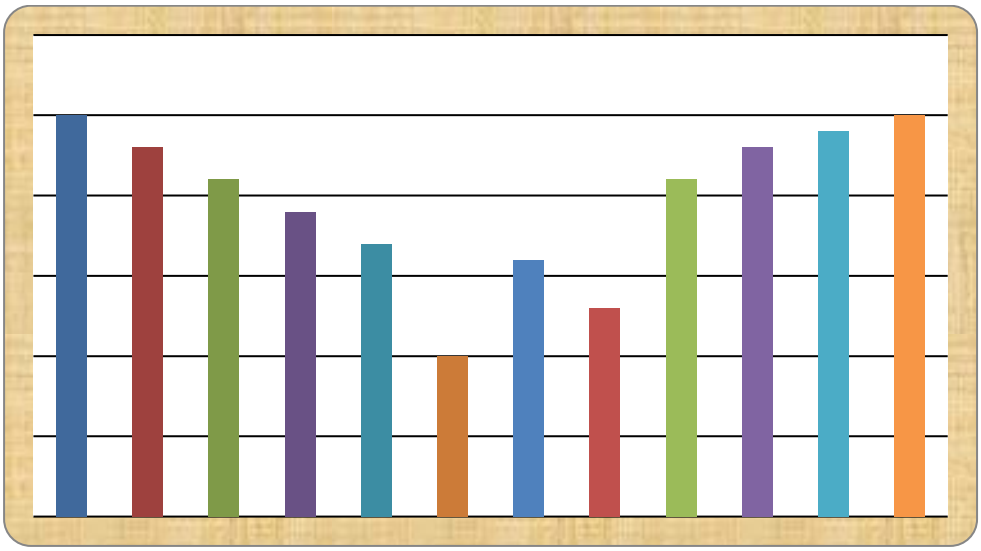
(f) Variations in total solids (mg/l) in site-II i.e. Har Ki Pauri



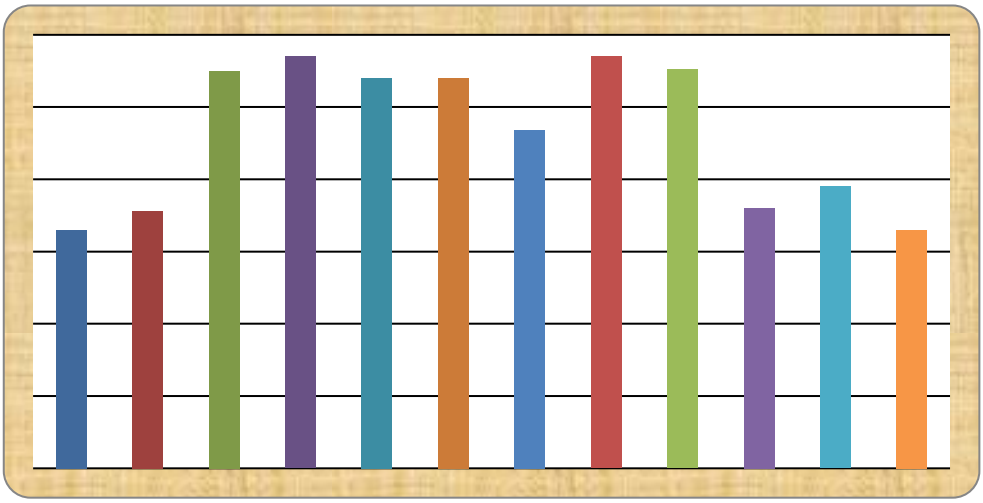
(g) Variations in total dissolved solids (mg/l) in site-II i.e. Har Ki Pauri



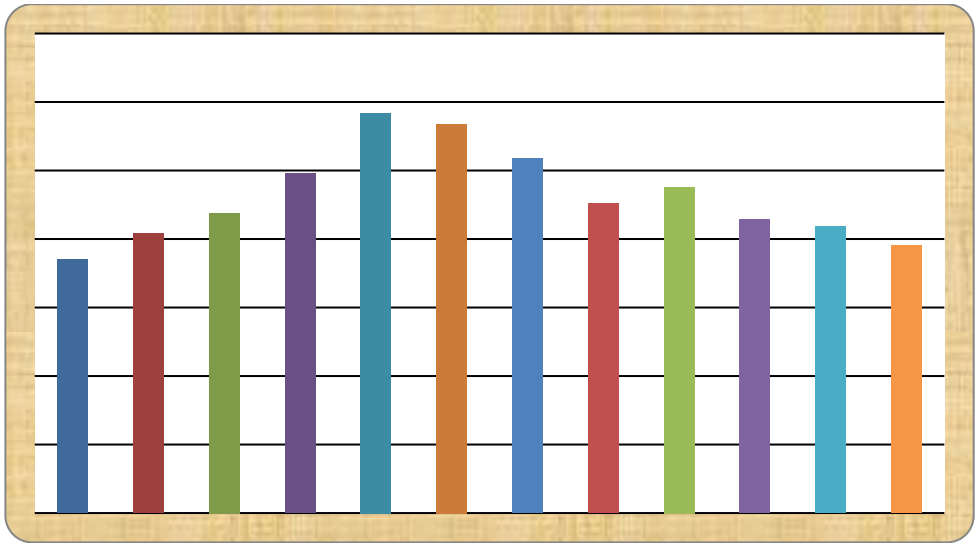
(h) Variations in total suspended solids (mg/l) in site-II i.e. Har Ki Pauri



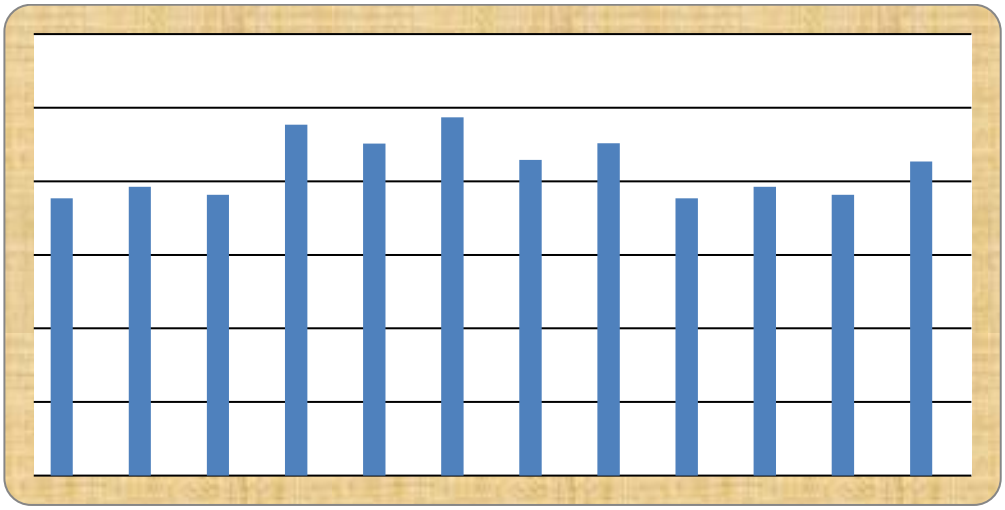
(i) Variations in dissolved oxygen (mg/l) in site-II i.e. Har Ki Pauri



