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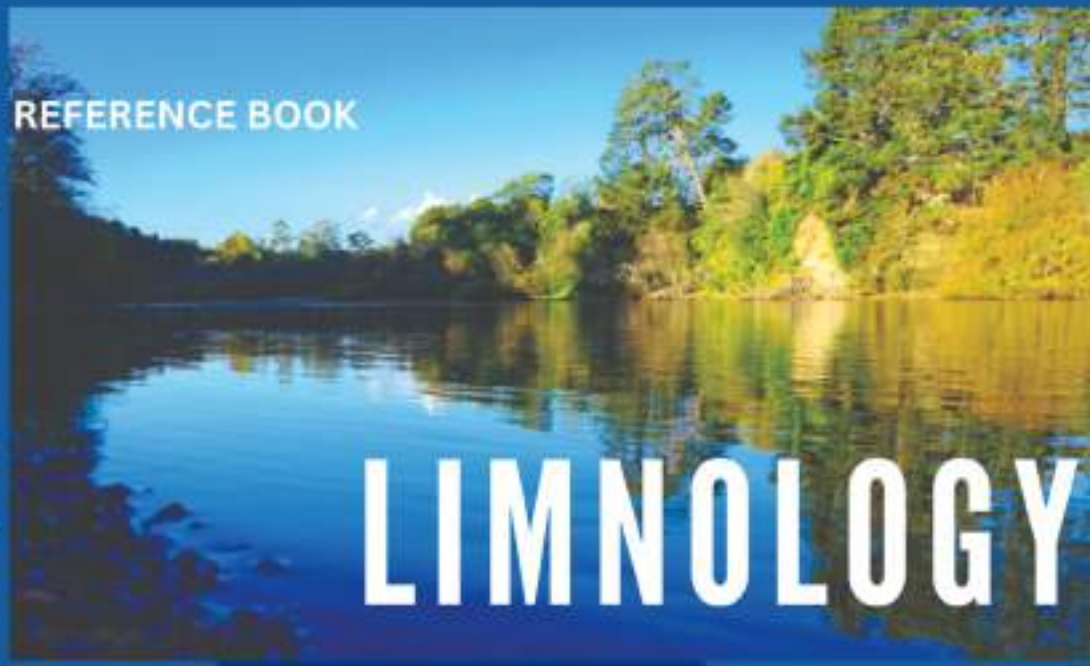

LIMNOLOGY

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LIMNOLOGICAL STUDIES ON MANSAROVAR TALAB OF JEERAPURA, DHAR DISTRICT (M.P.)

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CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF MAP AND PHOTOGRAPHS

INTRODUCTION

INTRODUCTION

Organic life, which began about three billion years ago in which water is predominant inorganic constituent of living organic matter. In the creation of the atmosphere, a small portion of the hydrosphere region is actually available as resource. Water is the most important requirement for survival. In generally living cell is made up of three quarters by weight of water. It is one of the five basic elements of the body. Water is available in plenty on the surface of the earth but more than 97% occurs in the form of sea water, whose salinity makes it useless, while fresh water makes up only 2.6%. The 4/5 of this is immobilized as ice and thus practically useless. Only less than 1% water is available for drinking. Both urban and rural people communities are highly dependent on the water available for their daily needs. Little amount really available is that in the form of surface and ground running water.

The need for storing the surface runoff water, by constructing dam on rivers has been felt ever since the human civilization. This hydraulic civilization has caused creation of several reservoirs in many water deficit areas of the world. The ponds, lakes and reservoirs are inland depressions containing fresh water and are used for navigation, aquaculture, fish culture & transport, hydropower generation recreation, irrigation and a host of other purposes. It has great social and economic importance because it affects man's health in turn influence all his other activities in many parts of the world. Women and children still spend as much as 50% of their time hauling water for household and stock water purposes. Over and above man also uses these water bodies as most convenient and the cheapest refuse-disposal system for domestic and industrial wastes. This cultural exploitation of our

precious water resources has put a severe stress with the result, the fresh water is becoming rarer day by day as the civilization progresses.

Freshwater bodies may be classified into two types viz, standing water (lentic) and flowing water (lotic). Ponds, reservoirs, lakes and swamps come under lentic water, whereas rivers, springs, perennial monsoon streams are included under the lotic water. The weightage of freshwater resources, their protaction and utilization has attained utmost importance during the current time.

The Limnology word was first introduced by F. A. Forel in his work entitled 'Le Leman: monographielimologique' on Lake Geneva, Switzerland in 1892, 95 and 1904. Forel then published the first text book on Limnology in 1901 'Handbuch der Seenkunde:allgemeineLimnologie'. Forel was a professor at the University of Lausanne and he has been considered as the Father of Modern Limnology.

The biological studies of fresh water commenced with the invention of microscope by *Leeuwenhock in 1674.* Though Leeuwenhock considered himself a microbiologist, his work on aquatic biology describing the filamentous green algae *Spirogyra* from BorkeleseLake was of limnological type. This was the firstavailable account of seasonal cycle in lakes, hinting about the food dynamics and influence of wind on algae ecology. The physical studies of water bodies began in Switzerland when the engineer F.de Duillier measured the waves in lakes in 1730. Further the influence of light, heat, temperature and wind was observed in lake ecosystems.These earlier workers not only established and laid down firm foundation of limnology but also provided guidelines and inspiration to the present-day

workers. In the second half of this century the limnological work took rapid strides and detailed investigations with a stress on productivity in relation to other ecological parameters were carried out by ***Goldman and Wetzel, 1963; Lund, 1972; Edmondson, 1977***; etc.

Limnology of fresh water bodies in the temperate regions has been well studied by***Berg, 1964; Jenkin, 1942;Mortimer, 1942;Lindman, 1942; Ganapati, 1941,1960; George, 1976; Sreenivasan, 1969 and 1974; Michael, 1968; Vasisht, 1968; Munawar, 1970, 74.***

In India the science of limnology was pioneered by ***Ganapati in 1941*** who made the physico-chemical investigations in the ponds of Madras city. Ganapati continued his studies and published an extensive literature on Indian Reservoir Ecology ***(1956, 64, 66 and 81).Govind (1969 and 1978)*** reported the plankton of Tungabhadra reservoir.

The study of the fresh water organism was attempted by Michael ***1968. Okland(1964)*** has described the surface and bottom fauna with special reference to gastropods. The relationship between water quality and organisms has attracted some attention recently. ***Brinkhurst, 1965, 1970, 1974*** has studied the Oligochaets fauna and its relation with organic pollution. ***Mortimer (1942)***,for the first time suggested the role of physical feature of water body in determining the quality of water and described Oligochaete fauna in relation to organic pollution. Sreenivasan gave a comparative account of major reservoirs of Madras state. ***Unni(1972 &1985)***also reported a comparative limnological account of several reservoirs of central India. In ***1982& 1992, Jhingran*** reviewed the available broad morphometric featurs of Indian reservoirs. ***Rao(1987)*** discussed the

morphometry of Rangasagar in relation to its productivity and community structure. ***Choubey in(1987)***recorded and discussed the morphometric details of the Gandhisagar reservoir. ***Bhatnagar(1984)***incorporated morph metric features and sewage pollution & eutrophication in his studies on the lower lake of Bhopal. ***Kulshrestha (1988)***reviewed the previous limnological work on lakes of Bhopal and also investigated the effects of M.I.C. gas leakage on aquatic population of lower lake of Bhopal.

The physico-chemical characteristics of the water body are essentially considered to assess and to monitor the water quality for various purposes. ***Bhowmik (1968)*** reported the environmental factors affecting the fish food in freshwater fisheries. ***Golterman (1967)*** reported the influence of soil and chemistry of water in relation to productivity.

The contribution gave in planktonic studies by ***Welch (1948& 1952), Ruttner (1963), Wetzel(1975)***etc.In India ***Sreenivasan(1974)***worked on the planktons of Bhavanisagar reservoir.

Macro benthic invertebrates are a ubiquitous and diverse group of long-lived species that react strongly and often predictably to human influences in aquatic ecosystem. In addition, they are sedentary, therefore body burdens reflect local conditions, allowing detection of a variety of perturbations in a range of aquatic habitats ***(Rosenberg &Resh, 1993).***

Macro benthic invertebrates are an important and integral part of any aquatic ecosystem as they form the basis of the tropic level and any negative effects caused by pollution in the community structure can in turn affect tropic relationships. These can include those that feed on them directly or indirectly such as fish and bird populations, respectively. In addition, aquatic

invertebrates have the ability to clean rivers as they utilize the organic and detritus matter. According to ***Carlisle etal., (2007)***macro-invertebrate populations in streams and rivers can assist in theassessment of the overall health of the stream.

Biological assessment and criteria can be used as the basis for management programs, restoring and maintaining the chemical, physical and biological integrity of freshwater. Live organisms offer valuable information regarding their surrounding conditions and can be used to evaluate the physical, chemical and biological impact and their cumulative ***effects (Karr & Chu, 1999).***

Central India is a water deficit area. Now it should be everybody's concern to take care and conserve our existing water resources. Very little work is done on the benthic biodiversity of shore line of tropical shallow lake of the West Malwa region in M.P. Mansarovar Talab of Jeerapurareservoir is a medium sized reservoirand was originally constructed for drinking water supply alongwith fish culture. This important water body has been neglected so far and no limnological work has been attempted to understand its characteristics. This is the first attempted to carried out the**"Limnological studies on mansarovartalab of Jeerapura, Dhar district (M.P.)."**

Selection of Mansarovar Talab for the present investigation is evident in the light of its importance and in the event of present fresh water crisis faced by the area.

The present research work aims to investigate physico-chemical characteristics, plankton density & diversity, productivity, seasonal

variations and correlation between biotic & abiotic variables of Mansarovar Talab reservoir. The investigated data would further be utilized for comparative limnological studies and for maintenance & conservation of this precious water resource.

Now we realize that dams are very important for the human welfare but in other hand due to the dam formation, aquatic biodiversity are reduced day by day and some species are endangered in condition. The noteworthy contribution of this study would be developing a technique to conserve the macro-invertebrates and Icthyo fauna diversity of MANSAROVAR TALAB OF JEERAPURA as well as to provide new modern technique of fishing to fishermen. This information will be help in the development of conservation & management plan for the planers and this data will be utilized by different government departments, scientists, environmentalists and environmental managers.

REVIEW OF LITERATURE

REVIEW OF LITERATURE

Limnological studies were carried out by many workers like ***Brinkhurst (1970), Naik & Purohit (2001), Khanna & Bhatia (2003).***

In India, few works have been done on the study of benthic fauna of fresh water aquatic bodies and published record are available. Some of them are ***Patil S.G. et al. (1984), Singhal (1991), Barbhuyan& Khan (1992), Sinha et al. (1997), Chatergee (1994), Kumar & Singh (1997), Shah & Pandit (2001), Sukla&Shrivastva (2004), Negi R. K. et al. (2008).***

Benthic macroinvertebrates fauna are those organisms that live on or inside the deposit at the bottom of a water body ***(Idowu &Ugwumba, 2005)***. Water quality are those physical, chemical and biological factors that influence species composition, diversity, stability, production and physiological conditions of indigenous population of a water body ***(Boyd, 1982).***

Benthic macroinvertebrates have also been identified and the highest species number was recorded near tributaries due to the availability of food while the lowest are in the impacted areas where there are pollution discharges and gravel excavation ***(Beqiraj et al., 2006).***The occurrence and distribution of macro-invertebrates are governed mostly by the physical & chemical quality of water and immediate substrate of occupation. Temperature, Dissolved oxygen, pH and nutrients have considerable effects on the life of aquatic organisms. Macro invertebrates play an important role in aquatic community which includes mineralization, mixing of sediments and flux of oxygen into sediment, cycling of organic matter and also in assessing the quality of inland water ***(George et al. 2009).***

Water is one of the most important natural resource around the world ***(EPA 2001, Voelz et al., 2005).*** It is a necessity for life and provides a variety of use from drinking water in cities to the irrigation of crops in agricultural areas. Water also provides recreational use as well as habitat for wildlife. River and streams are very important natural, environment and linked to human lives, animal and vegetation ***(Haase& Blodgett 2009).***

According to ***Wetzel (1975)***, limnology is the study of functional relationship and productivity of fresh water biotic environmental parameters.

According to ***Golterman (1978)***, limnology is interdisciplinary science combining various aspects of hydrobiology, hydrochemistry, hydrophysics and geology.

The distribution of macro-invertebratesfauna is determined by a number of factors such as the physical nature of the substratum, depth and nutritive content, degree of stability and oxygen content of the water body. Macro-invertebrate organisms are threatened by changes in their habitat which are associated with pollution, erosion and siltation ***(Lydeard et al., 2004).***

Most of these macro-invertebrates share their biological life in fresh water while their adults fly over for miles in search of suitable habitat for reproduction and laying eggs ***(Mustow 1996; Akolkar et al., 1999; Muhammed Zaheer Khan 2006; Khanna & Vats 2006; Prasum et al., 2006; Sharma et al., 2013).***

Macro-invertebrate diversity for bioassessment provides a simpler approach and this is due to the fact that they can be sampled quantitatively as well as the known relatively sensitive or tolerance of some of them to

contamination ***(Adakole&Annune, 2003)***. Species vary in their degree of tolerance with the result that under polluted conditions, a reduction in species diversity is the most obvious effect ***(Rosenberg &Resh, 1993; Edokpayi et al., 2000; Emere, 2000; Olomukoro&Egborge; 2003)***. The macro-invertebrates are popular as pollution indicators ***(Hellawell, 1986).*** Benthic macro-invertebrates are best indicator for bio assessment ***(Kumar, 2003).***

Studies on water quality management using macro-invertebrates in evaluating the impacts of specific pollutants in aquatic environments have been reported by ***Ogbeibu, (2001); Ogbogu& Olajide, (2002); Hart &Zabbey, (2005); Arimoro&Ikomi, (2007); Strayer, (2008); George et al., (2009); Esenowo&Ugwumba, (2010); Sharma et al., (2010); OgidiakaEfe(2012)*** and Bio monitoring of Kukatpally IDL lake using Benthic Macro-invertebrates done by ***Sultana & Kala (2012)***.

Fish production in lake, talab & reservoir is directly or indirectly dependent on the abundance of plankton and bottom fauna ***(Das and Chand, 2003).***The physico-chemical properties of water determine the quality and quantity of the fauna ***(Srivastava, 1980)***. According to ***S. K. Pathak & L.K. Mudgal (2005)*** the most dominant family was cyprinidae followed by Bargridae and Mastacembelidae. This is because these three groups are dominant in lentic water reservoirs of India and Bangladesh and are more tolerant towards pollution.

MATERIAL

&

METHODS

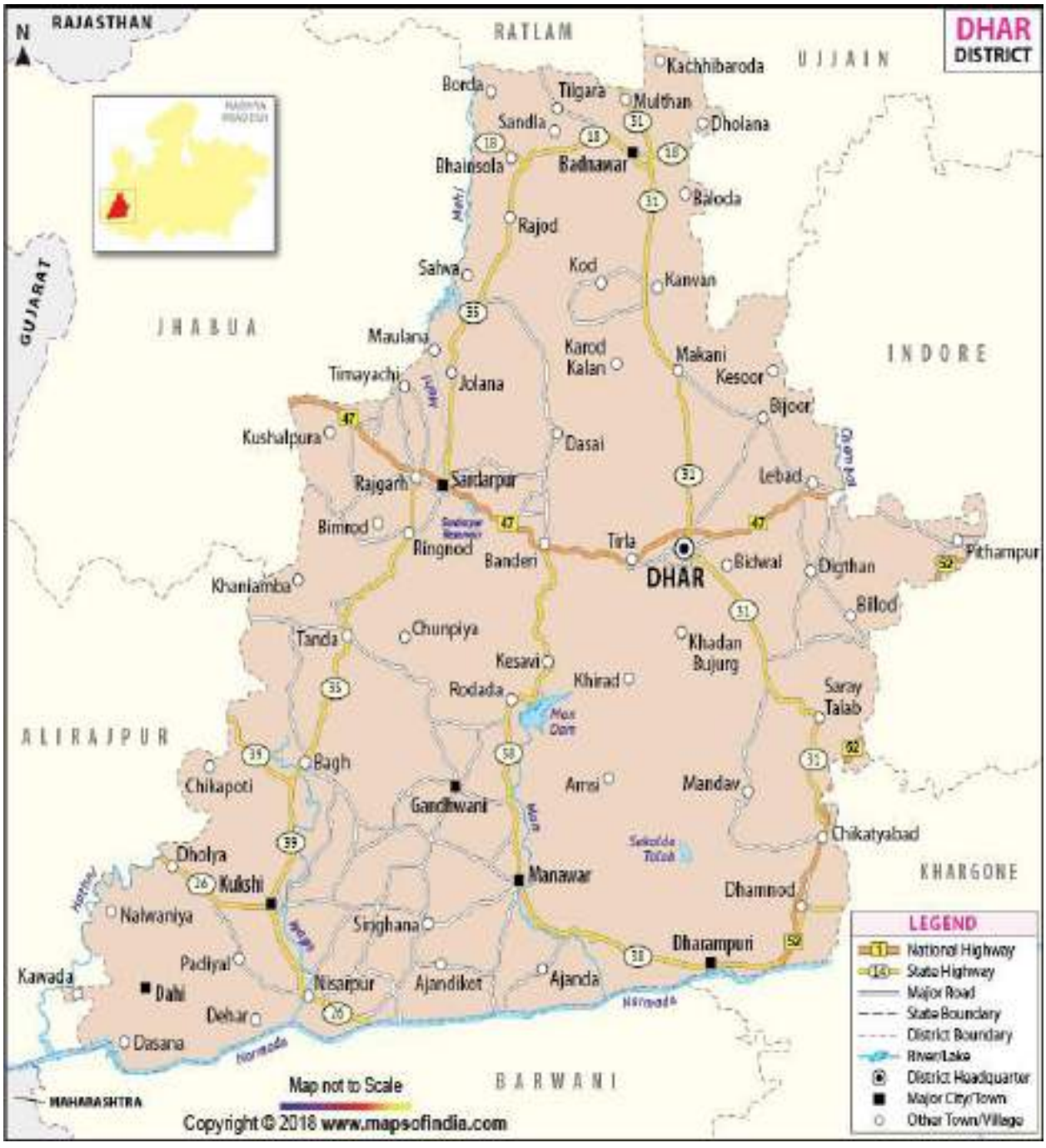
MATERIAL AND MEHTOD

Study Area- Dhar is the city located in the Malwa region of western Madhya Pradesh state in Central India. It is situated between latitude 22.598° N and longitude is 75.304° E. Mansarovar Talab of jeerapura is situated in the Dhar, Mandav road, 23k.m. away from Dhar in Madhya Pradesh. The talab is made by parmars. This is very old talab. The talab used to agriculture, fish culture, drinking etc.

The jeerapura is a very old and a gateway of the Mandav of Dhar (M.P.). The jeerapura town is closely located to the Mandav. This is very rich in water resources having large ponds, rivers, irrigational channels. Along these, the mansarovar talab deserves a leading position as it plays a significant role in daily routine work of local inhabitants. It is large, deep, perennial water body and irregularly rectangular in shape. The mansarovar talab was well infested with aquatic weeds.

Photograph showing the map of India

Photograph showing the map of Madhya Pradesh



Photograph showing the map of Dhar

Photograph showing Satellite view of the area of Mansarovar Talab of Jeerapura

Photograph showing the area of Mansarovar Talab of Jeerapur

Sampling stations

This study was carried out at four selected sampling stations identified in the East (Station 01), North (Station 02), West (Station 03) and South (Station 04).

Photograph showing the East direction (Station 01) of Mansarovar Talab of Jeerapura

Photograph showing the North direction (Station 02) of Mansarovar Talab ofJeerapura

Photograph showing theWest direction (Station 03) of Mansarovar Talab of Jeerapura

Photograph showing theSouth direction (Station 04) of Mansarovar Talab of Jeerapura

METHODOLOGY

Thereserch work of present study was during July 2014 to June 2016 for the period of 02 years. For the assessment of water quality following parameters such as Transparency, WaterTemperature,Turbidity, Hydrogen Ion Concentration (pH),Dissolved Oxygen (D.O.), Total Solid, Free CO_2, Total Alkalinity, Biological Oxygen Demand (BOD), Hardness, Magnesiun, Calcium, Chloride, Nitrate, Phosphate, Sulphate, Total Coliform & Faecal Coliform were estimated.

Following physico-chemical parameters were estimated as per methods given in ***APHA (2002), Welch (1998), Trivedi and Goel (1986) &Golterman (1978)***.

1. Water Tempreture:

water temperature as a function of depth is often required. Identification of source of water supply such as deep wells often is possible by temperature measurement alone.

Procedure: - Normally, temperature may be made with any good mercury filled Celsius-thermometer. As a minimum, a thermometer should have a scale marked for every 0.1º C, with marking etched on the capillary glass and a minimal thermal capacity to permit rapid equilibrium.

Depth temperature is required for limnological studies were measured with a reversing thermometer. The temperature of surface and sub surface waters was recorded by drawing water sample with the help of a sample or by dipping the thermo probe to the desired depth. Since only the physico-chemical characterization of water bodies was intended not the detailed

study of thermal regime. Simple mercury thermometer was used to note the water temperature usually at the time of sampling that was morning.

2. Transparency:

Transpraency was determined by Metal secchi disc of 20 cm in diameter was prepared with two white and two black equal quadrants alternatively on its upper surface. To eliminate the possibility of reflection of light from the other side it was painted black on the middle of the upper surface. A hook was soldered to tie a long wide plastic string and an opposite surface a heavy iron rod was fixed. This extra weight helped in the immersion of disc in the water. The disc was dipped into water with the help of tagged thread and the point of its disappearance was noted. It was then gradually lifted till also disappeared. The point of its reappearance was recorded. The turbidity was calculated by these two readings.

$$\text{Turbidity (cm.)} = \frac{d1 + d2}{2}$$

Where,

d_1= depth when Secchi disc disappeared

d_2= depth when Secchi disc reappeared

3. Turbidity:

Turbidity is a characteristic property of water. it measures the depth to which light penetrates into the water body.The turbidity of the water sample was measured by Nepthelo turbidity meter.The method is based on the comprasion of the intensity of the light scattered by a sample and a standard reference under same condition. For this 5 ml. of hydrazine sulphate solution 1% mixed with 5 ml of hexa methylene tetramine solution (10%) and diluted

to 1000 ml. 10 ml of this solution is diluted to 400 ml forming turbidity standard. Resut is expressed in NTU.

4. Hydrogen ion concentration (pH):

pH was determined by pH meter.

Principle: -The pH of the solution refers to its Hydrogen ion activity and is expressed as logarithm of reciprocal of hydrogen ion concentration in moles per liter at given temperature. pH is "intensity" factor of acidity. pH scale ranges from 0-14 with midpoint 7 as a neutral point below and above acidic or alkaline respectively.

Nearest equation governing the effect of concentration of ions and formation of single electrode potential across the glass membrane is the basic concept of pH measurement. pH is an important factor of water chemistry since it enters into the calculation of acidity & alkalinity and processes such as coagulation, disinfection, softening and corrosion control.

Procedure: - pH measured by systronix battery operated pH meter. The pH meter was earlier calibrated against standard buffer solutions of 7.0 pH and 9.2 pH buffers.

5. Dissolved Oxygen:

The paramount importance to all living organism and is considered to be the lone Factor which to greater extant reveal the nature of whole aquatic system.

Principal: - The magnoussulphte reacts whith the alkaline potassium hydroxide to form a white precipitate of magnous hydroxide which in the

presence of oxygengets oxidized to brown colour compond. In the strong acid medium manganic ions are reduced by iodine which gets converted to iodine equivalent to the original concentration of oxygen in the sample. The liberated iodine can be titrated against sodium thiosulphate using starch as an indicator.

$$MnSO_4 + 2\ KOH \rightarrow Mn\ (OH)_2 + K_2SO_4$$

$$2\ Mn\ (OH)_2 + O_2 \rightarrow 2\ Mn\ (OH)_3$$

$$Mn\ (SO_4) + 2\ KI \rightarrow MnSO_4 + K_2SO_4 + I_2$$

$$2\ NaS_2O_3 + I_2 \rightarrow Na_2S_4O_6 + 2\ NaI$$

Procedure: - The sample is collected in 300 ml BOD bottle. 2 ml mangnoussulphate (36%) and 2 ml alkaline potassium iodine solution (100 g KOH and 50 g KI in 200ml of distilled water) is added to the sample and shake.

The precipitate is allowed to settle. Then 2 ml of concentrate H_2SO_4 is added shaken well till the precipitate dissolved. Trtrate the liberated I_2 with 0.25 $Na_2S_2O_3$ (Sodium Thiosulphate) using starch as an indicator.

Calculaction: -

$$\text{Dissolved Oxygen in mg/l} = \frac{V1 \times N \times 8 \times 1000}{V2}$$

Where

V1= Volume of $Na_2S_2O_3$ in ml.

N= Normality of $Na_2S_2O_3$.

V2= Volume of sample used.

6. Total Solids (TS):

Procedure: - Take 100 ml beaker and empty weight is taken using weighing balance. Take 100 ml of sample in the place it in the oven at 103^0c for 24 hrs. (01 day) the water will evaporate and solids will remain as residue at the bottom of the beaker. Put the beaker in the dedicator and allow it to cool for some time. Now the weightof the beaker. The total solids are given the following formula.

100: Total solids= $\frac{\text{ker with residue- weight of empty beaker)}}{\text{ml of sample taken}}$

7. Free CO_2:

Carbon dioxide concentration influence the acidity of water and thus causes corrosion in the distribution system. The influence of carbon dioxide on water's pH also means that CO_2 concentration can influence the amount of lime which must be added to soften water. The test for CO_2 concentration is very similar to that used to calculate phenolphthalein alkalinity. However, the titrant used in CO_2 testing is N/44 NaOH reacts with CO_2 to from sodium bicarbonate.

Procedure: - free CO_2 was determined by titrating 50 ml of water sample with N/44 NaOH solution using phenolphthalein as indicator.

Free CO_2 (mg/l) = $\frac{V1\times1000\times N\times0.02}{V2}$

Where,

V1= Volume of NaOH.

V2= Volume of water sample.

N= Normality of NaOH.

8. Total Alkalinity:

Alkalinity is a measure of the basic constituents of water and is defined as the capacity of a solution to neutralize a standard acid, in natural water. It is usually present as the carbonate & bicarbonatesalts of Calcium, Magnesium, Sodium and Potassium.

Alkalinity is determined by titration with a standard solution of a strong acid to certain end points given by indicator solutions. Phenolphthalein is satisfactory for the first point (pH up to 8.3) contributed by hydroxide &carbonate and methyl orange is used for the second point (pH up to. 4.5) contributed by the bicarbonates.

The phenolphthalein end point of the titration is defined as 'P' alkalinity and the end point observed by continuing the titration with same solution using methyl orange indicator is known as total or T- alkalinity.

Procedure: -

Take 50 or 100 ml of sample in an Erlenmeyer flask, add 2 drops of Phenolphthalein indicator and titrate over a white surface with 0.02N H_2SO_4, until the color change pink coloration just disappears.

Calculation: -

Total Alkalinity = ml. of 0.02N H_2SO_4 X 1000 / ml of sample.

9. Biological Oxygen Demand (BOD):

Biological oxygen demand is the measure of the degraded organic material present in a water sample and can be defined as the amount of Oxygen required by the microorganism in stabilizing the biologically degradable organic matter under aerobic conditions.

Principle: - The principle of the method involves measuring the difference of the oxygen concentration between the sample before and after incubating it for 3 days at 27°C.

Procedure: - Two BOD bottles are taken and filled fully with sample up to the neck. One of the bottles is placed in incubator for 3 days at 27^o C and in the second BOD bottle, initial BOD is determined by fixing it with 1 ml of Alkali azide and 1 ml of Magnus sulphate. Then 2 ml. of conc. H_2SO_4 is added so that the precipitate gets settle down. Now 200 ml. of this sample is taken and titrate with Sodium Thiosulphate by adding starch as an indicator, till the sample becomes colourless. BOD bottle is taken out after 3 days from the incubator and the final BOD is determined using the same procedure.

Calculations: -

BOD in mg/l = $(D_0 - D_3)$

Where: D_o = Initial D_o in the sample; D_3 = Final D_3 after 3 days

at 27^0 C.

10. Total Hardness:

Total hardness in water is the sumof the concentration of alkaline earth metal action (Mg^{++}, Ca^{++}) etc.

Principal: -Erichrome black 'T' forms wine red complex compound with metal ion, the di- sodium salt of EDTA (ethylene diamine tetra acetic acid) extracts. The metal ions form the dye metal ion complex as colourless chelate complexes leaving a blue coloured aqueous solution of the dye.

Method: -50 ml. of sample is taken and 2 ml. of ammonia buffer solution and a pinch of Erichrome Black 'T' is added as an indicator. Titrate with EDTA solution until blue colour appears.

Calculation: -

$$\text{Total Hardness in (Mg/l)} = \frac{\text{ml of titrant x 1000}}{\text{Volume of Sample}}$$

(As $CaCO_3$)

11. Magnesium:

Magnesium in natural water comes mainly from the leaching of igneous and carbonates rocks. In areas where these sources are common, Magnesium concentrations in water often range from 5 to 50mg per litre. Magnesium is

related to water hardness in the same manner as calcium and it also an essential nutrient for plant growth and development.

Reagents:

EDTA solution, 0.01N

Dissolve 3.723gm of EDTA in distilled water to prepare 1000ml solution.

Buffer solution:

(1) Dissolve 16.9gm NH_4C1 in 143ml. of concentrated NH_4OH.

(2) Disslove 1.179gm of EDTA and 0.78gm $MgSO_4.7H_2O$ in 50ml distilled water.

Mix both (1) and (2) solutions and dilute to 250ml with distilled water.

Eriochrome Black T:

Mix 0.40gm Eriochrome Black T, with 100gm Nacl and grind them.

Procedure: -

(1) Find out the volume of EDTA used in calcium determination.

(2) Also find out the volume of EDTA usedin hardness (Mg^{++}, Ca^{++}).

Calcultion: -

$$\text{mg/l} = \frac{\text{y}-\text{x}400.8}{Volume of sample\ 1.645}$$

Where,

y = EDTA used in hardness determination

x = EDTA used in calcium determination for the same volume of the sample.

12.Calcium:

It is essential for all organisms, being an important cell wall constituent and regulates several physiological processes. It has direct effect on pH and carbonate system.

Principle: - Ammonium purpurate indicator forms pink coloured complexes with Ca^{++} ion with the addition of disodium salts EDTA, the Ca^{++} forms a colourless chelate complex leaving behind a purple solution of the dye.

Procedure: - 50 ml of sample was taken and 1 ml of 0.1 N Sodium Hydroxide Solution and a pinch of ammonium purpurate was added and titrated with EDTA solution untill purple colour appeared.

Calculation: -

$$\text{Ca hardness in mg/ l} = \frac{\text{ml of titrant} \times 1000}{\text{Volume of sample}}$$

13.Chloride:

Chloride is usually present in low concentration in natural waters and play metabolically active role in photolysis of water.Free chloride which is commonly used as a disifictant for dinking and waste soon gets either

converted into chloride or combines with organic matter to from toxic componds.

Principal: - Inpotable water the salty taste is produce by chloride ion concentration. The chloride ions are determined by the titration with standard silver nitrate solution in which silver chloride precipitates out. The end point of the titration is indicated by the formation of red silver chromate from excess silveer nitrate. The potassium chromate is used as an indicator in neutral to slightly alkaline solution.

Method: - 50 ml sample is taken and 1 to 2 drops of potassium chromate solution is added as an indicator and titrated with silver nitrate solution until colour appears**.**

Calculations: -

$$\text{Chloride in Mg/l} = \frac{\text{Reading of titrant x 500}}{\text{Volume of Sample}}$$

14.Nitrate:

Nitrate is the highest oxidation from of nitrogen and in water its mostimportante source is biological oxidation of nitrogenous matter of aoutochthonous and allochthonous origin. Domestic sewage and agriculture runoff are the chief sources of allochthonous nitrogenous organic matter. Metabolic wastes of aquatic community and dead organisms add to the autochthonous nitrogenous organic metter. Nitrifying becteria (aminifyingbecteria, Nitrosomonas, Nitrobactor) play significant role in oxidation of such organic matter. Certain nitrogen – fixing bacteria (viz., Azobactor) and algae (viz., blue- greens like Anabena, Nostoc) have

capacity to fix molecule nitrogen in nitrates. In ground water nitrates may through leaching from soil and at times by contamination. The high concentration of nitrate in water is indicative of pollution

Procedure: - Take 10 ml of sample in an Erlenmeyer flask and add 2 ml of sodium chloride solution.Shake the contents and place the flask in a cool water bath. Add slowly 10 ml of sulphuric acid and 0.5 ml of brucine – sulphanilic acid solution. Shake well and put the flask in a hot water bath with boiling water for 20 minutes. Cool the content and record the absorbance on spectrophotometer at 410 nm. Use distilled water as blank.

Calculations:

Run the standard nitrate solutions in similar manner and note the absorbance for each. Plot a standard curve between absorbance and concentrations of various standard solutions. Deduce the value of nitrate – nitrogen in sample by comparing the absorbance of sample (S) with the standard curve and express the result in mg No_3^--N/l.

15.Phosphate:

Phosphate occurs in traces in many natural waters, and often in appreciable amounts during periods of low biologic productivity. Waters reciving raw or treated sewage, agriculture drainage and certain industrial waters normally contain significant concentration of phosphate.

Procedure: - 50 ml of sample was taken. 2 ml of ammonium molybdate solution and 1 ml of stannous chloride solution is added to it. Blue colour appeard for some time and then the reading is taken by specrophotometre at 690 nm and compared against the calibration curve draw for various known concentration.

Calculation:

$$\text{Phosphate in mg/l} = \frac{\text{Graph reading x 1000 x dil factor}}{\text{Volume of Sample}}$$

16.Sulphate:

Sulphates are generally pesent in appreciable concentration and impart hardness to water. Mostly they are present in amounts more then adequate for fresh water productivity.

Pricipale: - Sulphate gets precipitated with Barium ions in acid solution to form BaSO4 crystals of uniform size which are estimated spectrophotometrically at 420 nm.

Method: - 100 ml of sample taken and 20 ml buffer solution is then added. Solution is thoroughly stirred and while stirring BaCl2 crystals are added and kept for 10 minutes for developing the colour. Then it is measured 420 nm usuing spectrophotometer and compared against the calibration curve drawn for various known concentration.

17.Total Coliform:

Principle: -The coli form group of bacteria is the most widely used indicator organism. It meets many requirements of an ideal indicator.

The coli forms are present in the digestive tract of humans, both diseased and healthy and warm- blooded animals. They find out the number of pathogens in contaminated water and therefore can be detected in a limited volume of water sample. Test for coli forms is relatively simple and inexpensive. It can be performed in ordinary water quality laboratories. The organisms can be reliably identified and enumerated.

They do not multiply in natural aquatic environment. Their die-off rate in the environment is slower compared to most of the pathogenic organisms. Further, they respond to the water treatment processes in the same manner as the pathogen. The coli forms are non-pathogenic, aerobic and facultative, rod shaped bacteria. The coli form group or total coli forms, comprise organisms both of faecal as well as non-faecal origin.

Procedure: -Arrange the fermentation tubes in three rows of five test tubes each.

