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In Joint Collaboration with

Nepal Aquaculture Society, Kathmandu, Nepal (NEAQUAS)

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Physico-Chemical Analysis of Gulbheli River and Nalganga Reservoir, Nalgangapur, Dist.Buldana, Maharashtra State, India

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Abstract: *Water is one of the essential commodities of everyday life and is placed in position just after air. Drinking water is never pure. Water naturally contains minerals and microorganisms from the rocks, soil and air with which it comes in contact. Human activities can add many more substances to water. But drinking water does not need to be pure to be safe. In fact, some dissolved minerals in water can be beneficial to health. A survey conducted by WHO in 1975 on community water supplies revealed the fact that in India while 80% of the population in urban areas had access to community water supplies and only 18% of the rural population had reasonable access to safe water. To assess, the water quality parameters for sustainability of all living organism.*

Key Words: *Physico - chemical parameters, Wrinkler's method, Gulbheli River, and Nalganga*

Introduction:

Water is also known as "Blue Diamond". It is one of the most precious gifts of creature given by the nature. Man uses water for different purposes like drinking, washing, in agriculture, food processing and in some many other applications. People say Earth is "Blue Planet" because largest part of the earth is occupied by water. Water covers more than 70% of the earth surface, 97.3% is in ocean and 20% is fresh water. There exists a continuous exchange and circulations and water between the earth and atmosphere. The great philosopher, Aristotle has defined together with air fire and earth as constituents of the universe.

Aquatic ecosystem consists of two water bodies that is fresh water body, and marine water body. Lakes, rivers, streams, ponds, and reservoirs are the fresh water bodies. Whereas, seas and oceans are the marine water bodies one. Water is not man-made, it is the natural substance that is found in three states liquid, solid, and gas. Today, pure water is an essential resource for life. For human being pure water use is not always available naturally due to occurrence of suspended and dissolved impurities in water. Good quality of drinking water is essentially needed for all the people throughout the world. The best quality of potable water is free from different sources like lakes, rivers, hand pumps, wells and others.

Due to absence of pure drinking water and the presence of microbial contamination, health problems occur in almost all the citizens. Most of the contaminants are introduced into environment through anthropogenic as well as natural phenomenon. WHO has published 17 types of bacteria can be found in tap water which can cause water borne diseases that affect human health? Today's situation is the need of pure as well as fresh water assessment of water quality is assured for the protection of environment and precious human lives and for all living beings. Most of the rivers, streams and reservoirs are contaminated. We see that, millions of people in the world struggling for pure drinking water. The ecology of reservoirs is radically different from that of the parent river. Dams alter river hydrology both up and downstream of the river. The obstruction of river flow and the consequent inundation trigger off sudden transformation of lotic environment into a lentic one.

Physico-chemical factors are very important in the estimating the constituent of water and concentration of contaminant. The chemical factors and biological factors are interrelated and interdependent. The important physical and chemical parameters influencing the aquatic environment are temperature, rainfall, pH, salinity, dissolved oxygen and these parameters are the limiting factors for the survival of aquatic organisms observed by Mahesh et al., (2013),

India is facing a serious problem of natural resource scarcity, especially that of water in view of population growth and economic development. Most of fresh water bodies all over the world are getting contaminated, and decreasing the potability of water. All life is depending on water and exists in nature in many forms like ocean, river, lake, clouds, rain, snow, and fog also. High quality of water required only for drinking purposes while other uses like agriculture and industry, the quality of water is quite flexible and water contaminated up to certain extent in general sence is regarded as pure. Due to use of contaminated water, human population suffers from water borne diseases. This is due to the

low temperature in winter season. Also, by Gorde and Jadhav (2013) showed the water quality parameters slightly higher in the wet season than in the dry season.

Therefore, for the protection of aquatic life bioassay is primary oriented towards developing water quality and then used to develop water quality standards. In future there is a need to preserve and maintain water quality standards. There are some points are considering under the head need of investigation.

Need of Investigation:

- To study the process of water analysis of streams, rivers and reservoir.
- To know whether water from a particular supply of water is suitable for specific purpose such as drinking, irrigation.
- To know the quality of water used and proposed to be used for human being.
- To ascertain if the supplies maintain the required degree of purity and to find out to the extent of any variation which occur.
- To suggest the best method of purifying rivers, streams and reservoir water.

