तृतीय अध्याय

Chapter - 3

MATERIALS & METHODS

Study Area :

Jaunpur district has its extension in middle Gangetic plane at east- end of Varanasi zone from $25^0$18' North to 25^0 54' North latitude and 4' east to $83^0$57' east longitude at an average height of 79 metres from sea level. Maximum length east to west is 84 km. and north to south is 58km. of this district. The area of this district is 991866 Acere.

Gomati is the most important river of this district which has tributries as Sai, Basuhi, Baruna & Pilee. The field of study Gomati and Sai river. River Sai enters into Jaunpur near Balhamau village and after travelling a distance of 53 km. It meets to Gomati near Rajepur village in Jaunpur.

Climate :

The climate is important factor of physical atmosphere. The district is situated in middle of Gomati plane and just north to tropic of cancer. This special situation presents severe cold and hot summer. In general the weather of whole year can be classified in 3 seasons.

1. Winter season	:	November to February
2. Summer Season	:	March to June
3. Monsoon	:	June to October

Winter is accompanied by cold waves, fog and mist, January is coldest with a minimum local temperature upto 6^0C. High temperature and 100' is characteristic of summer with temperature of 46^0C sometimes. Rainfall occurs maximum in July and August. Average rainfall is 1000 mm per year. Monsoon is accompanied by open sky, itching summer and due. Sometimes cyclones of Arabian sea and bay of Bengal create heavy rainfall in post monsoon season.

Temperature & Humidity :

The annual average temperature of Jaunpur district is 28.11^0C and it flactuates between 16.2^0C in January to 46^0C in late May and yearly June. December and January are the cold months of the year. Temperature rises from mid February and continues to increase till mid June. Average monthly temperature maximum occurs in June starting at 40.79^0C and in January 23.68^0C. Average minimum monthly temperature in January is 8.72^0C and in May 23.48^0C.

Relative humidity between July to September is greater (80-85%)

whereas it is greater in the morning in winter and post monsoon season. In summer from March to May at midday it is verylow (<25%). Sometimes in December and January due to cyclonic rainfall reltive humidity equals to that of rainy season.

Rainfall :

South west monsoon approaches to the district in mid June generally and returns in September last. Annual average rainfall of the district is 1058.3mm. In South and South east part of the district rainfall is 870mm in North and North West is 1040mm. over 75% of annual rainfall comes from south west monsoon. August month is most rainfall sharing 25% of whole year.

Table 1

Place	:	Industries
Jaunpur (Dohara)	:	Cotton Mills, Tanning Colour, Tobacco Industries
Satharia	:	Industry, Soft drinks, cement plates, Metal & Iron plates, sugar distillaries.

THE RIVER GOMATI & SAI

The river Gomati originates from Bhoogarbh from Gomat tal in the district Pileebheet Uttar Pradesh. The Sai river origintes from Sitapur district U.P. The river Gomati & From Pileebheet to Lucknow receives one of the its major tributaries namely Adi Ganga Gomati while the river Sai which is the 2nd largest river of ditrict Jaunpur & meets in Rajepur village. The Gomati river meet in Ganga river in Kaithi Markande Mahadev District Varanasi. The Gomati river receives bulk of run off through the rivers Sai, Baruna, Bashuhi & Peeli on the left bank while contribution to run off from the right bank is received through the Sultanpur Lucknow & the Gomati river run from its origin place that 960km. from the Gomttal to the meeting place of Ganga that is Kithi village.

The Gomati & Sai at Jaunpur District

The river Gomati & Sai at Jaunpur meanders between lat $24^0 18'$ - 14^0 N long 80^0 43- 80-38^0 in the middle of the Gangatic plain embracing Jaunpur city on its north bank.

Municipal & Industrial effluents enter through numerous point along the north bank; stretch during which is the river has to cater to the bathing & recreation facilities of the city population.