1. Fill 10 ml of the Tryptose Broth in each test tube by pipette.
2. Place inverted tube in each test tube.
3. Place the cotton plug on each test tube.
4. Shift the filled test tubes and pipettes in the autoclave for sterilization.
5. After the sterilization let the test tubes to cool.
6. Now inoculate the sample with the help of the sterilized pipettes in the volume of 10 ml, 1.0 ml and 0.1 ml using the Spirit lamp as a Sterilizer.
7. Incubate the inoculated tubes at 35±0. 5°C after 48±3 hrs swirl each test tube gently and examine it for growth gas and acidic reactions (Shades of yellow color).The growth with the acidity signifies a positive reaction.

Calculation: -Count the number of Positive tubes in each row and calculate the MPN for total coli form in the sample using the following Table or formula:

$$\text{MPN/100 ml} = \frac{\text{No. of positive tubes X100}}{\sqrt{\text{ml. sample in negative tubes X ml. sample in all tubes}}}$$

18. Faecal Coliform:

Faecal coliform such as *Escherichia coli* possess an enzyme β-Glucuronidase and are capable of cleaving the fluorogenic substrate MUG (4 methylumbliferyl-β-D-Glucuronide) with corresponding release of fluorogen when growth in EC-MUG medium at 44.5°C within 24±2 hours, if the test tubes are examined in long wavelength UV lamp, there will be bright blue fluorescence.

Method: 5 tubes in each three row of 10 ml EC-MUG medium were prepared. The fermentation tubes showing growth of gas and acidity for total coli form were rotated gently. Through wire loop the growth was transferred in each EC-MUG test tube. All the inoculated test tubes were kept in incubator at 44.5°C for 24 hours. After incubation all the test tubes were examined for the fluorescence using UV light. The presence of bright blue fluorescence was considered as a positive test for feacal coli form. The numbers of total positive tubes in each row were counted and the MPN number was calculated using MaCardy's table.

Biological samples: -

Monthly samplings of these four selected sampling sites were made (July 2014 to June 2016).

By Different method benthic macro-invertebrates were collected.From the target habitat, samples were collected from the deeper profundal zone by using EKman grab and from shallow profundal zone by using Kick net following ***Wetzel (2001)***. Quantitative sampling was done by Kick net and Ekman grab.

Kick Net

Macro-invertebrate samples were collected by using Kick net (20*20 cm) into a single sample following the semi quantitative procedure of ***Stark et al., (2001)***. Organisms were collected by stirring and disturbing the substance for about 5 minutes to the depth of several inches to dislodge the borrowing macro-invertebrates ahead of the net per square meter ***(Hoffsten&Malmqvist 2000); (Llmonen&Paasivira 2005)***. Samples were obtained from the same location by brushing the organism of the cobbles and rocks, following standard method of ***Borror et al., (1976)*** and ***APHA (2002)***.

Ekman grab sampler

This sampler is designed to collect an accurate representative sample of the sediment bottom. Ekman grab equipped with drop-weight system so that sampling can be carried out at any depth. The bite of the sampler should be deep enough so all depths are sampled equally. The sampler should be designed to minimize disturbance of the topmost sediment by the pressure wave as it is lowered to the bottom.

As the sampler is lowered two hinged upper lids swing open to let water pass through and close upon retrieval preventing sample washout. When the sampler reaches the bottom, a messenger is sent down the line tripping the overlapping spring-loaded scoops. Each sampler is constructed of 316 stain-less steel including the springs, cables and fasteners.

The number of Macro-invertebrates per unit area was calculated as follows: -

Macro-invertebrates No. /cm^2 = $\frac{N \times 104}{A}$

Were,

N = No. of organisms per sample

A = Area of the sampler (20*20cm)

The sample were preserved in 4% formalin solution and transported to the laboratory for further investigation. In the laboratory, samples were washed thoroughly with distilled water to remove preservative through a service with 5mm and 1mm grids. Samples were then poured in a white bottomed tray of the appropriate size for good visualization and the Macro-invertebrates fauna were then identified.

Collected samples were examined under a standard microscope with proper resolution and the fauna was identification using cited taxonomic literature. Samples were assigned to a family/species using taxonomic keys; ***APHA (2005), Pennak (2004), Welch (1998),Willium&Feltmate (1992),Tonapi (1980) and Needham & Needham (1969).***

Collection of Fishes: -

The Collection of fishes will be done from selected station every month during study- period (July 2014 to June 2016). The gill cost net will be used for the collection. After collection of fishes they are preserved in 5% formalin and glycerin. The identification of fishes would be the help of ***Shrivastav (1982), Jhingran (1982) and Jayaram (1976).***

Correlation Coefficient between Abiotic (physico-chemical parameters) and Biotic (benthic macro-invertebrates) factors: -

To study the relationship between the physico-chemical parameters and benthic macro-invertebrates during study period (July 2014 to June 2016) Karl Pearson's correlation coefficient (r) method was used.

Correlation analysis provides us information about the relationship between the two variables but it does not indicate us about the causes and effect of relationship.

If both the variables are changing in the same direction that means both are increasing or both are decreasing, then there is a positive correlation between the two variables. If the two variables change in opposite direction, then they possess negative correlation.

The Karl Pearson's correlation is calculated by following formula-

$$r_{xy} = \frac{N \sum XY - \sum X \sum Y}{\sqrt{[N \sum X^2 - (\sum X)^2] [N \sum Y^2 - (\sum Y)^2]}}$$

Where

r = coefficient of correlation.

N = no. of months.

X and Y = variables.

For interpretation purpose

r = 1 is considered to be perfect positive correlation.

0 < r < 0.39 is considered to be low positive correlation.

0.40 < r < 0.69 is considered to be moderate positive correlation.

0.70 < r < 0.99 is considered to be high positive correlation.

-0.39 < r < -0.1 is considered to be low negative correlation.

-0.69 < r < -0.40 is considered to be moderate negative correlation.

-0.99 < r < -0.70 is considered to be high negative correlation.

BenthometricDiversity: -

The calculation of diversity indexis generally simple as it only requires information of the species number (richness) and the number of individuals of the species (abundance).

Shannon and Weaver Diversity Index

The numerical relationship between the species population and whole communities often provides better reliable indications of pollution then single species (***Dutta & Dutta 1995***). These relationships are represented by "Diversity Indices." Several types of indices are used. In the present study Shannon and Weaver diversity index (H) (1963) was used.

Shannon and Weaver diversity index: It has been calculated as

$$H = \sum_{i=1}^{S} (p_i \ln p_i)$$

Where as

H = Shannon and Weaver Index.

P_i = ni / N (ni = number of individuals of the species).

N = Total number of individuals in the sample.

The value of Shannon and Weaver Index theoretically range from 0.00 to 4.00. Value less than 1.00 indicates poor water quality, value from 1.00 to 3.00 indicates moderate water quality and value above 3.00 indicates good water quality.

Water Quality Index: -

For calculation of WQI, selection of parameters has great importance. Since selection of too many parameters might widen the water quality index and the importance of various parameters depends on the intended use of water, nine physico-chemical parameters,pH,Temprature, BOD, DO, Phosphate, Faecal Coliform, TDS, Nitrate, and Turbidity were used to calculate the WQI. The calculation of WQI was made using a weighted arithmetic index method given below (***Brown et al., 1970***) in the following steps:

Calculation of sub index of quality rating (q_n)

Let there be n water quality parameters where the quality rating or sub index (q_n) corresponding to the n^{th} parameter is a number reflecting the relative value of this parameter in the polluted water with respect to its standard permissible value. The value of *qn*is calculated using the following expression-

$qn= 100[(V_n- V_{io}) / (S_n- V_{io})]$

Where,

q_n= quality rating for the n^{th} water quality parameter.

V_n= estimated value of the n^{th} parameter at a given sampling station.

S_n= standard permissible value of n^{th} parameter

V_{io}= ideal value of n^{th} parameter in pure water.

All the ideal values (V_{io}) are taken as zero for drinking water except for pH=7.0 and dissolved oxygen = 14.6mg/l.

Calculation of quality rating for pH

For pH the ideal value is 7.0 (for natural water) and a permissible value is 8.5 (for polluted water). Therefore, the quality rating for pH is calculated from the following relation:

qpH= 100 [(VpH-7.0)/ (8.5 -7.0)] (2)

Where

VpH= observed value of pH during the study period.

Calculation of quality rating for dissolved oxygen-

The ideal value (VDO) for dissolved oxygen is 14.6 mg/l and standard permitted value for drinking water is 5 mg/L. Therefore, quality rating is calculated from following relation:

qDO= 100 [(VDO - 14.6)/ (5 – 14.6)] (3)

where

VDO= measured value of dissolved oxygen

Calculation of unit weight (*Wn*): -

Calculation of unit weight (*Wn*) for various water quality parameters are inversely proportional to the recommended standards for the corresponding parameters.

Wn= K/Sn (4)

where

Wn= unit weight for n^{th} parameters

Sn= standard value for n^{th} parameters

K = constant for proportionality

Calculation of WQI: -

WQI is calculated from the following equation.

$$WQI = \sum_{n=1}^{n} q_n W_n / \sum_{n=1}^{n} W_n$$

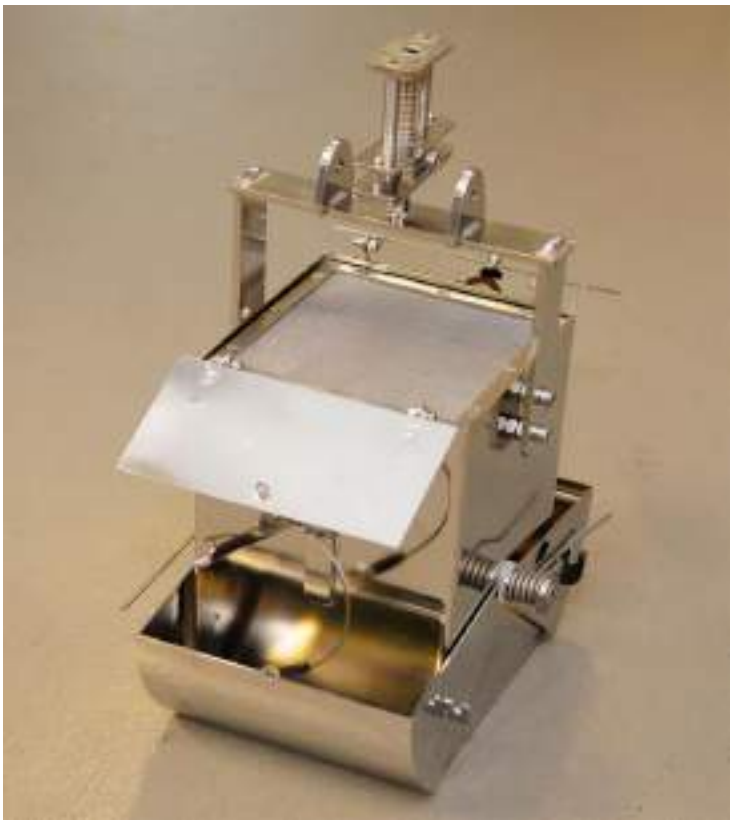
NSFWQI (National Sanitation Foundation Water Quality Index): -

NSF international is a not- for-profit, non- governmental organization thatprovides standards development, product certification, auditing, education and risk manegment for public health and safty. Acommonly used water quality index (WQI) was developed by the National Sanitation Foundation (NSF) in *1970(Brown and others1970).* The NSF WQI was developed to provide a standardized method for comparing the water quality of various bodies of water. The water quality ranges from 0 to 100. The WQI ranges have been defined as 91 to100 (Excellent), 71 to 90 (Good), 51 to 70 (Medium), 26 to 50 (Poor), 0 to 25 (Bad).

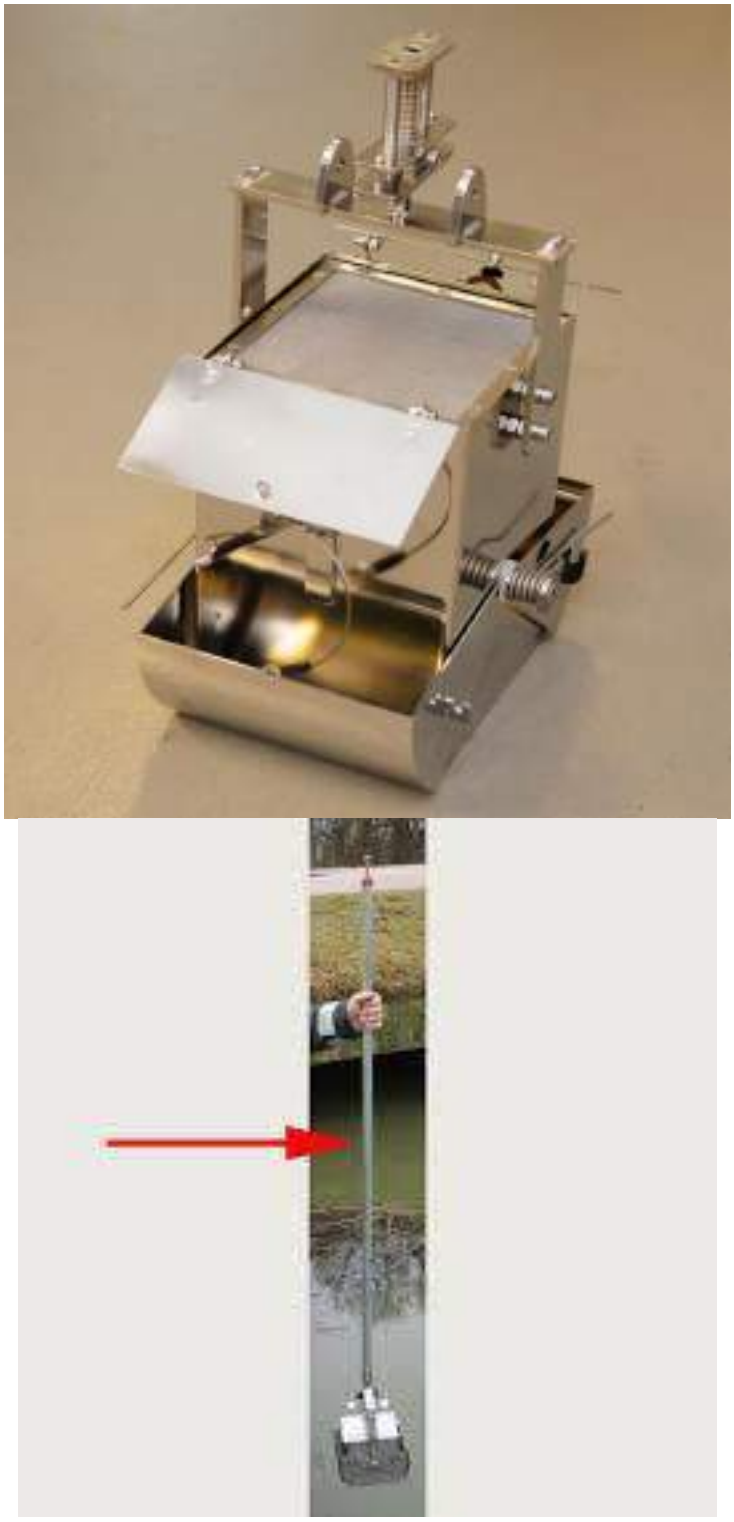
Water quality	**NSFWQI**	**WQ class**
Excellent	91 to100	I
Good	71 to 90	II
Medium or average	51 to 70	III
Poor	26 to 50	IV
Bad	0 to 25	V

Photograph showing the Kick Net Photograph showing the Hand Net

D-shaped netSurber sampler



Photograph showing the Ekman Grab



Photograph showing theEkman Grab Sampler

Gill Cost Net

Gill Cost Net

OBSERVATIONS

&

RESULTS

OBSERVATION AND RESULTS

1. Temperature: -

July 2014 – June 2015

Sampling Site 01. The water temperaturevaried from 24.9^{0}C to 36.2°C. The lowest water temperature was observed in December where ashighest was in wsJune (Table 1 & fig.1).

SamplingSite02. At this station water temperature fluctuated between 25.1^{0}C to 36.8°C. The lowest water temperature was observed in December where ashighest was in June (Table 1 & fig.1).

SamplingSite 03. The water temperatureoscillatedbetween 25.2^{0}C to 36.8°C. The lowest water temperature was observed in December where ashighest was in June (Table 1 & fig.1).

SamplingSite 04. At this station the water temperature ranged between 24.8^{0}C to 37.1°C. The lowest water temperature was observed in December where as highest was in June (Table 1 & fig.1).

July 2015 – June 2016

SamplingSite 01. The water temperature varied from 25.5^{0}C to 37.0°C. The lowest water temperature was recorded in December where ashighest was in June (Table 2 & fig.2).

SamplingSite 02. At this station water temperature fluctuated between 26.2^{0}C to 37.5°C. The lowest water temperature was recorded in December where ashighest was in June (Table 2 & fig.2).

SamplingSite 03. The water temperature ocillated between 26.5^{0}C to 37.2°C. The lowest water temperature was recorded in December where ashighest was in June (Table 2 & fig.2).

SamplingSite 04. At this station the water temperature ranged between 27.3^{0}C to 37.9°C. The lowest water temperature was recorded in December where ashighest was in June (Table 2 & fig.2).

It was fluctuated between 24.8^{o}C to 37.9^{o}C. The lowest water temperature was observed at samplingsite 04.in December in the year 2014-2015 and highest value was observed at samplingsite 04 in June in the year 2015-2016 (Table 1 & fig.1 and Table 2 & fig.2).

Table- 1. Monthly Variations in Water Temperature (°C) in Mansarovar

Month	Site 01	Site 02	Site 03	Site 04
Jul.	26.5	26.4	25.5	26.9
Aug.	28.8	29.5	27.5	28.8
Sep.	30.5	31.0	30.0	30.5
Oct.	28.8	29.2	28.2	29.0
Nov.	26.5	25.5	26.9	26.5
Dec.	**24.9**	**25.1**	**25.2**	**24.8**
Jan.	27.0	26.5	27.5	26.9
Feb.	29.5	28.9	30.2	29.5
Mar.	31.2	32.5	30.8	31.9
Apr.	33.9	34.2	33.5	35.0
May	35.8	35.9	35.2	36.2
Jun.	**36.2**	**36.8**	**36.8**	**37.1**

Talab of Jeerapura (Dhar) Year July 2014- June 2015.

Table- 2. Monthly Variations in Water Temperature (°C) in Mansarovar Talab of Jeerapura (Dhar) Year July 2015- June 2016.

Month	Site 01	Site 02	Site 03	Site 04
Jul.	27.5	28.5	28.2	29.0
Aug.	29.2	29.9	27.9	28.5
Sep.	30.8	31.2	29.5	30.5
Oct.	29.1	29.5	30.0	28.5
Nov.	26.5	27.0	27.5	28.3
Dec.	**25.5**	**26.2**	**26.5**	**27.3**
Jan.	28.0	27.5	28.8	28.4
Feb.	28.5	28.0	29.5	29.0
Mar.	32.2	32.7	31.9	32.5
Apr.	34.0	34.6	35.0	35.5
May	35.9	36.2	36.0	36.5
Jun.	**37.0**	**37.5**	**37.2**	**37.9**

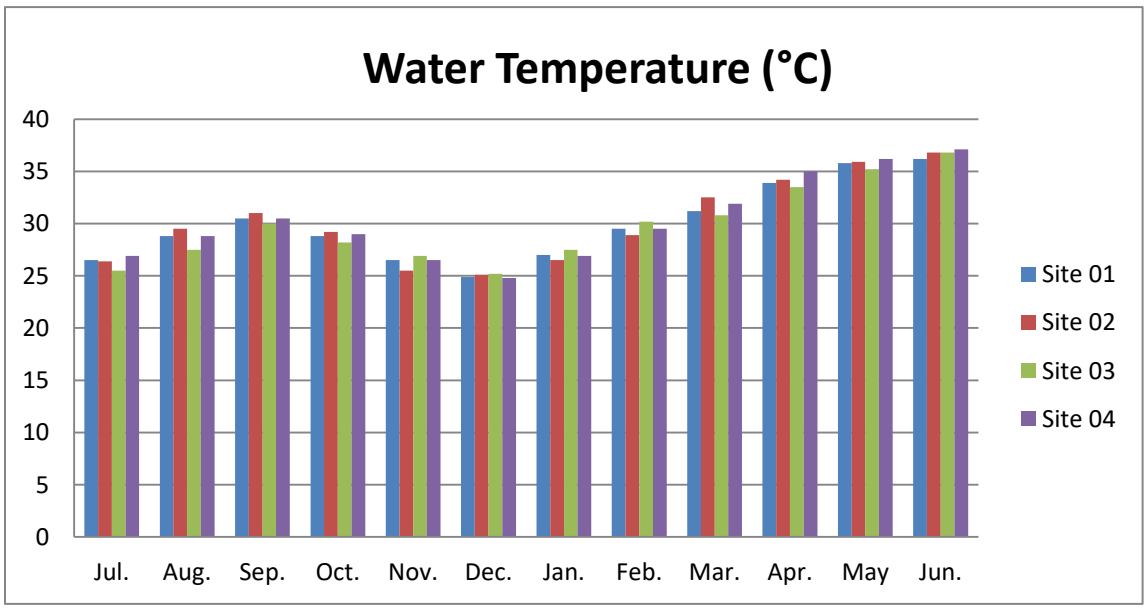


Fig.-1. Monthly Variations in Water Temperature (°C) in Mansarovar Talab of Jeerapura (Dhar) Year July 2014- June 2015.

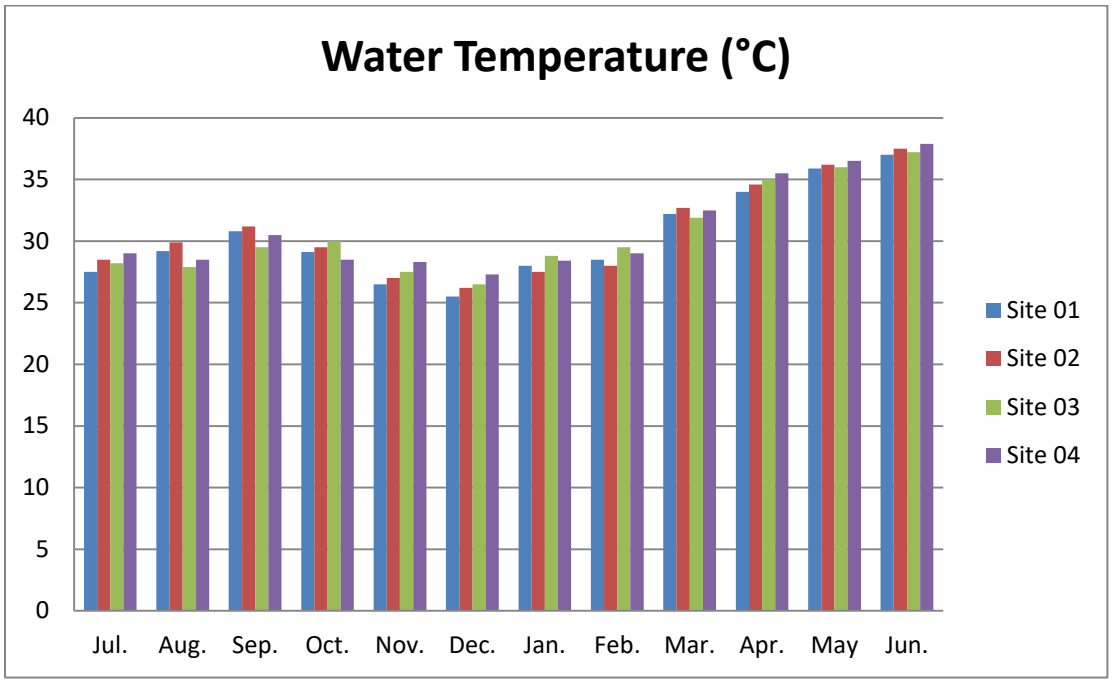


Fig. - 2. Monthly Variations in Water Temperature (°C) in Mansarovar Talab of Jeerapura (Dhar) Year July 2015- June 2016.

2 Light Transparency: -

July 2014 – June 2015

SamplingSite 01. The water light transparencyvaried from 21.6 cm to 44.2 cm. The lowest water Light Transparency was recorded in May where ashighest was in November (Table 3 & fig.3).

SamplingSite 02. At this station light transparency fluctuated between 20.2 cm. to 49.2 cm. Thelowest waterLight Transparency was recorded in Julywhere ashighest was in October (Table 3& fig.3).

SamplingSite 03. The water light transparency oscillated between 22.0 cm. to 42.2 cm. The lowest water Light Transparency was recorded in July where ashighest was in November (Table 3 & fig.3).

SamplingSite 04. At this station the water light transparency ranged between 21.2 cm. to 44.2 cm. Thelowest Light Transparency was observed in July where ashighest was in October and November (Table 3 & fig.3).

July 2015 – June 2016

SamplingSite 01. The water light transparency varied from 20.0 cm to 48.5 cm. The lowest water light transparency was recorded in Maywhere ashighest was in December (Table 4 & fig.4).

SamplingSite 02. At this station water light transparency fluctuated between 19.8 cm to 47.2 cm. The lowest water light transparency was recorded in Julywhere ashighest was in November (Table 4 & fig.4).

SamplingSite 03. The water light transparencyoscillated between 23.0 cm to 49.4 cm. The lowest water light transparency was recorded in May where ashighest was in December (Table 4 & fig.4).

SamplingSite 04. At this station the water light transparency ranged between 20.5 cm to 50.0 cm. The lowest water light transparency was recorded in July where ashighest was in November (Table 4 & fig.4).

In general transparency fluctuated between 19.8 cm to 50.0 cm. The lowest transparency was observed at sampling site 02 in July in the year of 2015-16. The highest transparency was at samplingsite 04 in November in the year 2015-2016 (Table 4 & fig.4).

Table- 3. Monthly Variations in Light Transparency (cm.) in Mansarovar Talab of Jeerapura (Dhar) Year July 2014 - June2015.

Month	Site 01	Site 02	Site 03	Site 04
Jul.	23.0	**20.2**	**22.0**	**21.2**
Aug.	24.5	21.5	24.9	22.5
Sep.	28.6	24.5	29.2	23.5
Oct.	43.2	**49.2**	40.2	**44.2**
Nov.	**44.2**	46.2	**42.2**	**44.2**
Dec.	41.5	40.0	40.5	38.8
Jan.	38.2	37.0	39.1	38.2
Feb.	39.8	37.5	40.2	38.5
Mar.	30.7	31.8	31.6	32.3
Apr.	28.0	31.2	29.0	32.0
May	**21.6**	38.0	22.5	39.0
Jun.	26.5	35.1	27.4	36.5

Table- 4. Monthly Variations in Light Transparency (cm.) in Mansarovar Talab of Jeerapura (Dhar) Year July 2015- June 2016.

Month	Site 01	Site 02	Site 03	Site 04
Jul.	22.0	**19.8**	23.2	**20.5**
Aug.	23.9	20.5	25.0	21.5
Sep.	26.5	24.9	28.5	26.5
Oct.	40.2	44.2	42.5	45.5
Nov.	46.2	**47.2**	48.0	**50.0**
Dec.	**48.5**	42.0	**49.4**	44.2
Jan.	36.5	35.0	37.5	36.2
Feb.	38.2	35.9	39.5	38.2
Mar.	30.0	29.8	32.0	33.5
Apr.	27.0	30.0	29.0	32.2
May	**20.0**	36.0	**23.0**	38.4
Jun.	24.2	32.0	27.5	35.0

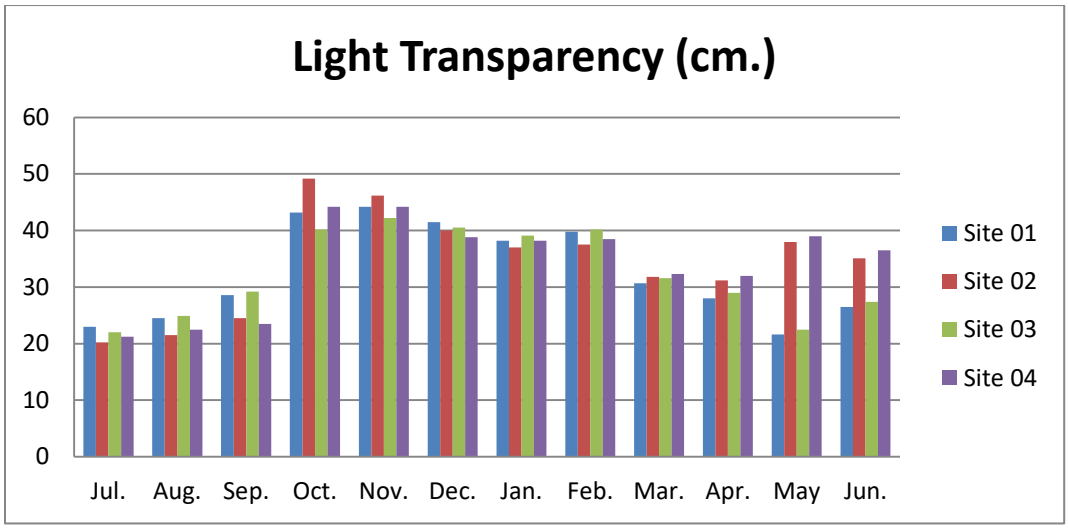


Fig.-3. MonthlyVariations in Light Transparency (cm.) in Mansarovar Talab of Jeerapura (Dhar) Year July 2014 - June 2015.

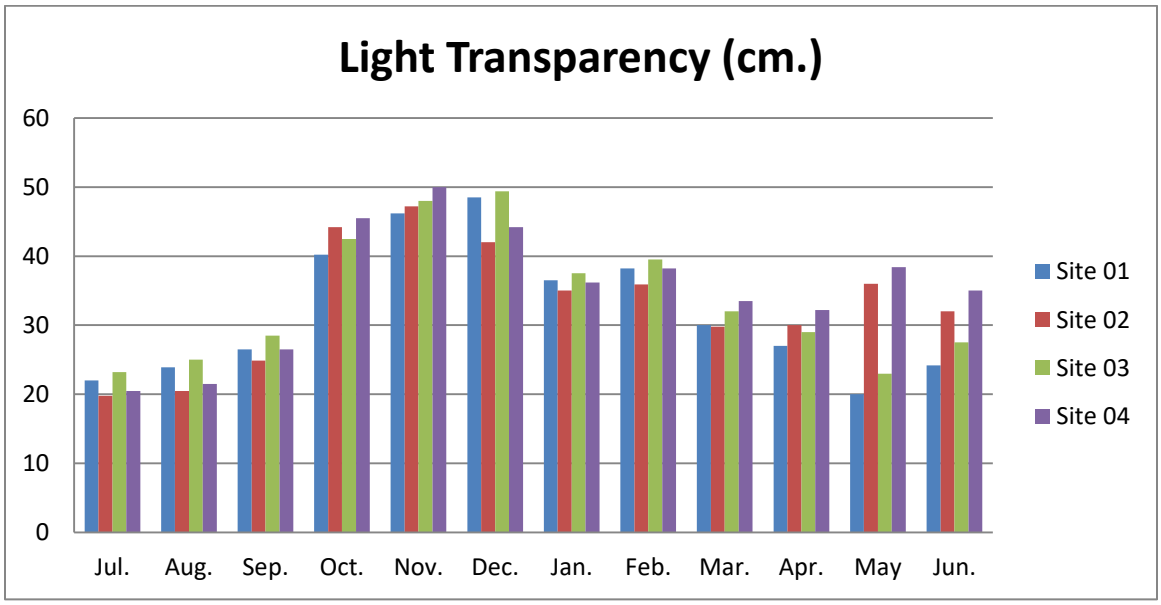


Fig. - 4. Monthly Variations in Light Transparency (cm.) in Mansarovar Talab of Jeerapura (Dhar) Year July 2015- June 2016.

3. Turbidity: -

July 2014 – June 2015

SamplingSite 01. The water turbidity varied from 12 to 55. The lowest water turbidity was recorded in December where ashighest was in October (Table 5 & fig.5).

SamplingSite 02. At this station water turbidity fluctuated between 14 to 62. Thelowest waterturbidity was recorded in Decemberwhere ashighest was in October (Table 5& fig.5).

SamplingSite 03. The water turbidity oscillated between 14 to 50. Thelowest water turbiditywas recorded in December where ashighest was in October (Table 5 & fig.5).

SamplingSite 04. At this station the water turbidity ranged between 11 to 60. Thelowest water turbiditywas recorded in Decemberwhere as highest was in October (Table 5 & fig.5).

July 2015 – June 2016

SamplingSite01. The water turbidity varied from 18 to 55. The lowest water turbidity was recorded in December, March and Aprilwhere ashighest was in October (Table 6 & fig.6).

SamplingSite 02. At this station water turbidity fluctuated from 19 to 65. The lowest water turbidity was recorded in Aprilwhere ashighest was in October (Table 6 & fig.6).

SamplingSite 03. The water turbidity oscillated between 17 to 53. The lowest water turbidity was recorded in April where ashighest was in August (Table 6 & fig.6).

SamplingSite 04. At this station the water turbidity ranged between 20 to 68. The lowest water turbidity was recorded in April where ashighest was in October (Table 6& fig.6).

In the present study turbidity fluctuated between 11 to 68. The lowest turbidity was observed at site 04 in December in the year 2014-2015 and highest value was observed at site 04 in October in the year 2015-2016 (Table 5 & fig.5 and Table 6 & fig.6).

Table 5. Monthly Variations in Turbidity (NTU) in Mansarovar Talab of Jeerapura (Dhar) Year July 2014- June 2015.

Month	Site 01	Site 02	Site 03	Site 04
Jul.	38	35	36	34
Aug.	30	36	31	33
Sep.	45	48	40	45
Oct.	**55**	**62**	**50**	**60**
Nov.	30	16	29	18
Dec.	**12**	**14**	**14**	**11**
Jan.	20	22	23	20
Feb.	28	25	30	28
Mar.	15	18	18	20
Apr.	19	20	17	19
May	30	26	32	29
Jun.	32	34	33	35

Table- 6. Monthly Variations in Turbidity (NTU)in Mansarovar Talab of Jeerapura (Dhar) Year July 2015- June 2016.