Materials and Method:

The study was conducted on Nalganga reservoir situated 20 Km away from Malkapur, which lies between 20º 43' 34'' N latitude and 76º 10' 49'' E longitude. The study evolved physico-chemical parameters from the year February 2011 to January 2013. For the study two sampling locations were selected which were as follows.

1) GulbheliRiver 2) Nalganga reservoir.

Nalganga Reservoir:

Maharashtra state has occupied a pride to be at the heart of the country. Not only this, it has also received a ecologically fragile western coast of 500km and its geographical area also has received the benefits of being situated at the southern tip of the Satpuda mountain and at the east to the Western Ghats. This geographical situation of the state has bestowed with rich flora and fauna flourished. These two ranges Western Ghats and Satpudas have gifted many perennial rivers to t he state. However, irrigation department have tap these water sources and created good water potential for the development of the state. However, the major and minor irrigation projects that have created in past 50 years have been adopted by many endangered land migratory birds. Some of the reservoirs have really become ideal wetlands and supporting rich avian fauna. Nalganga reservoir is among one of these major irrigation projects of Maharashtra State. It comes in Buldana irrigation division of Akola Irrigation Circle (Maharashtra).Nalganga river, tributary of Tapi river, originates in the hills near Rohinkhed village close to Buldana town and flows through Wadgaon, Sanglad villages and meets Purna river near Muktainagar in Jalgaon district.Nalganga reservoir is an earthfill reservoir, constructed about 16 miles from source across Nalganga river near village Sanglad in the state of Maharashtra in India. This has resulted information of Nalganga reservoir named after the river Nalganga itself. This reservoir was constructed as part of irrigation project by the government of Maharashtra in the year 1967 and impounds Nalganga river nearest city to Reservoir is Malkapur and the Reservoir is situated in Motala Taluka of Buldana district of Maharashtra, around 8741 hectors land of 28 villages. This reservoir is spread across an area of 1098 hectors and benefits. The purpose of this water reservoir is irrigation as Summary and Conclusion:

Collection of samples:

Water samples were collected from different station by using glass and polythene bottles. Before collection of water sample the bottle rinsed and cleaned thoroughly. Water were collected from deep and shallow level of water. For the analysis of physico-chemical parameter of Water by using Wrinkler's method.

Observation and Result: Physico-chemical parameters:

The observations and results are as presented in Table No. 1.1.1 and 1.1.2.

1) Atmospheric Temperature

In the present study revealed that, in 2011-2012, the atmospheric temperature recorded minimum in the month January of winter season and maximum atmospheric temperature were

recorded in the month of May in summer season, while in 2012-2013, the atmospheric temperature was observed minimum in January of winter season and maximum in May month of summer season at sampling station - Gulbheli. This entire tributary meet to the Nalganga reservoir, the atmospheric temperature were minimum in winter season, moderate in monsoon season and maximum in summer season.

At Nalganga reservoir, in 2011-2012, the atmospheric temperature minimum in the month of January of winter season, while maximum in the month of May of summer season. Similarly, in 2012-13, the minimum atmospheric temperature was recorded in January month of winter season, moderate in September of monsoon season and maximum atmospheric temperature were observed. In 2011-2012, the atmospheric temperature showed fluctuation because of rainfall less than 2012-2013. So, the atmospheric temperature range is variable than that of each month of each season.

The atmospheric temperature values were maximum in summer season while temperature values were minimum in winter season because during the summer season, solar radiation and clear sky condition enhanced the atmospheric temperature. Whereas, during the monsoon season rainfalls and cloudy skies brought down the atmospheric temperature and subsequently the water temperature noted decreased trend. In winter season due to cloudy skies and low intensity of light the atmospheric temperature is lower than another season.

Temperature is one of the most important factors in the aquatic environment that regulates various physico-chemical activities. According to Singhai et al., (1990) the atmospheric temperature varies with the water temperature and also found by a direct relationship between atmospheric and water temperature. Also, by Afreen (2010) from Rui project, Bade et al., (2009) in Sai reservoir, Latur.

2) Water Temperature

In the present study, in 2011-2012, the water temperature observed minimum in January of winter season, while moderate in monsoon season and rised water temperature in the month of May in summer season. Similarly, in 2012-2013, water temperature were decreased in January month of winter season, moderate in monsoon season and higher in the month of May of summer season at sampling station Gulbheli, and the last sampling station Nalganga reservoir also. In summer season water temperature higher because of low water level, low velocity of water, clear atmosphere and greater solar radiations.