Major contribution to the pollutionary load in the River Gomati are received through effluents at Jaunpur, Shahganj, Satharia, Trilochan & Municiapl waste at Hanumanghat, Surajghat & Ramghat. Out of these sources of pollution, the municipal sewage drain at various places constitutes the bulk of city waste water disposals. Additional pollutionary loads are expected from its tributaries the river Sai which is more are less controlled stream and joins the River Gomati at Rajepur village.

Although waste loads from different towns of Jaunpur presently received by the river may be a small fraction of the total fresh water how, ironically, the hydrological characteristics of the stream around Jaunpur do not allow diffusion of wastes across its entire section, especially during the lean period.

Table 2

Jaunpur District, Climatic Characteristics

Month	Relative Humidity	Wet Bulb Temp.(C)	Maximum Temp.(C)	Minimum Temp.(C)	Rainfall (mm)	Pressure (mb)	Mean temp.
January	73.58	12.20	23.68	08.72	16.04	1016	16.20
February	68.46	14.34	27.58	11.24	20.25	1014	19.40
March	55.52	17.00	32.01	15.62	06.99	1010	23.81
April	45.00	22.59	37.33	21.14	05.30	1004	29.23
May	64.54	26.45	40.79	23.48	10.70	999	32.13
June	70.48	26.82	39.40	25.71	112.60	996	32.55
July	79.95	25.97	34.24	23.86	295.50	998	29.05
August	84.00	25.50	32.30	22.95	310.00	998	27.62
September	83.78	24.65	32.60	22.82	224.60	1004	27.71
October	72.50	23.00	31.53	19.36	49.00	1010	25.44
November	70.85	22.70	28.50	12.97	06.70	1014	20.73
December	73.24	18.51	24.80	10.55	06.10	1015	17.67
Average	69.82	21.73	32.04	18.18	1063.78	1006.15	25.11

Sampling Sites :

Selection of Sites for river Gomati :

At Jaunpur the flow of river is from west to east. The river is subjected to pollution by industrial effluents cotton mills Sugar distillery and alkaloid factory, sewage disposal and small industries run off.

Site -I : is located hanumanghat upstream of the river Gomati.

Site-II : is located Suraj Ghat Pachhatia is situated just on the north bank of the river Gomati.

Site-III : is located 3 kms. away from city towards down stream of the river Gomati i.e. Ramghat

Selection of sites for river Sai :

In Janupur district river Sai meets to the river Gomati at Village Rajepur passing through a number of places like Jalalpur, Dronipur, Kandhi, Kalchhuli, Khunshapur, Sikrara etc. during its course of travelling it receives a lot of pollutants from agricultural run off waste disposal from various small towns and effluents of Satharia Industria area near M. Badshahpur.

Site-I : is located at Dronipur village which is 26 kms away from City Jaunpur west direction upward stream.

Site-II : is located near Sikrora village which receives effluents from Satharia.

Site-III : is located 15 kms. away from the site-II near village Jalalpur down stream.

DATA COLLECTION AND ANALYSIS OF WATER

Sample Collection and Preservation :

Samples of the river water were collected at monthly intervals in the second week of each month from July 2005 to June 2006 triplicate samples, each of two litres were collected at a time in polythene bottles between 8 hrs to 10 hrs. from each sampling site and brought to the laboratory in ice boxes for theanalysis of various physio-chemical parameters i.e. pH, total alkalinity, and ions like chloride, calcium, sulphate, phosphate, sodium, potassium. Temperature of water samples was recorded on the sampling sites immediately with the help of celsius thermometer. Dissolved Oxygen (DO) of river water was mixed on the sampling sites with mangnese sulphate and was determined by Winkler's azide method.

Free CO_2 was determined at the site by titrating the samples with sodium carbonate by using phenolpthlein indicator. Free CO_2 is distinguished as the concentration of $CO_2 + H_2CO_3$

Sampling of Zooplanktons :

For the collection of Zooplanktons at different sampling sites, the river water (100 litres) was sieved through a number 20 plankton net, concentrated into a 60ml. vial and preserved in 1% Lugol's solution. To retain colour of the preserved plankton, cupric sulphate was added and brought to the laboratory 60ml. samples were concentrated to 20ml by centrifugation. A Hensen stemped pipette was used to take 1 ml. aliquotes into four Sedgewick-Rafter counting chambers. Each cell was then examined under microscope for identification and counting. The zooplankton identification was done following Desikachary (1959), Philipose (1959), Nygaard (1976) and APHA (1985).