Month	Site 01	Site 02	Site 03	Site 04
Jul.	45	40	47	42
Aug.	50	55	**53**	55
Sep.	46	44	48	49
Oct.	**55**	**65**	52	**68**
Nov.	38	25	42	30
Dec.	**18**	20	20	23
Jan.	25	28	27	29
Feb.	32	35	34	37
Mar.	**18**	22	19	23
Apr.	**18**	**19**	**17**	**20**
May	20	21	21	24
Jun.	35	38	38	39

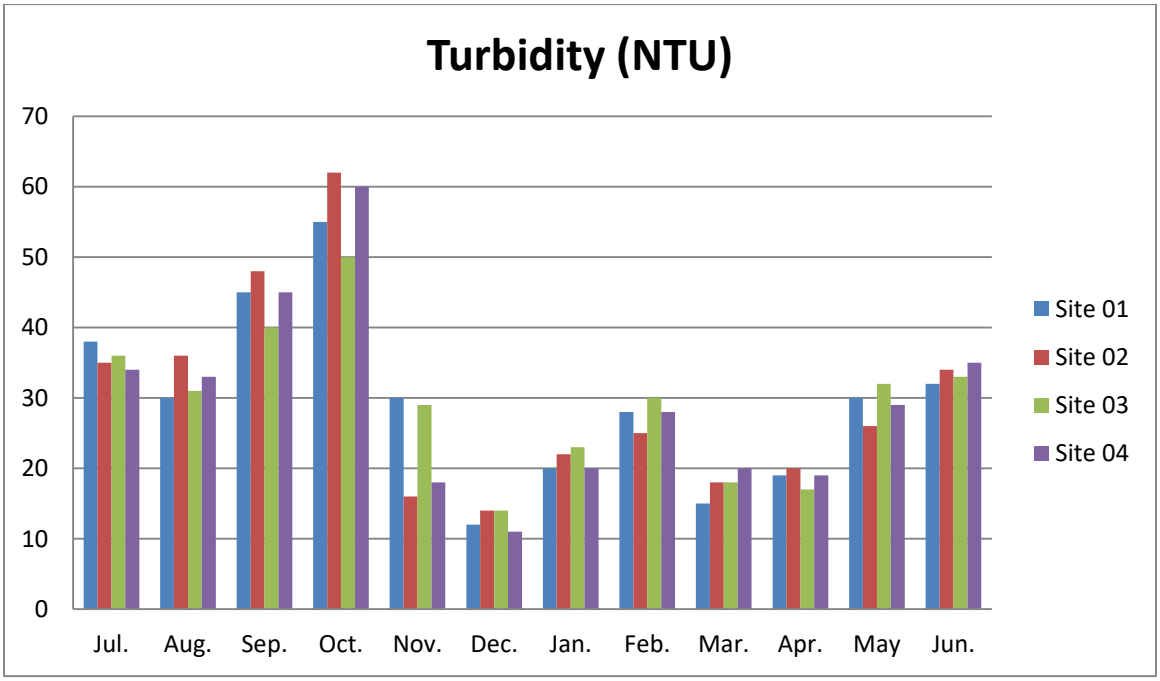


Fig. - 5. Monthly Variations in Turbidity (NTU)in Mansarovar Talab of Jeerapura (Dhar) Year July 2014- June 2015.

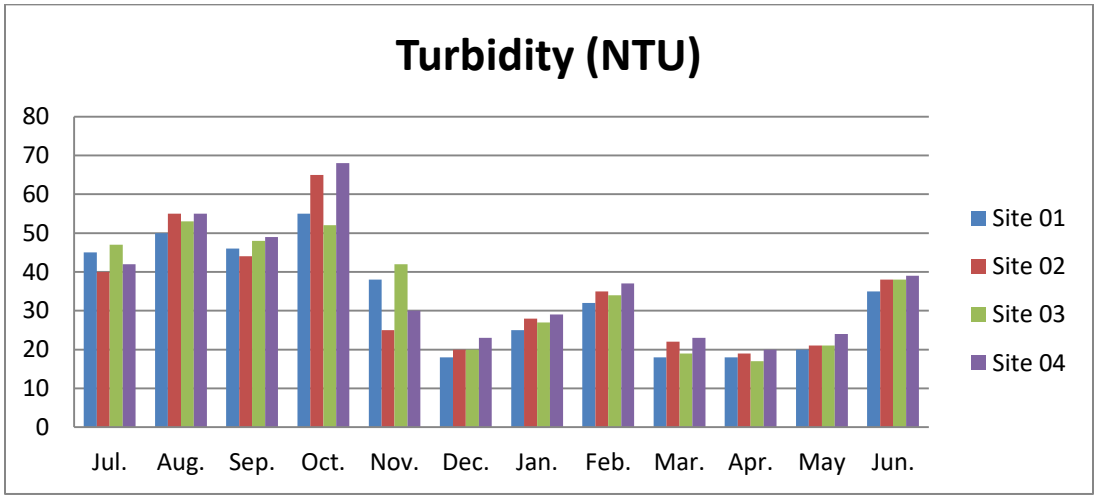


Fig. - 6. Monthly Variations in Turbidity (NTU)in Mansarovar Talab of Jeerapura (Dhar) Year July 2015- June 2016.

4. Hydrogen Ion Concentration (pH): -

July 2014 – June 2015

SamplingSite 01. The water Hydrogen Ion Concentration (pH)varied from 7.4 to 8.5. The lowest water Hydrogen Ion Concentration (pH) was recorded in Januarywhere ashighest was in October (Table 7 & fig.7).

SamplingSite 02. At this station water Hydrogen Ion Concentration (pH) fluctuated between 7.6 to 8.5. The lowest water Hydrogen Ion Concentration (pH) was recorded in Januarywhere ashighest was in June (Table 7& fig.7).

SamplingSite 03. The water Hydrogen Ion Concentration (pH)oscillatedbetween 7.7 to 8.8. The lowest water Hydrogen Ion Concentration (pH) was recorded in August and Januarywhere ashighest was in April (Table 7 & fig.7).

SamplingSite 04. At this station the water Hydrogen Ion Concentration (pH) ranged between 7.8 to 8.9. The lowest water Hydrogen Ion Concentration (pH) was recorded in Januarywhere ashighest was in April and June (Table 7 & fig.7).

July 2015 – June 2016

SamplingSite 01. The water Hydrogen Ion Concentration (pH)varied from 7.6 to 8.9. The lowest water Hydrogen Ion Concentration (pH) was recorded in Januarywhere ashighest was in April (Table 8 & fig.8).

SamplingSite 02. At this station water Hydrogen Ion Concentration (pH) fluctuated between 7.8 to 9.0. The lowest water Hydrogen Ion Concentration (pH) was recorded in July and Januarywhere ashighest was in June (Table 8 & fig.8).

SamplingSite 03. The water Hydrogen Ion Concentration (pH)ocillated between 7.8 to 8.9. The lowest water Hydrogen Ion Concentration (pH) was recorded in Augustwhere ashighest was in June (Table 8 & fig.8).

SamplingSite 04. At this station the water Hydrogen Ion Concentration (pH) ranged between 7.9 to 9.1. The lowest water Hydrogen Ion Concentration (pH) was recorded in Julywhere ashighest was in June (Table 8 & fig.8).

pH fluctuated between 7.4 to 9.1. The lowest pH was observed at samplingsite 01 in January in the year 2014-15. The highest pH was obderved at samplingsite 04 in June in 2015-16 (Table 7 & fig.7 and Table 8 & fig.8).

Table 7. Monthly Variations in Hydrogen Ion Concentration (pH) in Mansarovar Talab of Jeerapura (Dhar) Year July 2014- June 2015.

Month	Site 01	Site 02	Site 03	Site 04
Jul.	7.7	7.9	7.8	8.0
Aug.	7.9	8.1	**7.7**	8.2
Sep.	8.2	8.4	8.1	8.5
Oct.	**8.5**	8.2	8.6	8.4
Nov.	7.6	7.8	7.8	7.9
Dec.	7.9	8.1	8.1	8.3
Jan.	**7.4**	**7.6**	**7.7**	**7.8**
Feb.	7.9	8.2	7.8	8.4
Mar.	8.4	8.3	8.6	8.5
Apr.	8.4	7.9	**8.8**	**8.9**
May	8.0	7.8	8.3	8.2
Jun.	8.2	**8.5**	8.6	**8.9**

Table 8. Monthly Variations in Hydrogen Ion Concentration (pH) in Mansarovar Talab of Jeerapura (Dhar) Year July 2015- June 2016.

Month	Site 01	Site 02	Site 03	Site 04
Jul.	7.9	**7.8**	8.0	**7.9**
Aug.	7.7	8.3	**7.8**	8.4
Sep.	8.4	8.5	8.6	8.8
Oct.	8.6	8.2	8.9	8.7
Nov.	7.9	8.1	8.5	8.7
Dec.	8.2	8.4	8.5	8.6
Jan.	**7.6**	**7.8**	7.9	8.0
Feb.	8.0	8.3	8.2	8.4
Mar.	8.6	8.7	8.8	8.9
Apr.	**8.9**	8.8	8.7	8.6
May	8.8	8.9	8.4	9.0
Jun.	8.6	**9.0**	**8.9**	**9.1**

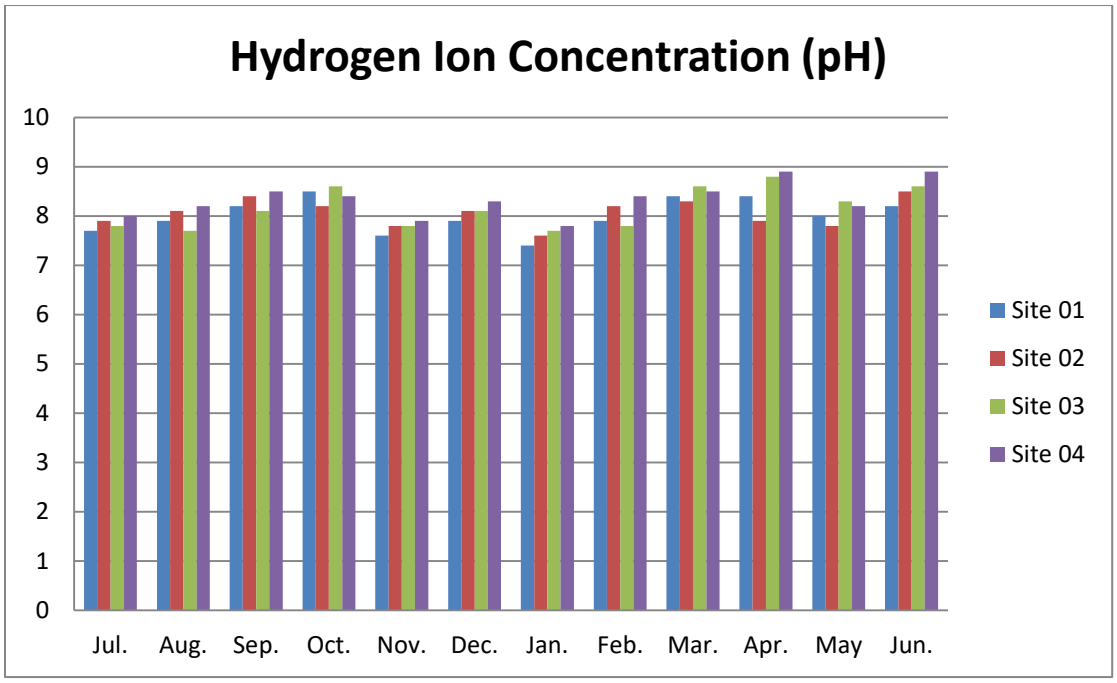


Fig.-7. Monthly Variations in Hydrogen Ion Concentration (pH) in Mansarovar Talab of Jeerapura (Dhar) Year July 2014- June 2015.

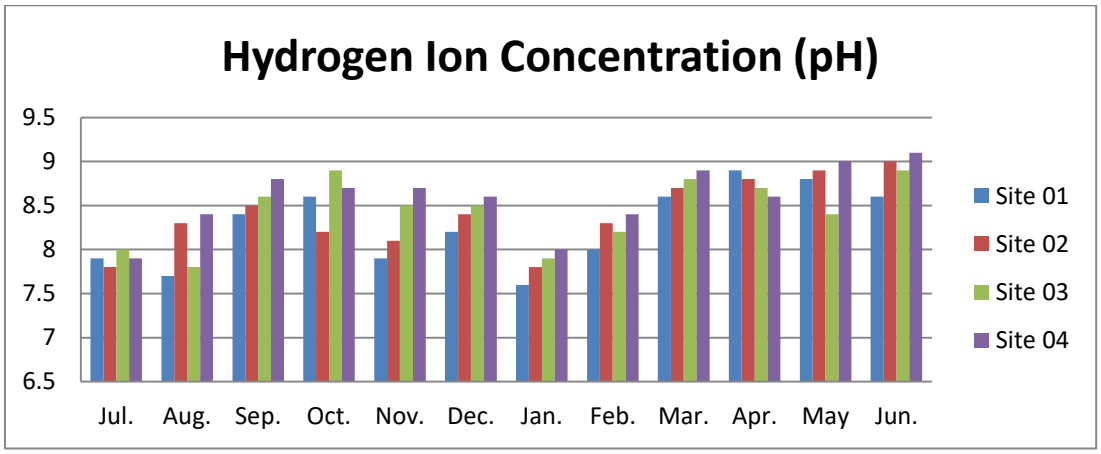


Fig.-8. Monthly Variationsin Hydrogen Ion Concentration (pH) in Mansarovar Talab of Jeerapura (Dhar) Year July 2015- June 2016.

5. Dissolved Oxygen (D.O.): -

July 2014 – June 2015

SamplingSite 01. The water Dissolved Oxygen (D.O.) varied from 5.6 mg/l to 12.3 mg/l. The lowest water Dissolved Oxygen (D.O.) was recorded in September where ashighest was in June (Table 9 & fig.9).

SamplingSite 02. At this station water Dissolved Oxygen (D.O.) fluctuated between 6.4 mg/l to 12.0 mg/l. The lowest water Dissolved Oxygen (D.O.) was recorded in Augustwhere ashighest was in November (Table 9 & fig.9).

SamplingSite 03. The water Dissolved Oxygen (D.O.) oscillatedbetween 5.2 mg/l to 10.2 mg/l. The lowest water Dissolved Oxygen (D.O.) was recorded in September where ashighest was in June (Table 9 & fig.9).

SamplingSite 04. At this station the water Dissolved Oxygen (D.O.) ranged between 6.2 mg/l to10.0 mg/l. The lowest water Dissolved Oxygen (D.O.) was recorded in August and September where ashighest was in November (Table 9 & fig.9).

July 2015 – June 2016

SamplingSite 01. The water Dissolved Oxygen (D.O.) varied from 6.2mg/l to 9.8 mg/l. The lowest water Dissolved Oxygen (D.O.) was recorded in Julywhere ashighest was in June (Table 10& fig.10).

SamplingSite 02. At this station water Dissolved Oxygen (D.O.) fluctuated between 6.0 mg/l to 9.8 mg/l. The lowest water Dissolved Oxygen (D.O.)

was recorded in July and Septemberwhere ashighest was in December (Table 10& fig.10).

SamplingSite 03. The water Dissolved Oxygen (D.O.) ocillated between 5.9 mg/lto 9.0 mg/l. The lowest water Dissolved Oxygen (D.O.) was recorded in Augustwhere ashighest was in May (Table 10& fig.10).

SamplingSite 04. At this station the water Dissolved Oxygen (D.O.) ranged between 5.8 mg/l to 8.7mg/l. The lowest water Dissolved Oxygen (D.O.) was recorded in July and Septemberwhere ashighest was in June (Table 10& fig.10).

In general, dissolved oxygen varied between 5.2 to 12.3 mg/l. The lowest value was observed at samplingsite 03 in September in the year of 2014-15. The highest dissolved oxygen value was recorded at samplingsite 01 in June in the year of 2014-15 (Table 10& fig.10).

Table 9. Monthly Variations in Dissolved Oxygen (mg/l) in Mansarovar Talab of Jeerapura (Dhar) Year July 2014- June 2015.

Month	Site 01	Site 02	Site 03	Site 04
Jul.	6.7	6.9	6.2	6.5
Aug.	6.6	**6.4**	6.0	**6.2**
Sep.	**5.6**	6.5	**5.2**	**6.2**
Oct.	8.8	8.5	8.0	7.8
Nov.	10.8	**12.0**	9.8	**10.0**
Dec.	9.2	10.0	8.8	9.0
Jan.	9.5	9.2	8.5	8.2
Feb.	7.5	7.9	7.2	7.0
Mar.	8.5	8.9	8.0	8.2
Apr.	9.2	8.8	8.8	8.3
May	10.5	11.5	9.6	9.1
Jun.	**12.3**	11.2	**10.2**	9.8

Table 10. Monthly Variations in Dissolved Oxygen (mg/l) in Mansarovar Talab of Jeerapura (Dhar) Year July 2015- June 2016.

Month	Site 01	Site 02	Site 03	Site 04
Jul.	**6.2**	**6.0**	6.0	5.8
Aug.	6.9	7.2	**5.9**	6.9
Sep.	6.6	**6.0**	7.0	**5.8**
Oct.	7.5	7.9	6.2	6.8
Nov.	8.8	9.2	7.5	8.0
Dec.	8.2	**9.5**	7.9	8.2
Jan.	8.8	8.9	8.4	8.2
Feb.	7.9	7.0	7.4	7.6
Mar.	8.0	7.7	7.8	7.5
Apr.	8.5	8.0	8.0	8.3
May	9.5	8.8	**9.0**	8.3
Jun.	**9.8**	9.2	8.9	**8.7**

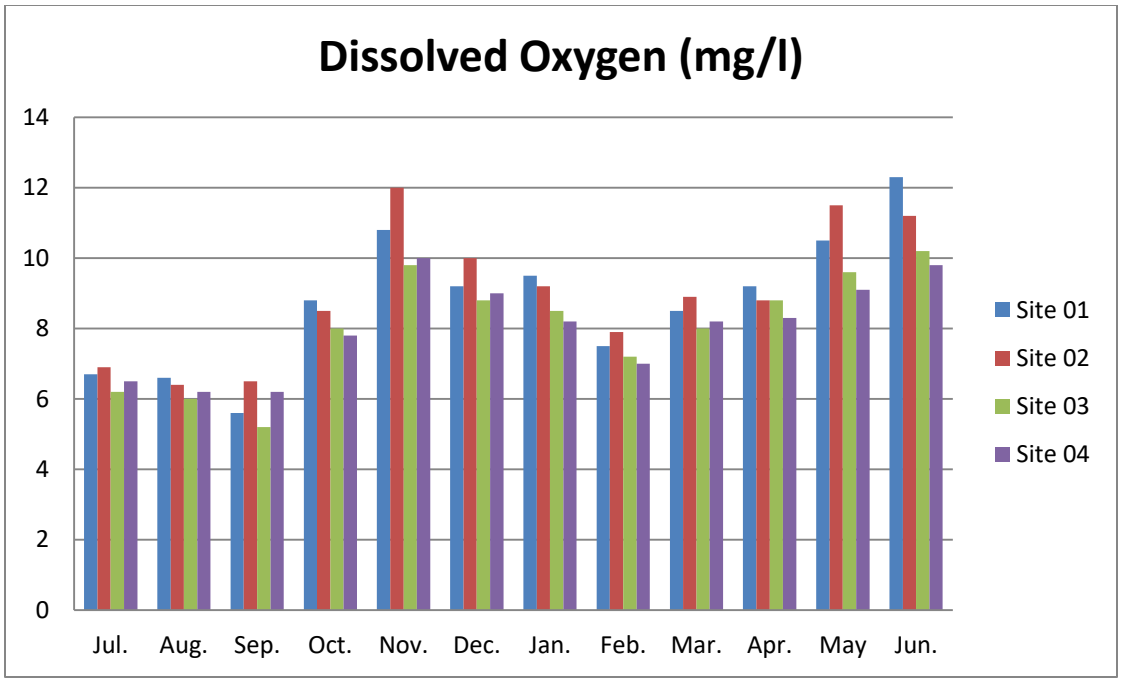


Fig. - 9. Monthly Variations in Dissolved Oxygen (mg/l) in Mansarovar Talab of Jeerapura (Dhar) Year July 2014- June 2015.

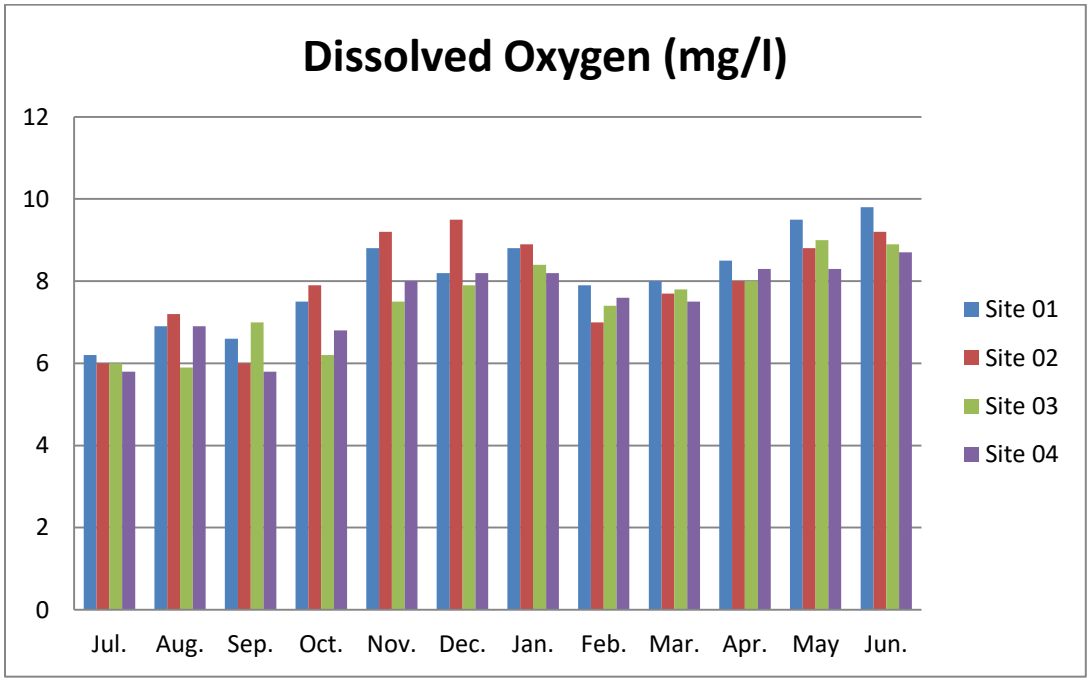


Fig. - 10. Monthly Variations in Dissolved Oxygen (mg/l) in Mansarovar Talab of Jeerapura (Dhar) Year July 2015- June 2016.

6. Total Solid: -

July 2014 – June 2015

SamplingSite 01. TheTotal Solidvaried from 188mg/l to 380 mg/l. The lowestTotal Solid was recorded in Novemberwhere ashighest was in December (Table 11& fig.11).

SamplingSite 02. Atthis station Total Solidfluctuated between 170 mg/l to 365 mg/l. The lowestTotal Solid was recorded in Novemberwhere ashighest was in December (Table 11& fig.11).

SamplingSite 03. TheTotal Solidoscillatedbetween 210 mg/l to 390 mg/l. The lowestTotal Solid was recorded in Novemberwhere as hghest was in December (Table 11& fig.11).

SamplingSite 04. At this station the Total Solidranged between 235 mg/l to 375 mg/l. The lowestTotal Solidwas recorded in Octoberwhere ashighest was in Decmber(Table 11& fig.11).

July 2015 – June 2016

SamplingSite 01. The Total Solidranged from 190mg/l to 295mg/l. The lowestTotal Solid was recorded in October and Aprilwhere ashighest was in January (Table 12& fig.12).

SamplingSite 02. At this station Total Solidfluctuated between 205 mg/l to 285 mg/l. The lowestTotal Solidwas recorded in October and Aprilwhere ashighest was in July (Table 12& fig.12).

SamplingSite 03. TheTotal Solidocillated between 200 mg/l to 290 mg/l. The lowestTotal Solidwas recorded in Aprilwhere ashighest was in July and August (Table 12& fig.12).

SamplingSite 04. At this station the Total Solidranged between 225mg/l to 305mg/l. The lowestTotal Solid was recorded in Aprilwhere ashighest was in July (Table 12& fig.12).

It was fluctuated between 170 to 390 mg/l. The lowest Total Solid was observed at samplingsite 02 in November in the year 2014-2015 and highest value was observed at samplingsite 03 in December in the year 2014-2015 (Table 11 & fig.11).

Table 11. Monthly Variations in Total Solid (mg/l) in Mansarovar Talab of Jeerapura (Dhar) Year July 2014- June 2015.

Month	Site 01	Site 02	Site 03	Site 04
Jul.	350	315	370	340
Aug.	300	280	315	260
Sep.	278	225	290	250
Oct.	235	210	225	235
Nov.	**188**	**170**	**210**	**240**
Dec.	**380**	**365**	**390**	**375**
Jan.	320	295	333	295
Feb.	255	268	266	280
Mar.	280	270	290	300
Apr.	290	302	280	312
May	325	298	335	358
Jun.	320	335	340	365

Table 12. Monthly Variations in Total Solid (mg /l) in Mansarovar Talab of Jeerapura (Dhar) Year July 2015- June 2016.

Month	Site 01	Site 02	Site 03	Site 04
Jul.	280	**285**	**290**	**305**
Aug.	270	255	**290**	268
Sep.	215	225	235	255
Oct.	**190**	**205**	210	235
Nov.	228	235	252	247
Dec.	245	200	265	230
Jan.	**295**	278	285	298
Feb.	260	240	277	250
Mar.	205	220	225	240
Apr.	**190**	**205**	**200**	**225**
May	225	210	245	250
Jun.	255	272	278	288

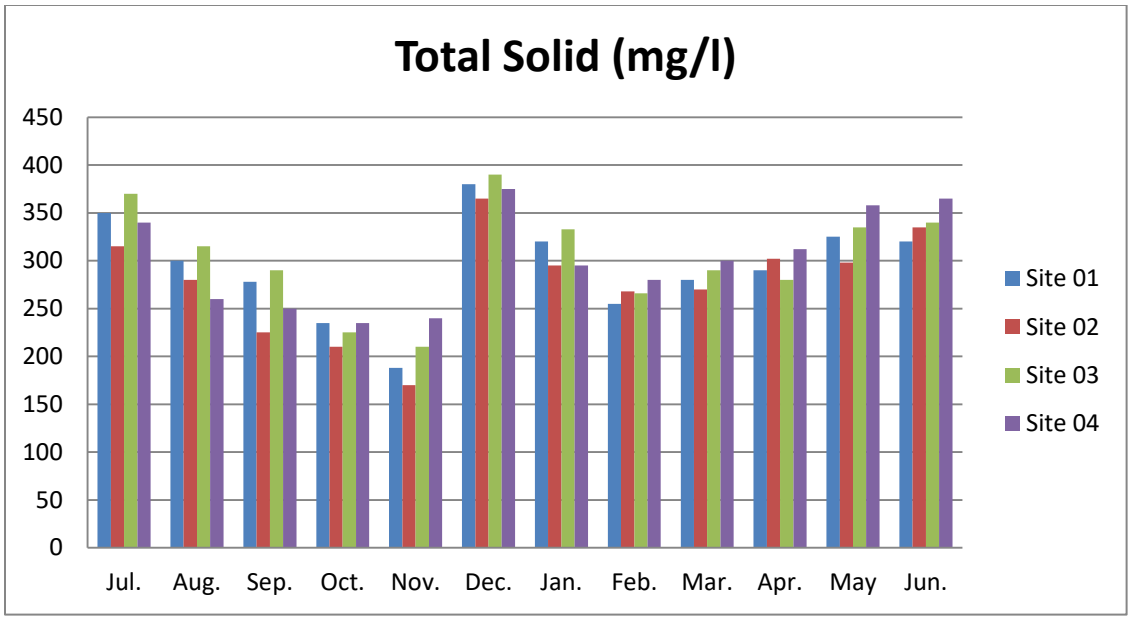


Fig. - 11. Monthly Variations in Total Solid (mg /l) in Mansarovar Talab of Jeerapura (Dhar) Year July 2014- June 2015.

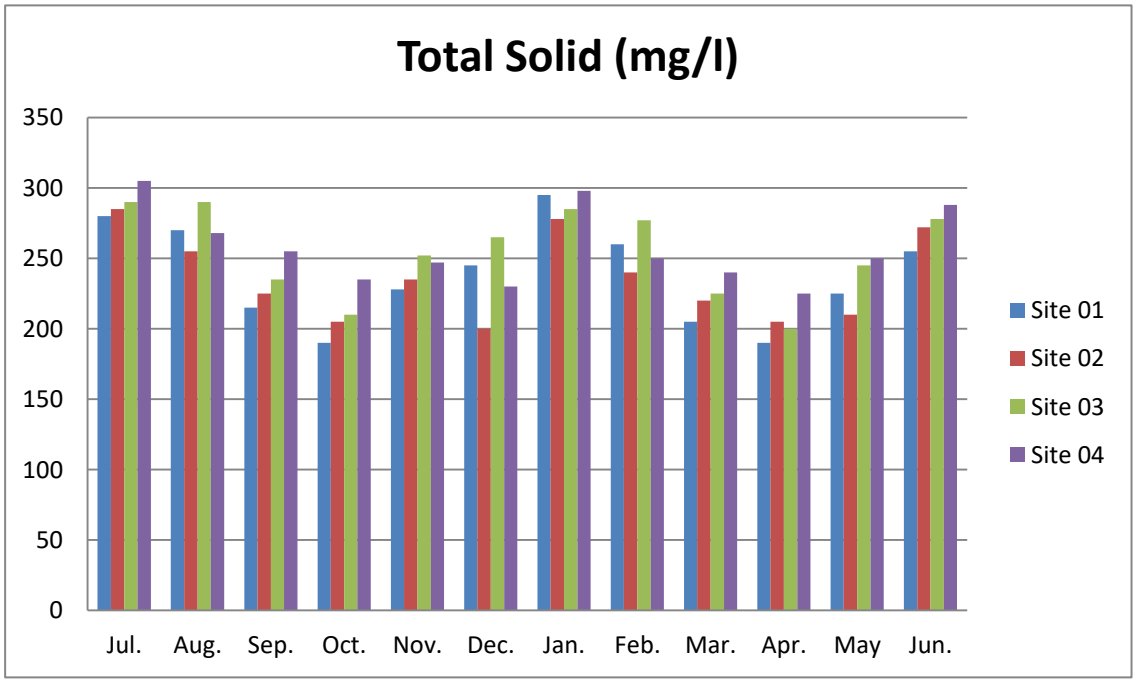


Fig. – 12. Monthly Variationss in Total Solid (mg/l) in Mansarovar Talab of Jeerapura (Dhar) Year July 2015- June 2016.

7.Free CO_2: -

July 2014 – June 2015

SamplingSite 01. The Free CO_2varied from 1.2mg/l to 6.4mg/l. The lowest Free CO_2 was observed in Aprilwhere ashighest was in October (Table 13& fig.13).

SamplingSite 02. At this station Free CO_2 fluctuated between 1.5mg/l to 6.9mg/l. The lowest Free CO_2 was observed in Marchwhere ashighest was in November (Table 13& fig.13).

SamplingSite 03. TheFree CO_2 oscillatedbetween 1.6mg/l to 6.8mg/l. The lowest Free CO_2 was recorded in Aprilwhere ashighest was in November (Table 13& fig.13).

SamplingSite 04. At this station the Free CO_2 ranged between 1.9 mg/l to 6.5mg/l. The lowest Free CO_2 was recorded in January and Marchwhere ashighest was in October (Table 13& fig.13).

July 2015 – June 2016

SamplingSite 01. The Free CO_2 varied from 1.9mg/l to 7.0mg/l. The lowest Free CO_2 was observed in Aprilwhere ashighest was in November (Table 14& fig.14).

SamplingSite 02. At this station Free CO_2 fluctuated between 2.2mg/l to 7.5mg/l. The lowest Free CO_2 was observed in Januarywhere ashighest was in November (Table 14& fig.14).

SamplingSite 03. TheFree CO_2 ocillated between 2.8mg/l to 8.0mg/l. The lowest Free $CO_2$was recorded in Aprilwhere ashighest was in November (Table 14& fig.14).

SamplingSite 04. At this station the Free CO_2 ranged between 2.6mg/l to 8.5mg/l. The lowest Free CO_2 was recorded in Januarywhere ashighest was in November (Table 14& fig.14).

It was fluctuated between1.2 to 8.5 mg/l. The lowest Free $CO_2$was observed at samplingsite 01 in April in the year 2014-2015 and highest value was observed at samplingsite 04 in November in the year 2015-2016 (Table 13& fig.13 and Table 14 & fig.14).

Table 13. Monthly Variations in Free CO_2(mg/l) in Mansarovar Talab of Jeerapura (Dhar) Year July 2014- June 2015.

Month	Site 01	Site 02	Site 03	Site 04
Jul.	3.6	3.5	3.0	3.8
Aug.	4.2	4.5	3.9	4.0
Sep.	4.3	4.8	4.1	4.2
Oct.	**6.4**	6.2	6.0	**6.5**
Nov.	6.0	**6.9**	**6.8**	6.2
Dec.	3.8	3.9	3.2	3.0
Jan.	1.9	1.7	2.0	1.9
Feb.	2.8	2.5	2.9	2.8
Mar.	1.7	**1.5**	3.0	**1.9**
Apr.	**1.2**	1.8	**1.6**	2.0
May	2.5	2.9	2.9	3.0
Jun.	4.5	4.9	5.0	5.2

Table 14. Monthly Variations inFree CO_2 (mg/l) in Mansarovar Talab of Jeerapura (Dhar) Year July 2015- June 2016.

Month	Site 01	Site 02	Site 03	Site 04
Jul.	3.9	4.0	4.1	4.5
Aug.	4.4	4.8	4.8	4.6
Sep.	4.9	5.2	4.4	5.5
Oct.	6.9	7.2	6.2	7.0
Nov.	**7.0**	**7.5**	**8.0**	**8.5**
Dec.	4.8	4.9	6.2	5.8
Jan.	2.8	**2.2**	2.9	**2.6**
Feb.	3.0	3.5	3.2	3.8
Mar.	2.9	2.5	3.2	3.5
Apr.	**1.9**	2.5	**2.8**	2.7
May	2.5	3.5	3.5	4.0
Jun.	4.9	4.5	5.2	5.9

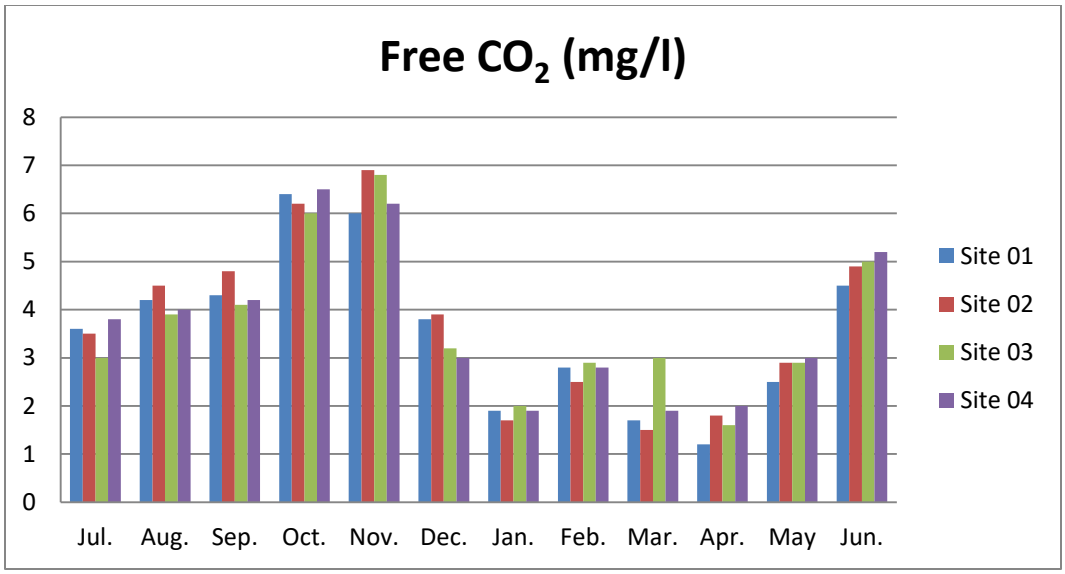


Fig. - 13. Monthly Variations in Free CO_2(mg/l) in Mansarovar Talab of Jeerapura (Dhar) Year July 2014- June 2015.