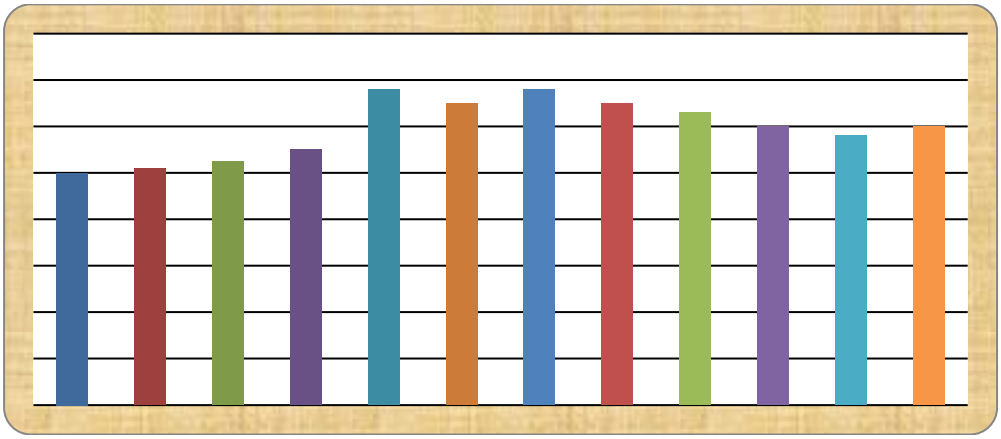
Variations in biochemical oxygen demand (mg/l) in site-II i.e. Har Ki Pauri



(j) Variations in chlorides (mg/l) in site-II i.e. Har Ki Pauri

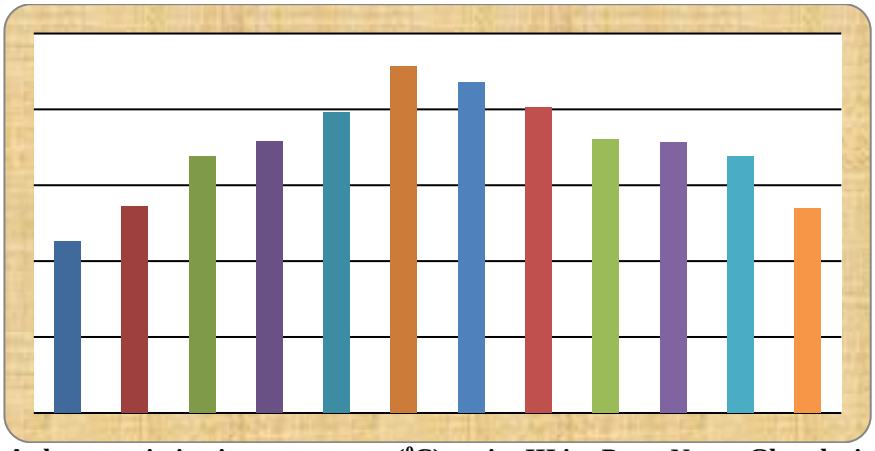


(k) Variations in Total Hardness (mg/l) in site-II i.e. Har Ki Pauri

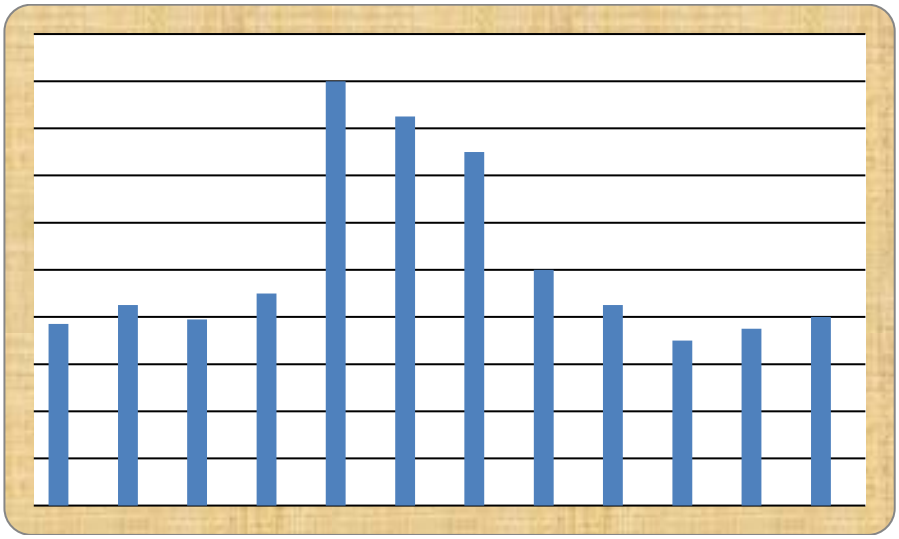


(m) Variations in Alkalinity (mg/l) in site-II i.e. Har Ki Pauri

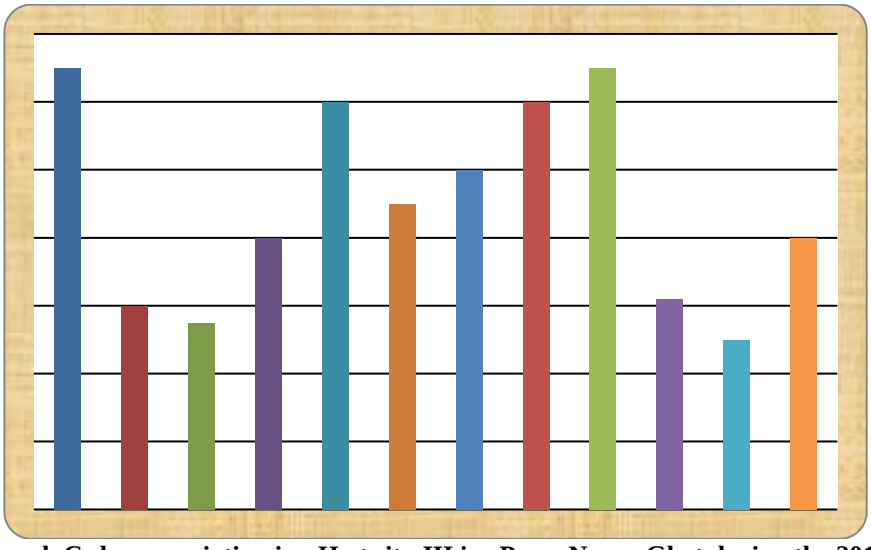
(Graphs a to m) Showing physicochemical variations at site-II i.e. Har Ki Pauri during the first year of study i.e. 2016