Analysis of Water Sample :

A different limnological parameters of water viz. temp, pH, alkalinity, Do; Na, K, Cl, Ca & phosphate were determined. Various Physico-chemical analysis of river water were done by standard methods. Examination of water is carried out by standard methods as described by American public health Association (APHA), American water works Association and Water pollution control federation (1985).

Physico- Chemical Parameters :

Temperature :

The temperature of river water was recorded with the help of Celsius thermometer at the time of sampling on the sites and expressed in degree centigrade (^{0}C).

pH:

pH was measured in the laboratory with the help of systronic pH meter fitted with combination electrode having a precision of 0.05. pH meter was standardized with stock buffers before each reading.

Alkalinity :

Potentiometer titration method was used for the determination of alkalinity of water. Titrant sulphuric acid (0.025 N) was used to lower down the pH of water (100ml) at 8.3 (Phenolphthalein alkalinity) and to the pH 3.7 (methyl orange alkalmty) Following formula is used to calculate the alkalinity of water

$$Total\ Alkalinity\ \frac{V \times N \times 50{,}000}{ml\ sample}\ mgl.^4\ CaCO_3$$

where,

V and N are volume and normality of the titrant respectively. The pH

more than 8.3, showed presence of hydroxide alkalinity (which is rare) and carbonate alkalinity along with bicarbonate alkalinity, when the pH of water sample was below 8.3 the total alkalinity represented the amount of bicarbonate alkalinity only.

Carbonate alkalinity = 2 x Phenolphthalein alkalinity.

Bicarbonate alkalinity = Total alkalinity - Carbonate alkalinity

Dissolved Oxygen (DO):

Winkler's modified azide method was used for the estimation of dissolved oxygen in water. DO of water sample is measured by recipitating as manganic basic oxide which is dissolved by concentrated sulphuric acid forming manganic sulphate. It immediately reacts with potasium iodide, already present liberating iodine which is determined by titration with sodium thiosulphate (0.025 N).

The chemical reaction involved are

$Mn(OH)_2 + O_2 = 2MNO(OH)_2$ (mangame basic oxide)

$Mn(OH)_2 + 2H2SO_4 = Mn(SO_4)_2 + 3H_2O$ (Manganic sulphate)

$(SO_4)_2 + 2KI = MnSO_4 + K_2SO_4I_2$

$S_2O_4 + I_2$ $Na_2S_4O_6 + 2NaI_2$

quality of iodine liberated during these reactions is equivalent to the quantity of oxygen present in the sample. The DO value was calculated with help of following formula

$$Dissolved\ oxygen = \frac{V\ x\ N\ x8x1000}{ml\ sample}\ mgL^{-4}$$

are, V and N are volume and normality of the titrant respectively.

Free CO_2 : Free Co_2 was determined at the site by titrating the samples with sum carbonate by using phenolphathalein indicator. Free CO_2 is distinguished as the concentration of $CO_2 + H_2CO_3$. It was calculated by following formula.

$$Free\ CO_2 = \frac{V\ x\ N\ x\ 44000}{ml\ sample}\ mgL^{-4}$$

Sodium (Na) and Potassium (K) :

Sodium and potassium were estimated using Systronics type 121 Flame Photometer with specific filters. Known volume (100ml) of after samples were evaporated to dryness on stream bath in porcelain crucibles. The crucibles were transferred to muffle furnace at the temperature of 450^0C for overnight. Ash was dissolved in cone. Conc. HCl and warm distilled filter. Diluted sample were filtered filterate was neutralised with NH_4OH made upto the volume with double-distilled water Known concentration of

sodium and potassium were prepared from NaCl and KCl, respectively for galvanometer adjustment and transmission standardization. The submission of unknown solution was recorded and the concentrations were calculated by the formula given in Systronic Type 121 manual.

$$C = C_2 + \frac{(C_1 - C_2)}{(a_1 - a_2)}(a - a_2)$$

where,

C= concentration of unknown solution

C_1 = maximum concentration in ppm of NaCl and KCl solution

C_2 = minimum concentration in ppm of NaCl and KCl solution

a = transmission reading of unknown solution

a_1 = transmission reading of maximum concentration of NaCl and KCl solution a_2 = transmission reading of minimum concentration of NaCl and KCl solution.