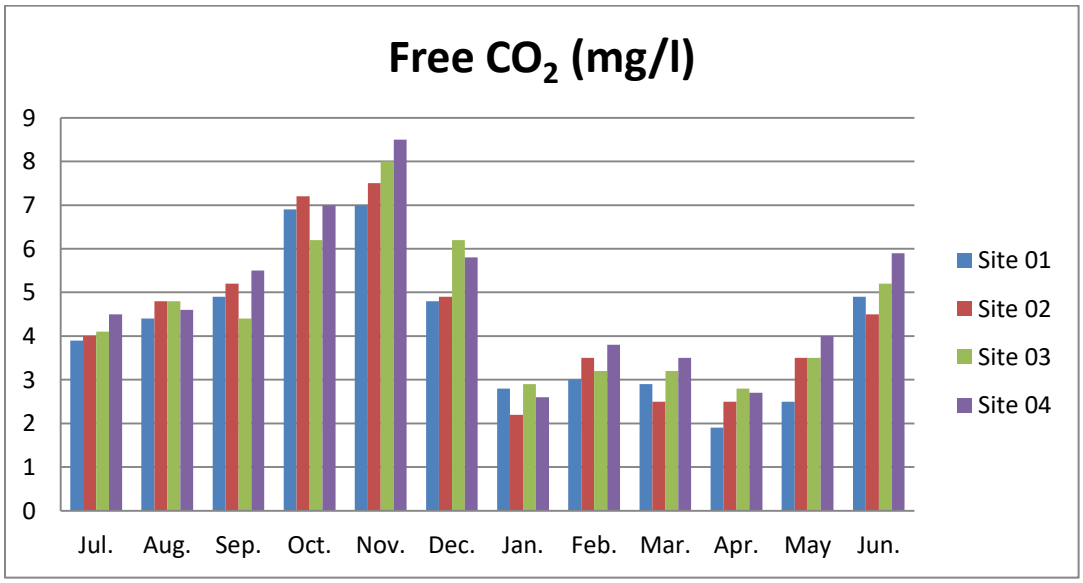


Fig. - 14. Monthly Variations inFree CO_2(mg/l) in Mansarovar Talab of Jeerapura (Dhar) Year July 2015- June 2016.

8. Total Alkalinity: -

July 2014 – June 2015

SamplingSite 01. The Total Alkalinity ocillated from 235.2mg/l to 475.0mg/l. The lowest Total Alkalinity was recorded in Marchwhere as highest was in November (Table 15& fig.15).

SamplingSite 02. At this station Total Alkalinity fluctuated between 225.4mg/l to 490.3mg/l. The lowest Total Alkalinity was recorded in Marchwhere ashighest was in November (Table 15& fig.15).

SamplingSite 03. TheTotal Alkalinity oscillatedbetween 255.0mg/l to 420.0mg/l. The lowest Total Alkalinity was recorded in Marchwhere ashighest was in November (Table 15& fig.15).

SamplingSite 04. At this station the Total Alkalinity ranged between 245.9mg/l to 480.0/l. The lowest Total Alkalinity was recorded in Marchwhere ashighest was in November (Table 15& fig.15).

July 2015 – June 2016

SamplingSite 01. The Total Alkalinity ocillated from 255.9mg/l to 490.0mg/l. The lowest Total Alkalinity was observed in Marchwhere ashighest was in November (Table 16& fig.16).

SamplingSite 02. At this station Total Alkalinity fluctuated between 245.8mg/l to 499.0mg/l. The lowest Total Alkalinity was observed in Marchwhere ashighest was in November (Table 16& fig.16).

SamplingSite 03. TheTotal Alkalinityocillated between 265.5mg/l to 478.0mg/l. The lowest Total Alkalinity was recorded in Marchwhere ashighest was in November (Table 16& fig.16).

SamplingSite 04. At this station the Total Alkalinity ocillated between 259.2mg/l to 460.0mg/l. The lowest Total Alkalinity was observed in Marchwhere ashighest was in November (Table 16& fig.16).

The value of total alkalinity is fluctuated from 225.4to 499.0 mg/l. The lowest value was observed at samplingsite 02 in March in the year of 2014-15. The highest value was observed at samplingsite 02 in November in the year of 2015-16 (Table 15 & fig.15 and Table 16 & fig.16).

Table 15. Monthly Variations in Total Alkalinity (mg/l) in Mansarovar Talab of Jeerapura (Dhar) Year July 2014 – June 2015.

Month	Site 01	Site 02	Site 03	Site 04
Jul.	390.0	325.0	398.0	335.0
Aug.	365.5	375.8	355.0	360.2
Sep.	410.5	420.5	400.0	410.0
Oct.	435.5	385.8	405.0	375.2
Nov.	**475.0**	**490.3**	**420.0**	**480.0**
Dec.	300.5	290.0	315.5	300.0
Jan.	265.0	258.5	285.0	295.0
Feb.	272.5	265.9	290.0	285.5
Mar.	**235.2**	**225.4**	**255.0**	**245.9**
Apr.	280.5	270.2	290.8	290.0
May	255.0	269.2	275.6	288.4
Jun.	280.5	272.5	299.5	305.5

Table 16. Monthly Variations in Total Alkalinity (mg/l) in Mansarovar Talab of Jeerapura (Dhar) Year July 2015- June 2016.

Month	Site 01	Site 02	Site 03	Site 04
Jul.	390.0	360.0	370.0	385.0
Aug.	385.0	395.0	395.3	405.2
Sep.	425.0	435.1	438.2	442.0
Oct.	455.0	435.0	465.0	455.0
Nov.	**490.0**	**499.0**	**478.0**	**460.0**
Dec.	405.0	435.0	425.0	448.0
Jan.	385.0	368.5	392.0	374.2
Feb.	292.5	285.2	302.5	325.5
Mar.	**255.9**	**245.8**	**265.5**	**259.2**
Apr.	290.5	305.2	299.2	315.7
May	325.0	340.2	345.0	360.0
Jun.	286.5	275.5	300.5	322.5

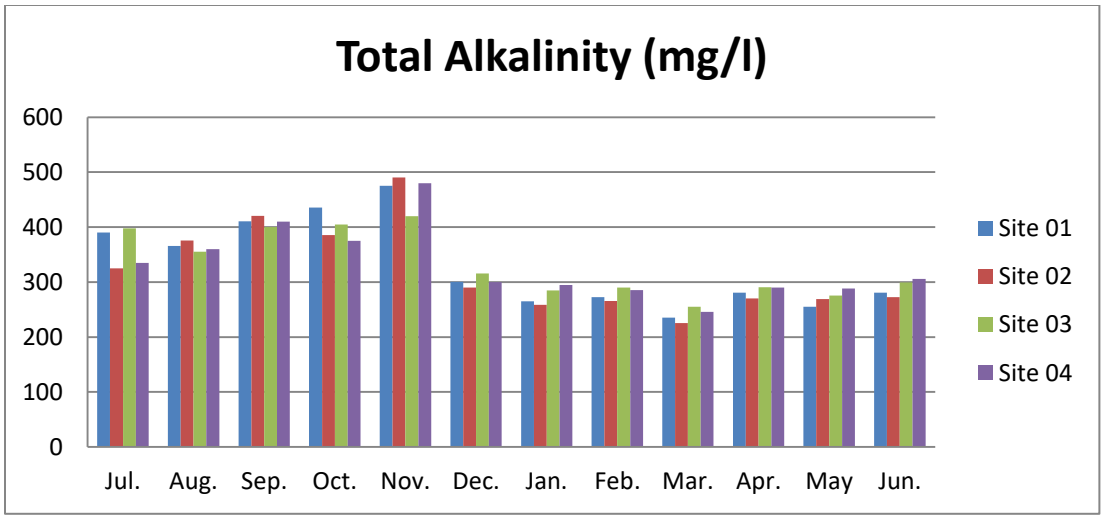


Fig. - 15. Monthly Variations in Total Alkalinity (mg/l) in Mansarovar Talab of Jeerapura (Dhar) Year July 2014 – June 2015.

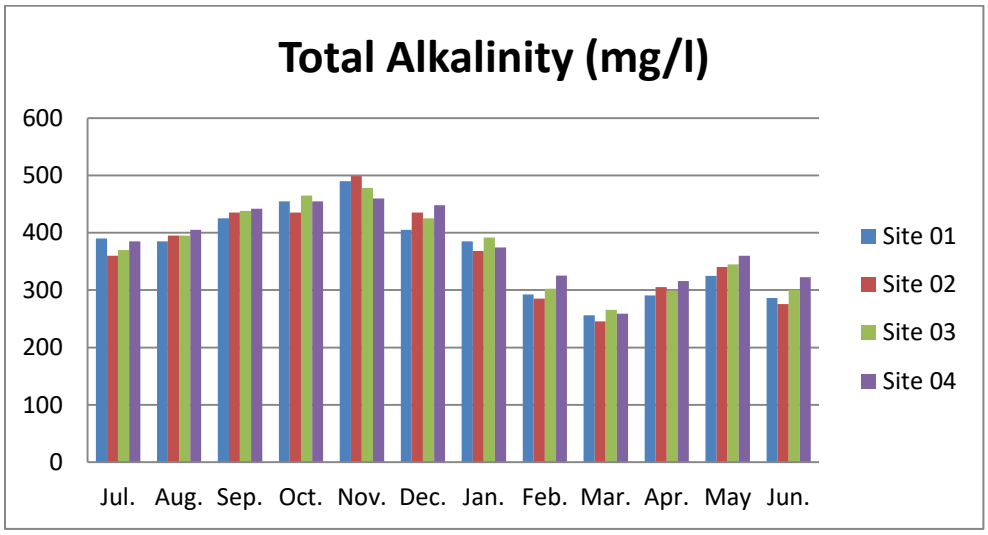


Fig. - 16. Monthly Variationss in Total Alkalinity (mg/l) in Mansarovar Talab of Jeerapura (Dhar) Year July 2015- June 2016.

9. Biochemical Oxygen Demand (B.O.D.): -

July 2014 – June 2015

SamplingSite 01. The B.O.D. varied from 2.0mg/l to 6.3mg/l. The lowest B.O.D. was recorded in Augustwhere ashighest was in January (Table 17& fig.17).

SamplingSite 02. At this station B.O.D. fluctuated between 2.2mg/l to 6.7mg/l. The lowest B.O.D. was recorded in Augustwhere ashighest was in January (Table 17& fig.17).

SamplingSite 03. The B.O.D. oscillatedbetween 2.2mg/l to 5.9mg/l. The lowest B.O.D. was recorded in July and Marchwhere ashighest was in January (Table 17& fig.17).

SamplingSite 04. At this station the B.O.D. ranged between 2.5mg/l to 6.0mg/l. The lowest B.O.D. was recorded in Septemberwhere ashighest was in January (Table 17& fig.17).

July 2015 – June 2016

SamplingSite 01. The B.O.D. varied from 3.5mg/l to 6.8mg/l. The lowest B.O.D. was recorded in Marchwhere ashighest was in January (Table 18& fig.18).

SamplingSite 02. At this station B.O.D. fluctuated between 3.0mg/l to 6.9mg/l. The lowest B.O.D. was recorded in Februarywhere ashighest was in January (Table 18& fig.18).

SamplingSite 03. The B.O.D. Ocillated between 2.9mg/l to 6.2mg/l. The lowest B.O.D. was recorded in Marchwhere ashighest was in January (Table 18& fig.18).

SamplingSite 04. At this station the B.O.D. ranged between 3.5mg/l to 6.0mg/l. The lowest B.O.D. was recorded in Februarywhere ashighest was in January (Table 18& fig.18).

The biochemical oxygen demand value fluctuated between 2.0 to 6.9 mg/l. The lowest biochemical oxygen demand value was observed at site 01 in August in the year 2014-15. The highest value was observed at site 02 in January in the year of 2015-16 (Table 17 & fig.17 and Table 18 & fig.18).

Table 17. Monthly Variationss in Biochemical Oxygen Demand (mg/l) in Mansarovar Talab of Jeerapura (Dhar) Year July 2014- June 2015.

Month	Site 01	Site 02	Site 03	Site 04
Jul.	2.9	2.5	**2.2**	2.6
Aug.	**2.0**	**2.2**	2.8	2.6
Sep.	2.5	2.6	2.4	**2.5**
Oct.	2.8	3.0	2.8	3.8
Nov.	3.2	3.3	3.4	3.5
Dec.	2.7	2.4	3.8	3.2
Jan.	**6.3**	**6.7**	**5.9**	**6.0**
Feb.	5.0	3.0	5.2	3.8
Mar.	2.8	3.1	**2.2**	3.2
Apr.	3.8	4.3	4.8	4.0
May	4.7	5.1	3.9	3.0
Jun.	5.5	5.7	4.5	4.1

Table 18. Monthly Variations in Biochemical Oxygen Demand (mg/l) in Mansarovar Talab of Jeerapura (Dhar) Year July 2015- June 2016.

Month	Site 01	Site 02	Site 03	Site 04
Jul.	4.6	4.5	4.8	4.1
Aug.	4.8	4.2	4.5	4.0
Sep.	3.7	4.2	3.9	4.6
Oct.	4.9	4.6	5.2	5.6
Nov.	4.5	4.8	5.5	5.8
Dec.	5.0	5.9	5.6	5.9
Jan.	**6.8**	**6.9**	**6.2**	**6.0**
Feb.	5.0	**3.0**	5.8	**3.5**
Mar.	**3.5**	3.9	**2.9**	4.5
Apr.	4.2	4.8	4.9	5.2
May	4.9	5.5	5.8	5.0
Jun.	5.8	5.9	4.8	4.2

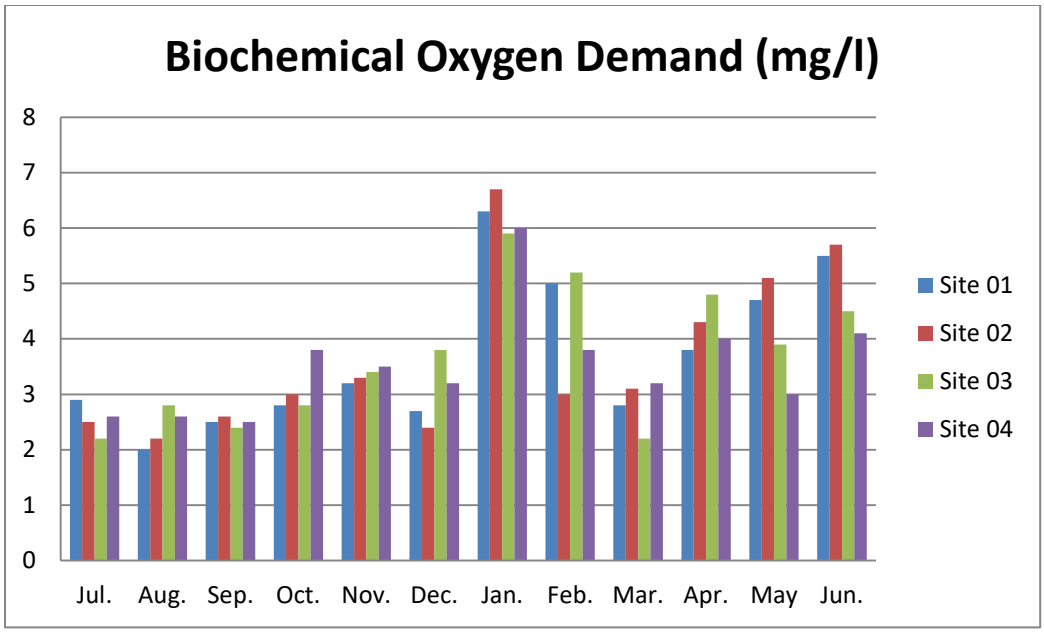


Fig. - 17. Monthly Variationss in Biochemical Oxygen Demand (mg/l) in Mansarovar Talab of Jeerapura (Dhar) Year July 2014- June 2015.

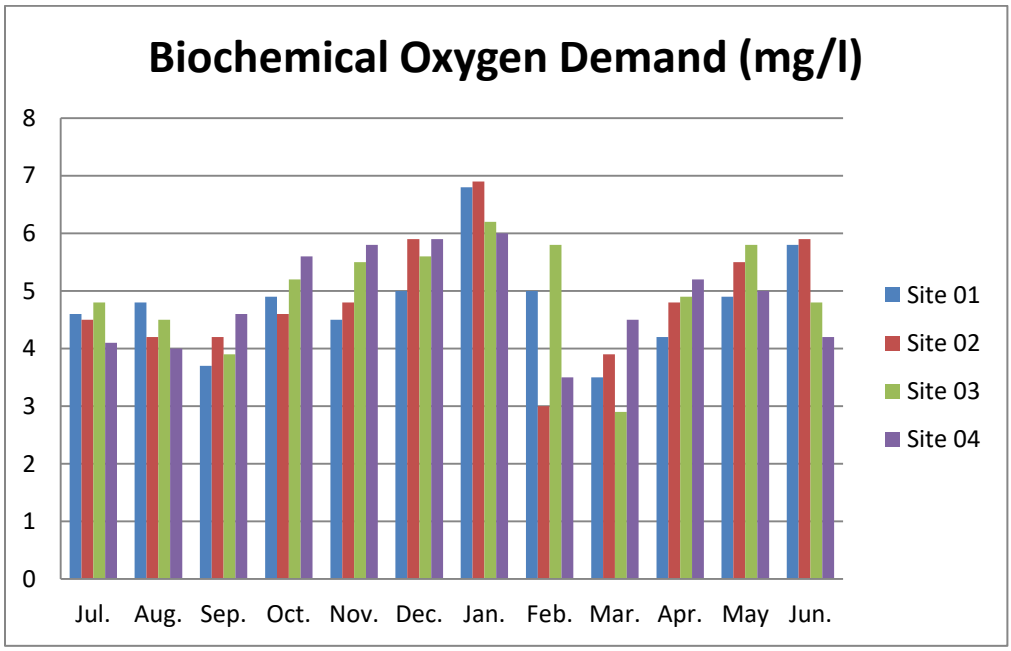


Fig.-18. Monthly Variations in Biochemical Oxygen Demand (mg/l) in Mansarovar Talab of Jeerapura (Dhar) Year July 2015- June 2016.

10. Total Hardness: -

July 2014 – June 2015

SamplingSite 01. The Total Hardness ocillatedbetween 115.0mg/l to 240.0mg/l. The lowest Total Hardness was observed in Februarywhere ashighest was in May (Table 19& fig.19).

SamplingSite 02. At this station Total Hardness variedfrom 105.0mg/l to 265.5mg/l. The lowest Total Hardness was observed in Februarywhere ashighest was in November (Table 19& fig.19).

SamplingSite 03. TheTotal Hardness fluctuatedbetween 130.0mg/l to 295.0mg/l. The lowest Total Hardness was observed in January where ashighest was in June (Table 19& fig.19).

SamplingSite 04. At this station the Total Hardness variedfrom 145.8mg/l to 330.0mg/l. The lowest Total Hardness was observed in Februarywhere ashighest was in June (Table 19& fig.19).

July 2015 – June 2016

SamplingSite 01. The Total Hardness fluctuatedbetween 125.0mg/l to 290.0mg/l. The lowest Total Hardness was recorded in Februarywhere ashighest was in June (Table 20& fig.20).

SamplingSite 02. At this station Total Hardness variedfrom135.0mg/l to 290.0mg/l. The lowest Total Hardness was observed in Februarywhere ashighest was in November (Table 20& fig.20).

SamplingSite 03. TheTotal Hardnessfluctuatedbetween 134.0mg/l to 300.0mg/l. The lowest Total Hardness was recorded in Februarywhere ashighest was in June (Table 20& fig.20).

SamplingSite 04. At this station the Total Hardness fluctuatedbetween 155.0mg/l to 305.0mg/l. The lowest Total Hardness was observed Februarywhere ashighest was in December (Table 20& fig.20).

It was fluctuated between105.0to 330.0 mg/l. The lowest total hardness was observed at samplingsite 02 in February in the year of 2014-15 and highest total hardness at samplingsite 04 in June in the year of 2014-15 (Table 19 & fig.19).

Table 19. Monthly Variations in Total Hardness (mg/l) in Mansarovar Talab of Jeerapura (Dhar) Year July 2014- June 2015.

Month	Site 01	Site 02	Site 03	Site 04
Jul.	220.5	235.8	240.0	250.2
Aug.	195.8	198.5	205.5	215.0
Sep.	235.5	225.6	255.0	265.0
Oct.	190.0	175.2	205.0	225.0
Nov.	230.8	**265.5**	245.0	275.5
Dec.	220.5	210.9	245.5	230.2
Jan.	120.0	145.0	**130.0**	155.8
Feb.	**115.0**	**105.0**	135.0	**145.8**
Mar.	222.0	195.5	245.0	215.5
Apr.	225.8	218.8	255.0	262.9
May	**240.0**	232.0	260.0	275.0
Jun.	198.0	230.0	**295.0**	**330.0**

Table 20. Monthly Variations inTotal Hardness (mg/l) in Mansarovar Talab of Jeerapura (Dhar) Year July 2015- June 2016.

Month	Site 01	Site 02	Site 03	Site 04
Jul.	240.0	250.0	252.0	260.0
Aug.	220.0	215.0	235.0	225.0
Sep.	255.0	259.0	272.0	285.0
Oct.	220.0	195.0	233.0	215.0
Nov.	256.0	**290.0**	2680	300.0
Dec.	250.0	225.0	280.0	**305.0**
Jan.	130.0	165.0	145.0	177.0
Feb.	**125.0**	**135.0**	**134.0**	**155.0**
Mar.	220.0	205.5	240.0	225.8
Apr.	245.5	225.2	267.3	236.2
May	255.0	265.0	268.0	279.0
Jun.	**290.0**	285.0	**300.0**	291.0

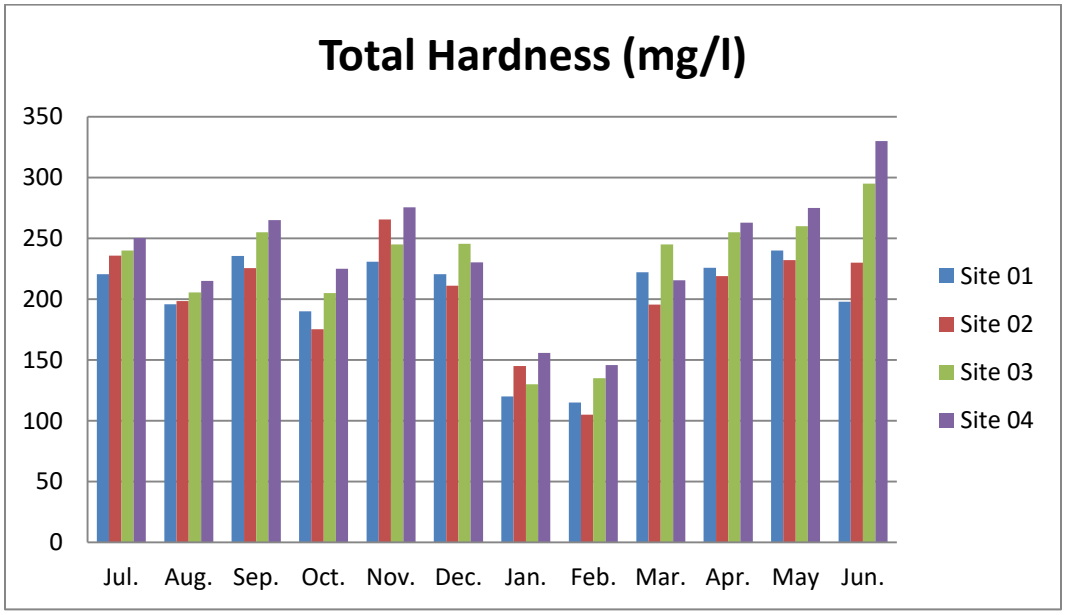


Fig. -19. Monthly Variations in TotalHardness (mg/l) in Mansarovar Talab of Jeerapura (Dhar) Year July 2014- June 2015.

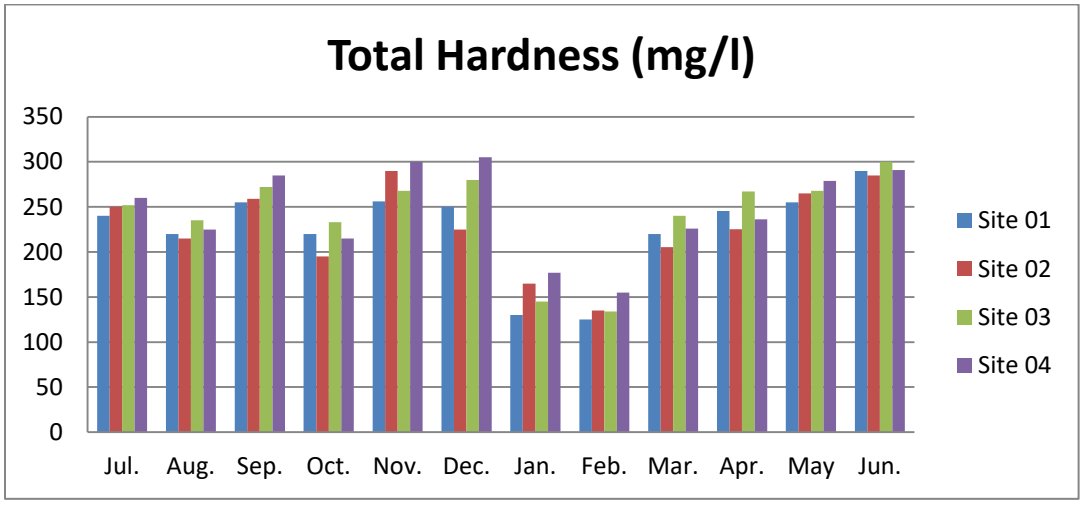


Fig. - 20. Monthly Variations inTotal Hardness (mg/l) in Mansarovar Talab of Jeerapura (Dhar) Year July 2015- June 2016.

11. Magnesium: -

July 2014 – June 2015

SamplingSite 01. The Magnesium ranged from 18.9mg/l to 35.5mg/l. The lowest Magnesium was recorded in January and Maywhere ashighest was in November (Table 21& fig.21).

SamplingSite 02. At this station Magnesium fluctuated between 18.3mg/l to 40.5mg/l. The lowest Magnesium was recorded in Ferbuarywhere ashighest was in November (Table 21& fig.21).

SamplingSite 03. The Magnesium oscillatedbetween18.5mg/l to 36.5mg/l. The lowest Magnesiumwasobserved in Ferbuarywhere ashighest was in November (Table 21& fig.21).

SamplingSite 04. At this station the Magnesium ranged between 19.9mg/l to 39.5mg/l. The lovest Magnesium was recorded in Ferbuarywhere ashighest was in November (Table 21& fig.21).

July 2015 – June 2016

SamplingSite 01. The Magnesium varied from 18.9mg/l to 38.5mg/l. The lowest Magnesium was observed in Ferbuarywhere ashighest was in November (Table 22& fig.22).

SamplingSite 02. At this station Magnesium fluctuated between 19.3mg/l to 43.5mg/l. The lowest Magnesium was observed in Ferbuarywhere ashighest was in November (Table 22& fig.22).

SamplingSite 03. The Magnesiumocillated between 19.2mg/l to 39.5mg/l. The lowest Magnesium was observed in Ferbuarywhere ashighest was in November (Table 22& fig.22).

SamplingSite 04. At this station the Magnesium ranged between 20.8mg/l to 44.0mg/l. The lowest Magnesium was recorded in Ferbuarywhere ashighest was in November (Table 22& fig.22).

It was fluctuated between18.3 to 44.0 mg/l. The lowestMagnesium was observed at samplingsite 02 in February in the year 2014-2015 and highestrange was observed at samplingsite 04 in November in the year 2015-2016 (Table 21 & fig.21 and Table 22 & fig.22).

Table 21. Monthly Variations in Magnesium (mg/l) in Mansarovar Talab of Jeerapura (Dhar) Year July 2014- June 2015.

Month	Site 01	Site 02	Site 03	Site 04
Jul.	30.5	32.9	31.8	33.5
Aug.	27.1	26.5	28.2	27.5
Sep.	27.1	28.9	28.4	29.5
Oct.	24.2	22.5	25.4	23.5
Nov.	**35.5**	**40.5**	**36.5**	**39.5**
Dec.	29.5	27.2	30.8	29.0
Jan.	**18.9**	20.5	19.5	22.2
Feb.	19.5	**18.3**	**18.5**	**19.9**
Mar.	21.5	22.0	22.7	23.5
Apr.	25.5	19.5	26.7	21.5
May	**18.9**	20.2	20.6	23.5
Jun.	25.1	26.5	27.3	28.8

Table 22. Monthly Variations in Magnesium (mg/l) in Mansarovar Talab of Jeerapura (Dhar) Year July 2015- June 2016.

Month	Site 01	Site 02	Site 03	Site 04
Jul.	31.5	33.0	32.5	32.9
Aug.	28.5	27.9	29.5	28.2
Sep.	28.5	29.9	29.0	30.0
Oct.	26.2	24.5	28.0	25.5
Nov.	**38.5**	**43.5**	**39.5**	**44.0**
Dec.	32.5	35.2	33.8	36.7
Jan.	20.5	21.2	22.5	24.2
Feb.	**18.9**	**19.3**	**19.2**	**20.8**
Mar.	22.5	23.0	24.2	25.8
Apr.	26.2	21.5	27.5	24.5
May	22.9	21.2	25.2	23.5
Jun.	24.2	25.5	26.5	28.2

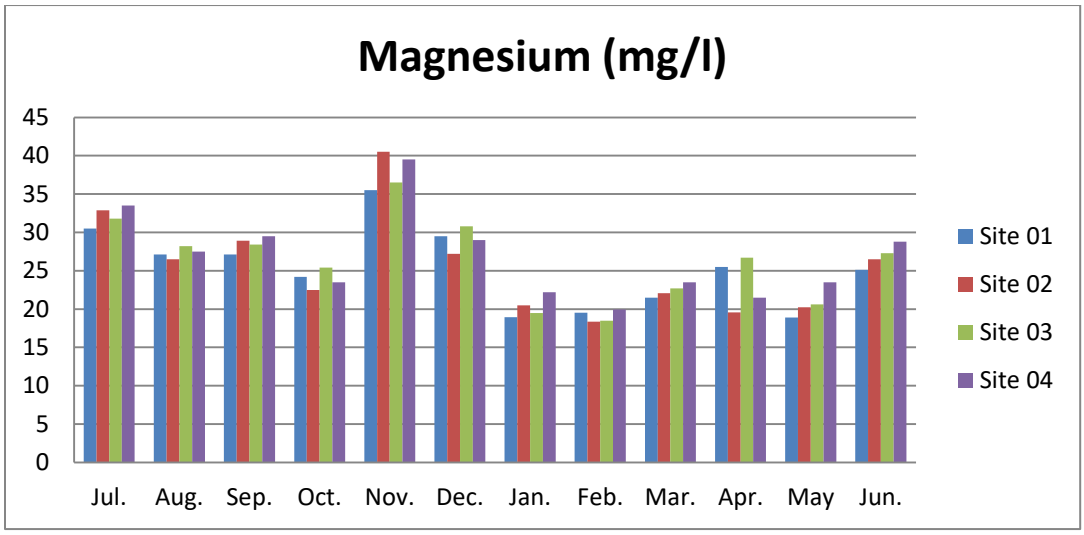


Fig. - 21. Monthly Variations in Magnesium (mg/l) in Mansarovar Talab of Jeerapura (Dhar) Year July 2014- June 2015.

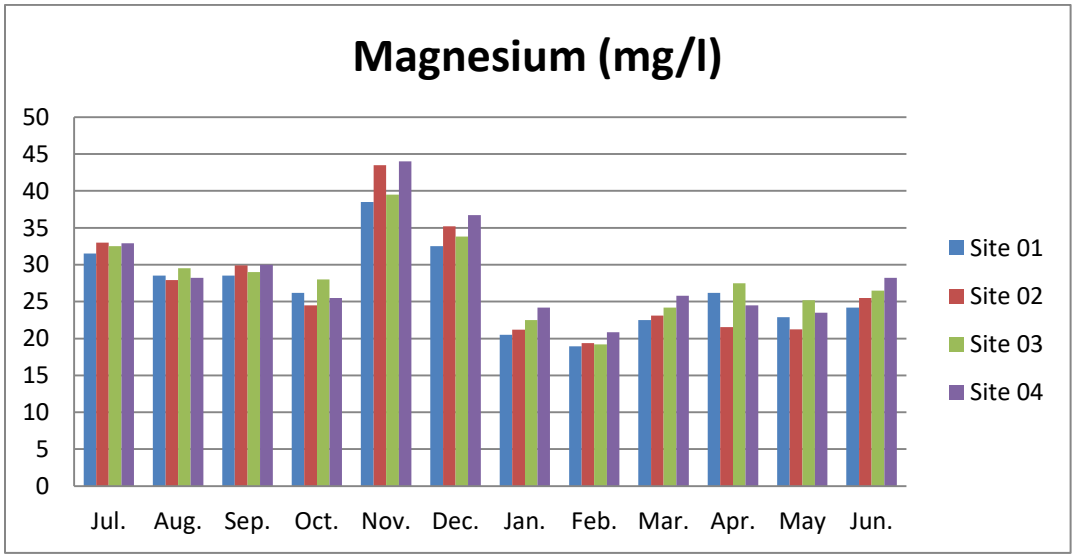


Fig. - 22. Monthly Variations in Magnesium (mg/l) in Mansarovar Talab of Jeerapura (Dhar) Year July 2015- June 2016.

12. Calcium: -

July 2014 – June 2015

SamplingSite 01. The Calcium varied from 35.5mg/l to 68.9mg/l. The lowest Calcium was recorded in Augustwhere ashighest was in May (Table 23& fig.23).

SamplingSite 02. At this station Calcium fluctuated between 36.2mg/l to 72.4mg/l. The lowest Calcium was observed in Augustwhere ashighest was in May (Table 23& fig.23).

SamplingSite 03. The Calcium fluctuatedbetween 36.5mg/l to 69.0mg/l. The lowest Calcium was observed in Augustwhere ashighest was in May (Table 23& fig.23).

SamplingSite 04. At this station the Calcium vared from 37.0mg/l to 74.2mg/l. The lowest Calcium was observed in Augustwhere ashighest was in May (Table 23& fig.23).

July 2015 – June 2016

SamplingSite 01. The Calcium varied from 36.5mg/l to 68.2mg/l. The lowest Calcium was observed in Augustwhere ashighest was in June (Table 24& fig.24).

SamplingSite 02. At this station Calcium fluctuated between 37.7mg/l to 70.4mg/l. The lowest Calcium was recorded in Augustwhere ashighest was in May (Table 24& fig.24).

SamplingSite 03. The Calciumocillated between 37.5mg/l to 69.8mg/l. The lowest Calcium was observed in Augustwhere ashighest was in June (Table 24& fig.24).

SamplingSite 04. At this station the Calcium ranged between 38.2mg/lto 72.5mg/l. The lowest Calcium was observed in Augustwhere ashighest was in May (Table 24& fig.24).

It was fluctuated between35.5 to 74.2 mg/l. The lowest Calciumwas observed at samplingsite 01 in August in the year 2014-2015 and highestrange was observed at samplingsite 04 in May in the year 2014-2015 (Table 23 & fig.23).

Table 23. Monthly Variations in Calcium (mg/l) in Mansarovar Talab of Jeerapura (Dhar) Year July 2014- June 2015.