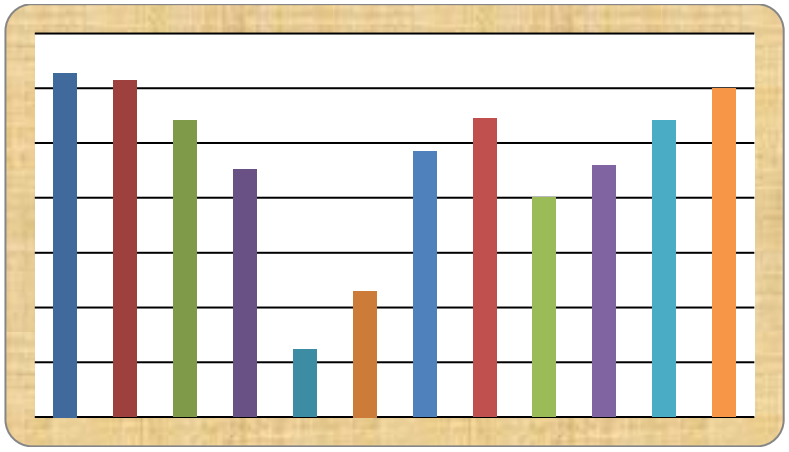
Graph A shows variation in temperature (^{0}C) at site-III i.e. Prem Nagar Ghat during 2016



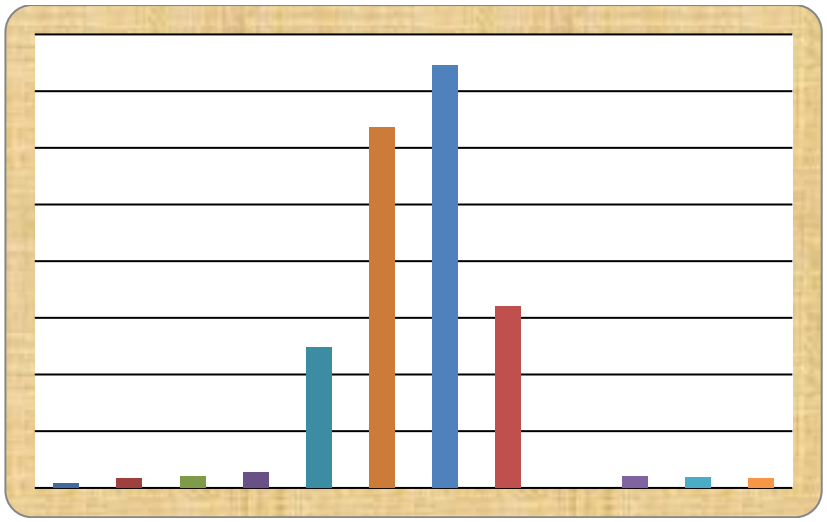
Graph B shows variation in Velocity (m/s) at site-III i.e. Prem Nagar Ghat during the 2016



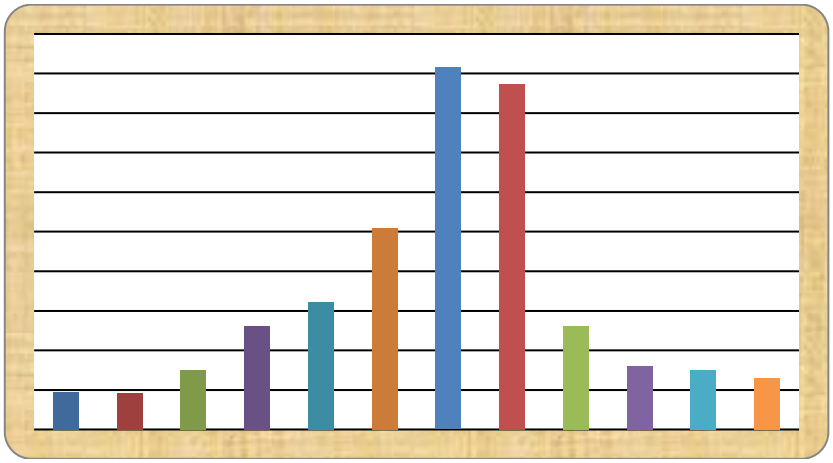
Graph C shows variation in pH at site-III i.e. Prem Nagar Ghat during the 2016



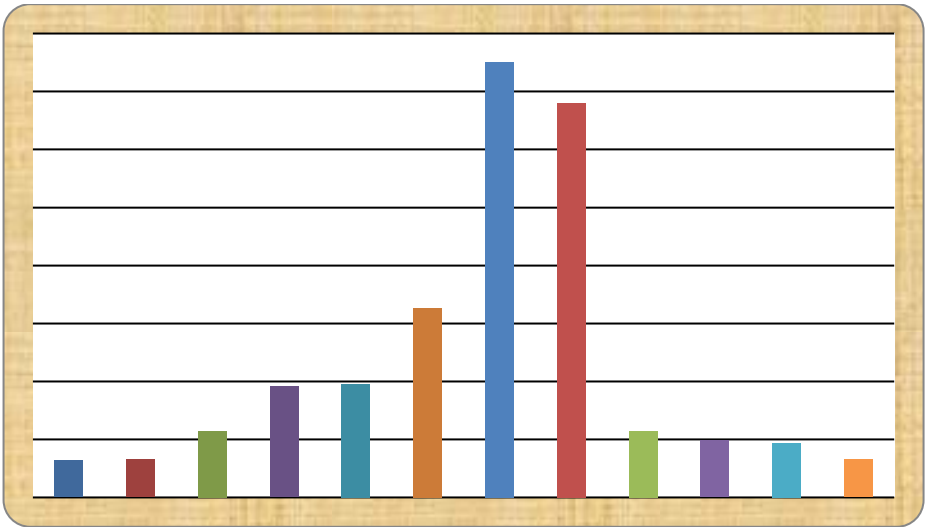
Graph D shows variation in Transparency (cm) at site-III i.e. Prem Nagar Ghat during the 2016