The minimum water temperature in the rainy seasons and winter months because of frequents clouds, high percentage of humidity, high current velocity and high-water levels reported by Pawale and Lokhande (2012) observed Dhanora reservoir, Nanded; Lokhande (2013) noted water temperature fluctuation of Dhanegaon reservoir, Osmanabad.

The significant correlation between ambient temperature and water temperature were observed and pointed out the seasonal changes were mainly dependent on water temperature. The low oxygen values coincided with high temperature during the summer months reported by Pawar and Phulle (2005) studied in Pethwadaj dam of Nanded; and Ugale (2011) studied on Jakekur project of Osmanabad.

3) Hydrogen ion concentration (pH)

In the present study, at sampling station N1- Khadki, the lowest pH values were recorded in the month of September in monsoon season, while medium in winter season and highest in May of summer season in 2011-2012. In 2012-2013, the lowest value of pH in September of monsoon season, At sampling station Gulbheli river, the pH values were lower in August of monsoon season and moderate in winter season, while higher in May of summer season in 2011-2012. Similarly, the pH values were recorded lower in September of monsoon season, higher in May of summer season in 2012-2013. Similar observations at sampling station N8- Nalganga reservoir. The values of pH were noted lower in September of monsoon season, while higher in May of summer season in 2011-2012.Jakhar and Rawat (2003) observed the maximum pH during summer, explained by correlating rise of temperature with increase in rate of photosynthesis which results in higher consumption of carbon-dioxide. Jaybhaye et al., (2006) observed in a minor reservoir of Sawana of Hingoli, Maharashtra.

The alkaline pH river water is the presence of alkalinity minerals in water. The variation occurs in the pH values to change in the values of CO2, carbonate and bicarbonate in the water reported by APHA (1998); Gatlewar et al., (2011). The lower values of pH cause tuberculation and corrosion while the higher values produced incrustation, sediment, deposition and difficulties in chlorination for disinfections of water investigated by Trivedi and Goel (1984).

4) Total Alkalinity

The total alkalinity were recorded minimum in January month of winter season, while moderate in monsoon season and were recorded maximum in the month of May in summer season during 2011-2012 and in 2012-2013, total alkalinity were minimum in the month of January of winter season, maximum in the month of May in summer season at sampling station Nalganga reservoir. In 2011-2012, the total alkalinity values were noted minimum in December of winter season, and maximum in May of summer season. In 2012-2013, the total alkalinity values were minimum in January of winter season while total alkalinity were observed maximum in May of summer season at sampling station Gulbheli, during 2011-2012, the values of total alkalinity were observed minimum in January of winter season, while moderate in monsoon season and total alkalinity were maximum in May of summer season.

In 2012-2013, the total alkalinity was recorded minimum in December month of winter season and maximum in the month of May in summer season. The alkalinity values trend showed maximum in summer and minimum in monsoon. The increased the rate of organic decomposition during which CO2 is liberated, this liberated CO2 reacts with water to form HCO3, thereby increasing the total alkalinity in summer. The decreased alkalinity values of water were due to the dilution by the rain water in monsoon. In the present study observed that both the year 2011-2012 and 2012-2013, at sampling station of Gulbheli tributary showed total alkalinity range were maximum due to the domestic waste, and human activities, so that tributaties rivers become contaminated.

The alkalinity values were maximum in May of summer season due to increase in bicarbonates in the water and minimum in winter due to high photosynthetic rate reported by Hulyal and Kaliwal (2011). The higher values of total alkalinity were with high bicarbonate contents in the rivers studied by Hujare (2008); Chinnaiah and Rao (2011). Chaudhary et al., (2013) reported variation in the values of total alkalinity which interferes with the water quality. The values were high during the summer and low during winter. The fall values during monsoon due to dilution of water. The high value of alkalinity indicates the presence of weak and strong base such as carbohydrate and hydroxide in the water body. Also similar observation reported by Latha and Mohan (2010); Dhanorkar (2011); Rahul (2012) observed that declined alkalinity during summer.