Month	Site 01	Site 02	Site 03	Site 04
Jul.	36.4	38.9	37.0	39.5
Aug.	**35.5**	**36.2**	**36.5**	**37.0**
Sep.	40.0	38.2	42.0	40.2
Oct.	41.2	44.5	43.2	45.5
Nov.	40.9	39.2	42.2	40.5
Dec.	46.2	44.5	48.0	42.5
Jan.	45.2	46.2	47.4	45.5
Feb.	47.5	49.1	48.2	50.2
Mar.	50.8	52.5	51.5	53.3
Apr.	54.6	55.7	55.5	56.7
May	**68.9**	**72.4**	**69.0**	**74.2**
Jun.	65.2	60.1	68.5	63.5

Table 24. Monthly Variations in Calcium (mg/l) in Mansarovar Talab of J

Month	**Site 01**	**Site 02**	**Site 03**	**Site 04**
Jul.	38.5	39.9	37.9	40.2
Aug.	**36.5**	**37.7**	**37.5**	**38.2**
Sep.	42.5	44.2	43.5	45.0
Oct.	45.2	47.5	46.4	48.5
Nov.	43.9	41.5	44.2	42.5
Dec.	48.2	46.5	49.0	45.5
Jan.	55.2	49.2	54.1	50.5
Feb.	46.5	45.2	47.5	48.2
Mar.	52.8	55.5	53.5	56.5
Apr.	56.6	59.7	57.5	60.5
May	67.9	**70.4**	68.7	**72.5**
Jun.	**68.2**	62.5	**69.8**	66.2

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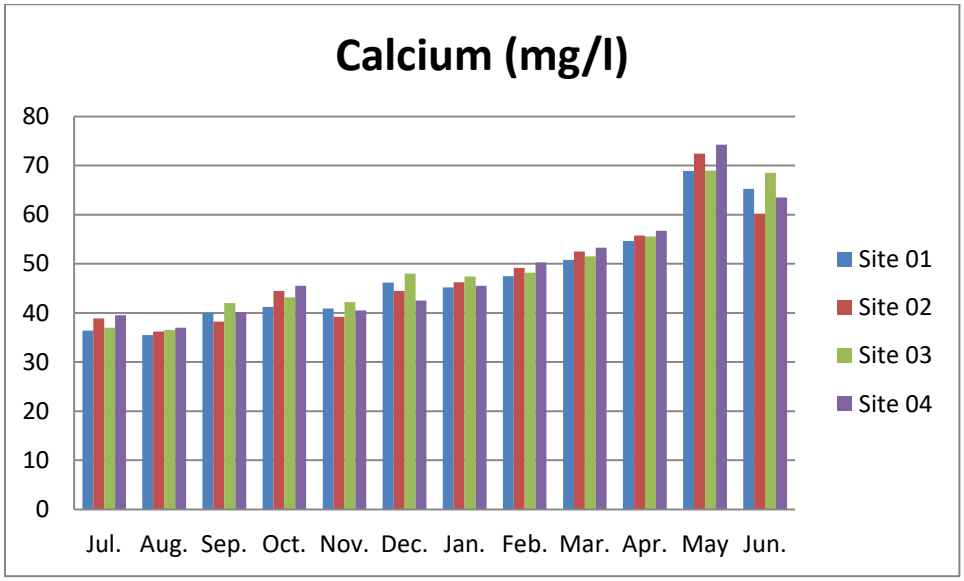

Fig. - 23. Monthly Variations in Calcium (mg/l) in Mansarovar Talab of Jeerapura (Dhar) Year July 2014- June 2015.

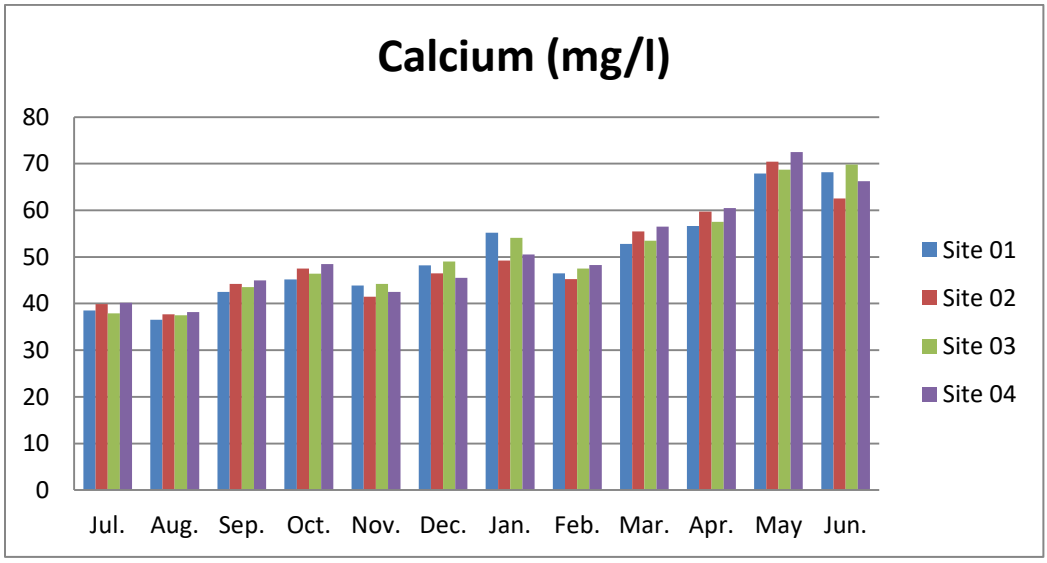

Fig. - 24. MonthlyVariationsin Calcium (mg/l) in Mansarovar Talab of Jeerapura (Dhar) Year July 2015- June 2016.

13. Chloride: -

July 2014 – June 2015

SamplingSite 01. The Chloride varied from 23.4mg/l to 60.1mg/l. The lowest Chloride was recorded in December where ashighest was in June (Table 25& fig.25).

SamplingSite 02. At this station Chloride fluctuated between 25.5mg/l to 65.2mg/l. The lowest Chloride was observed in October where ashighest was in June (Table 25& fig.25).

SamplingSite 03. The Chloride oscillated between 25.2mg/l to 62.5mg/l. The lowest Chloride was obsereved in December where ashighest was in June (Table 25& fig.25).

SamplingSite 04. At this station the Chloride ranged between 28.2mg/l to 69.3mg/l. The lowest Chloride was observed in Octoberwhere ashighest was in June (Table 25& fig.25).

July 2015 – June 2016

SamplingSite 01. The Chloride varied from 35.0mg/l to 59.6mg/l. The lowest Chloride was recorded in December where ashighest was in June (Table 26& fig.26).

SamplingSite 02. At this station Chloride fluctuated between 36.0mg/l to 62.2mg/l. The lowest Chloride was observed in December where ashighest was in July (Table 26& fig.26).

SamplingSite 03. The Chlorideocillated between 40.0mg/l to 59.0mg/l. The lowest Chloride was recorded in December where ashighest was in June (Table 26& fig.26).

SamplingSite 04. At this station the Chloride ranged between 38.0mg/l to 64.0mg/l. The lowest Chloride was observed in December where ashighest was in July (Table 26& fig.26).

It was fluctuated between23.4to 69.3 mg/l. The lowestrange was observed at samplingsite 01 in December in the year 2014-15 and highestrange was at samplingsite 04 in June in the year of 2014-15 (Table 25& fig.25).

Table 25. Monthly Variations in Chloride (mg/l) in Mansarovar Talab of Jeerapura (Dhar) Year July 2014- June 2015.

Month	Site 01	Site 02	Site 03	Site 04
Jul.	45.5	58.2	42.0	55.5
Aug.	40.7	43.5	44.2	45.5
Sep.	44.5	41.2	47.5	42.2
Oct.	28.1	**25.5**	32.0	**28.2**
Nov.	32.5	26.8	35.5	28.5
Dec.	**23.4**	27.3	**25.2**	29.2
Jan.	40.5	45.2	42.5	47.2
Feb.	46.5	47.9	48.5	49.0
Mar.	48.8	49.1	50.2	50.9
Apr.	50.2	52.1	52.2	53.2
May	55.1	59.2	58.5	60.1
Jun.	**60.1**	**65.2**	**62.5**	**69.3**

Table 26. Monthly Variations in Chloride (mg/l) in Mansarovar Talab of Jeerapura (Dhar) Year July 2015- June 2016.

Month	Site 01	Site 02	Site 03	Site 04
Jul.	48.0	**62.2**	50.0	**64.0**
Aug.	55.0	58.0	56.2	60.1
Sep.	45.4	50.0	54.0	52.0
Oct.	42.0	45.1	48.0	46.0
Nov.	48.0	39.0	50.0	42.2
Dec.	**35.0**	**36.0**	**40.0**	**38.0**
Jan.	47.5	48.2	48.5	49.2
Feb.	50.5	52.2	52.2	52.2
Mar.	51.5	50.1	52.2	52.1
Apr.	49.2	50.1	50.5	52.2
May	53.2	55.2	54.2	56.2
Jun.	**59.6**	61.2	**59.0**	62.5

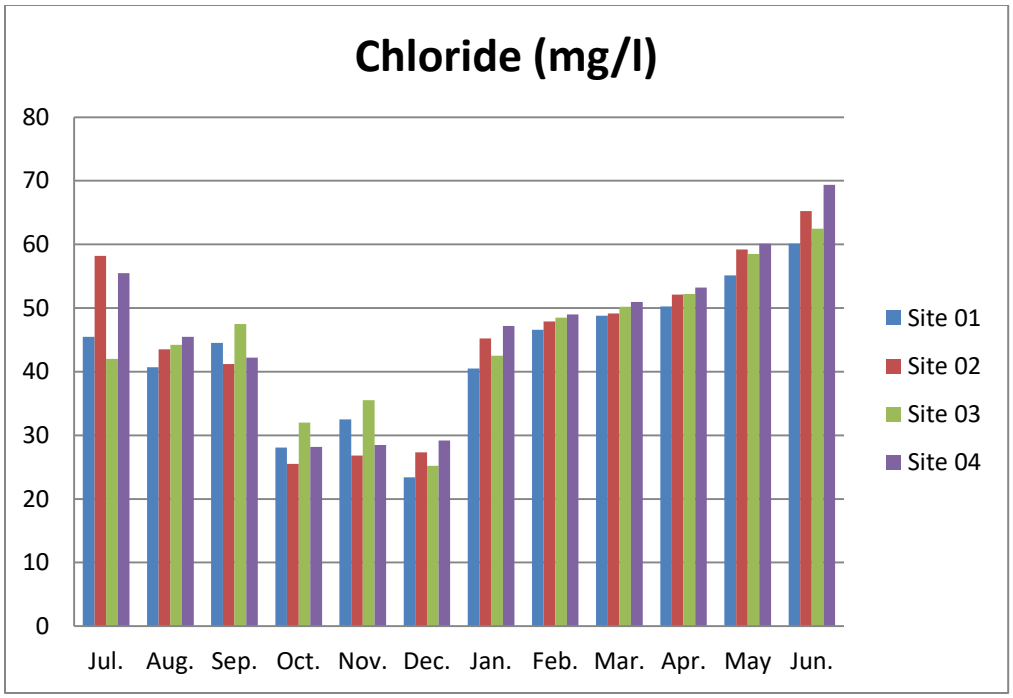

Fig. - 25. Monthly Variations in Chloride (mg/l) in Mansarovar Talab of Jeerapura (Dhar) Year July 2014- June 2015.

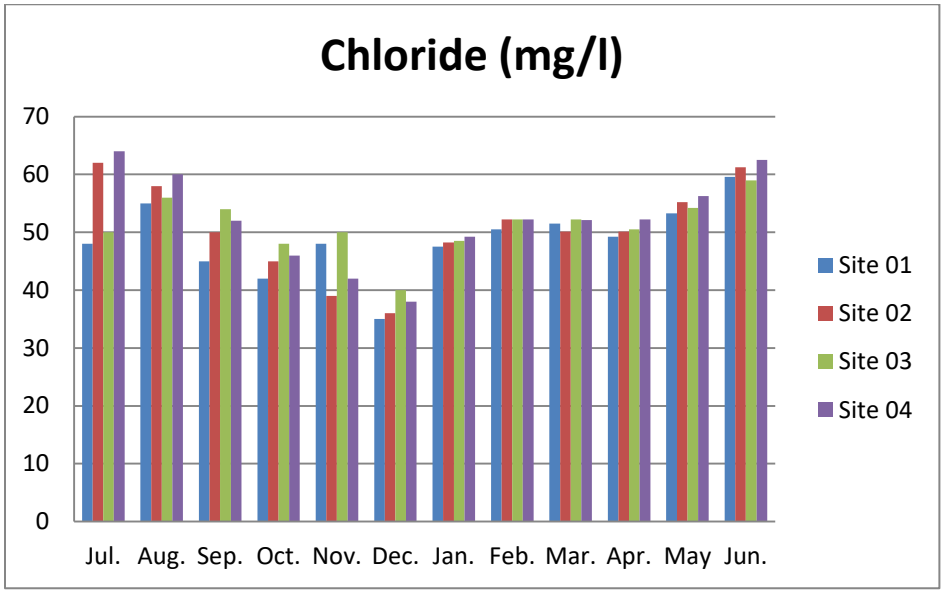

Fig. - 26. Monthly Variations in Chloride (mg/l) in Mansarovar Talab of Jeerapura (Dhar) Year July 2015- June 2016.

14.Nitrate: -

July 2014 – June 2015

SamplingSite 01. The Nitrate varied from 27.0mg/l to 48.0mg/l. The lowest Nitrate was recorded in Novemberwhere ashighest was in June (Table 27& fig.27).

SamplingSite 02. At this station Nitrate fluctuated between 26.0mg/l to 50.3mg/l. The lowest Nitrate was observed in Octoberwhere ashighest was in May (Table 27& fig.27).

SamplingSite 03. The Nitrate oscillated between 30.2mg/l to 51.3mg/l. The lowest Nitrate was observed in Julywhere ashighest was in June (Table 27& fig.27).

SamplingSite 04. At this station the Nitrate ranged between 32.5mg/l to 54.0mg/l. The lowest Nitrate was observed in Julywhere ashighest was in May (Table 27& fig.27).

July 2015 – June 2016

SamplingSite 01. The Nitrate varied from 35.0mg/l to 59.4mg/l. The lowest Nitrate was recorded in Julywhere ashighest was in May (Table 28& fig.28).

SamplingSite 02. At this station Nitrate fluctuated between 38.0mg/l to 57.0mg/l. The lowest Nitrate was observed in Julywhere ashighest was in April (Table 28& fig.28).

SamplingSite 03. The Nitrateocillated between 38.0mg/l to 68.0mg/l. The lowest Nitrate was recorded in Julywhere ashighest was in June (Table 28& fig.28).

SamplingSite 04. At this station the Nitrate ranged between 41.2mg/l to 65.1mg/l. The lowest Nitrate was obsreved in Julywhere ashighest was in May (Table 28& fig.28).

In general, Nitrate valuevaried from 26.0to 68.0 mg/l. The lowestranged was observed at samplingsite 02 in month of October in the year of 2014-15 and highestranged was observed at samplingsite 03 in June in the year of 2015-16 (Table 27 & fig.27 and Table 28 & fig.28).

Table 27. Monthly Variations in Nitrate (mg/l) in Mansarovar Talab of Jeerapura (Dhar) Year July 2014- June 2015.

Month	Site 01	Site 02	Site 03	Site 04
Jul.	29.2	30.5	**30.2**	**32.5**
Aug.	32.8	34.4	33.5	35.7
Sep.	36.0	39.0	38.0	40.0
Oct.	28.0	**26.0**	32.0	36.0
Nov.	**27.0**	29.0	32.0	35.0
Dec.	35.0	37.0	39.0	36.2
Jan.	32.0	35.0	34.0	38.0
Feb.	38.0	40.4	41.0	43.0
Mar.	45.1	48.0	48.2	50.0
Apr.	45.0	48.0	47.0	52.3
May	47.2	**50.3**	50.0	**54.0**
Jun.	**48.0**	44.0	**51.3**	49.4

Table 28. Monthly Variations in Nitrate (mg/l) in Mansarovar Talab of Jeerapura (Dhar) Year July 2015- June 2016.

Month	Site 01	Site 02	Site 03	Site 04
Jul.	**35.0**	**38.0**	**38.0**	**41.2**
Aug.	42.0	45.0	44.2	46.0
Sep.	48.0	50.4	49.0	53.3
Oct.	55.0	45.0	58.0	47.0
Nov.	38.2	40.3	42.3	45.2
Dec.	45.0	45.0	48.0	50.0
Jan.	40.0	45.0	44.0	49.0
Feb.	47.5	49.1	48.0	51.1
Mar.	50.0	51.0	53.4	55.0
Apr.	55.0	**57.0**	58.0	59.0
May	**59.4**	55.2	62.1	**65.1**
Jun.	58.0	54.0	**68.0**	60.0

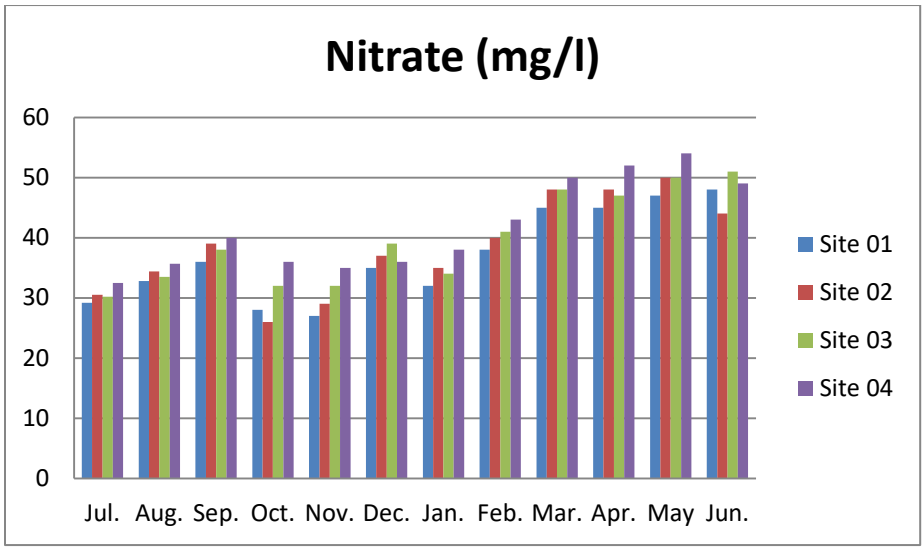

Fig. - 27. Monthly Variations in Nitrate (mg/l) in Mansarovar Talab of Jeerapura (Dhar) Year July 2014- June 2015.

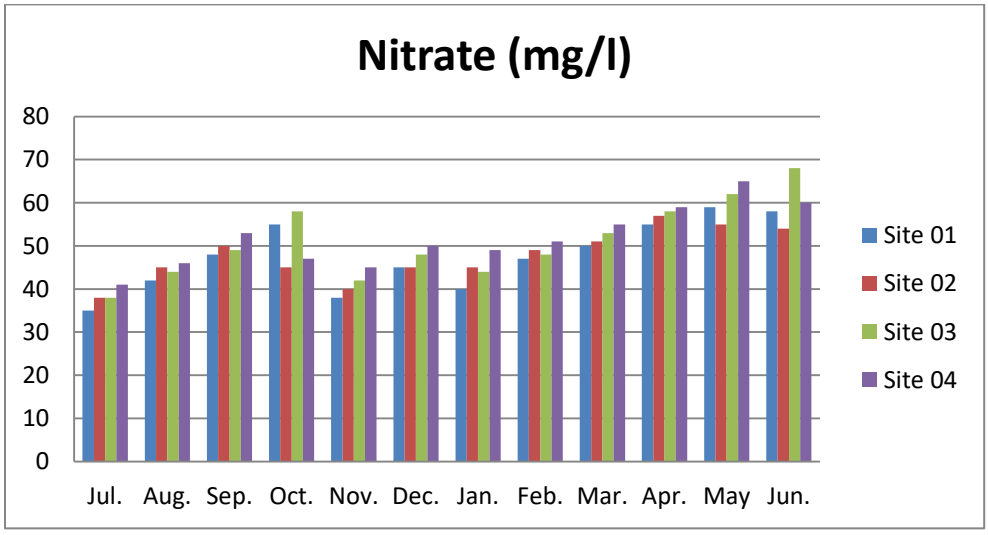

Fig. - 28. Monthly Variations in Nitrate (mg/l) in Mansarovar Talab of Jeerapura (Dhar) Year July 2015- June 2016.

15. Phosphate: -

July 2014 – June 2015

SamplingSite 01. The Phosphate varied from 1.18mg/l to 2.38mg/l. The lowest Phosphate was observed in August and Octoberwhere ashighest was in May (Table 29& fig.29).

SamplingSite 02. At this station Phosphate fluctuated between 1.15mg/l to 2.50mg/l. The lowest Phosphate was observed in Junewhere ashighest was in May (Table 29& fig.29).

SamplingSite 03. The Phosphate oscillatedbetween 1.95mg/l to 3.80mg/l. The lowest Phosphate was observed in July and Novemberwhere ashighest was in June (Table 29& fig.29).

SamplingSite 04. At this station the Phosphate ranged between 2.15mg/l to 3.75mg/l. The lowest Phosphate was observed in Novemberwhere ashighest was in Many (Table 29& fig.29).

July 2015 – June 2016

SamplingSite 01. The Phosphate varied from 1.40mg/l to 2.50mg/l. The lowest Phosphate was observed in Januarywhere ashighest was in November (Table 30& fig.30).

SamplingSite 02. At this station Phosphate fluctuated between 1.45mg/l to 2.65mg/l. The lowest Phosphate was observed in Januarywhere ashighest was in November (Table 30& fig.30).

SamplingSite 03. The Phosphateocillated between 1.60mg/l to 3.50mg/l. The lowest Phosphate was recorded in Julywhere ashighest was in May (Table 30& fig.30).

SamplingSite 04. At this station the Phosphate ranged between 1.90mg/l to 3.68mg/l. The lowest Phosphate was observed in Julywhere ashighest was in May (Table 30& fig.30).

It was fluctuated between1.15 to 3.80 mg/l. The lowestrangeobserved at samplingsite 02 in June in the year of 2014-15. The highestrange atsamplingsite 03 in June in the year of 2014-15 (Table 29 & fig.29).

Table 29. Monthly Variations in Phosphate (mg/l) in Mansarovar Talab of Jeerapura (Dhar) Year July 2014- June 2015.

Month	Site 01	Site 02	Site 03	Site 04
Jul.	1.25	1.52	**1.95**	2.20
Aug.	**1.18**	1.25	2.30	2.45
Sep.	1.25	1.35	2.25	2.35
Oct.	**1.18**	1.25	2.10	2.35
Nov.	1.46	1.55	**1.95**	**2.15**
Dec.	1.70	1.85	2.90	2.75
Jan.	1.20	1.48	2.30	2.40
Feb.	1.61	1.75	2.69	2.85
Mar.	1.87	1.90	2.99	3.10
Apr.	2.15	2.24	3.55	3.20
May	**2.38**	**2.50**	3.55	**3.75**
Jun.	1.58	**1.15**	**3.80**	2.95

Table 30. Monthly Variations in Phosphate (mg/l) in Mansarovar Talab of Jeerapura (Dhar) Year July 2015- June 2016.

Month	Site 01	Site 02	Site 03	Site 04
Jul.	1.50	1.70	**1.60**	**1.90**
Aug.	1.80	1.95	2.20	2.50
Sep.	2.10	2.25	2.80	2.45
Oct.	2.35	2.45	2.55	2.68
Nov.	**2.50**	**2.65**	2.72	2.95
Dec.	1.85	2.00	2.55	2.60
Jan.	**1.40**	**1.45**	1.90	2.15
Feb.	1.55	1.65	2.55	2.65
Mar.	1.85	1.95	2.85	2.95
Apr.	2.20	2.35	3.05	3.25
May	2.45	2.51	**3.50**	**3.68**
Jun.	2.10	1.95	3.10	3.55

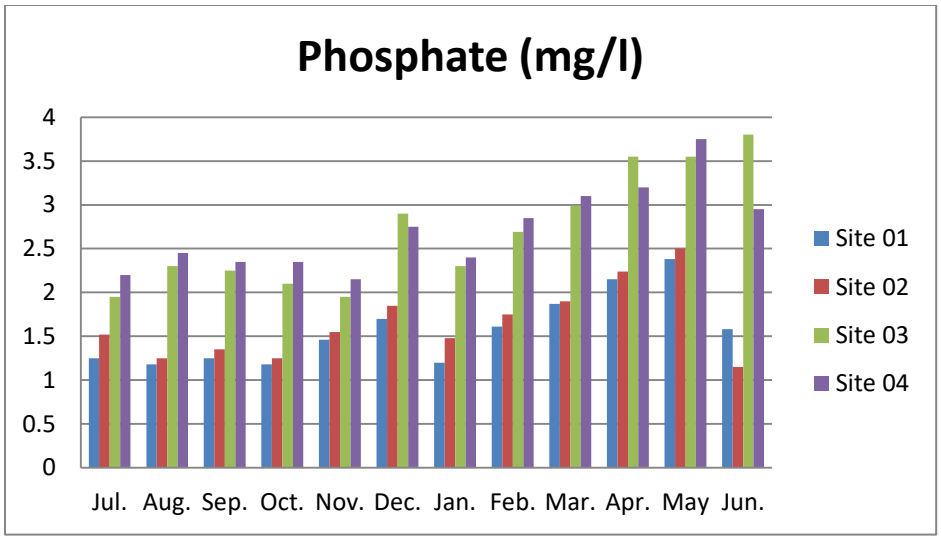

Fig. -29. Monthly Variations in Phosphate (mg/l) in Mansarovar Talab of Jeerapura (Dhar) Year July 2014- June 2015.

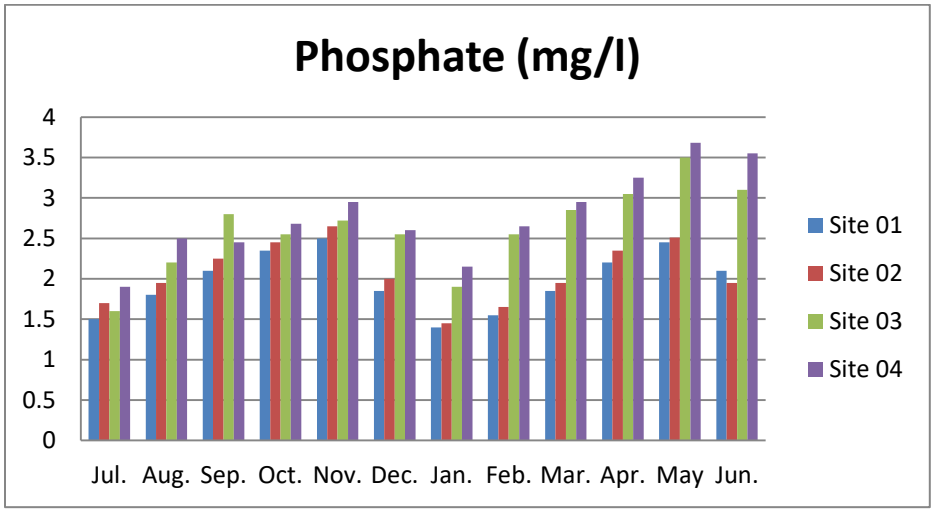

Fig. - 30. Monthly Variations in Phosphate (mg/l) in Mansarovar Talabof Jeerapura (Dhar) Year July 2015- June 2016.

16. Sulphate: -

July 2014 – June 2015

SamplingSite 01. The Sulphate varied from 5.3 mg/l to 9.6 mg/l. The lowest Sulphate was observed in Februarywhere ashighest was in September (Table 31& fig.31).

SamplingSite 02. At this station Sulphate fluctuated between 4.9 mg/l to 9.6 mg/l. The lowest Sulphate was observed in Februarywhere ashighest was in September (Table 31& fig.31).

SamplingSite 03. TheSulphatevaried from 5.5 mg/l to 8.6 mg/l. The lowest Sulphate was observed in Februarywhere ashighest was in September (Table 31& fig.31).

SamplingSite 04. At this station the Sulphate varied from 5.2 mg/l to 9.4 mg/l. The lowest Sulphate was observed in Februarywhere ashighest was in September (Table 31& fig.31).

July 2015 – June 2016

SamplingSite01. The Sulphate varied from 6.0 mg/l to 9.5 mg/l. The lowestSulphate was observed in January where as highets was in September (Table 32& fig.32).

SamplingSite 02. At this station Sulphate varied from 7.2 mg/l to 9.8 mg/l. The lowest Sulphate was observed in Maywhere ashighest was in October (Table 32& fig.32).

SamplingSite 03. TheSulphatevaried from 7.0 mg/l to 9.6 mg/l. The lowest Sulphate was observed in Februarywhere ashighest was in September (Table 32& fig.32).

SamplingSite 04. At this station the Sulphate varied from 7.1 mg/l to 9.9 mg/l. The lowest Sulphate was observed in Februarywhere ashighest was in September (Table 32& fig.32).

It was fluctuated between4.9 to 9.9 mg/l. The lowest value wasobservedat samplingsite 02 in Februaryin the year of 2014-15. The highest value was at samplingsite 04 in September in the year of 2015-16(Table 31& fig.31and Table 32& fig.32).

Table 31. Monthly Variations in Sulphate (mg/l) in Mansarovar Talab of Jeerapura (Dhar) Year July 2014- June 2015.

Month	Site 01	Site 02	Site 03	Site 04
Jul.	8.9	9.0	6.9	8.8
Aug.	9.4	9.4	8.3	9.2
Sep.	**9.6**	**9.6**	**8.6**	**9.4**
Oct.	8.3	8.5	8.2	8.2
Nov.	7.5	7.9	7.8	7.7
Dec.	6.9	6.8	7.4	6.9
Jan.	6.7	6.6	5.8	6.5
Feb.	**5.3**	**4.9**	**5.5**	**5.2**
Mar.	5.8	6.2	6.5	5.8
Apr.	6.2	6.4	5.8	6.4
May	6.5	6.6	6.3	6.6
Jun.	6.9	6.8	6.8	7.0

Table 32. Monthly Variations in Sulphate (mg/l) in Mansarovar Talab of Jeerapura (Dhar) Year July 2015- June 2016.

Month	Site 01	Site 02	Site 03	Site 04
Jul.	9.0	9.2	8.9	8.8
Aug.	9.2	9.4	9.0	8.9
Sep.	**9.5**	9.6	**9.6**	**9.9**
Oct.	8.8	**9.8**	8.6	8.5
Nov.	8.6	9.2	8.4	8.3
Dec.	7.2	9.5	8.9	8.8
Jan.	**6.0**	8.4	7.8	7.7
Feb.	6.6	8.6	**7.0**	**7.1**
Mar.	7.2	8.5	8.4	8.3
Apr.	6.4	8.4	8.6	9.4
May	6.8	**7.2**	8.2	8.8
Jun.	7.2	7.5	8.7	9.2

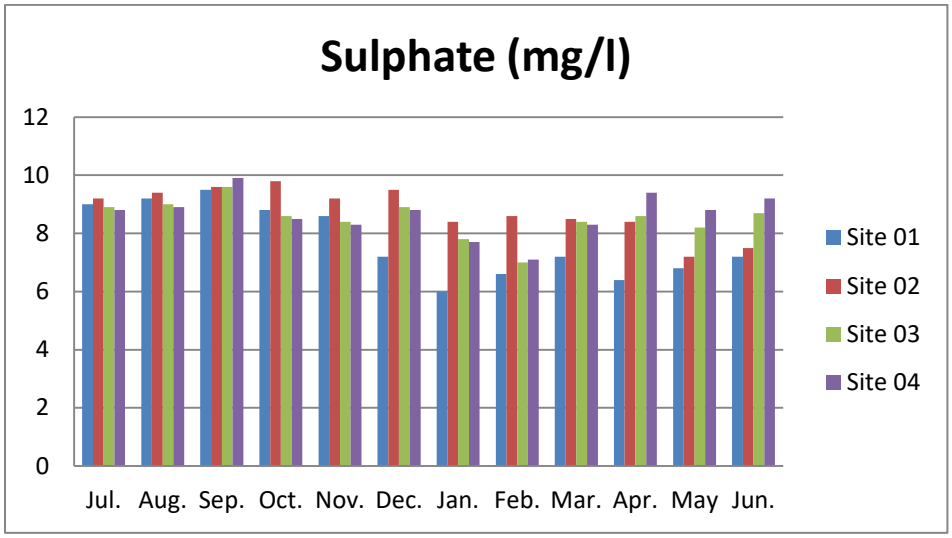

Fig. -31. Monthly Variations in Sulphate (mg/l) in Mansarovar Talab of Jeerapura (Dhar) Year July 2014- June 2015.

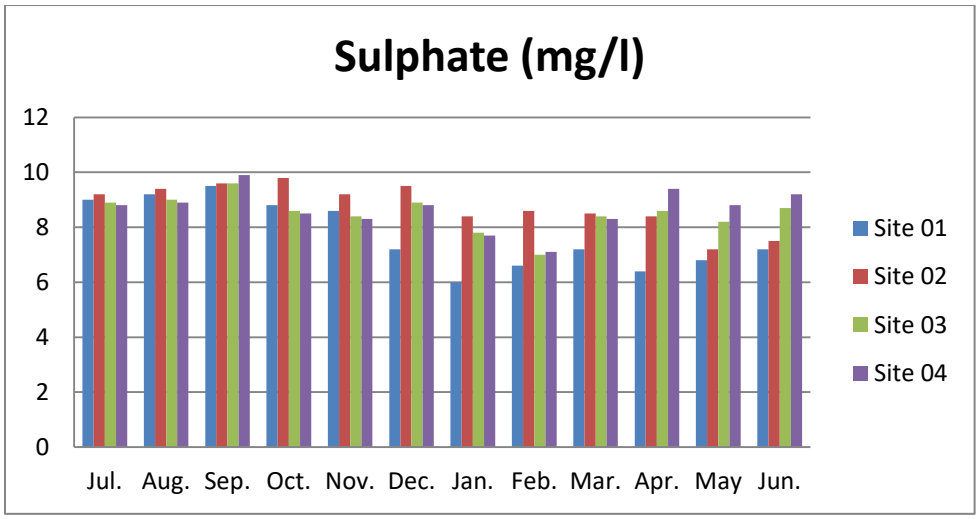

Fig. - 32. Monthly Variations in Sulphate (mg/l) in Mansarovar Talab of Jeerapura (Dhar) Year July 2015- June 2016.

17. Total Coli Form (MPN/100 ml): -

July 2014 – June 2015

SamplingSite 01. The Total Coli Form oscillated between 300 to 530 (MPN/100 ml). The lowest Total Coli Form was recorded in Julywhere ashighest was in June (Table 33& fig. 33).

SamplingSite 02. At this station Total Coli Form value fluctuated between320 to 570 (MPN/100 ml). The lowest Total Coli Form was observed in July where ashighest was in June (Table 33& fig.33).

SamplingSite 03. The Total Coli Form oscillatedbetween 330 to 590 (MPN/100 ml). The lowest Total Coli Form was recorded in Julywhere ashighest was in June (Table 33& fig. 33).

SamplingSite 04. At this station the Total Coli Form ranged between 340 to 650 (MPN/100 ml). The lowest Total Coli Form was observed in Julywhere ashighest was in May (Table 33& fig. 33).

July 2015 – June 2016

SamplingSite 01. The Total Coli Form oscillated between 355 to 625 (MPN/100 ml). The lowest Total Coli Form was observed in Julywhere ashighest was in December (Table 34& fig. 34).

SamplingSite 02. At this station Total Coli Form fluctuated between 350 to 620 (MPN/100 ml). The lowest Total Coli Form was recorded in Januarywhere ashighest was in December (Table 34& fig. 34).