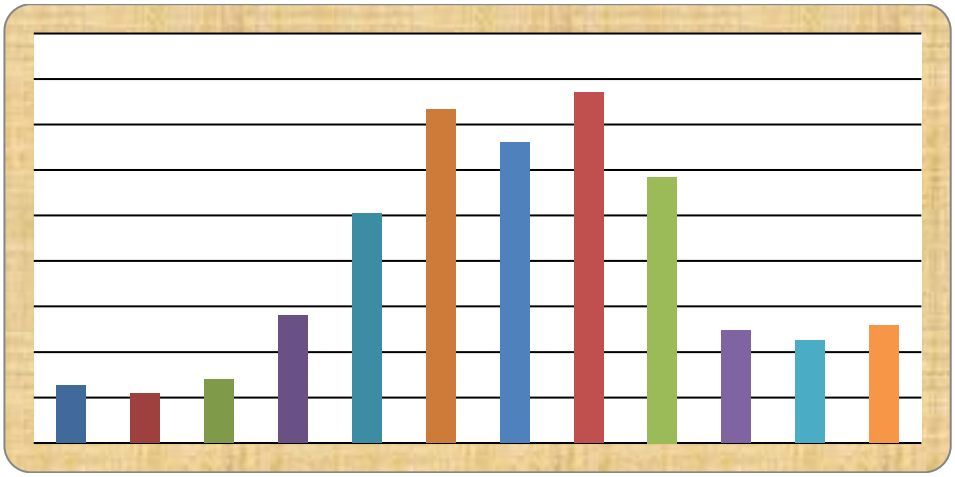
Graph E showing variation in Turbidity (NTU) at site-III i.e. Prem Nagar Ghat during 2016



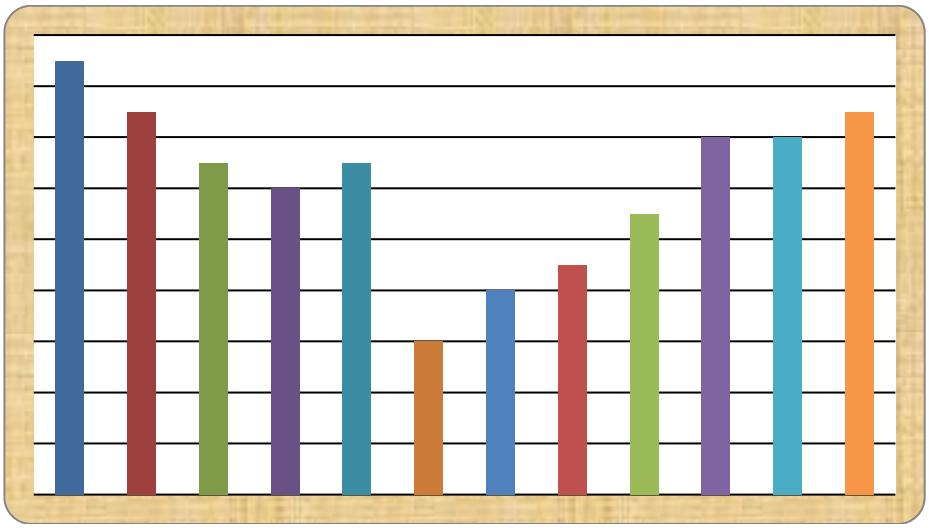
Graph F shows variation in Total Solids (mg/l) at site-III i.e. Prem Nagar Ghat during the 2016



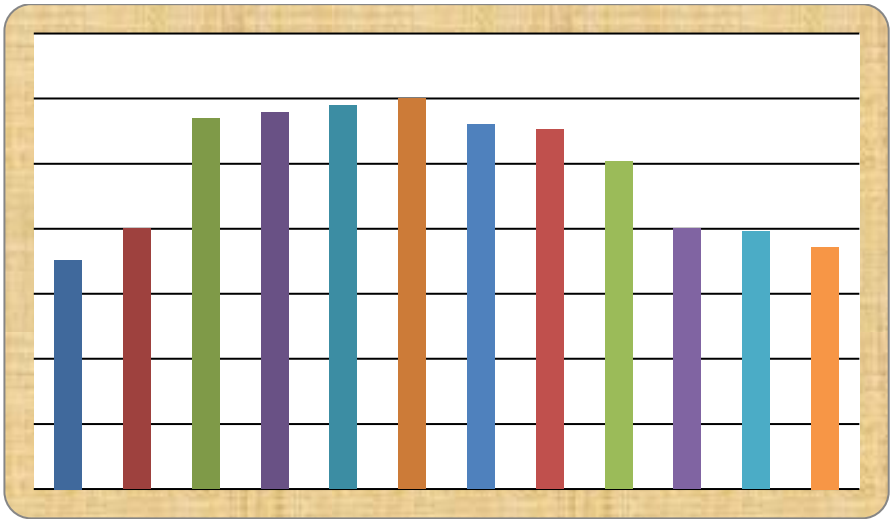
Graph G shows variation in total dissolved solids (mg/l) at site-III i.e. Prem Nagar Ghat during the 2016



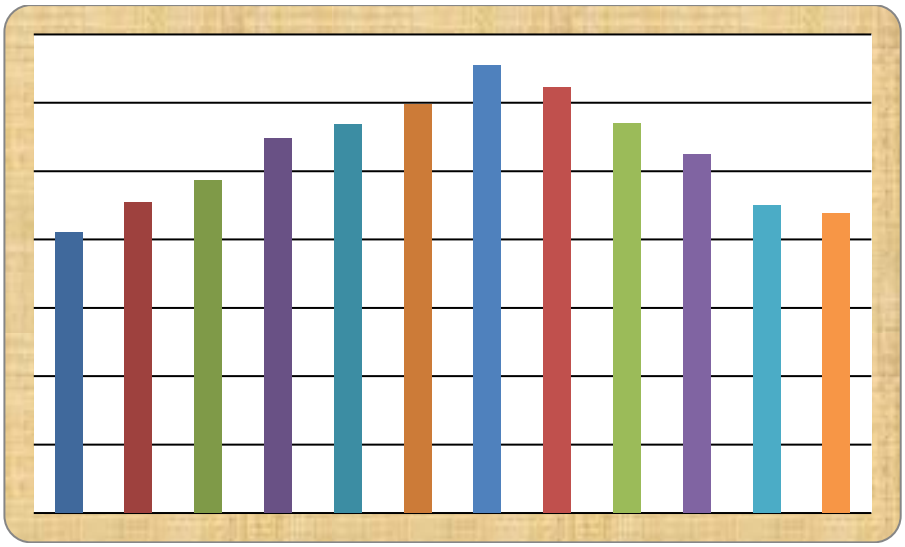
Graph H shows variation in total suspended solids (mg/l) at site-III i.e. Prem Nagar Ghat during the 2016