5) Chloride

In the present study period, 2011-2012, moderate in winter season and maximum in the month of May of summer season, similar values of chloride at sampling station N8- Nalganga. The concentration of chloride were minimum in September of monsoon season, while maximum in May of summer season in 2011-2012 and in 2012-2013. At sampling station N3- Gulbheli in 2011-2012, the minimum concentration of chloride were noted in July month of monsoon season, while moderate in winter season and maximum concentration of chloride were noted in May of summer season, while in 2012-2013, concentration of chloride were observed minimum in the month of September of monsoon season, and maximum in May of summer season. The chloride concentration range of the Gulbheliriver were observed higher than that of other river and streams because of high anthropogenic and animal activities in summer season, and low due to diluted with rain water in rainy season.

Chloride anion is generally present in natural water. The chloride concentration is higher in organic wastes and its higher level in natural water is definite indication of impured water from domestic sewage. Higher chloride concentration during summer season due to high temperature and higher evaporation while lower concentration in rainy season due to dilution of water. The ecological significance of chloride lies in its potential to regulate salinity of water and exert consequent osmotic stress in biotic communities. The increase in chloride concentration in Lakes, Rivers and Dams is due to the discharge of Municipal and industrial wastes reported by Kalwale and Savale (2012). Adoni (1985) attributed high chloride values due to increased organic matter, chloride also increases the degree of eutrophication also by WHO (1993); Lohar and Patel (1998). Similar trend of chloride ion concentration was given by Garg et al., (2010).

6) Total Hardness

The low values of total hardness were in the month of September in monsoon season, while moderate in winter season and the values were higher in May of summer season in 2011-2012 and similar result obtained in 2012-2013 at N8- Nalganga reservoir.

In 2011-2012, total hardness were declined noted in September of monsoon season, while moderate in winter season, and inclined in May of summer season. In 2012-2013, the declined values were observed in September of monsoon season and were inclined in April of summer season at sampling station N3- Gulbheli.In the present study the inclined trend were noted in the three

sampling stations of Gulbheli. The higher values of hardness were noted in summer due to decreased water level and evaporation of water. Similar observations studied by Sahib (2011); Sanghpal et al., (2011). Total Hardness of water is the sum of concentration of alkaline earth metal cations. The lower values during rainy season attributed to dilution on account of heavy precipitation were reported by Rajalaxmi and Shreelatha (2005). Salve and Hiware (2008) reported that the total hardness were higher in winter, moderate in monsoon, and lower in summer season.

7) Calcium Hardness

The concentrations of calcium ions were decreased in September of monsoon season, while medium in winter season and the concentrations were increased in the month of May in summer season in 2011-2012, and in 2012-2013 also similar trend showed at sampling station Gulbheli, and at Nalganga reservoir.

It is an important constituent in all organisms and is incorporated into the shells of many invertebrates and bones of vertebrates. Calcium is most abundant ion in the fresh water and in an important in shell construction, bone building and plant precipitation of lime studied by Vasanthy et al., (2009). The maximum values were found to be below the desirable limit. The maximum values were recorded in the summer season as high temperature causes rapid decomposition of organic matter and minimum values were recorded in the winter season due to low temperature. Similar results were observed by Rajshekhar et al., (2007); Thitame and Pondhe (2010) and Sheikh et al., (2013).

8) Magnesium Hardness

The magnesium hardness of the water were decreased in the month of September in monsoon season, while moderate in winter season, and increased in the month of May of summer season in 2011-2012. In 2012-2013, the values of magnesium concentration were noted minimum in September of monsoon season, and maximum values were noted in the month of May in summer season at sampling station Nalganga reservoir also.

In 2011-2012, the values of magnesium were recorded minimum in August of monsoon season, while moderate in winter season, and maximum was recorded in May of summer season. While in 2012-2013, the magnesium values were minimum July of monsoon season, and maximum noted in May of summer season at sampling station N3- Gulbheli. In 2011-2012, the value of magnesium was recorded minimum in September month of monsoon season, while moderate in winter season, and was recorded maximum in May of summer season.

Gulbheliriver, the magnesium level showed increased trend indicated impurity of water. Magnesium is absolutely essential for chlorophyll bearing plants and algae. Magnesium appears to act as a carrier of phosphorous. The season wise analysis showed that minimum in rainy season and maximum in summer season.

Similar findings by Sachidanandamurthy and Yajurvedi (2006); Singh et al., (2012). Generally, magnesium content is lower than calcium ions in natural water also follows the same trend in the fish ponds due to the addition of animal manures and other waste in the water bodies, which increases the values of magnesium. These element increases the hardness of the water reported by Choudhary et al., (2010) observed in a Kolar dam in different season.