SamplingSite 03. TheTotal Coli Form ocillated between 358 to645 (MPN/100 ml). The lowest Total Coli Form wasobservedin Julywhere ashighest was in December (Table 34& fig. 34).

SamplingSite 04. At this station the Total Coli Form ranged between 402 to 660 (MPN/100 ml). The lowest Total Coli Form was recorded in Julywhere ashighest was in December (Table 34& fig. 34).

It was fluctuated between 300 to 660 (MPN/100 ml). The lowestrange was observed at samplingsite 01 in July in the year 2014-15. The highestrange was observedat samplingsite 04 in December in the year of 2015-16 (Table 33 & fig.33 and Table 34 & fig.34).

Table 33. Monthly Variations in Total Coli Form (MPN/100 ml) in Mansarovar Talab of Jeerapura (Dhar) Year July 2014- June 2015.

Month	Site 01	Site 02	Site 03	Site 04
Jul.	**300**	**320**	**330**	**340**
Aug.	355	370	375	390
Sep.	395	410	400	420
Oct.	430	455	450	478
Nov.	420	436	439	495
Dec.	475	490	485	500
Jan.	360	350	400	380
Feb.	395	410	425	450
Mar.	425	450	475	500
Apr.	470	485	550	565
May	490	510	520	650
Jun.	**530**	**570**	**590**	**570**

Table 34. Monthly Variations in Total Coli Form (MPN/100 ml) in Mansarovar Talab of Jeerapura (Dhar) Year July 2015- June 2016.

Month	Site 01	Site 02	Site 03	Site 04
Jul.	**355**	395	**358**	**402**
Aug.	420	450	435	470
Sep.	495	500	505	520
Oct.	520	550	540	580
Nov.	560	575	594	615
Dec.	**625**	**620**	**645**	**660**
Jan.	380	**350**	485	455
Feb.	415	420	465	490
Mar.	445	460	515	550
Apr.	480	492	580	592
May	500	525	620	625
Jun.	541	510	585	610

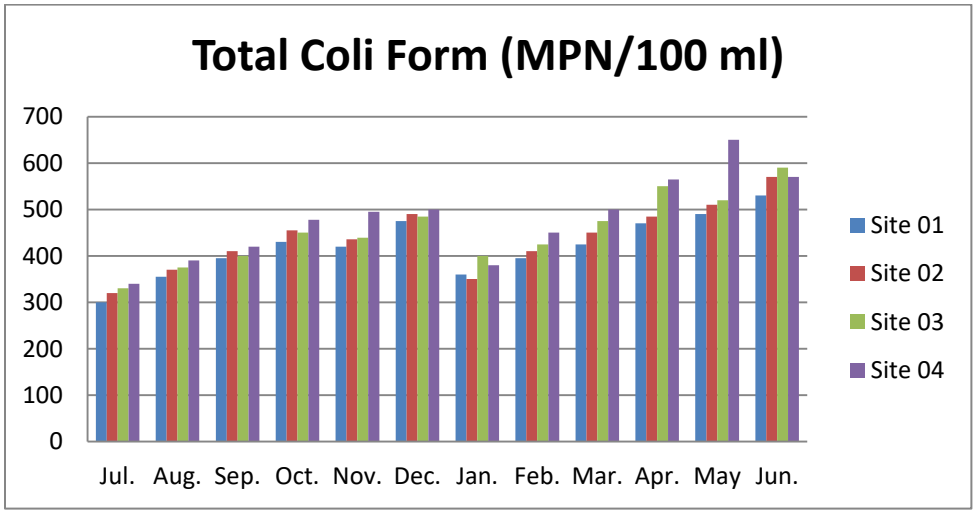

Fig.-33. Monthly Variations in Total Coli Form (MPN/100 ml) in Mansarovar Talab of Jeerapura (Dhar) Year July 2014- June 2015.

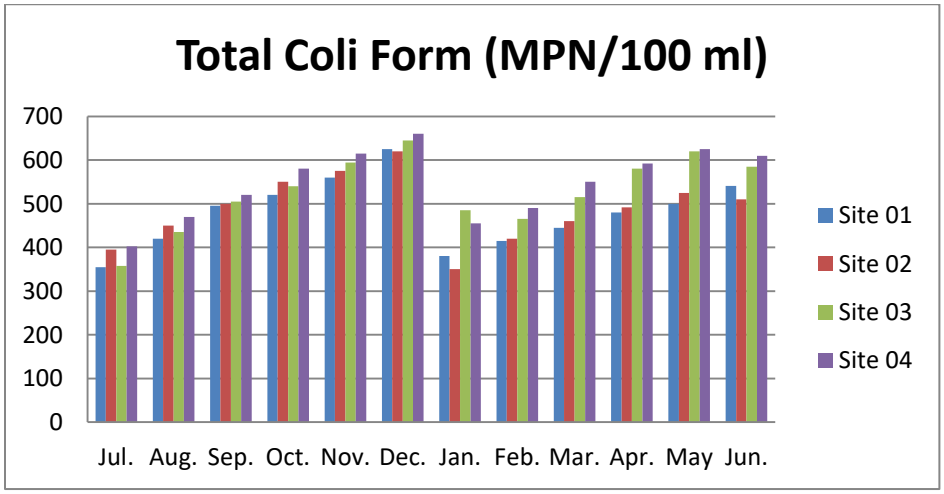

Fig.-34. Monthly Variations in Total Coli Form (MPN/100 ml) in Mansarovar Talab of Jeerapura (Dhar) Year July 2015- June 2016.

18. Fecal Coli Form (MPN/100 ml): -

July 2014 – June 2015

SamplingSite 01. The Fecal Coli Form oscillated between 145 to 365 (MPN/100 ml). The lowest Fecal Coli Form was observed in Julywhere ashighest was in June (Table 35& fig.35).

SamplingSite 02. At this station Fecal Coli Form fluctuated between 162 to 380 (MPN/100 ml). The lowest Fecal Coli Form was recorded in July where ashighest was in June (Table 35& fig.35).

SamplingSite 03. The Fecal Coli Form oscillated between 155 to 390 (MPN/100 ml). The lowest Fecal Coli Form was observed in Julywhere ashighestwas in May (Table 35& fig.35).

SamplingSite 04. At this station the Fecal Coli Form ranged between 170 to 410 (MPN/100 ml). The lowest Fecal Coli Form was observed in Julywhere ashighest was in May (Table 35& fig.35).

July 2015 – June 2016

SamplingSite 01. The Fecal Coli Form oscillated between 170 to 385 (MPN/100 ml). The lowest Fecal Coli Form was recorded in Januarywhere ashighest was in December (Table 36& fig.36).

SamplingSite 02. At this station Fecal Coli Form fluctuated between 199 to 398 (MPN/100 ml). The lowest Fecal Coli Form was observed in Januarywhere ashighest was in December (Table 36& fig.36).

SamplingSite 03. The Fecal Coli Formoscillated between220 to 455 (MPN/100 ml). The lowest Fecal Coli Form was recorded in Julywhere ashighest was in June (Table 36& fig.36).

SamplingSite 04. At this station the Fecal Coli Form ranged between 250 to 480 (MPN/100 ml). The lowest Fecal Coli Form was observed in Julywhere ashighest was in June (Table 36& fig.36).

It was fluctuated between 145 to 480 (MPN/100 ml). The lowestrange was observed at samplingsite 01 in July in the year 2014-15. The highestrange was observed at samplingsite 04 in June in the year of 2015-16 (Table 35 & fig.35 and Table 36 & fig. 36).

Table-35. Monthly Variations in Fecal Coli Form (MPN/100 ml) in Mansarovar Talab of Jeerapura (Dhar) Year July 2014- June 2015.

Month	Site 01	Site 02	Site 03	Site 04
Jul.	**145**	**162**	**155**	**170**
Aug.	178	192	180	199
Sep.	215	222	225	242
Oct.	242	235	255	265
Nov.	260	272	280	295
Dec.	284	295	280	325
Jan.	180	190	288	295
Feb.	210	240	245	270
Mar.	255	280	295	310
Apr.	300	335	330	355
May	350	330	**390**	**410**
Jun.	**365**	**380**	385	350

Table -36. Monthly Variations in Fecal Coli Form (MPN/100 ml) in Mansarovar Talab of Jeerapura (Dhar) Year July 2015- June 2016.

Month	Site 01	Site 02	Site 03	Site 04
Jul.	180	210	**220**	**250**
Aug.	220	240	235	266
Sep.	260	280	275	297
Oct.	275	295	315	345
Nov.	320	340	362	381
Dec.	**385**	**398**	401	418
Jan.	**170**	**199**	225	266
Feb.	220	250	290	320
Mar.	262	290	355	390
Apr.	320	355	380	385
May	370	390	395	420
Jun.	345	360	**455**	**480**

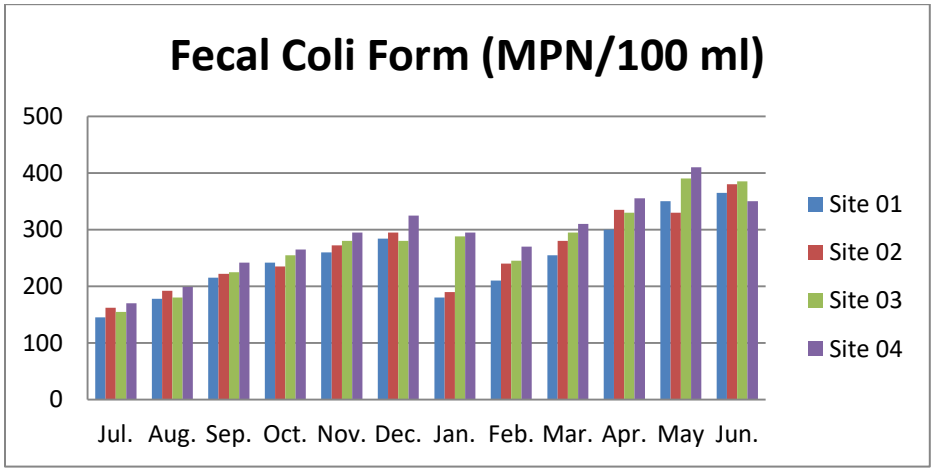

Fig.-35. Monthly Variations in Fecal Coli Form (MPN/100 ml) in Mansarovar Talab of Jeerapura (Dhar) Year July 2014- June 2015.

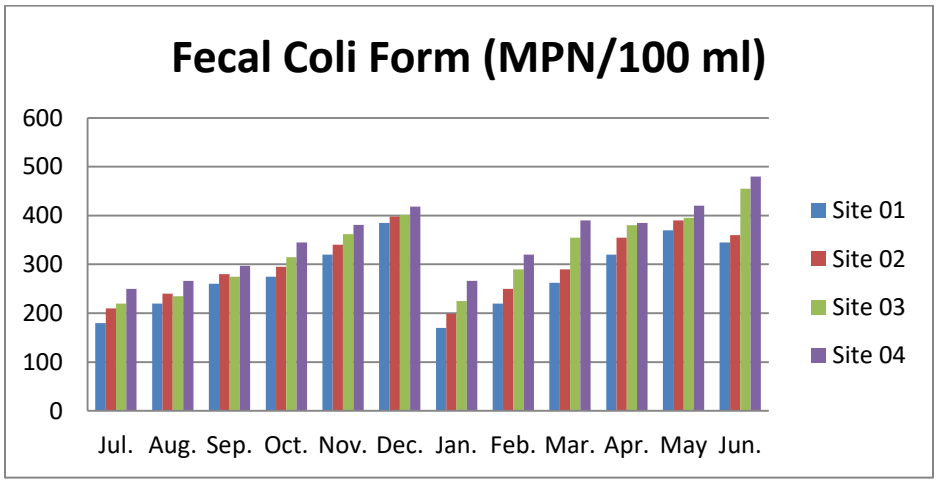

Fig.-36. Monthly Variations in Fecal Coli Form (MPN/100 ml) in Mansarovar Talab of Jeerapura (Dhar) Year July 2015- June 2016.

Table -37. Mothly variation in Diversity of Macro-invertebrates reported in Mansarovar Talab of Jeerapura (Dhar) Year July 2014 toJune 2015.

S.No.	Macro-invertebrates (Bottom fauna)	July	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May	June	Total	Remarks
1	Oligochaeta	67	59.4	50.1	43	45.1	42.5	32	30.3	31	41.5	49.8	61.4	554 553.1	I
2	Hirudinea (Leeches)	4.2	3.3	2	2.3	2.2	2	4.3	3.1	3	3.8	3.5	4	37.7	VI
3	Gastropoda	6.5	7.9	5.1	7.3	8.8	12.9	15	17.2	26.7	28.5	19.2	8.2	163	III
4	Pelecypoda (Bivalvia)	4.9	6.9	4.3	3.6	2.8	3.1	4.2	9.7	7.3	5.3	4.8	5.9	62.8	IV
5	Insecta	11	14.2	28.5	34	30.9	33.9	36	30.9	24.8	15.6	16.2	13.5	288 289.5	II
6	Ostracoda	2.2	3.9	6.5	5.2	3	2.5	4.5	4.8	3.5	2.4	2.2	2	42.7	V
7	Shrimps	2.8	2.5	2	1.9	1.7	2	3	2.8	2.2	1.9	2.5	3	28.3	VII
8	Miscellaneous	1.8	1.9	1.5	2.8	5.5	1.1	1.5	1.2	1.5	1	1.8	2	23.6	VIII

Table -38. Mothly variation in Diversity of Macro-invertebrates reported in Mansarovar Talab of Jeerapura (Dhar) Year July 2015 to June 2016.

S.No.	Macro-invertebrates (Bottom fauna)	July	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May	June	Total	Remarks
1	Oligochaeta	70	60.8	43.5	40	44.1	39.2	36	32.5	30.3	46.3	62.9	68.7	575 574.3	I
2	Hirudinea (Leeches)	5.4	3.1	3.4	3	2.1	2.5	1.8	1.5	0.7	1.5	1.5	7.5	34	V
3	Gastropoda	8.5	11.2	8.7	8.2	9.3	8.2	14	19.8	25.6	29.6	16.5	6.2	166	III
4	Pelecypoda (Bivalvia)	4.8	3.2	3.5	2.5	1.3	1.5	2.5	4.8	5.8	4.2	2.1	4.2	40.4	IV
5	Insecta	6.3	12.9	35.8	37	34.9	42.8	40	33.2	31.5	11.5	12.3	8.2	307 306.4	II
6	Ostracoda	1.3	3.5	2.5	3.2	1.2	2.3	2.9	3.2	3	2.2	1.9	1.2	28.4	VI
7	Shrimps	1.8	2.8	1.5	1.2	2.2	1.5	2.2	3.4	1.2	1.9	2.3	3.5	25.5	VII
8	Miscellaneous	1.7	2.5	1.1	4.4	4.9	2	0.2	1.6	1.9	2.8	0.5	0.5	24.1	VIII

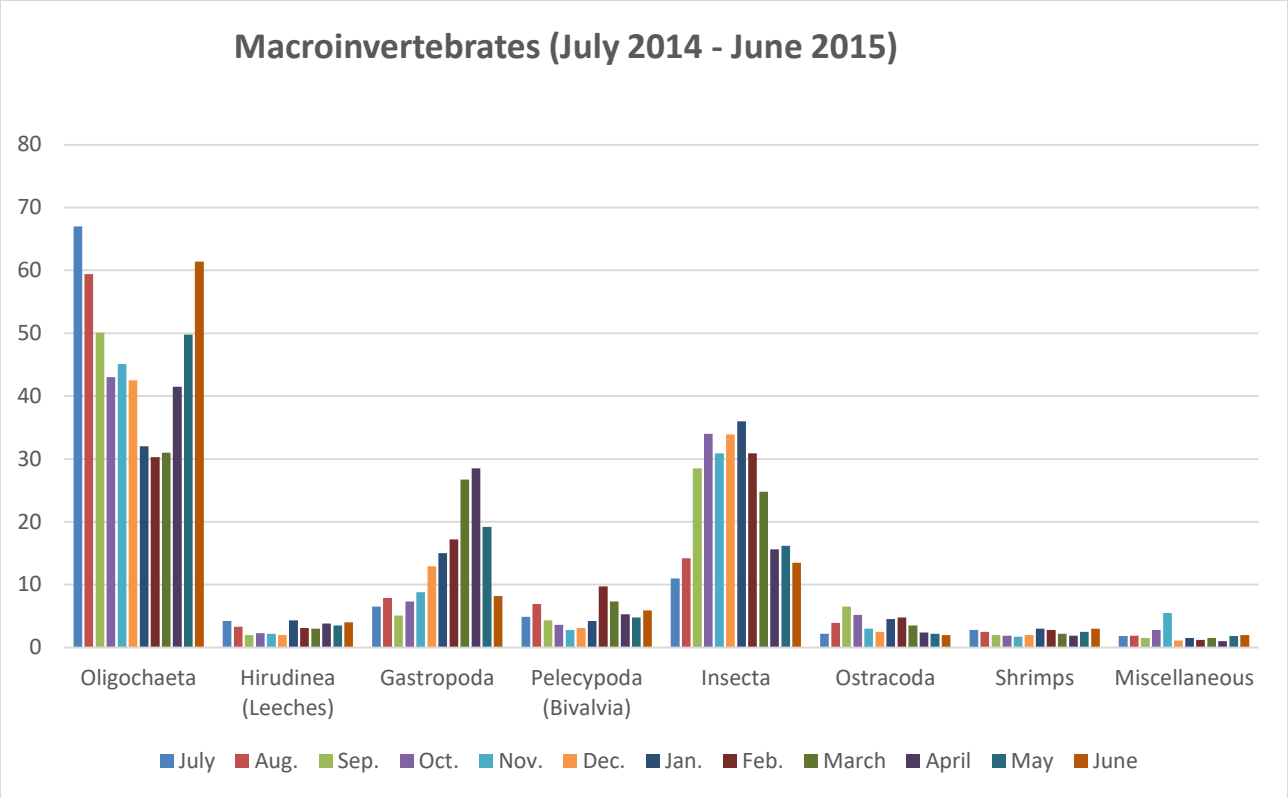

Fig.-37. Mothly variation in Diversity of Macro-invertebrates reported in Mansarovar Talab of Jeerapura (Dhar) Year July 2014 to June 2015.

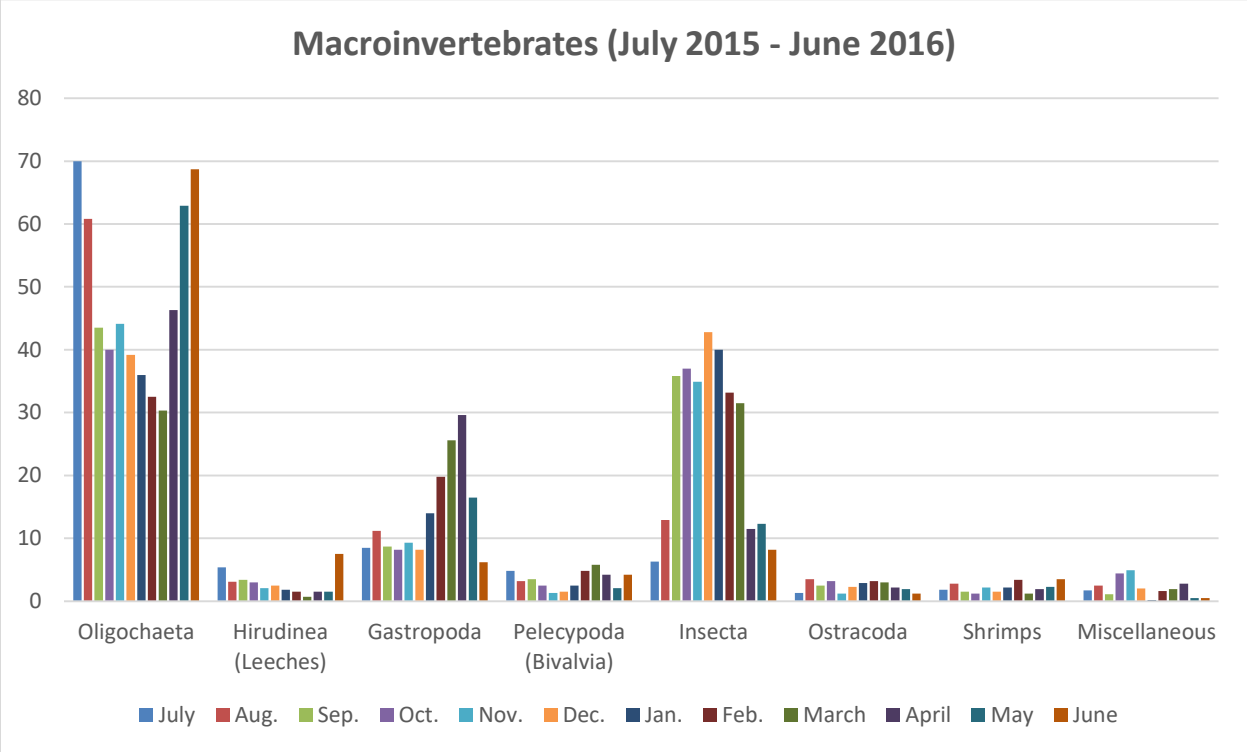

Fig.-38. Mothly variation in Diversity of Macro-invertebrates reported in Mansarovar Talab of Jeerapura (Dhar) Year July 2015 to June 2016.

Biological analysis

Table -39. Listof Benthic Macro-invertebrates species reported in Mansarovar Talab from July 2014 to June 2016.

Phylum	Class	Species
Annelida	**Oligocheata**	*1. Tubifex tubifex* *2. Chaetogaster species* *3. Nais simplex* *4. Derolimnosa* *5. Branchiurasowerbyi* *6. Stylariafossularis* *7. Dero digitata* *8. Srachiondrilussemperi* *9. Branchiodrilussemperi*
	Hirudinea	*10. Helobdella species* *11. Glossiphonia species*
Mollusca	**Gastropoda**	*12. Planorbis species* *13. Limnaeaauricularia* *14. Limnaeaacumainata* *15. Vivipara bengalenis* *16. Viviperaoxytropsis* *17. Bellamya bengalensis* *18. Pisidium clarkeanum* *19. Digoniostomapulchella* *20. Melanoidestuberculatus* *21. Melanoideslineatus*
	Pelecypoda (Bivalvia)	*22. Lamellidensmarginalis* *23. Lamellidensconsobrinus*
Arthropoda	**Insecta**	*24. Chironomus phumosus* *25. Chaoborusspecies* *26. Baetis simplex* *27. Berosus species*
	Crustacea	*28. Daphnia cercinata* *29. Dephnia magna* *30. Cyclopes* *31. Nauplius* *32. Cypris*

Table -40. Depthwise Status of Benthic Macro-invertebrates.

Group	Macro-invertebrates	0.2m	0.5m	1m	1.5m
1. Phylum Annelida	1.*Tubifex tubifex*	RA	RA	RA	RA
(A) Class-Oligochaeta	*2.Chaetogaster species*	I	I	I	SR
	3.Nais simplex	I	I	I	I
	4.Dero limnosa	I	I	I	NR
	5.Branchiura sowerbyi	I	I	RA	RA
	6.Stylaria fossularis	RA	RA	RA	RA
	7.Dero digitata	RA	RA	RA	RA
	8.Srachiondrilus semperi	I	I	NR	NR
	9.Branchiodrilus semperi	I	I	NR	NR
(B) Class-Hirudinea (Leeches)	*10.Helobdella species*	NR	NR	NR	ILA
	11.Glossiphonia species	RA	RA	RA	SR
	12.Planorbis species	RA	RA	SR	NR
2. Phylum Mollusca	*13.Limnaea auricularia*	RA	RA	SR	NR
(A) Class-Gastropoda	*14.Limnaea acumainata*	I	I	I	I
	15.Vivipara bengalenis	RA	RA	RA	ILA
	16.Vivipera oxytropsis	RA	RA	RA	ILA
	17.Bellamya bengalensis	RA	ILA	RA	RA
	18.Pisidium clarkeanum	ILA	ILA	NR	NR
	19.Digoniostoma pulchella	ILA	ILA	NR	NR
	20.Melanoides tuberculatus	RA	RA	RA	RA
	21.Melanoides lineatus	RA	RA	RA	RA

	22.Lamellidens marginalis	ILA	ILA	ILA	-
(B) Class-Pelecypoda (Bivalvia)	*23.Lamellidens consobrinus*	I	I	RA	-
	24.Chironomus phumosus	I	I	I	I
3. Phylum Arthropoda	*25.Chaoborus species*	ILA	ILA	I	-
	26.Baetis simplex	RA	RA	RR	RR
(A) Class-Insecta	*27.Berosus species*	RA	RA	I	I
	28.Daphnia cercinata	RA	IR	-	-
	29.Dephnia magna	ILA	ILA	-	-
(B) Class-Crustacea	*30.Cyclopes*	ILA	ILA	ILA	ILA
1. Branchipoda (Shrimps)	*31.Nauplius*	ILA	ILA	ILA	ILA
	32.Cypris	ILA	ILA	-	-
		ILA	-	-	-
		RLA	ILA	-	-

Key:

RA = Regular and abundant.

I = Irregular

- = Absent

ILA = Irregular and less abundant

NR = Not Recorded

RLA = Regular & less abundant

Photographs showing the species of Annelids in Mansarovar Talab Jeerapura (Dhar).


Tubifex tubifexChaetogaster species


Dero limnosaBranchiurasowerbyi

StylariafossularisDerodigitate

Glossiphonia species

Photographs showing the species of Molluscansin Mansarovar Talab Jeerapura (Dhar).

*Limnaea auricularia**Limnaeaacumainata*

*Vivipara bengalensis**Bellamya bengalensis*

Pisidium clarkeanum *Melanoidestuberculatus*

Lamellidens marginalisLamellidensconsobrinus

Photographs showing the species of ArthopodsMansarovar Talab Jeerapura (Dhar).

Baetis simplexBerosus species

Daphnia cercinata *Daphnia magna*

Cyclops

Nauplius

Cypris

Table -41. Karl Pearsons coefficient of correlation between Physico-chemical parameters and Macro Invertebrates and Fishes at Station-I

Parameter	Macro Invertebrates	Fishes
Temperature	0.37	0.21
Ph	-0.96	-0.97
BOD	0.83	0.72
Fecal Coliform	-0.11	0.07
Nitrate	0.16	-0.01
Phosphate	-0.20	-0.05
DO % Saturation	-0.29	-0.46
Turbidity	-0.93	-0.88
Total Solids	-0.83	-0.74

Table -42. Karl Pearsons coefficient of correlation between Physico-chemical parameters and Macro Invertebrates and Fishes at Station-II

Parameter	Macro Invertebrates	Fishes
Temperature	0.37	0.34
Ph	-0.96	-0.97
BOD	0.90	0.88
Fecal Coliform	-0.13	-0.11
Nitrate	0.23	0.19
Phosphate	-0.14	-0.13
DO % Saturation	-0.32	-0.35
Turbidity	-0.94	-0.94
Total Solids	-0.84	-0.83

Table -43. Karl Pearsons coefficient of correlation between Physico-chemical parameters and Macro Invertebrates and Fishes at Station-III

Parameter	Macro Invertebrates	Fishes
Temperature	0.41	0.38
Ph	-0.86	-0.89
BOD	0.98	0.96
Fecal Coliform	-0.25	-0.21
Nitrate	-0.17	-0.22
Phosphate	0.26	0.29
DO % Saturation	-0.16	-0.21
Turbidity	-0.86	-0.83
Total Solids	-0.70	-0.68

Table -44. Karl Pearsons coefficient of correlation between Physico-chemical parameters and Macro Invertebrates and Fishes at Station-IV

Parameter	Macro Invertebrates	Fishes
Temperature	0.51	0.49
Ph	-0.92	-0.94
BOD	0.75	0.71
Fecal Coliform	-0.01	0.06
Nitrate	0.10	0.04
Phosphate	0.07	0.11
DO % Saturation	-0.18	-0.25
Turbidity	-0.97	-0.97
Total Solids	-0.90	-0.89

Table -45.Seasonal Variation in fishes of Mansarovar Talab of Jeerapura (Dhar) Year Jul. 2014 – June 2015.

2014-15									
Family	**Species**	**Jul.-Sep. (Monsoon)**	**Oct.-Dec. (Post Monsoon)**	**Jan.-march (Winter)**	**Apr.-June (Summer)**	**Jul.- Sep. (Monsoon)**	**Oct.-Dec. (Post Monsoon)**	**Jan.-march (Winter)**	**Apr.-June (Summer)**
Cyprinidae	*Labeorohita*	+	++	+++	+	+	+	+++	+
	Labeocalbasu	+	-	+++	-	+	++	+++	+
	Labeobata	-	+	-	++	-	++	++	-
	Cirrhinusmrigale	-	+	+++	++	+	+	+++	+
	Puntius sarana	-	+	++	-	-	+	++	-
	Puntius ticto	+	-	+++	++	-	-	++	-
	Cyprinus carpio	-	-	-	+	-	+	-	-
	Rasbora daniconius	+	+	++	+	+	++	+++	-
	Catlacatla	+	++	+++	++	+	+	+++	+
Bagridae	*Mystusbleekari*	+	++	+++	+	+	+	+++	+
	Mystusseenghala	+	+	+++	-	+	-	+++	++
Mastacembelidae	*Mastacembalusarmatus*	+	++	++	-	+	+	+++	+
	Mastacembeluspancalus	+	+++	++	+++	+	++	++	+
Notopteridae	*Notopterusnotopterus*	-	+	-	++	-	++	++	-
anabantidae	*Colisa fasciatus*	+	+	+	-	-	-	+	-
Heteropneustidae	*Heteropneustesfossillis*	+	+++	++	+++	+	++	++	+
Nemacheilidae	*Noemacheilusbotia*	+	+	+++	++	-	++	++	+
Clariidae	*Clariasbatrachus*	-	+	++	-	-	+	++	+
Ambassidae	*Chanda nama*	+	+	++	+	+	+	+	+
Ophiocephalidae	*Channa punctatus*	-	-	-	+	-	-	+	-
Clupeidae	*Hilsa hilsa*	+	+	-	+	-	-	-	+
Nandidae	*Nandus nandus*	-	+	-	-	-	+	-	-
Siluridae	*Wallago attu*	+	+	++	++	+	++	+	++

Indication:+++ (Abundant), **++** (Less Abundant, Always Visible),**+** (Rare, Sometime Visible), **-** (Absent).

Table -46.Seasonal Variation in fishes of Mansarovar Talab of Jeerapura (Dhar) Year Jul. 2015– June 2016.

2015-16									
Family	**Species**	**Jul.-Sep. (Monsoon)**	**Oct.-Dec. (Post Monsoon)**	**Jan.-march (Winter)**	**Apr.-June (Summer)**	**Jul.- Sep. (Monsoon)**	**Oct.-Dec. (Post Monsoon)**	**Jan.-march (Winter)**	**Apr.-June (Summer)**
Cyprinidae	*Labeorohita*	+	+	+++	++	+	+	+++	+
	Labeocalbasu	+	-	+++	+	+	++	+++	-
	Labeobata	-	-	++	+	-	+	+	-
	Cirrhinusmrigale	+	+	+++	+	+	++	+++	+
	Puntius sarana	+	+	+++	-	-	+	++	-
	Puntius ticto	+	-	++	-	-	-	++	-
	Cyprinus carpio	-	-	-	+	+	-	-	-
	Rasbora daniconius	-	-	++	-	-	-	-	-
	Catlacatla	+	+	+++	+	+	++	++	+
Bagridae	*Mystusbleekari*	+	+	+++	++	+	+	++	+
	Mystusseenghala	+	-	+++	-	+	-	+++	-
Mastacembelidae	*Mastacembalusarmatus*	+	-	+++	+	+	-	++	-
	Mastacembeluspancalus	+	++	+	++	+	++	++	++
Notopteridae	*Notopterusnotopterus*	-	-	++	+	-	+	+	-
anabantidae	*Colisa fasciatus*	-	-	-	-	-	-	-	-
Heteropneustidae	*Heteropneustesfossillis*	+	++	+	++	+	++	++	+++
Nemacheilidae	*Noemacheilusbotia*	-	-	-	-	-	-	-	-
Clariidae	*Clariasbatrachus*	-	-	+++	++	-	+	+++	++
Ambassidae	*Chanda nama*	-	-	++	+	-	-	-	-
Ophiocephalidae	*Channa punctatus*	-	-	-	-	-	-	-	-
Clupeidae	*Hilsa hilsa*	+	+	-	-	-	++	+	-
Nandidae	*Nandus nandus*	-	-	-	-	-	-	-	-
Siluridae	*Wallago attu*	+	+	++	++	+	++	++	+

Indication:+++ (Abundant), **++** (Less Abundant, Always Visible),**+** (Rare, Sometime Visible), **-** (Absent).

Table -47. Monthly Variation in Shannon & Weaver index and Simpson's Diversity Index during the study period (July 2014 to June 2016).

Months	Shannon & Weaver Index		Simpson's diversity Index	
	2014-2015	2015-2016	2014-2015	2015-2016
July	1.91	1.93	0.83	0.84
Aug.	1.33	1.37	0.59	0.61
September	1.37	1.26	0.67	0.63
October	1.85	1.99	0.82	0.85
Nov.	1.37	1.37	0.67	0.67
December	1.25	1.28	0.64	0.66
Jan.	1.93	1.91	0.84	0.84
February	1.55	1.66	0.74	0.77
Marh	1.43	1.47	0.72	0.70
Apr.	1.42	1.46	0.68	0.71
May	1.17	1.47	0.56	0.68
June	1.16	1.01	0.50	0.50

Diversity Index during the study period July 2014 to June 2016:

Shannon and Weaver Index from July 2014 to June 2015 was boserved in the varied from 1.16 to 1.93. The lowest value observed in June and highest value observed in January. July 2015 to June 2016 was observed in the varid from 1.01 to 1.99. The lowest value observed in June and highest value observed in October. This indicates that station has moderate water quality (H= 1 - 3).

The value of Simpson index varies between 0 - 1. Zero represents no diversity and 1 represents infinite diversity. This indicates that bigger the value of D, greater is the diversity and smaller the value, smaller the diversity.

The value of Simpson diversity index from July 2014 to June 2015 was observed in the varied from 0.50 to 0.84. The lowest value observed in June and highest value observed in January. July 2015 to June 2016 was observed in the varied from 0.50 to 0.85. The lowest value observed in June and highest range observed in October.Thus, value of D is higher (close to 1) and indicates higher diversity.

Table -48.Fish Species percentage.

Family	**Species**	**No. of Species**	**Percentage (%)**
Bagridae	*Mystusbleekari*	2	8.695652174
	Mystusseenghala		
Cyprinidae	*Labeorohita*	9	39.13043478
	Labeocalbasu		
	Labeobata		
	Cirrhinusmrigale		
	Puntius sarana		
	Puntius ticto		
	Cyprinus carpio		
	Rasbora daniconius		
	Catlacatla		
Siluridae	*Wallago attu*	1	4.347826087
Notopteridae	*Notopterusnotopterus*	1	4.347826087
Mastacembelidae	*Mastacembalusarmatus*	2	8.695652174
	Mastacembeluspancalus		
anabantidae	*Colisa fasciatus*	1	4.347826087
Heteropneustidae	*Heteropneustesfossillis*	1	4.347826087
Nemacheilidae	*Noemacheilusbotia*	1	4.347826087
Clariidae	*Clariasbatrachus*	1	4.347826087
Ambassidae	*Chanda nama*	1	4.347826087
Ophiocephalidae	*Channa punctatus*	1	4.347826087
Clupeidae	*Hilsa hilsa*	1	4.347826087
Nandidae	*Nandus nandus*	1	4.347826087

Table -49.Seasonal Variations in fish species from July 2014 to June 2015.