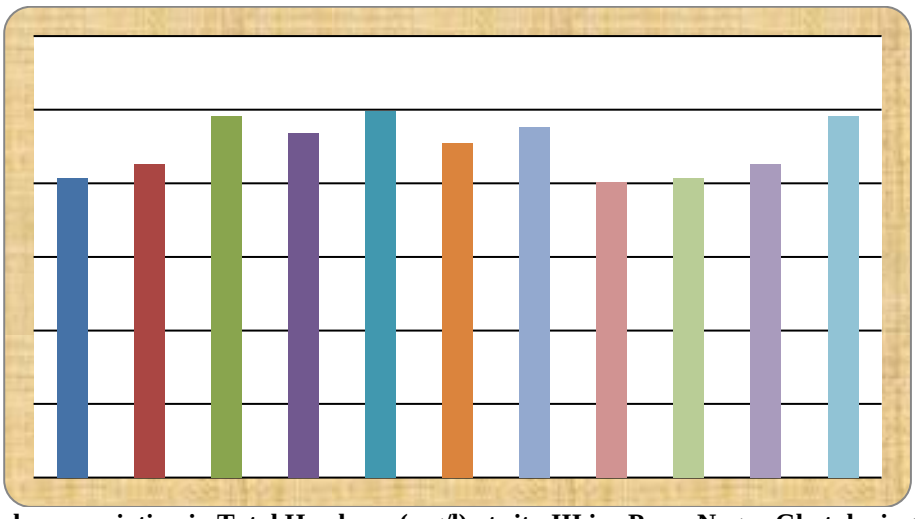
Graph I shows variation in DO (mg/l) at site-III i.e. Prem Nagar Ghat during the 2016



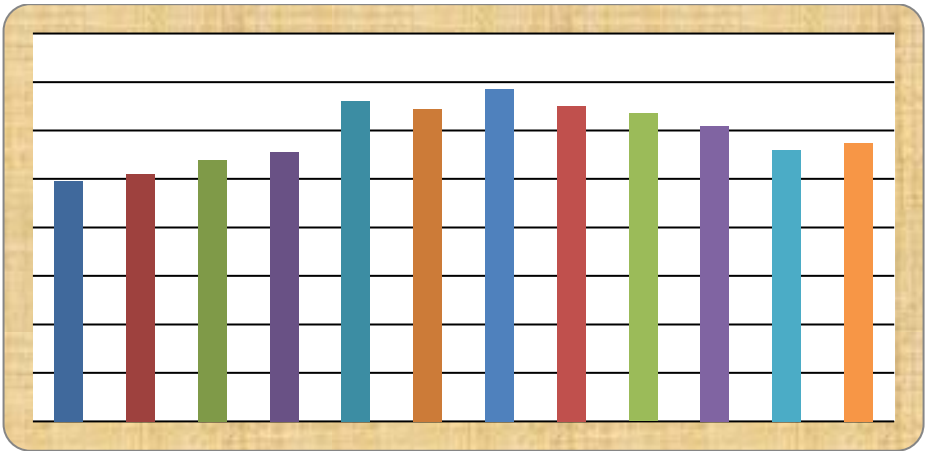
Graph J shows variation in BOD (mg/l) at site-III i.e. Prem Nagar Ghat during the 2016



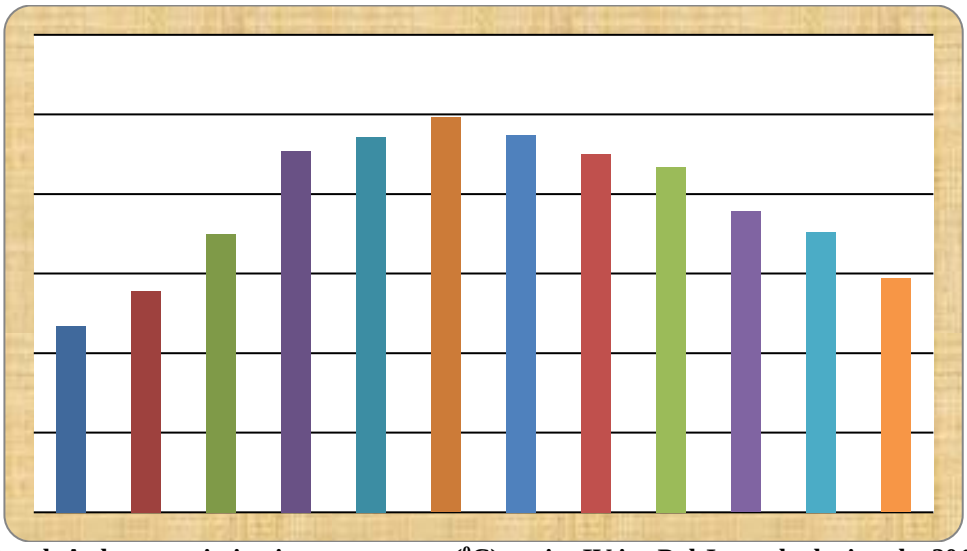
Graph K shows variation in chlorides (mg/l) at site-III i.e. Prem Nagar Ghat during the 2016



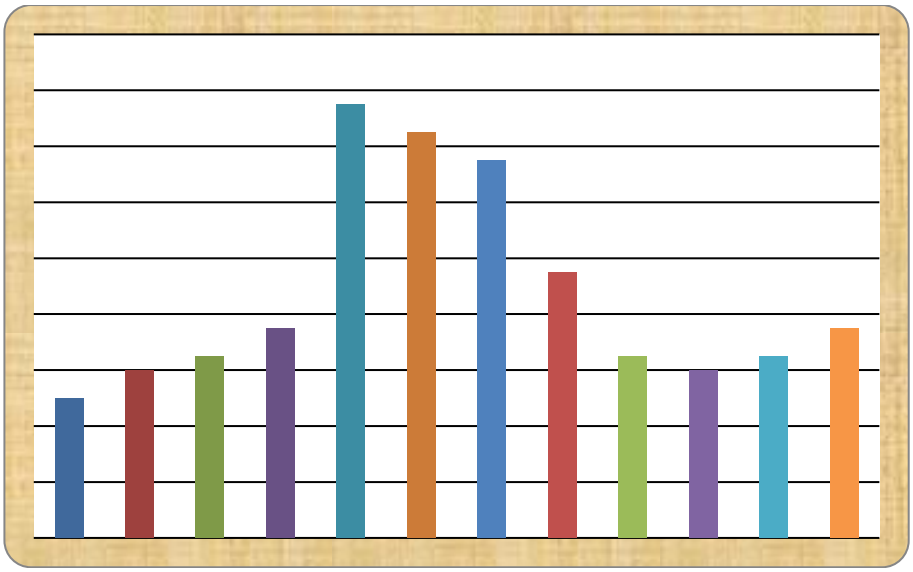
Graph L shows variation in Total Hardness (mg/l) at site-III i.e. Prem Nagar Ghat during the 2016