9) Turbidity

The values of turbidity were minimum in February, and May month of summer season, while were maximum turbidity in September of monsoon at N8- Nalganga reservoir. At sampling station Gulbheli, the values of turbidity were lower in the month of March in summer season, while moderate in winter season and maximum in the month of September in monsoon season during 2011-2012. In 2012-2013, the values of turbidity were minimum in May of summer season, and maximum in the month of September in monsoon season. The range of turbidity was noted above the desirable limit so that sampling stations are contaminated like N3- Gulbheli.

In the present study, the maximum turbidity values were maximum during monsoon and minimum during summer. High values of turbidity in monsoon due to suspended influx of rain water from catchments and cloudiness, less penetration of light, washes silts, sand, high organic matter and low transparency due to suspended inert particulate matter. However, low values of turbidity in summer due to clear atmosphere, evaporation of water and high light penetration.

Turbidity is the suspension of particles such as clay, silt and organic matter. Maximum values were observed in the month of July in monsoon season, while minimum during October of winter season. During rainy season silt, clay and suspended particles contribute to the turbidity values while during winter season settlement of silt, clay and suspended particles resulting low turbidity. High

turbidity during rainy season has been reported by Garg et al., (2006); Nikam et al., (2011). Turbidity is a measurement of the cloudiness of water, measured by passing a beam of light through the water and measuring photometrically. Cloudiness is caused by material suspended in water, clay, silt, organic matter.

10) Total Dissolved Solid

In the year 2011-2012, the values of total dissolved solid were minimum in the month of January of winter season, while moderately fluctuated in summer season, and the values of total dissolved solid were maximum in the month of September in monsoon season. Similar results observed in 2012-2013, the total dissolved solid were minimum in January of winter season, and maximum in the month of September in summer season at sampling station Nalganga reservoir.

The values of total dissolved solid were observed minimum in the month of January of winter season, while moderate in summer season, and were noted maximum in the September of monsoon season during 2011-2012. While, in 2012-2013, the values of total dissolved solid were recorded minimum in January month of winter season, and were noted maximum in the month of July in monsoon season at sampling station N3- Gulbheli.

In the present study, the Gulbheliriver was mostly contaminated due to suspended organic and inorganic matter present in water by anthropogenic activities. Total dissolved solid values were maximum during monsoon and minimum during winter. High values of total suspended solid in monsoon due to siltation, deterioration, heavy precipitation and mixing run off rain water which carried mud, sand and others mixed in the streams, rivers and dam water.

The total dissolved solids are the amounts of particles that are dissolved in the water. The seasonal distribution of total dissolved solid is minimum in winter season and maximum in the rainy season. It slightly fluctuated in the summer season due to the leaching of surrounding rain water reported by Chinnaiah et al., (2011). The quantity of total dissolved solid was proportional to the degree of contamination reported by Rain and Thatcher (1990); Naik et al., (2012).

The high amount of total dissolved solid in pre-monsoon due to increase in the rate of evaporation of water and high concentration of total dissolved solid is an indication of nutrient that leads to eutrophication reported by Latha and Ramchandra (2010); Thakre et al., (2012); Panigrah and Patra (2013).

11) Dissolved - Oxygen

Dissolved-oxygen values were observed low in the month of February of summer season, while moderate in monsoon season, and higher in January month of winter season during 2011-2012. While in 2012-2013, the value of dissolved-oxygen were recorded low in May month of summer season, and were noted maximum in the month of January in winter season at sampling station Gulbheli station.

At sampling station Nalganga reservoir, dissolved-oxygen were recorded lower in May month of summer season, while moderate in monsoon season, and were noted higher values in the month of January of winter season in 2011-2012. In 2012-2013, also low values were noted in May of summer season, and high values were noted in January month of winter season.

The large fluctuation of dissolved-oxygen value obtained maximum than three rivers like Gulbheli.

Dissolved Oxygen is extensively used as a parameter determining the water quality and to evaluate the degree of freshness of lotic ecosystem. Dissolved Oxygen content indicates the health and ability of water body to purity itself through biochemical processes. Oxygen is also needed for many chemical reactions that are important to lake functioning, such as oxidation of metals, decomposition of dead and decaying matters stated by Rajagopal et al., (2010).