S.No.	Name of fish	Jul.-Sep. (Monsoon)	Oct.-Dec. (Post Monsoon)	Jan.-March (Winter)	Apr.-June (Summer)	Jul.-Sep. (Monsoon)	Oct.-Dec. (Post Monsoon)	Jan.-March (Winter)	Apr.-June (Summer)
1	***Labeorohita***	3.57	0.00	7.78	0.00	8.00	8.75	9.03	4.76
2	***Labeocalbasu***	0.00	1.22	0.00	7.95	0.00	8.75	3.87	0.00
3	***Labeobata***	0.00	1.22	0.00	6.82	0.00	7.50	3.23	0.00
4	***Notopterusnotopterus***	7.14	8.54	8.98	9.09	8.00	2.50	9.03	4.76
5	***Catlacatla***	3.57	1.22	2.99	1.14	8.00	10.00	1.94	0.00
6	***Puntius sarana***	3.57	0.00	7.78	7.95	0.00	0.00	4.52	0.00
7	***Rasbora daniconius***	0.00	1.22	2.99	0.00	0.00	2.50	4.52	0.00
8	***Cirrhinusmrigale***	3.57	7.32	2.99	0.00	8.00	2.50	8.39	4.76
9	***Puntius ticto***	0.00	1.22	6.59	9.09	8.00	2.50	7.74	4.76
10	***Cyprinus carpio***	3.57	2.44	3.59	7.95	8.00	8.75	1.29	14.29
11	***Mastacembalusarmatus***	7.14	13.41	4.79	14.77	8.00	8.75	4.52	4.76
12	***Mastacembeluspancalus***	0.00	0.00	0.00	1.14	0.00	1.25	0.00	0.00
13	***Mystusseenghala***	3.57	8.54	7.78	1.14	4.00	2.50	9.03	4.76
14	***Mystusbleekari***	7.14	15.85	4.79	15.91	8.00	8.75	4.52	2.38
15	***Wallago attu***	3.57	2.44	7.78	0.00	8.00	0.00	7.74	19.05
16	***Clariasbatrachus***	3.57	2.44	3.59	2.27	8.00	1.25	0.65	2.38
17	***Heteropneustesfossillis***	0.00	1.22	2.99	0.00	0.00	2.50	0.00	4.76
18	***Colisa fasciatus***	0.00	1.22	0.00	0.00	0.00	1.25	0.00	0.00
19	***Chanda nama***	3.57	1.22	0.00	0.00	0.00	0.00	0.65	0.00
20	***Channa punctatus***	28.57	15.85	7.19	2.27	8.00	7.50	3.87	16.67
21	***Nandus nandus***	0.00	0.00	0.00	0.00	0.00	0.00	0.65	0.00
22	***Noemacheilusbotia***	7.14	1.22	0.00	1.14	0.00	0.00	0.00	2.38
23	***Hilsa hilsa***	3.57	2.44	7.19	9.09	0.00	10.00	4.52	4.76

Table -50.Seasonal Variation in fish species from July 2015 to June 2016.

PHOTOGRAPHS OF FISH SPECIES OF MANSAROVR TALAB OF JEERAPURA (DHAR).

S.No.	Name of fish	Jul.-Sep. (Monsoon)	Oct.-Dec. (Post Monsoon)	Jan.-March (Winter)	Apr.-June (Summer)	Jul.-Sep. (Monsoon)	Oct.-Dec. (Post Monsoon)	Jan.-March (Winter)	Apr.-June (Summer)
1	***Labeorohita***	5.26	0.00	7.39	2.67	11.11	13.11	10.95	0.00
2	***Labeocalbasu***	0.00	0.00	2.84	1.33	0.00	1.64	0.73	0.00
3	***Labeobata***	0.00	0.00	3.41	2.67	0.00	3.28	0.73	0.00
4	***Notopterusnotopterus***	10.53	6.67	7.39	2.67	5.56	11.48	3.65	2.13
5	***Catlacatla***	0.00	0.00	3.98	0.00	0.00	0.00	0.00	0.00
6	***Puntius sarana***	5.26	0.00	2.84	0.00	0.00	0.00	3.65	0.00
7	***Rasbora daniconius***	5.26	6.67	7.95	0.00	0.00	3.28	3.65	0.00
8	***Cirrhinusmrigale***	5.26	0.00	6.25	2.67	5.56	0.00	5.11	0.00
9	***Puntius ticto***	10.53	6.67	7.95	2.67	11.11	11.48	10.22	4.26
10	***Cyprinus carpio***	10.53	3.33	3.41	9.33	11.11	9.84	4.38	2.13
11	***Mastacembalusarmatus***	5.26	20.00	1.14	10.67	11.11	9.84	4.38	17.02
12	***Mastacembeluspancalus***	0.00	0.00	0.00	1.33	5.56	0.00	0.00	0.00
13	***Mystusseenghala***	10.53	6.67	8.52	10.67	11.11	3.28	5.11	2.13
14	***Mystusbleekari***	5.26	20.00	1.14	12.00	11.11	13.11	5.84	31.91
15	***Wallago attu***	10.53	0.00	9.09	0.00	5.56	0.00	8.03	0.00
16	***Clariasbatrachus***	0.00	0.00	2.84	2.67	0.00	0.00	0.00	0.00
17	***Heteropneustesfossillis***	0.00	0.00	7.39	9.33	0.00	3.28	10.22	17.02
18	***Colisa fasciatus***	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19	***Chanda nama***	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20	***Channa punctatus***	0.00	23.33	4.55	18.67	0.00	3.28	10.95	19.15
21	***Nandus nandus***	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22	***Noemacheilusbotia***	5.26	3.33	3.41	0.00	0.00	9.84	0.73	0.00
23	***Hilsa hilsa***	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

LabeorohitaLabeocalbasu

Labeo bataNotopterusnotopterus


Catla catlaRasbora daniconius


Puntius saranaPuntius ticto

Cirrhinus mrigale *Cyprinus carpio*

Wallago attuMystusseenghala


MystusbleekariNoemacheilusbotia

Hilsa hilsa

Table -51. Water Quality Index-Analysed Status Station I & II (July 2014 to June 2016)

	Jul-14		**Aug-14**		**Sep-14**		**Oct-14**		**Nov-14**		**Dec-14**	
Stations	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2
NSFQI Value	54.4	54.22	54.91	52.97	49.41	50.45	50.57	52.06	53.19	48.29	54.75	53.41
Status	Medium	Medium	Medium	Medium	Poor	Medium	Medium	Medium	Medium	Poor	Medium	Medium
	Jan-15		**Feb-15**		**Mar-15**		**Apr-15**		**May-15**		**Jun-15**	
Stations	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2
NSFQI Value	53.27	52.85	53.27	53.18	51.37	50.91	48.05	50.46	41.15	42.22	40.67	40.55
Status	Medium	Medium	Medium	Medium	Medium	Medium	Poor	Medium	Poor	Poor	Poor	Poor
	Jul-15		**Aug-15**		**Sep-15**		**Oct-15**		**Nov-15**		**Dec-15**	
Stations	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2
NSFQI Value	50.73	50.14	51.3	49.59	49.01	47.01	47.81	49.49	51.79	50.62	51.85	49.38
Status	Medium	Medium	Medium	Poor	Poor	Poor	Poor	Poor	Medium	Medium	Medium	Poor
	Jan-16		**Feb-16**		**Mar-16**		**Apr-16**		**May-16**		**Jun-16**	
Stations	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2
NSFQI Value	52.54	51.45	52.07	50.89	50.89	49.29	48.12	47.1	43.93	44.31	38.34	41.47
Status	Medium	Medium	Medium	Medium	Medium	Poor	Poor	Poor	Poor	Poor	Poor	Poor

	July 2014 to Dec 2014															
	Jul-14								**Aug-14**							
Parameter	S1	Q	W	QW	S2	Q	W	QW	S1	Q	W	QW	S2	Q	W	QW
Temperature	26.5	13.5	0.1	1.35	26.4	13.6	0.1	1.36	28.5	11.5	0.1	1.15	29.5	10.5	0.1	1.05
PH	7.7	91	0.11	10.01	7.9	87	0.11	9.57	7.9	87	0.11	9.57	8.1	80	0.11	8.8
BOD	2.9	68	0.11	7.48	2.5	70	0.11	7.7	2	80	0.11	8.8	2.2	76	0.11	8.36
Fecal coliform	142	41	0.16	6.56	165	39	0.16	6.24	178	38	0.16	6.08	192	38	0.16	6.08
Nitrate	29.2	28	0.1	2.8	30.5	27	0.1	2.7	32.8	24	0.1	2.4	34.4	23	0.1	2.3
Phosphate	1.2	36	0.1	3.6	1.48	32	0.1	3.2	1.61	30	0.1	3	1.75	29	0.1	2.9
DO % saturation	83	89	0.17	15.13	85	91	0.17	15.47	85	91	0.17	15.47	84	90	0.17	15.3
Turbidity	38	47	0.08	3.76	35	49	0.08	3.92	30	53	0.08	4.24	36	48	0.08	3.84
Total solids	350	53	0.07	3.71	315	58	0.07	4.06	300	60	0.07	4.2	280	62	0.07	4.34
	NSFWQI			**54.4**	NSFWQI			**54.22**	NSFWQI			**54.91**	NSFWQI			**52.97**
	Sep-14								**Oct-14**							
Parameter	S1	Q	W	QW	S2	Q	W	QW	S1	Q	W	QW	S2	Q	W	QW
Temperature	30.5	9.5	0.1	0.95	31	9	0.1	0.9	28.8	11.2	0.1	1.12	29.2	10.8	0.1	1.08
PH	8.2	77	0.11	8.47	8.5	66	0.11	7.26	8.5	66	0.11	7.26	8.2	77	0.11	8.47
BOD	2.5	70	0.11	7.7	2.6	69	0.11	7.59	2.8	68	0.11	7.48	3	67	0.11	7.37
Fecal coliform	215	37	0.16	5.92	222	36	0.16	5.76	242	36	0.16	5.76	235	36	0.16	5.76
Nitrate	36.0	21	0.1	2.1	39.0	18	0.1	1.8	28.0	29	0.1	2.9	26.0	31	0.1	3.1
Phosphate	1.87	28	0.1	2.8	1.4	33	0.1	3.3	2.15	26	0.1	2.6	2.24	26	0.1	2.6
DO % saturation	75	81	0.17	13.77	87	93	0.17	15.81	114	93	0.17	15.81	111	95	0.17	16.15
Turbidity	45	42	0.08	3.36	48	40	0.08	3.2	55	36	0.08	2.88	62	32	0.08	2.56
total solids	278	62	0.07	4.34	225	69	0.07	4.83	235	68	0.07	4.76	210	71	0.07	4.97
	NSFWQI			**49.41**	NSFWQI			**50.45**	NSFWQI			**50.57**	NSFWQI			**52.06**

	Nov-14								**Dec-14**							
Parameter	S1	Q	W	QW	S2	Q	W	QW	S1	Q	W	QW	S2	Q	W	QW
Temperature	26.5	13.5	0.1	1.35	25.5	15	0.1	1.5	24.9	16.1	0.1	1.61	25.2	15.3	0.1	1.53
PH	7.6	92	0.11	10.12	7.8	90	0.11	9.9	7.9	87	0.11	9.57	8.1	80	0.11	8.8
BOD	3.2	66	0.11	7.26	3.3	65	0.11	7.15	2.7	69	0.11	7.59	2.4	72	0.11	7.92
Fecal coliform	260	35	0.16	5.6	272	34	0.16	5.44	284	34	0.16	5.44	295	34	0.16	5.44
Nitrate	27.0	30	0.1	3.0	29.0	28	0.1	2.8	35.0	22	0.1	2.2	37.0	20	0.1	2.0
Phosphate	2.38	25	0.1	2.5	2.5	24	0.1	2.4	1.58	30	0.1	3.0	1.25	35	0.1	3.5
DO % saturation	134	82	0.17	13.94	146	50	0.17	8.5	111	95	0.17	16.15	121	89	0.17	15.13
Turbidity	30	53	0.08	4.24	16	66	0.08	5.28	12	72	0.08	5.76	14	69	0.08	5.52
Total solids	188	74	0.07	5.18	170	76	0.07	5.32	380	49	0.07	3.43	365	51	0.07	3.57
	NSFWQI			**53.19**	NSFWQI			**48.29**	NSFWQI			**54.75**	NSFWQI			**53.41**

	Jan. 2015 to June 2015															
	JAN-2015								**FEB-2015**							
Parameter	S1	Q	W	QW	S2	Q	W	QW	S1	Q	W	QW	S2	Q	W	QW
Temperature	27	13	0.1	1.3	26.5	13.5	0.1	1.35	29.5	10.5	0.1	1.05	28.9	11.1	0.1	1.11
pH	7.4	93	0.11	10.23	7.6	92	0.11	10.12	7.9	87	0.11	9.57	8.2	77	0.11	8.47
BOD	6.3	49	0.11	5.39	6.7	47	0.11	5.17	5.08	55	0.11	6.05	3	67	0.11	7.37
Fecal coliform	180	38	0.16	6.08	190	38	0.16	6.08	210	37	0.16	5.92	240	36	0.16	5.76
Nitrate	32.0	25	0.1	2.5	35.0	22	0.1	2.2	38.0	19	0.1	1.9	40.4	17	0.1	1.7
Phosphate	1.2	36	0.1	3.6	1.48	32	0.1	3.2	1.61	30	0.1	3.0	1.75	29	0.1	2.9
DO % saturation	119	90	0.17	15.3	114	93	0.17	15.81	98	99	0.17	16.83	102	99	0.17	16.83
Turbidity	20	61	0.08	4.88	22	59	0.08	4.72	28	55	0.08	4.4	25	57	0.08	4.56
Total solids	320	57	0.07	3.99	295	60	0.07	4.2	255	65	0.07	4.55	268	64	0.07	4.48
		NSFWQI		**53.27**		NSFWQI		**52.85**		NSFWQI		**53.27**		NSFWQI		**53.18**
	Mar-2015								**Apr-2015**							
Parameter	S1	Q	W	QW	S2	Q	W	QW	S1	Q	W	QW	S2	Q	W	QW
Temperature	31.2	8.8	0.1	0.88	32.5	7.5	0.1	0.75	33.9	6.1	0.1	0.61	24.2	16.8	0.1	1.68
pH	8.4	70	0.11	7.7	8.3	73	0.11	8.03	8.4	70	0.11	7.7	7.9	87	0.11	9.57
BOD	2.8	68	0.11	7.48	3.1	66	0.11	7.26	3.8	62	0.11	6.82	4.3	59	0.11	6.49
Fecal coliform	255	35	0.16	5.6	280	34	0.16	5.44	300	34	0.16	5.44	335	32	0.16	5.12
Nitrate	45.1	14	0.1	1.4	48.0	12	0.1	1.2	45.0	14	0.1	1.4	48.0	12	0.1	1.2
Phosphate	1.87	28	0.1	2.8	1.9	28	0.1	2.8	2.15	26	0.1	2.6	2.24	26	0.1	2.6
DO % saturation	115	93	0.17	15.81	113	94	0.17	15.98	130	84	0.17	14.28	125	87	0.17	14.79
Turbidity	15	67	0.08	5.36	18	63	0.08	5.04	19	62	0.08	4.96	20	61	0.08	4.88

Total solids	280	62	0.07	4.34	270	63	0.07	4.41	290	61	0.07	4.24	302	59	0.07	4.13
	NSFWQI			**51.37**		NSFWQI		**50.91**	NSFWQI			**48.05**		NSFWQI		**50.46**

	May-2015								**Jun-2015**							
Parameter	S1	Q	W	QW	S2	Q	W	QW	S1	Q	W	QW	S2	Q	W	QW
Temperature	35.8	3.2	0.1	0.32	35.9	4.1	0.1	0.41	36.2	4.8	0.1	0.48	36.8	4.2	0.1	0.42
pH	8	84	0.11	9.24	7.8	90	0.11	9.9	8.2	77	0.11	8.47	8.5	66	0.11	7.26
BOD	4.7	57	0.11	6.27	5.1	55	0.11	6.05	5.5	53	0.11	5.83	5.7	52	0.11	5.72
Fecal coliform	370	31	0.16	4.96	330	33	0.16	5.28	365	32	0.16	5.12	380	31	0.16	4.96
Nitrate	47.2	12	0.1	1.2	50.3	10	0.1	1	48.0	12	0.1	1.2	44.0	15	0.1	1.5
Phosphate	2.38	25	0.1	2.5	2.5	24	0.1	2.4	1.58	30	0.1	3	1.15	37	0.1	3.7
DO % saturation	153	50	0.17	8.5	168	50	0.17	8.5	180	50	0.17	8.5	166	50	0.17	8.5
Turbidity	30	53	0.08	4.24	26	56	0.08	4.48	32	51	0.08	4.08	24	58	0.08	4.64
Total solids	325	56	0.07	3.92	298	60	0.07	4.2	320	57	0.07	3.99	335	55	0.07	3.85
		NSFWQI		**41.15**		NSFWQI		**42.22**		NSFWQI		**40.67**		NSFWQI		**40.55**

	July 2015 to Dec.2015

	Jul-2015								**Aug.-2015**							
Parameter	S1	Q	W	QW	S2	Q	W	QW	S1	Q	W	QW	S2	Q	W	QW
Temperature	27.5	12.5	0.1	1.25	28.5	11.5	0.1	1.15	29.2	10.8	0.1	1.08	29.9	10.1	0.1	1.01
pH	7.9	87	0.11	9.57	7.8	90	0.11	9.9	7.7	91	0.11	10.01	8.3	73	0.11	8.03
BOD	4.6	58	0.11	6.38	4.5	58	0.11	6.38	4.8	57	0.11	6.27	4.2	60	0.11	6.6
Fecal coliform	180	38	0.16	6.08	210	36	0.16	5.76	220	36	0.16	5.76	240	36	0.16	5.76
Nitrate	35.0	22	0.1	2.2	38.0	19	0.1	1.9	42.0	16	0.1	1.6	45.0	14	0.1	1.4
Phosphate	1.5	31	0.1	3.1	1.7	29	0.1	2.9	1.8	29	0.1	2.9	1.95	27	0.1	2.7
DO% saturation	78	85	0.17	14.45	77	84	0.17	14.28	90	95	0.17	16.15	95	98	0.17	16.66
Turbidity	45	42	0.08	3.36	40	45	0.08	3.6	50	39	0.08	3.12	55	36	0.08	2.88
Total solids	280	62	0.07	4.34	285	61	0.07	4.27	270	63	0.07	4.41	255	65	0.07	4.55
	NSFWQI			**50.73**	NSFWQI			**50.14**	NSFWQI			**51.3**	NSFWQI			**49.59**
	Sep-2015								**Oct-2015**							
Parameter	S1	Q	W	QW	S2	Q	W	QW	S1	Q	W	QW	S2	Q	W	QW
Temperature	30.8	9.2	0.1	0.92	31.2	8.8	0.1	0.88	29.1	10.9	0.1	1.09	29.5	10.5	0.1	1.05
pH	8.4	70	0.11	7.7	8.54	66	0.11	7.26	8.6	63	0.11	6.93	8.2	77	0.11	8.47
BOD	3.7	63	0.11	6.93	4.2	60	0.11	6.6	4.9	56	0.11	6.16	4.6	58	0.11	6.38
Fecal coliform	260	35	0.16	5.6	280	34	0.16	5.44	275	34	0.16	5.44	295	34	0.16	5.44
Nitrate	48.0	12	0.1	1.2	50.4	10	0.1	1	55.0	8	0.1	0.8	45.0	14	0.1	1.4
Phosphate	2.1	26	0.1	2.6	2.25	26	0.1	2.6	2.35	25	0.1	2.5	2.45	24	0.1	2.4
DO % saturation	88	93	0.17	15.81	81	88	0.17	14.96	98	99	0.17	16.83	103	99	0.17	16.83
Turbidity	46	41	0.08	3.28	44	43	0.08	3.44	55	36	0.08	2.88	65	31	0.08	2.48
Total solids	215	71	0.07	4.97	225	69	0.07	4.83	190	74	0.07	5.18	205	72	0.07	5.04
	NSFWQI			**49.01**	NSFWQI			**47.01**	NSFWQI			**47.81**	NSFWQI			**49.49**

	Nov-2015								**Dec-2015**							
Parameter	S1	Q	W	QW	S2	Q	W	QW	S1	Q	W	QW	S2	Q	W	QW
Temperature	26.5	13.5	0.1	1.35	27	13	0.1	1.3	25.5	15	0.1	1.5	26.2	13.8	0.1	1.38
pH	7.9	87	0.11	9.57	8.1	80	0.11	8.8	8.2	77	0.11	8.47	8.4	70	0.11	7.7
BOD	4.5	58	0.11	6.38	4.8	57	0.11	6.27	5	56	0.11	6.16	5.9	51	0.11	5.61
Fecal coliform	320	33	0.16	5.28	340	32	0.16	5.12	385	31	0.16	4.96	398	31	0.16	4.96
Nitrate	38.2	19	0.1	1.9	40.3	17	0.1	1.7	45.0	14	0.1	1.4	45.0	14	0.1	1.4
Phosphate	2.5	24	0.1	2.4	2.65	23	0.1	2.3	1.85	28	0.1	2.8	2	27	0.1	2.7
DO % saturation	109	96	0.17	16.32	115	93	0.17	15.81	100	99	0.17	16.83	117	92	0.17	15.64
Turbidity	38	47	0.08	3.76	25	57	0.08	4.56	18	63	0.08	5.04	20	61	0.08	4.88
Total solids	228	69	0.07	4.83	235	68	0.07	4.76	245	67	0.07	4.69	200	73	0.07	5.11
	NSFWQI			**51.79**	NSFWQI			**50.62**	NSFWQI			**51.85**	NSFWQI			**49.38**

	Jan.2016 to June 2016															
	Jan-2016								**Feb-2016**							
Parameter	S1	Q	W	QW	S2	Q	W	QW	S1	Q	W	QW	S2	Q	W	QW
Temperature	28	12	0.1	1.2	27.5	12.5	0.1	1.25	28.5	11.5	0.1	1.15	28	12	0.1	1.2
pH	7.6	92	0.11	10.12	7.8	90	0.11	9.9	8	84	0.11	9.24	8.3	73	0.11	8.03
BOD	6.8	47	0.11	5.17	6.9	46	0.11	5.06	5	56	0.11	6.16	3	67	0.11	7.37
Fecal coliform	170	39	0.16	6.24	199	37	0.16	5.92	220	36	0.16	5.76	250	35	0.16	5.6
Nitrate	40.0	18	0.1	1.8	45	14	0.1	1.4	47.5	12	0.1	1.2	49.1	11	0.1	1.1
Phosphate	1.4	33	0.1	3.3	1.45	32	0.1	3.2	1.55	31	0.1	3.1	1.65	30	0.1	3
DO % saturation	112	95	0.17	16.15	113	94	0.17	15.98	102	99	0.17	16.83	89	94	0.17	15.98
Turbidity	25	57	0.08	4.56	28	55	0.08	4.4	32	51	0.08	4.08	35	49	0.08	3.92
Total solids	295	60	0.07	4.2	278	62	0.07	4.34	260	65	0.07	4.55	240	67	0.07	4.69
		NSFWQI		**52.54**		NSFWQI		**51.45**		NSFWQI		**52.07**		NSFWQI		**50.89**
	Mar-2016								**Apr-2016**							
Parameter	S1	Q	W	QW	S2	Q	W	QW	S1	Q	W	QW	S2	Q	W	QW
Temperature	32.2	7.8	0.1	0.78	32.7	7.3	0.1	0.73	34	6	0.1	0.6	34.6	5.4	0.1	0.54
pH	8.6	63	0.11	6.93	8.7	59	0.11	6.49	8.9	52	0.11	5.72	8.8	56	0.11	6.16
BOD	3.5	64	0.11	7.04	3.9	62	0.11	6.82	4.2	60	0.11	6.6	4.8	57	0.11	6.27
Fecal coliform	262	35	0.16	5.6	290	34	0.16	5.44	320	33	0.16	5.28	355	32	0.16	5.12
Nitrate	50.0	10	0.1	1	51.0	10	0.1	1	55.0	8	0.1	0.8	57.0	7	0.1	0.7
Phosphate	1.85	28	0.1	2.8	1.95	27	0.1	2.7	2.205	26	0.1	2.6	2.35	25	0.1	2.5
DO % saturation	105	98	0.17	16.66	107	97	0.17	16.49	120	90	0.17	16.3	114	93	0.17	15.81
Turbidity	18	63	0.08	5.04	22	59	0.08	4.72	18	63	0.08	5.04	19	62	0.08	4.96
Total solids	205	72	0.07	5.04	220	70	0.07	4.9	190	74	0.07	5.18	205	72	0.07	5.04
		NSFWQI		**50.89**		NSFWQI		**49.29**		NSFWQI		**48.12**		NSFWQI		**47.1**

	May-2016								**Jun-2016**							
Parameter	S1	Q	W	QW	S2	Q	W	QW	S1	Q	W	QW	S2	Q	W	QW
Temperature	35.9	4.1	0.1	0.41	36.2	3.8	0.1	0.38	37	3	0.1	0.3	37.5	2.5	0.1	0.25
pH	8.8	56	0.11	6.16	8.9	52	0.11	5.72	8.6	63	0.11	6.93	9	49	0.11	5.39
BOD	4.9	56	0.11	6.16	5.5	53	0.11	5.83	5.8	52	0.11	5.72	5.9	51	0.11	5.61
Fecal coliform	370	31	0.16	4.96	390	31	0.16	4.96	345	32	0.16	5.12	360	32	0.16	5.12
Nitrate	59.4	7	0.1	0.7	55.2	8	0.1	0.8	58.0	7	0.1	0.7	54.0	8	0.1	0.8
Phosphate	2.45	24	0.1	2.4	2.51	24	0.1	2.4	2.1	26	0.1	2.6	1.95	27	0.1	2.7
DO % saturation	139	79	0.17	13.43	129	85	0.17	14.45	146	50	0.17	8.5	138	79	0.17	13.43
Turbidity	20	61	0.08	4.88	21	60	0.08	4.8	35	49	0.08	3.92	38	47	0.08	3.76
Total solids	225	69	0.07	4.83	210	71	0.07	4.97	255	65	0.07	4.55	272	63	0.07	4.41
		NSFWQI		**43.93**		NSFWQI		**44.31**		NSFWQI		**38.34**		NSFWQI		**41.47**

Table -52.Water Quality Index-Analysed Status Station III & IV (July 2014 to June 2016)

	Jul-14		**Aug-14**		**Sep-14**		**Oct-14**		**Nov-14**		**Dec-14**	
Stations	S3	S4	S3	S4	S3	S4	S3	S4	S3	S4	S3	S4
NSFQI Value	52.29	52.22	51.88	51.02	47.58	49.08	51.07	50.05	53.42	52.89	52.08	52.4
Status	Medium	Medium	Medium	Medium	Poor	Poor	Medium	Medium	Medium	Medium	Medium	Medium
	Jan-15		**Feb-15**		**Mar-15**		**Apr-15**		**May-15**		**Jun-15**	
Stations	S3	S4	S3	S4	S3	S4	S3	S4	S3	S4	S3	S4
NSFQI Value	52.17	51.66	52.08	50.1	50.65	49.85	45.96	45.27	44.55	45.68	37.08	36.92
Status	Medium	Medium	Medium	Medium	Medium	Poor	Poor	Poor	Poor	Poor	Poor	Poor
	Jul-15		**Aug-15**		**Sep-15**		**Oct-15**		**Nov-15**		**Dec-15**	
Stations	S3	S4	S3	S4	S3	S4	S3	S4	S3	S4	S3	S4
NSFQI Value	49.18	48.79	48.25	48.02	47.08	44.16	44.29	45.22	48.16	47.53	49.19	48.39
Status	Poor	Poor	Poor	Poor	Poor	Poor	Poor	Poor	Poor	Poor	Poor	Poor
	Jan-16		**Feb-16**		**Mar-16**		**Apr-16**		**May-16**		**Jun-16**	
Stations	S3	S4	S3	S4	S3	S4	S3	S4	S3	S4	S3	S4
NSFQI Value	51.24	50.49	49.45	49.53	49.85	46.95	47.03	46.3	44.88	43.42	41.88	41.17
Status	Medium	Medium	Poor	Poor	Poor	Poor	Poor	Poor	Poor	Poor	Poor	Poor

	July 2014 to Dec 2014															
	Jul-14								**Aug-14**							
Parameter	S3	Q	W	QW	S4	Q	W	QW	S3	Q	W	QW	S4	Q	W	QW
Temperature	25.5	14.5	0.1	1.45	26.9	13.1	0.1	1.31	27.5	12.5	0.1	1.25	28.8	11.2	0.1	1.12
PH	7.8	90	0.11	9.9	8.0	84	0.11	9.24	7.7	91	0.11	10.01	8.2	77	0.11	8.47
BOD	2.2	76	0.11	8.36	2.6	69	0.11	7.59	2.8	68	0.11	7.48	2.6	69	0.11	7.59
Fecal coliform	155	40	0.16	6.4	170	39	0.16	6.24	180	38	0.16	6.08	199	37	0.16	5.92
Nitrate	30.2	27	0.1	2.7	32.5	25	0.1	2.5	33.5	24	0.1	2.4	35.7	21	0.1	2.1
Phosphate	1.95	27	0.1	2.7	2.20	26	0.1	2.6	2.30	25	0.1	2.5	2.45	24	0.1	2.4
DO % saturation	76	82	0.17	13.94	81	88	0.17	14.96	76	82	0.17	13.94	80	87	0.17	14.79
Turbidity	36	48	0.08	3.84	34	50	0.08	4	31	52	0.08	4.16	33	51	0.08	4.08
Total solids	370	50	0.07	3.5	340	54	0.07	3.78	315	58	0.07	4.06	260	65	0.07	4.55
	NSFWQI			**52.29**	NSFWQI			**52.22**	NSFWQI			**51.88**	NSFWQI			**51.02**
	Sep-14								**Oct-14**							
Parameter	S3	Q	W	QW	S4	Q	W	QW	S3	Q	W	QW	S4	Q	W	QW
Temperature	30.0	10	0.1	1	30.5	9.5	0.1	0.95	28.2	11.8	0.1	1.18	29.0	11	0.1	1.1
PH	8.1	80	0.11	8.8	8.5	66	0.11	7.26	8.6	63	0.11	6.93	8.4	70	0.11	7.7
BOD	2.4	72	0.11	7.92	2.5	70	0.11	7.7	2.8	68	0.11	7.48	3.8	62	0.11	6.82
Fecal coliform	225	36	0.16	5.76	242	36	0.16	5.76	255	35	0.16	5.6	265	35	0.16	5.6
Nitrate	38.0	19	0.1	1.9	40.0	18	0.1	1.8	32.0	25	0.1	2.5	36.0	21	0.1	2.1
Phosphate	2.25	26	0.1	2.6	2.35	25	0.1	2.5	2.10	26	0.1	2.6	2.35	25	0.1	2.5
DO % saturation	69	73	0.17	11.73	83	89	0.17	15.13	103	99	0.17	16.83	101	99	0.17	16.83
Turbidity	40	45	0.08	3.6	45	42	0.08	3.36	50	39	0.08	3.12	60	33	0.08	2.64
total solids	290	61	0.07	4.27	250	66	0.07	4.62	225	69	0.07	4.83	235	68	0.07	4.76
	NSFWQI			**47.58**	NSFWQI			**49.08**	NSFWQI			**51.07**	NSFWQI			**50.05**

	Nov-14								**Dec-14**							
Parameter	S3	Q	W	QW	S4	Q	W	QW	S3	Q	W	QW	S4	Q	W	QW
Temperature	26.9	13.1	0.1	1.31	26.5	13.5	0.1	1.35	25.2	14.8	0.1	1.48	24.8	15.2	0.1	1.52
PH	7.8	90	0.11	9.9	7.9	87	0.11	9.57	8.1	80	0.11	8.8	8.3	73	0.11	8.03
BOD	3.4	65	0.11	7.15	3.5	64	0.11	7.04	3.8	62	0.11	6.82	3.2	66	0.11	7.26
Fecal coliform	280	34	0.16	5.44	295	34	0.16	5.44	280	34	0.16	5.44	325	33	0.16	5.28
Nitrate	32.0	25	0.1	2.5	35.0	22	0.1	2.2	39.0	18	0.1	1.8	36.2	21	0.1	2.1
Phosphate	1.95	27	0.1	2.7	2.15	26	0.1	2.6	2.90	22	0.1	2.2	2.75	23	0.1	2.3
DO % saturation	122	89	0.17	15.13	124	88	0.17	14.96	106	98	0.17	16.66	108	97	0.17	16.49
Turbidity	29	54	0.08	4.32	18	63	0.08	5.04	14	69	0.08	5.52	11	74	0.08	5.92
Total solids	210	71	0.07	4.97	240	67	0.07	4.69	390	48	0.07	3.36	375	50	0.07	3.5
	NSFWQI			**53.42**	NSFWQI			**52.89**	NSFWQI			**52.08**	NSFWQI			**52.4**

	Jan. 2015 to June 2015															
	JAN-2015								**FEB-2015**							
Parameter	S3	Q	W	QW	S4	Q	W	QW	S3	Q	W	QW	S4	Q	W	QW
Temperature	27.5	12.5	0.1	1.25	26..9	13.1	0.1	1.31	30.2	9.8	0.1	0.98	29.5	10.5	0.1	1.05
pH	7.7	91	0.11	10.01	7.8	90	0.11	9.9	7.8	90	0.11	9.9	8.4	70	0.11	7.7
BOD	5.9	51	0.11	5.61	6.0	51	0.11	5.61	5.2	55	0.11	6.05	3.8	62	0.11	6.82
Fecal coliform	288	34	0.16	5.44	295	34	0.16	5.44	245	35	0.16	5.6	270	35	0.16	5.6
Nitrate	34.0	23	0.1	2.3	38.0	19	0.1	1.9	41.0	17	0.1	1.7	43.0	15	0.1	1.5
Phosphate	2.30	25	0.1	2.5	2.40	25	0.1	2.5	2.69	23	0.1	2.3	2.85	22	0.1	2.2
DO % saturation	108	97	0.17	16.49	103	99	0.17	16.83	96	99	0.17	16.83	92	97	0.17	16.49
Turbidity	23	59	0.08	4.72	20	61	0.08	4.88	30	53	0.08	4.24	28	55	0.08	4.4
Total solids	333	55	0.07	3.85	395	47	0.08	3.29	266	64	0.07	4.48	280	62	0.07	4.34
		NSFWQI		**52.17**		NSFWQI		**51.66**		NSFWQI		**52.08**		NSFWQI		**50.1**
	Mar-2015								**Apr-2015**							
Parameter	S3	Q	W	QW	S4	Q	W	QW	S3	Q	W	QW	S4	Q	W	QW
Temperature	30.8	9.2	0.1	0.92	31.9	8.1	0.1	0.81	33.5	6.5	0.1	0.65	35.0	5	0.1	0.5
pH	8.6	63	0.11	6.93	8.5	66	0.11	7.26	8.8	56	0.11	6.16	8.9	52	0.11	5.72
BOD	2.2	76	0.11	8.36	3.2	66	0.11	7.26	4.8	57	0.11	6.27	4.0	61	0.11	6.71
Fecal coliform	295	34	0.16	5.44	310	33	0.16	5.28	330	33	0.16	5.28	355	32	0.16	5.12
Nitrate	48.2	11	0.1	1.1	50.0	10	0.1	1	47.0	12	0.1	1.2	52.3	9	0.1	0.9
Phosphate	2.99	21	0.1	2.1	3.10	21	0.1	2.1	3.55	19	0.1	1.9	3.20	20	0.1	2
DO % saturation	107	97	0.17	16.49	112	95	0.17	16.15	123	88	0.17	14.96	119	90	0.17	15.3
Turbidity	18	63	0.08	5.04	20	61	0.08	4.88	17	65	0.08	5.2	19	62	0.08	4.96
Total solids	290	61	0.07	4.27	300	73	0.07	5.11	280	62	0.07	4.34	312	58	0.07	4.06
	NSFWQI			**50.65**		NSFWQI		**49.85**	NSFWQI			**45.96**		NSFWQI		**45.27**