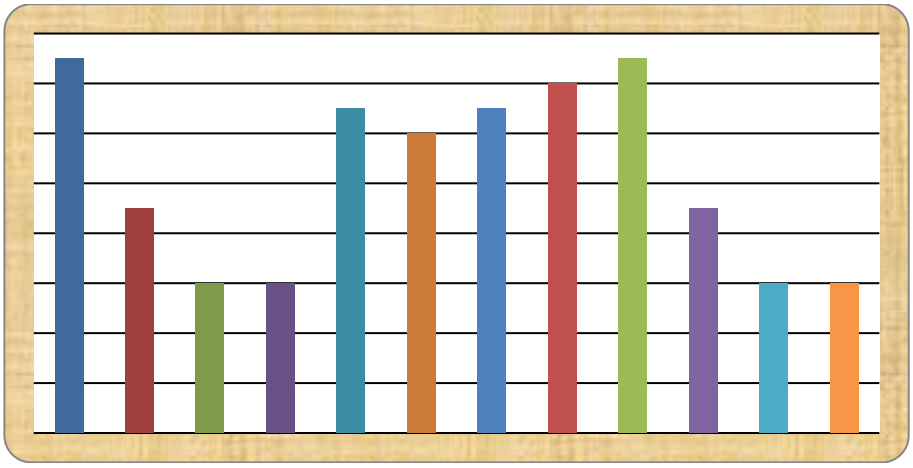
Graph M shows variation in Alkalinity (mg/l) at site-III i.e. Prem Nagar Ghat during the 2016



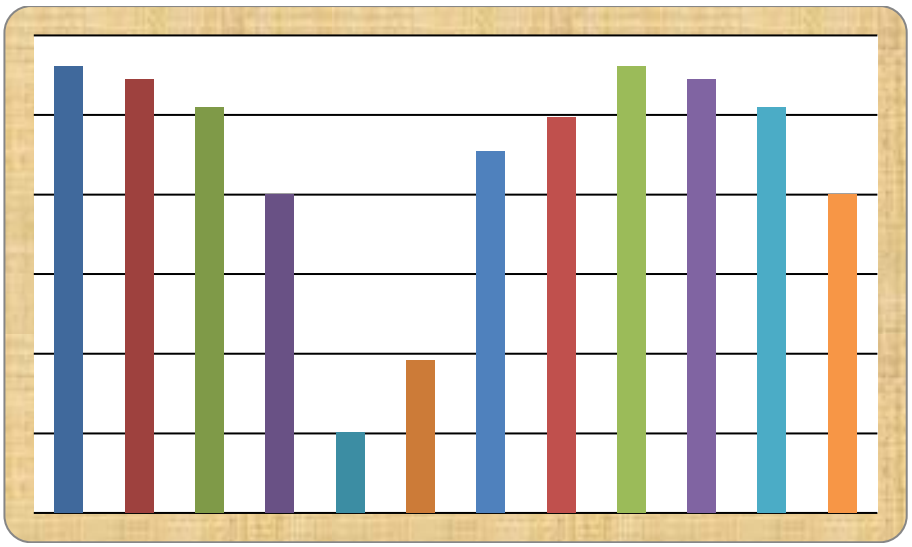
Graph A shows variation in temperature (^{0}C) at site-IV i.e. Pul Jatwada during the 2016



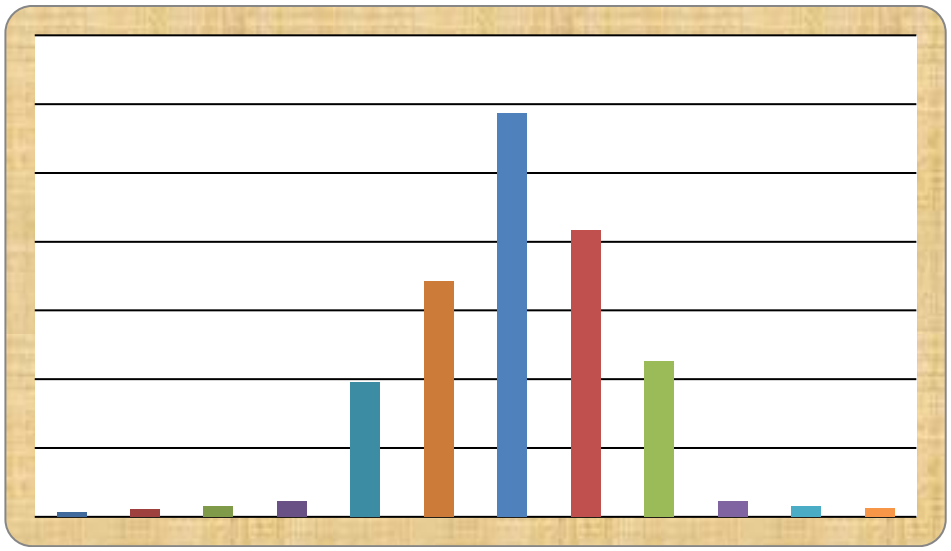
Graph B shows variation in Velocity (m/s) at site-IV i.e. Pul Jatwada during the 2016



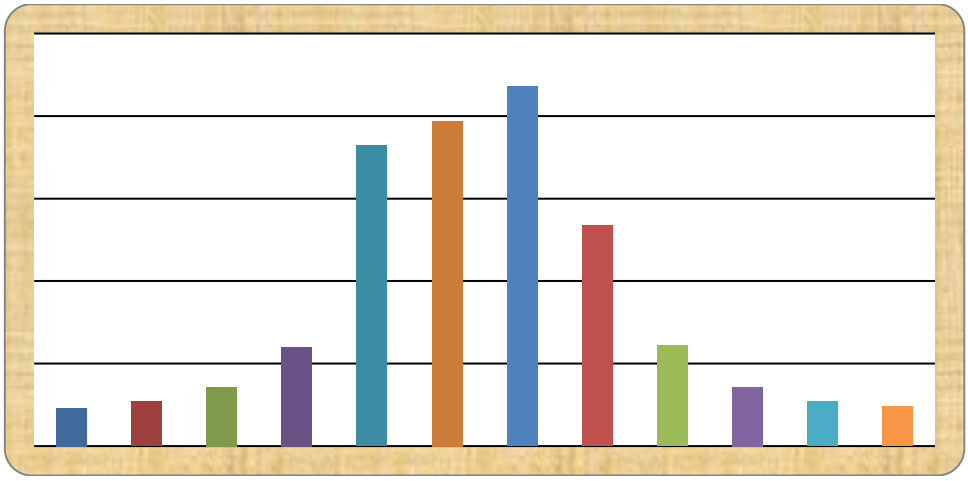
Graph C shows variation in pH at site-IV i.e. Pul Jatwada during the 2016