Chloride (Cl) :

Mohr's argentometric method was used for the determination of chloride in sample water. Chloride estimation is based on the fact in the titration of sodium chloride with silver nitrate. The solution is created with silver chloride at the equivalence point and contains equal concentration of

silver and chloride ions. When potassium chromate is used an indicator, any excess of silver ions precipitate as red silver chromate water sample was titrated with silver nitrate (0 01.41 N) using potassium as an indicator.

$$AgNO_4 = Ag + NO_4$$

$$Ag + Cl = AgCl$$

$$2Ag + CrO_4^{-2} = Ag_2CrO_4 \ (brick\ red)$$

The Chloride contents was calculated as follows:

$$Chloride = \frac{(a-b)\ x\ N\ x\ 35.45 x\ 1.000}{ml\ sample}\ mgL^{-4}$$

where,

a = volume of $AgNo_3$ used for the sample

b = volume of $AgNO_3$ used for the blank and

N = normality of $AgNO_4$

Calcium (Ca) :

EDTA titrimetric method was used for the analysis of calcium in water sample. When sodium salt of EDTA is added to the water maintaining both Ca and Mg. it first combines with calcium. In 50ml of sample 2ml. of NaOH was added to raise the pH to 12-13, 2-3 drops of

Eriochrome the Black R indicator was added and titration was done till the change of our from red to pure blue.

$$Calcium = \frac{A \; x \; B \; x \; 1000}{ml. \; sample} \; mgL^4 - CaCO_3$$

where,

A = ml of titrant used

B = mg $CaCO_3$ equivalent to 1.0ml EDTA titrant at the calcium indicator end- point.

Sulphate :

Sulphate was measured by colorimetric method in which Calcium sulphate was precipitated by addition of barium chloride. The optical density was taken at 420mm and content of chloride was calculated by the ... of standard graph.

Na_2SO_4 + $BaCl_2$ ---------- 2NaCl + $BaSO_4$ (white ppt.)

Phosphate :

Stannous chloride method was used for the determination of phosphate concentration in water sample. 4ml ammonium molybdate solution and 10 drops of stannous chloride solution were added to the 50ml

sample water and measure to 100ml with the distilled water. The development of blue colour denotes the presence of phosphate. The colour intensity as proportional to the amount of phosphate present and was measured in forms of optical density with the help of colorimeter at 690nm. The final calculation was made with the help of standard graph, prepared from known concentration of phosphate in solution.

$$H_3PO_4 + 12\ H_2\ MoO_4 \text{ ---------- } > H_3P\ (MoO_{10})_4\ \ 12H_2O$$

(Blue)

BIOLOGICAL PROPERTIES

Zooplankton Density :

The estimation of zooplankton density was done by taking 1 ml. of aliquot sample into Sedgwick- Rafter plankton- counting cell. The liquid was carefully covered with 60 x 30mm cover glass of number 1 thickness. The mounted slide was examined to count the number of zooplankton individuals under 10 x eye piece and 40 x objective combination of microscope and 10 microscopic fields were viewed by sliding the counting cell with the help of a mechanical stage under different focii. The numerical estimation of zooplankton was calculated in terms of individuals per litre of water according to the formula given below (Welch, 1948).

$$n = \frac{a \times c}{I}$$

where,

n = number of zooplankton per litre of original sample

a = average number of zooplankton in all counts in the counting cell of ml. capacity.

c = the volume of original concentrate in ml. and

I = volume of original water sample expressed in litre.