	May-2015								**Jun-2015**							
Parameter	S3	Q	W	QW	S4	Q	W	QW	S3	Q	W	QW	S4	Q	W	QW
Temperature	35.2	4.8	0.1	0.48	36.2	3.8	0.1	0.38	36.8	3.8	0.1	0.38	37.1	2.9	0.1	0.29
pH	8.3	73	0.11	8.03	8.2	77	0.11	8.47	8.6	63	0.11	6.93	8.9	52	0.11	5.72
BOD	3.9	62	0.11	6.82	3.0	67	0.11	7.37	4.5	58	0.11	6.38	4.1	60	0.11	6.6
Fecal coliform	390	31	0.16	4.96	410	31	0.16	4.96	385	31	0.16	4.96	350	32	0.16	5.12
Nitrate	50.0	10	0.1	1	54.0	8	0.1	0.8	51.3	9	0.1	0.9	49.4	10	0.1	1
Phosphate	3.55	19	0.1	1.9	3.75	18	0.1	1.8	3.80	18	0.1	1.8	2.95	22	0.1	2.2
DO % saturation	139	79	0.17	13.43	133	82	0.17	13.94	151	50	0.17	8.5	146	50	0.17	8.5
Turbidity	32	51	0.08	4.08	29	54	0.08	4.32	33	51	0.08	4.08	35	49	0.08	3.92
Total solids	335	55	0.07	3.85	358	52	0.07	3.64	340	54	0.07	3.87	365	51	0.07	3.57
		NSFWQI		**44.55**		NSFWQI		**45.68**		NSFWQI		**37.08**		NSFWQI		**36.92**

	July 2015 to Dec.2015															
	Jul-2015								**Aug.-2015**							
Parameter	S3	Q	W	QW	S4	Q	W	QW	S3	Q	W	QW	S4	Q	W	QW
Temperature	28.2	11.8	0.1	1.18	29.0	11	0.1	1.1	27.9	12.1	0.1	1.21	28.5	11.5	0.1	1.15
pH	8.0	84	0.11	9.24	7.9	87	0.11	9.57	7.8	90	0.11	9.9	8.4	70	0.11	7.7
BOD	4.8	57	0.11	6.27	4.1	60	0.11	6.6	4.5	58	0.11	6.38	4.0	61	0.11	6.71
Fecal coliform	220	36	0.16	5.76	250	35	0.16	5.6	235	36	0.16	5.76	266	35	0.16	5.6
Nitrate	38.0	19	0.1	1.9	41.2	17	0.1	1.7	44.2	14	0.1	1.4	46.2	13	0.1	1.3
Phosphate	1.60	30	0.1	3	1.90	28	0.1	2.8	2.20	26	0.1	2.6	2.50	24	0.1	2.4
DO% saturation	77	84	0.17	14.28	75	81	0.17	13.77	75	81	0.17	13.77	89	94	0.17	15.98
Turbidity	47	41	0.08	3.28	42	44	0.08	3.52	53	37	0.08	2.96	55	36	0.08	2.88
Total solids	290	61	0.07	4.27	305	59	0.07	4.13	290	61	0.07	4.27	268	64	0.07	4.48
	NSFWQI			**49.18**	NSFWQI			**48.79**	NSFWQI			**48.25**	NSFWQI			**48.02**
	Sep-2015								**Oct-2015**							
Parameter	S3	Q	W	QW	S4	Q	W	QW	S3	Q	W	QW	S4	Q	W	QW
Temperature	29.5	10.5	0.1	1.05	30.5	9.5	0.1	0.95	30.0	10	0.1	1	28.5	11.5	0.1	1.15
pH	8.6	63	0.11	6.93	8.8	56	0.11	6.16	8.9	52	0.11	5.72	8.7	59	0.11	6.49
BOD	3.9	62	0.11	6.82	4.6	58	0.11	6.38	5.2	55	0.11	6.05	5.6	53	0.11	5.83
Fecal coliform	275	34	0.16	5.44	297	34	0.16	5.44	315	33	0.16	5.28	345	32	0.16	5.12
Nitrate	49.0	11	0.1	1.1	53.3	8	0.1	0.8	58.0	7	0.1	0.7	47.0	12	0.1	1.2
Phosphate	2.80	22	0.1	2.2	2.45	24	0.1	2.4	2.55	24	0.1	2.4	2.68	23	0.1	2.3
DO % saturation	92	97	0.17	16.49	77	84	0.17	14.28	82	89	0.17	15.13	88	93	0.17	15.81
Turbidity	48	40	0.08	3.2	49	40	0.08	3.2	52	38	0.08	3.04	68	30	0.08	2.56
Total solids	335	55	0.07	3.85	255	65	0.07	4.55	210	71	0.07	4.97	235	68	0.07	4.76
	NSFWQI			**47.08**	NSFWQI			**44.16**	NSFWQI			**44.29**	NSFWQI			**45.22**

	Nov-2015								**Dec-2015**							
Parameter	S3	Q	W	QW	S4	Q	W	QW	S3	Q	W	QW	S4	Q	W	QW
Temperature	27.5	12.5	0.1	1.25	28.3	11.7	0.1	1.17	26.5	13.5	0.1	1.35	27.3	12.7	0.1	1.27
pH	8.5	66	0.11	7.26	8.7	59	0.11	6.49	8.5	66	0.11	7.26	8.6	63	0.11	6.93
BOD	5.5	53	0.11	5.83	5.8	52	0.11	5.72	5.6	53	0.11	5.83	5.9	51	0.11	5.61
Fecal coliform	362	32	0.16	5.12	381	31	0.16	4.96	401	31	0.16	4.96	418	30	0.16	4.8
Nitrate	42.3	16	0.1	1.6	45.2	14	0.1	1.4	48.0	12	0.1	1.2	50.0	10	0.1	1
Phosphate	2.72	23	0.1	2.3	2.95	21	0.1	2.1	2.55	24	0.1	2.4	2.60	24	0.1	2.4
DO % saturation	95	98	0.17	16.66	103	99	0.17	16.83	98	99	0.17	16.83	103	99	0.17	16.83
Turbidity	42	44	0.08	3.52	30	53	0.08	4.24	20	61	0.08	4.88	23	59	0.08	4.72
Total solids	252	66	0.07	4.62	247	66	0.07	4.62	265	64	0.07	4.48	230	69	0.07	4.83
	NSFWQI			**48.16**	NSFWQI			**47.53**	NSFWQI			**49.19**	NSFWQI			**48.39**

	Jan.2016 to June 2016															
	Jan-2016								**Feb-2016**							
Parameter	S3	Q	W	QW	S4	Q	W	QW	S3	Q	W	QW	S4	Q	W	QW
Temperature	28.8	11.2	0.1	1.12	28.4	11.6	0.1	1.16	29.5	10.5	0.1	1.05	29.0	11	0.1	1.1
pH	7.9	87	0.11	9.57	8.0	84	0.11	9.24	8.2	77	0.11	8.47	8.4	70	0.11	7.7
BOD	6.2	50	0.11	5.5	6.0	51	0.11	5.61	5.8	52	0.11	5.72	3.5	64	0.11	7.04
Fecal coliform	225	36	0.16	5.76	266	35	0.16	5.6	290	34	0.16	5.44	320	33	0.16	5.28
Nitrate	44.0	15	0.1	1.5	49.0	11	0.1	1.1	48.0	12	0.1	1.2	51.1	9	0.1	0.9
Phosphate	1.90	28	0.1	2.8	2.15	26	0.1	2.6	2.55	24	0.1	2.4	2.65	23	0.1	2.3
DO % saturation	109	96	0.17	16.32	105	98	0.17	16.66	97	99	0.17	16.83	99	99	0.17	16.83
Turbidity	27	55	0.08	4.4	29	54	0.08	4.32	34	50	0.08	4	37	47	0.08	3.76
Total solids	285	61	0.07	4.27	298	60	0.07	4.2	277	62	0.07	4.34	250	66	0.07	4.62
		NSFWQI		**51.24**		NSFWQI		**50.49**		NSFWQI		**49.45**		NSFWQI		**49.53**
	Mar-2016								**Apr-2016**							
Parameter	S3	Q	W	QW	S4	Q	W	QW	S3	Q	W	QW	S4	Q	W	QW
Temperature	31.9	8.1	0.1	0.81	32.5	7.5	0.1	0.75	35.0	5	0.1	0.5	35.5	4.5	0.1	0.45
pH	8.8	56	0.11	6.16	8.9	52	0.11	5.72	8.7	59	0.11	6.49	8.6	63	0.11	6.93
BOD	2.9	68	0.11	7.48	4.5	58	0.11	6.38	4.9	56	0.11	6.16	5.2	55	0.11	6.05
Fecal coliform	355	32	0.16	5.12	390	31	0.16	4.96	380	31	0.16	4.96	385	31	0.16	4.96
Nitrate	53.4	8	0.1	0.8	55.0	8	0.1	0.8	58.0	7	0.1	0.7	59.0	9	0.1	0.9
Phosphate	2.85	22	0.1	2.2	2.95	21	0.1	2.1	3.05	21	0.1	2.1	3.25	20	0.1	2
DO % saturation	107	97	0.17	16.49	103	99	0.17	16.83	115	93	0.17	15.81	120	90	0.17	15.3
Turbidity	19	62	0.08	4.96	23	59	0.08	4.72	17	65	0.08	5.2	20	61	0.08	4.88
Total solids	225	69	0.07	4.83	240	67	0.07	4.69	200	73	0.07	5.11	225	69	0.07	4.83
		NSFWQI		**48.85**		NSFWQI		**46.95**		NSFWQI		**47.03**		NSFWQI		**46.3**

	May-2016								**Jun-2016**							
Parameter	S3	Q	W	QW	S4	Q	W	QW	S3	Q	W	QW	S4	Q	W	QW
Temperature	36.0	4	0.1	0.4	36.5	3.5	0.1	0.35	37.2	2.8	0.1	0.28	37.9	2.1	0.1	0.21
pH	8.4	70	0.11	7.7	9.0	49	0.11	5.39	8.9	52	0.11	5.72	9.1	46	0.11	5.06
BOD	5.8	52	0.11	5.72	5.0	56	0.11	6.16	4.8	57	0.11	6.27	4.2	60	0.11	6.6
Fecal coliform	395	31	0.16	4.96	420	30	0.16	4.8	455	30	0.16	4.8	480	29	0.16	4.64
Nitrate	62.1	6	0.1	0.6	65.1	6	0.1	0.6	68.0	5	0.1	0.5	60.0	7	0.1	0.7
Phosphate	3.50	19	0.1	1.9	3.68	18	0.1	1.8	3.10	21	0.1	2.1	3.55	19	0.1	1.9
DO % saturation	132	83	0.17	14.11	122	89	0.17	15.13	132	83	0.17	14.11	131	83	0.17	14.11
Turbidity	21	60	0.08	4.8	24	58	0.08	4.64	38	47	0.08	3.76	39	46	0.08	3.68
Total solids	245	67	0.07	4.69	250	65	0.07	4.55	278	62	0.07	4.34	288	61	0.07	4.27
		NSFWQI		**44.88**		NSFWQI		**43.42**		NSFWQI		**41.88**		NSFWQI		**41.17**

DISCUSSION

DISCUSSION

The current study was conducted in02 years from July 2014 to June 2016. Four sampling sites were selected at the **Mansarovar Talab of Jeerapura** for the present research work.

Physico-chemical parameters:

1. Temperature:

The Temperature is one of the most important factors in an aquatic environment and profoundly influences the nature of water body. In general,water temperaturevaried from 24.8 to 37.9^{o}C. The lowest water temperature was observed at samplingsite04 in December in the year 2014-2015 and highest range was observed at sampling site 04 in June in the year 2015-2016. ***Sharma et al., (2013)***observedtemperature varied from 25ºC to 42ºC in Kunda river, Khargone (M.P.). ***Sharma et al., (2008)***observedtemperature fluctuation between 20.6ºC to 38.4ºC while studying the hydrological parameters of Narmada river at Hoshangabad. The result of current study is assisted by the research work of ***Sharma et al., (2008).***

2. Transparency:

Transparency of the water body is mainly affected by the suspended molecule and other component like plankton growth, nature of water, rainfall and temptature conditions. In general, transparency varied from 19.8 to 50.0 cm. The lowest transparency was observed atsamplng site 02 in July in the year of 2015- 2016. This was due to the increased number of particles which were added by surface runoff. The highest transparency was at sampling site04 in November in the year 2015-2016. This was due to settling

of particles. ***Yadav and Shrivastava (2011)***observed the water transparency varied from25 to110 cm in the river Ganga at Ghazipur. ***Prabhakar et al., (2012)*** observed Transparency rangefrom 7.30 cm to 20.89 cm. In palar River, Vellore district Tamilnadu. ***Zahoor et al., (2012)***recorded a similar range of transparency the physico-chemical parameters of Narmada river. ***Chaurasia (2013)***recorded same range of water transparency in Kunda river (M.P).

3. Turbidity:

Turbidity is the measure of relative clarity of a liquid. In general, turbidity ranged from 11 to 68. The lowest turbidity was observed at sampling site04 in December in the year 2014-2015 and highest value was observed at sampling site04 in October in the year 2015-2016.

4. pH:

pH is very affected by photosynthetic activity of aquatic plants,disposal of sewage and disposal of industrial water and exposure of air temperature, etc.pH ranged from 7.4 to 9.1. The lowest pH was observed at samplingsite01 in January in the year 2014-15. The highest pH was observed at samplingsite 04 in June in 2015-16. ***Chaudhari et al., (2001)***observed pH ranged from 7.6 to 9.8 from Chatri lake. ***Gupta et al., (2001)***observed pH variedfrom 7.8 to 9.3 in Udaipur lakes. ***Shitika Barkale (2013-2015)*** found the pH variedfrom 7.4 to 9.4 in Bilawali talab, Indore. This study is supported by ***Shitika Barkale (2013-2015).***

5. Dissolved Oxygen:

Dissolved Oxygen is important for aquatic system and also essential for the metabolism in the organisms. air and photosynthetic activity There are two main sources of dissolved oxygen in water. In general, dissolved

oxygen ocillated between 5.2 to12.3 mg/l. The lowestrange was observed at samplingsite03 in September in the year of 2014-2015. The highest dissolved oxygen value was recorded at samplingsite01 in June in the year of 2014-2015. ***Sharma &Chowdhary (2011)*** recorded DO ocillated between 0.4 to 8 mg/l in river Tawi of Jammu and Kashmir. ***Sisodiya and Moundiotiya (2006)***recorded dissolved oxygen rangefrom 5.2 to 12.08 mg/l in Kalakho Lake, Rajasthan and same range was also observed***Sharam et al., (2011)***. The result of current study is supported by ***Sisodiya and Moundiotiya (2006).***

6. Total Solid:

The Total Solids are the sum of dissolved, suspended and settleable solids in water. it is also used to determine a sludge dry weight. The Total Solids fluctuated between 170 to 390 mg/l. The lowest Total Solids was observed at samplingsite02 in November in the year 2014-2015 and highest value was observed at samplingsite03 in December in the year 2014-2015.**Bhutiani et al (2014)** reported total solids varied from 112.00 mg/l lowest valueand 650.60 mg/l highest value in Ganga river. ***Tripathi et al (2014)***reported total solids value ocillated between 325.6 to 411.3 mg/l in river Ganga at Allahabad. ***Patil and Sharma (2016)***recorded total solid varied from 216 to 617 mg/l in river Narmada.With the results of this study similar results were recorded by ***Tripathi et al (2014) and Patil and Sharma (2016).***

7. Free CO_2:

The quantity of free CO_2 depends on the quantity of water or the quantity of gas in the atmosphere. The CO_2 content fluctuated from 1.2 to

8.5 mg/l. in the year 2014-2016. The lowest Free CO_2 was recorded at samplingsite01 in April in the year 2014-2015 and highest value was observed at samplingsite04 in November in the year 2015-2016. This might be due to increased and decreased biological activities of aquatic of fauna & flora. ***Singh et al. (1997)*** and ***Lakra (1990)***recorded low value of Free CO_2 during winter months. ***Singh et al. (1987)*** also observed highest and lowest of CO_2 in different months. ***Mandal and Haking (1977)***observed the highest & lowest CO_2 concentration in Febuaryand April months.

8. Total Alkalinity:

Total alkalinity is varied from225.4 to 499.0 mg/l. The lowestrange was observed at samplingsite02 in March in the year of 2014-2015. The highestrange was observed at samplingsite02 in November in the year of 2015-2016. During present highest total alkalinity was observed in winter and lowest in summer, was mostly because of bicarbonate as the ranged for carbonate alkalinity were observed to be much lower. In the present study, on the basis of bicarbonate concentration, various seasons may be arranged in the order of summer, decreasingly followed by rainy and winter seasons. The observations of Ganapati (1960), that increase of bicarbonate alkalinity is attributed to the lowering of oxygen concentration, was supported by ***Adoni (1975), Sankhla (1981). Selot (1977), and Dhakar (1979),*** however, did not observe this relationship. In the present study a relationship of this kind was clearly observed. ***Selot (1977), Jain (1978)*** and ***Dhakar (1979)*** have observed a rise of bicarbonate values with a rise in temperature, reaching their maximum in June. In the present study also a similar trend of this kind was observed.

9. Biochemical Oxygen Demand:

Biochemical oxygendemand involving of oxygen consumed by the micro-organism in stabilizing the biologically decomposable organic matter under aerobic conditions. The biochemical oxygen demand rangedfom 2.0 to 6.9 mg/l. The lowestBOD value was observed at samplingsite01 in August in the year 2014-2015. In the highestrange was recorded at samplingsite02 in January in the year of 2015-2016. ***Pandey (2007)***observed BOD ranged from 2 to 5.7 mg/l in Yeshwantsagar reservoir, Indore. ***Sharma et al., (2013)***observed BOD ocillated between 3.1 to 5.63mg/l in Kunda river, Khargone (M.P.). In this research work BOD value is higher than the result of ***Sharma et al., (2013).***

10. Hardness:

The hardness is governed by contents of magnesium salt, and calcium, largely combine with carbonates and bicarbonates, and with sulphate, chloride and other elements. The total hardness ocillatedfrom 105.0 to 330.0 mg/l. The lowest total hardness was observed at samplingsite02 in February in the year of 2014-2015 and highest total hardness at samplingsite04 in June in the year of 2014-2015. This highest value is due to continuous leaching an accumulation of salts in the absence of flow in summer months. ***Murhekar (2011)*** recoreded the total hardnessranged from 312 to 687 mg/l in and around Akot city. ***Bhawna Dawar (2013-14)***got the range of total hardness from 220 mg/l to 440 mg/l. at Shahid Chandra shekharazad dam, Jobat. The result of present study is lower than ***Bhawna Dawar (2013-14)*** &***Murhekar (2011).***

11.Magnesium:

In the present study Magnesium varied from 18.3 to 44.0 mg/l. The lowest Magnesium was observed at samplingsite02 in February in the year 2014-2015 and highest range was recorded at samplingsite04 in November in the year 2015-2016.***Shitika Barkale(2014-15)***magnesium value ranges from 11 to 48mg/L. ***Mariappan et al., (2002)***theMagnsium value varied from 9 to 31 mg/l. in Sivakasi. ***Jain & Shrivastava (1998)*** the magnesium value ocillated between 12 mg/l. to 40.6 mg/l. in Bharar River, district Chhatarpur. ***Jain et al., (2001)***observed the magnesium value 3.9 mg/l to 292 mg/l. in Karnataka. ***Shoukat Ara et al., (2000-2001)*** found the magnesium varied from 4.7 to 11 mg/l. ***Garg(2003)***observed the Magnesium ocillatedbeetween5 to 25 mg/l. in Chitrakut. ***Baruah et al., (2003)***observed the magnesium fluctuated10 to 30 mg/l. in Subansiri River, Assam. The present study was supported by the research work of ***Shitika Barkale (2014-15).***

12. Calcium:

Calcium varied from 35.5 to 74.2 mg/l. The lowest Calciumwas observed at samplingsite01 in August in the year 2014-2015 and highestrange was observed at samplingsite04 in May in the year 2014-2015. It being an important supporter to hardness in water and it reduce the useful of water for domestic use. ***Shitika Barkale (2014-15)***recorded the value of calcium17.2 to 58 Mg/l. at Bilawali talab,Indore.***Jadhav et al., (2006)***observed calcium varied from 52 to73 mg/l in Krishna river at Kharad, Maharastra. ***Murhekar (2011)***recorded the calciumranged from 147 to 472 mg/l in and around Akot city. ***Bajpai (2012)***observed calcium ocillated between 49 to 50 mg/l in Hasdeo river and 112.8 to 113.2 mg/l in Arpa river, Bilaspur region. ***Hamaidi et al., (2013)***calcium fluctuated

between 90 to 104 mg/l in Chiffa river, Algeria. This study supported by the research work of ***Jadhav et al., (2006).***

13.Chloride:

Chloride is present in fresh water in the form of calcium, magnesium and sodium salts. The concentration of chloride content is also used as an indicator of pollution in fresh water. In general, chloride varied from 23.4 to 69.3 mg/l. The lowestrange was observed at samplingsite01 in December in the year 2014-2015 and highestrange was at samplingsite04 in June in the year of 2014-2015. ***Sharma & Chowdhary (2011)***observedchloride ranged from 21.95 to 59.88 mg/l in river Tawi Jammu and Kashmir. ***Sharma et al., (2013)***observed Chloride varied from 0.3 mg/l to 53.4 mg/l in Kunda river, Khargone (M.P.). ***Sharma & Chowdhary (2011)*** reportedlow chloride range than the present work.

14.Nitrate:

Nitrogen is present in the form of organic nitrogen compounds, nitrate, ammonia, as nitrite. In general, nitrate varied from 26.0 to 68.0 mg/l. The lowestrange was observed at samplingsite02 in month of October in the year of 2014-2015 and highestrange was observed at samplingsite03 in June in the year of 2015-2016. ***Manjare et al., (2010)***recorded nitrate ranged from 4.4 to 36.8 mg/l in Kolhapur district Maharashtra. ***Bhawna dawar (2013)***recorded nitrate value varied from 0.05 to 55.0 mg/l.in Shahid Chandra shekharazad dam, jobat. This result is slightly higher than the result of ***Bhawna dawar (2013).***

15.Phosphate:

The main sources of phosphorus are domestic sewage detergents, industrial waste water and agricultural effluents with fertilizers.The study was phosphate value varied from 1.15 to 3.80 mg/l. The lowestrange was observed at samplingsite02 in June in the year of 2014-2015. The highestrange was at samplingsite03 in June in the year of 2014-2015. ***Sharma et al., (2008)*** while studying on Narmada river observed phosphate ranged from 6.2 to 21 mg/l. Phosphate value variedfrom 0.05 to 3.80 mg/l.***Bhawna dawar*** at shahid Chandra shekharazad dam, jobat in ***2015***. The similarvalue of ***Sharam et al., (2014), Sharma et al., (2013), Chouhan (2013) and Choursiya (2013).***

16.Sulphate:

Sulphates are generally pesent in appreciable concentration and impart hardness to water. Mostly they are present in amounts more then adequate for fresh water productivity.It was fluctuated between4.9 to 9.9 mg/l. The lowestrange wasobserved at samplingsite 02 in Februaryin the year of 2014-2015. The highes value was at samplingsite 04 in September in the year of 2015-2016.***Shitika Barkale (2014-15)***recorded the value of sulphate varied from 4.8-115 mg/l. at bilawali talab, Indore. ***Sharma et al., (2011)*** recorded sulphate variedfrom 325 to 449 mg/l and 415 to 493 mg/l in pre-monsoon and monsoon seasons. ***Krishna (2012)*** recorded sulphate varied from 38.13 to 68.65 mg/l in Kaveri river, Kudige, Kodagu, Karnataka.This current research work supported by ***Shitika Barkale (2014-15).***

17.Total Coli Form:

The total coliform is found in the intestines of warm-blooded animal and therefor are present in sewage, on and in soil, surface waters and

vegetation. The total coliform group has been used for some time as an "indicator organism". An indicator organism byitself is considered to cause no dieseases in man or animal, but its presence usually indicates the presence of pathogenic or disease-causing organism.It was fluctuated between 300 to 660 MNP/100 ml. The lowest range wasobserved at samplingsite01 in July in the year 2014-2015. The highestrange was observed at samplingsite04 in December in the year of 2015-2016.***HrushikeshBehra et al. (2000)***recorded value of Total coliform from 1800 to 97000 MPN/100 ml. ***Bhawna dawar(2014-15)***recorded total coliform from 200 to 460 ml. in Shahid Chandra shekharazad dam, jobat. Present work is supported by ***Bhawna Dawar (2014-15).***

18. Faecal Coli form:

Faecal coliform bacteria are normally present in the feces of humans and animals. Faecal coliform bacteria enter the rivers directly or indirectly from the sewage system and agricultural runoffs. Disease causing organisms including bacteria, viruses, and other parasites can be a part of faecal coliform.Faecal coliform varied from 145 to 480 MNP/100 ml. The lowestFaecal coliform observed at samplingsite01 in July in the year 2014-2015. The highestFaecal coliform observed at samplingsite04 in June in the year of 2015-2016.Same results with the current study of Faecal coliform was obsreved by ***Basu et al (2012), Pratibha and Murulidhar (2015), Nicholson et al (2017).***

19.Biological Analysis:

The bottom fauna of this pond qualitatively diversified and rich. All together 32 species of bottom fauna were collected and identified. They

showed remarkable fluctuation both its quantity and quality in different season. The densities of oligochaetes and insects formed the main bulk consisting about 80% of the total collected benthos. The percentage abundance of oligochaetes was maximum in June and July while minimum in colder months. Insects, gastropods and ostracods showed their highest abundance during colder months and lowest during monsoon. However, variation in other groups were also registered but in haphazard fashion.

During biostatistical analysis of collected data, water temperature was correlated with DO but positive correlation of water temperature and phosphate as well as free CO_2. DO was found inverse relationship with Free CO_2. Inverse relationship such as Free CO_2 & pH, pH and phosphate but positive correlation with Free CO_2 and phosphate were exhibited.

Collected fishes of this pond were represented by 7 orders, 13 families, 17 genera and 23 species. Fishes were of all sizes but there were no any artificial manuring and introduction of fry, fingerlings and fishes could be recognized as the modest one.

Macro-invetrebrates- During the study period, Oligochaetes, Hirudinea (Leeches), Gastropods, palacypods, Insects, and Crustaceans were recorded.

20.Diversity Indices:

In Mansarovar Talab the physico-chemical characteristics develop many limnological habitats, with varying community structure and species composition. The higher the range of index, the greater the diversity and obviously the cleaner the environment. ***Willhm and Dorris (1966)*** have

distinguished three zones based on the status of water given with index values, which was found applicable to River Narmada.

The Shannon Weaver Species diversity Index (H) can be used for the evaluation of the stresses to the benthic macro invertebrate population due to changes in water quality. This will serve as a direct indication of the cumulative effect of environmental stress on benthic organisms.

In the current study, Shannon and Weaver Index from July 2014 to June 2015 was boserved in the variedfrom 1.16 to 1.93.July 2015 to June 2016 was observed in thevarid from 1.01 to 1.99.***Shukla and Shrivastava (2004)*** recorded value of H index in the range from 1.73 to 2.94 in Gandhisagar reservoir India. ***Nandan (2003)*** reported that diversity index for different species was generally low in the retting zones (H= 0.68 to 1.20) when compared to the non retting zone (H= 0.88 to 2.97) of Kadinamkulam backwaters. The lowest range of H was observed in the month of July and August, ***Bass and Potts (2001)*** reported the same decrease in diversity index during July and they attributed it to the emergence of several groups of aquatic insects prior to sampling. ***Bhat et al. (2011)*** recorded the value of H index in the range between H= 1.99 to 2.42 in Kashmir Himalayas. ***Sharma and Chowdhary (2011)***observed H value between H= 0.20 to 1.98 in River Tawi. ***Sharma et al (2010)***observedH index between H= 0.79 to 1.62 in river Chenab.

In the present study value of Simpson diversity index from July 2014 to June 2015 was observed in the varied from 0.50 to 0.84. July 2015 to June 2016 was observed in the varied from 0.50 to 0.85.***Shukla and Shrivastava (2004)*** recorded Simpson's index value between D= 0.74 to 0.86 at

Gandhisagar reservoir MP. Similar results were also reported by***Nkwoji (2010)*** giving the community diversity and species richness of macro invertebrates. ***Arab et al (2004)*** also reported high species richness in the upstream part of Chelif course, which decreases at the downstream site, where the water was heavily polluted. According to ***Duran and Suicmez (2007)***, the Cekerez stream of Turkey was characterised as class-I water quality with high species richness. ***Sharma et al (2010)*** recorded the value of Simpson's index between D= 0.21 to 0.54 in Chenab river. ***Sharma and Chowdhary (2011)*** recorded the value of Simpson's index between D= 0.31 to 0.91 in river Tawi, India.

21.Fish Diversity:

Fish production intalab, lake& reservoir is indirectly or directly dependent on the abundance of plankton and bottom fauna. The physico-chemical character of water determines the quantity and quality of the fauna. A total of twenty-three species of fish belonging to seventeen genera, under thirteen families and seven orders were recorded from Mansarovar talab. The most dominant family was cyprinidae 39.13% followed by Bargridae and Mastacembelidae 8.70% each. This is because these three groups are dominant in lentic water reservoirs of India & Bangladesh and are more tolerant towards pollution ***(Pathak, S. K. & Mudgal L.K., 2005)***. The family cyprinidae represents the bulk of fish species, which includes nine species. The important fish species recorded from this family *are Rasbora daniconius,Puntius sarana, Puntius ticto*, Family Bargridae represents second dominant family 8.70% comprised of two species namely *Mystusbleekeri and Mystusseenghala*. The family Siluridae represented by *Wallago attu*whereas Hetropneustidaerepresnted*by Heteropneustes fossilise*.

Family Clariidae is represented by a single species *Clariasbatrachus*, family Belontidae also recorded by single species*Colisa fasciatus*. The species recorded is Chanda nama andChannidae*Channa punctatus*, Family Notopteridae is alsorecorded by single species*Notopterusnotopterus*. The Mastacembelidae familyrecorded two species *Mastacebelusarmatus&Mastacembeluspancalus*. Family Clupeidae is also recorded by singlespecies *Hilsa hilsa*and family Nemacheilidae represented by *Noemacheilusbotia*. The Change in the composition of a fish assemblage often indicates a variation in the water quality parameters. Such asTemperature, pH, D.O. and Nutrient ***(Jhingran, 1982)***. Due to more fecundity of major corp and suitable environmental condition these exists a relatively higher number of cypriniforimes. Such type of observation was reported by ***Talwar &Jhingran (1991)*** and ***Das & Chand (2003) Pathak & Mudgal (2005)*** Indian fishes.

National Sanitation Foundation Water Quality Index (NSFWQI): -

It is a commonly-used water quality index (WQI) was developed by the National Sanitation Foundation (NSF) in 1970 ***(Brown and others, 1970)***. The NSF WQI was developed to provide a standardized method for comparing the water quality of various bodies of water. In the current study the same was used to check the status of water as per the standards. From the study it was observed that the value lies in the bad zone that is less than 50 but at some sites the value was just above the 50. The values of NSF WQI for different months of the two years are shown in the given. The lowest value was observed 36.92 in the month of June at S4 in the year 2014-2015 and 38.34 inthe monthof June at S1in the year 2015 -2016.This is mainly due to high temperature, high influence of humans as the site is mostly invaded by locals, high metabolic activities of living organisms due to the

suitable temperature which results in the high accumulation of excretion. The site receives the waste water drain which also increases its pollution level. The highest range was observed 54.91in the month of August at S1 in 2014 – 2015 and 52.54 in the month of January at S1 in the year 2015-16. This result is mostly due to low temperature.

CONCLUSION

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In the present study, Benthic macro-invertebrates were identified which belongs to class Oligochaeta, Hirudinea, Gastropoda, Palacypoda, Insect and Crutaceans. We found most abundant species from the class Oligochaeta, Insecta and than from the class Gastropoda but shrimp & Miscellaneous were found less during the study period July 2014-June 2016.

The bottom fauna of this pond is qualitatively diversified and rich. All togather 32 species of bottom fauna were collected and identified. They showed remarkable fluctuation both its quantity and quality in different season. The densities of oligochaetes and insects formed the main bulk consisting about 80% of the total collected benthos. The percentage abundance of oligochaetes was maximum in June and July while minimum in colder months. Insects, gastropods and ostracods showed their highest abundance during colder months and lowest during monsoon. However, variation in other groups were also registered but in haphazard fashion.

During biostatistical analysis of collected data, water temperature was correlated with DO but positive correlation of water temperature and phosphate as well as free CO_2. DO was found inverse relationship with Free CO_2. Inverse relationship such as Free CO_2 & pH, pH and phosphate but positive correlation with Free CO_2 and phosphate were exhibited.

Collected fishes of this pond were represented by 7 orders, 13 families, 17 genera and 23 species. Fishes were of all sizes but there were no any artificial manuring and introduction of fry and fingerlings and fishes could be recognized as the modest one.

Fish productivity of Mansarovar Talab was considered as very low due to lack of scientific culture. It was found that all abiotic and biotic components were still maintaining the pond productivity. The abiotic components of water are in the tolerable range of fishes.

In last, several suggestions are also made for improvement of aqua-culture, specially fishes. On the adoption of mentioned suggestions and guideline the Mansarovar Talab will improve the fish yield. It will increase per capita fish consumption of the area and consequently it will improve socio-econoinic conditions of the localities specially of those who are engaged in fish farming. Besides, it will help in solving the problem of protein deficiency in food of the society.

RECOMMONDATIONS & SUGGESTIONS

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Based on the observations made and experience gained during the course of this study, the following recommendation are made to improve the water quality and in- situ conservation of biodiversity of Mansarovar Talab.

Scientific studies in regard to in situ conservation should focus on the following lines where very little data are available.

- Applied research for conservation of living resources.
- Interlink ages between plant and animal species.
- Quantitative assessment of the conservation status of the species.
- Successional status of key species in different ecosystems.
- Multiplication and restoration of endangered, rare and endemic species using biotechnology.
- Ecological restoration of degraded micro and macro – habitats.
- Identification of critical index species and their sensitive parameters.
- Assessment of the impact of exotic species on the ecosystem.
- Determination of the impact on the ecosystem of various activities in the protected areas.
- The possible climate change and its impact on biodiversity.
- Hydrological change including surface run-off and percolation in the protected areas.
- Primary production and cycling of nutrients in the soil.
- Studies on satellite mapping of all protected areas.

- Development of methodologies for classification of microhabitats.

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