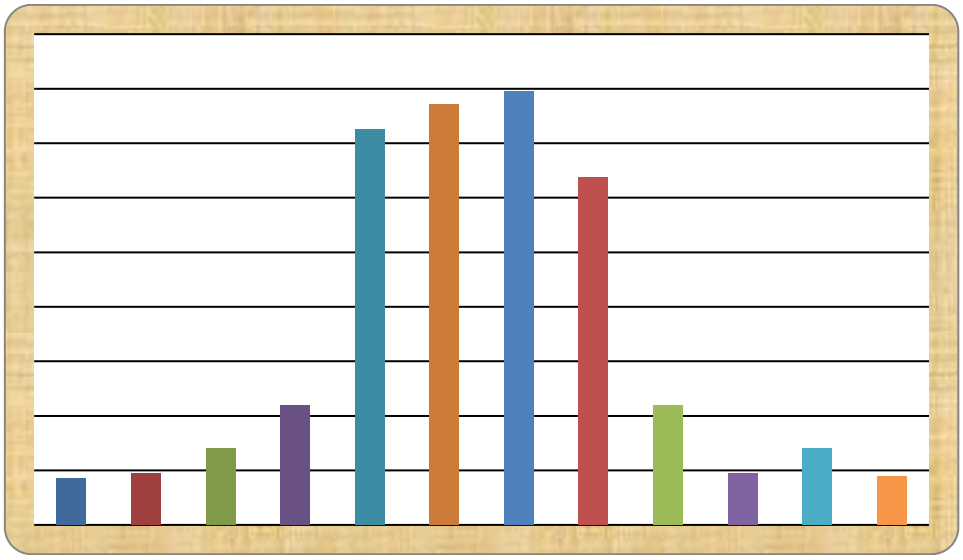
Graph D shows variation in Transparency (cm) at site-IV i.e. Pul Jatwada during the 2016



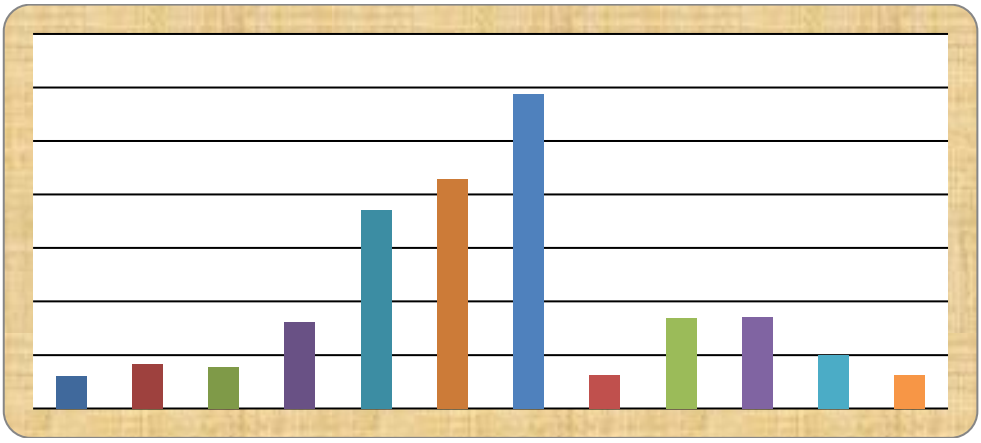
Graph E shows variation in Turbidity (NTU) at site-IV i.e. Pul Jatwada during 2016



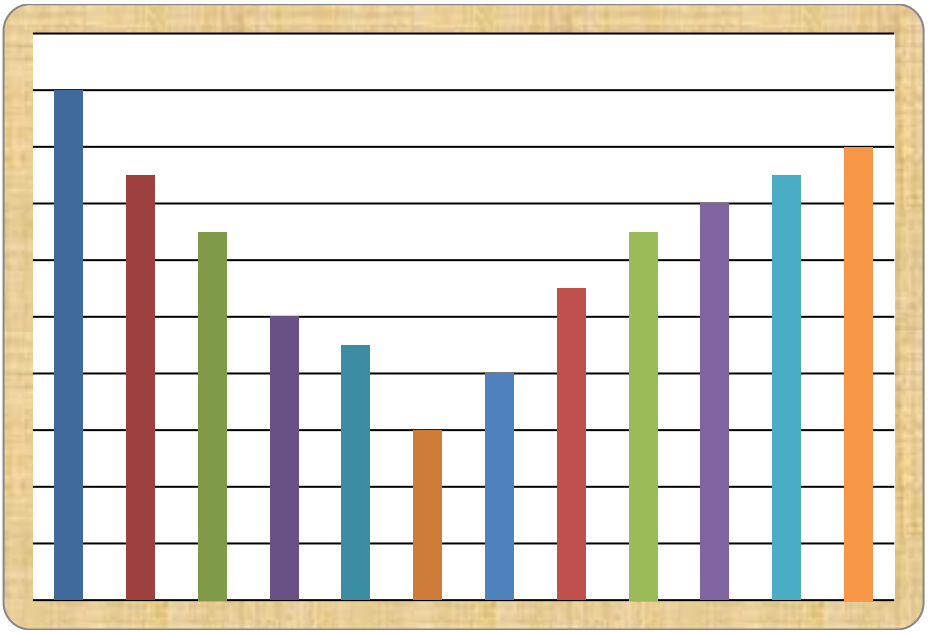
Graph F shows variation in TS (mg/l) at site-IV i.e. Pul Jatwada during the 2016



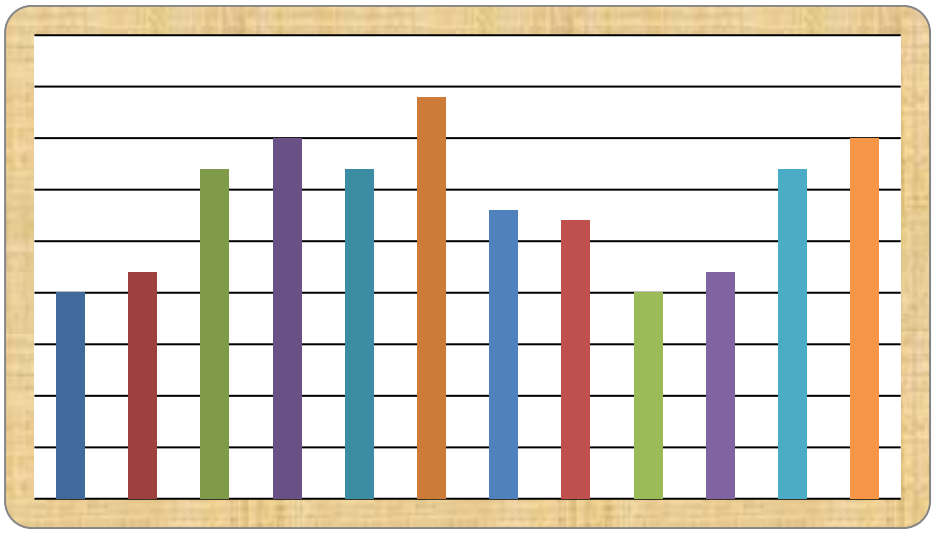
Graph G showing variation in TDS (mg/l) at site-IV i.e. Pul Jatwada during 2016