Dissolved oxygen in water comes from the atmosphere due to the air action. Algae and aquatic plants also release oxygen to water through photosynthesis ICMR (1975). The oxygen content of natural water varies with temperature, salinity, turbulence, respiration and photosynthetic activity of algae and higher plants and the atmospheric pressure. Dissolved oxygen values were higher in ponds where there was good aquatic life observed by Trivedi and Goel (1986); Verma and Saxena (2010); Tiwari and Ranga (2012).

12) Biological - Oxygen - Demand (BOD)

The values of biological oxygen demand were recorded minimum in January month of winter season, while maximum were noted in May of summer season in 2011-2012. In 2012-2013, the values of biological oxygen demand were recorded lower in January month of winter season, and higher were recorded in May month of summer season at sampling station Gulbheli and also at Nalganga

reservoir. The greater amount of decomposable matter present in water body of Gulbheli river greater the oxygen demand by microorganisms and increases the values of biological oxygen demand due to that reason these three rivers are contaminated.

In the present investigation, the maximum biochemical oxygen dissolved in summer is probably due to high microbial activities. Similar findings made by Gaddamwar and Rajput (2012); Lokhande et al., (2013). Increasing trend of biological oxygen demand and decreasing trend of dissolved oxygen towards downstream, clearly indicates increasing load of contamination towards downstream of river. The season wise analysis showed that in present investigation minimum in winter season and maximum in summer season. The fluctuations of the values from season to season were possible due to the presence of organic matter and microbial activity.

Biological oxygen demand variations were observed maximum being in contaminated waters and minimum in pollution free waters by Solanki and Karlikar (2011). Biological oxygen demand increases with the increased inflow of the domestic waste. High biological oxygen demand depletes the oxygen level to a critical condition thus indicating the contamination status of water stated by Parmar (2012).

13) Chemical – Oxygen - Demand (COD)

The values of chemical oxygen demand were observed declined in April month of summer season, while moderate in winter season, and inclined values were noted in September month of monsoon season in 2011-2012. In 2012-2013, the values of chemical-oxygen-demand were noted lower in February month of summer and higher in September month of monsoon season at sampling station N3- Gulbheli.

In 2011-2012, the chemical-oxygen-demand values were recorded lower in May of summer season, while moderate in winter season, and higher values were recorded in September of monsoon season. Similar observation in 2012-2013, the value of chemical oxygen demand were lower in May month of summer season, and higher value was recorded in September of monsoon season at sampling station at Nalganga reservoir.

The chemical oxygen demand were found highest in Gulbheli river, because of this was illegal discharge of slaughter house waste, dumping of garbage, poor (sewage) and surface run off to Motala river.

The season wise analysis showed that the values of chemical oxygen demand were minimum in summer season and maximum in rainy season. The minimum and maximum values of chemical oxygen demand recorded in the reservoir water due to the presence of accumulation of organic matter at the bottom of reservoir water. Similar observation made by Drusilla et al., (2004); Zombade et al., (2012). High value of chemical oxygen demand than biological oxygen demand indicates high degree of organic contamination studied by Adholia and Vyas (1992); Thirumala et al., (2006).

Chemical oxygen demand is a reliable parameter for judging the extent of contamination reported by Harney et al., (2013). The Chemical oxygen demand of water increases with increasing concentration of organic matter. The maximum desirable value of chemical oxygen demand is 40 ml/L for drinking water.

Summary and Conclusion:

Nalganga reservoir is the main source of drinking water as well as agriculture purpose for nearby situated villages. Today most of the water bodies are receiving millions of liters of sewage, domestic effluents and industrial effluents, agricultural runoff containing several kinds of harmful substances. These substances are making water unfit for human consumptions and its various other uses. It is very necessary to obtain accurate and timely information regarding the quality of any water body in order to applied sound public policy and implement water quality improvement programme.

In brief summarizing the present study results, it is very clear that in summer, monsoon and winter season showed different seasonal fluctuations in various physico-chemical parameters of water of Nalganga reservoir and its tributaries such as Gulbheliriver.

Among the rivers Gulbheli was found contaminated because of some physico-chemical parameters like total alkalinity, chlorides, total hardness, calcium, magnesium, turbidity, total dissolved solids, Biological oxygen demand, chemical oxygen demand values were found in higher range than the other rivers and streams feeding Nalganga reservoir and also due to the domestic sewage and human activities. This river site was not fit for drinking purposes.

In conclusion, today our responsibility is to preserve water and to avoided contamination. Public awareness is essential to effective water resources management changes in basic behavior and practices are necessary to achieve long term improvement in water use and water quality.

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