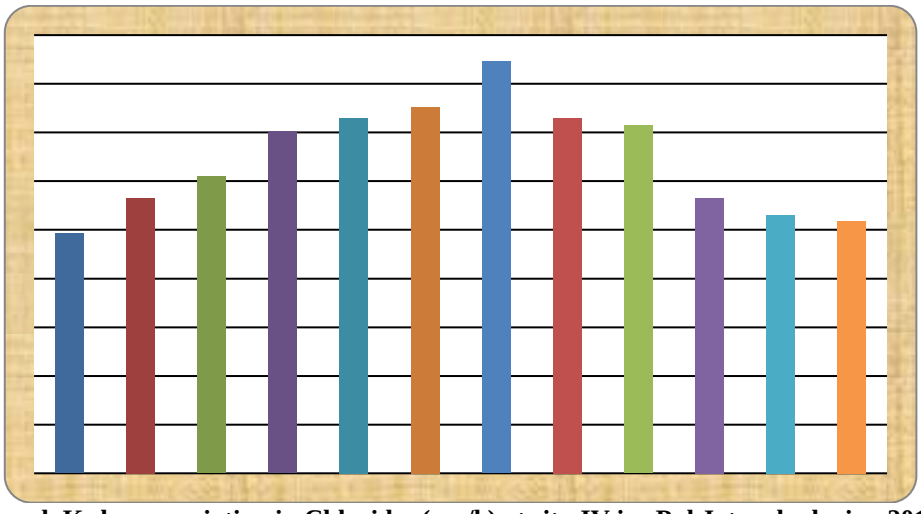
Graph H shows variation in TSS (mg/l) at site-IV i.e. Pul Jatwada during the 2016



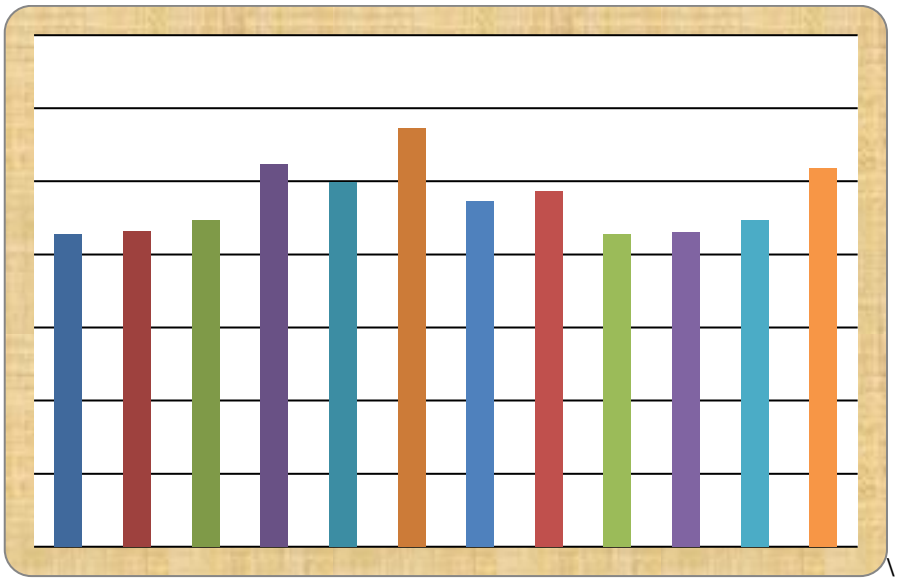
Graph I shows variation in DO (mg/l) at site-IV i.e. Pul Jatwada during 2016



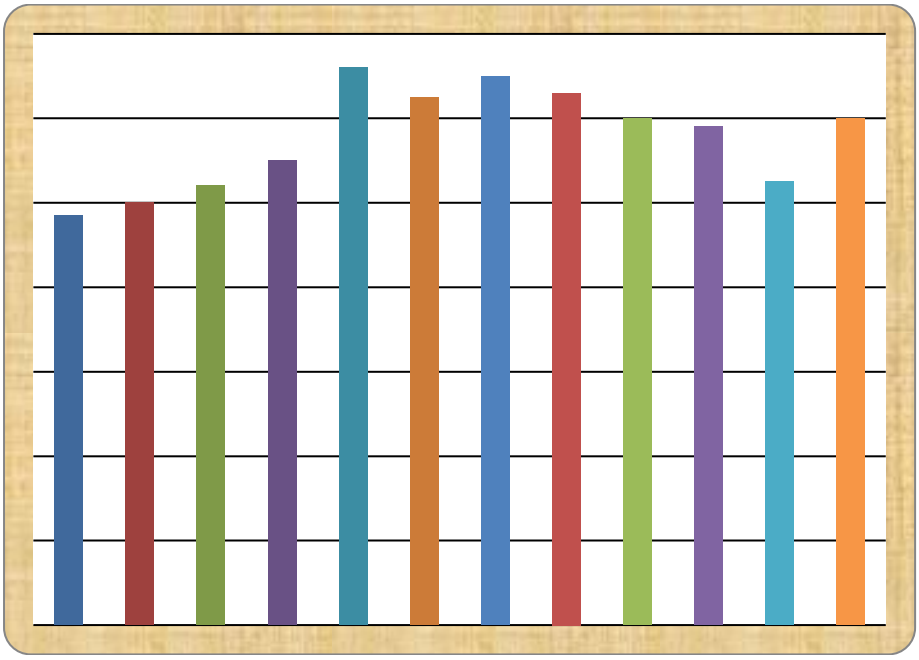
Graph J shows variation in BOD (mg/l) at site-IV i.e. Pul Jatwada during the 2016



Graph K shows variation in Chlorides (mg/l) at site-IV i.e. Pul Jatwada during 2016



Graph L shows variation in Chlorides (mg/l) at site-IV i.e. Pul Jatwada during 2016



Graph M shows variation in Total Hardness (mg/l) at site-IV i.e. Pul Jatwada during the 2016

2. CONCLUSION

The foregoing results and discussion reveal that anthropogenic activities with infrastructural development at Haridwar city have certainly disturbed the ecological constituents of the Ganga River ecosystem, which are responsible for occasional water quality degradation. It was also observed that the lack of municipal facilities has resulted in the degradation of water quality and solid waste generation. Flora and fauna are disturbed by the manmade activities in the concerned area. Therefore it is needed to make an appropriate strategy to check these problems which are related to unplanned pilgrimage. Keeping the forgoing account in mind, one may question whether the state should not be allowed tourists at all. Or should the tourist activities be curbed to the minimum? The answer is an emphatic 'No'. The remedy does not lie in isolating the tourist resort and the imposition of restrictions on holidaying. The need is only for careful environmental management, which is not a new concept. The government is fully aware that future growth of the tourism industry will necessitate a planned approach to avoid the over or improper development of the regions of natural beauty.

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