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Analysis of Water Pollution with Special Reference to Physio-Chemical Parameters and It's Corresponding Impact on Social Being

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Abstract: The environment includes natural and social dimensions. The natural environment refers to the biophysical context that includes geographical area, climate, natural resources, and so on, whereas the social environment indicates the total social relationship of an individual, cultural background, and the group to which he belongs. In this regard, water is an essential component of nature, required for the existence of life on earth. But the freshwater is continuously being polluted and also reduced in various ways. Water pollution is known as the biological or chemical change in the quality of water due to the presence of contaminants in water. Moreover, the pollution of water affects humans not only in the context of health but also in many realms of social life. To examine this issue, samples of water have been collected from different sites of the Mahananda River in Siliguri to check the physio-chemical properties of water and also its corresponding effects on human society have been recorded. This study aims to investigate the means of connectivity among natural and social environments and human beings as a part of it as well as how water pollution is affecting social beings and society.

Keywords: Environment, Society, Water Pollution, Physio-chemical parameters.

Introduction

Human beings get all kinds of resources for the satisfaction of their need in the environment and continuously interact with them to obtain their food, water, shelter and other necessary substances. No doubt, interactions between humans and their surroundings are ongoing and aimed at satisfying their needs. Therefore, the

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environmental problems on humans create a significant impact and affect all human activities, including health and socio-economic development. The environment is defined as the natural world, as a whole or in a particular geographical area, especially as affected by human activities. Giddens and Sutton (2009, 158) stated, 'The environment is assumed to mean all those non-human, natural surroundings within which human beings exist- sometimes called 'natural environment' and in its widest sense this is simply planet Earth as a whole'. It includes the entire natural resources on which man is dependent. Among all the natural resources, more than 70 per cent of the earth's surface materials are composed of water and apart from the air, the man breathes, water is one of the most consequential elements to man. In everyday life, for maximum purpose of use, man is directly or indirectly dependent on water and not only man but the whole ecosystem also somehow or other depends on the water. However, with time, people are continuously polluting the water bodies irrespective of thinking about the necessities and the consequences and in contemporary times with the rapid growth of urbanization, the local sources of water are at heavy risk. The waste material from industries, domestic and plastics, chemical pollutants, etc. led to a decrease in water quality and as a result, several diseases and environmental degradation come into being which both directly and indirectly affect humans by means of pollution. Pollution is defined by the Environment Protection Act 1 of 2016 as "the direct or indirect introduction by man, or due to natural processes, into the environment or substances, energy, organisms or genetic material that cause or are likely to cause a hazard to human health or harm to living resources or the environment". As water is one of the most important substances on earth and as well as the environment the increasing pollution in water sources and rivers may lead to hazardous effects on human life and can upshot human beings in several aspects as it is becoming a global issue over time. Water pollution can be defined as an alteration in the physical, chemical, or biological characteristics of water, making it unsuitable for designated best use in its natural state. The water sources of a specific area control the lifestyle of the communities inhabiting that particular area. An appropriate water source also plays an effective role in the growth of industries but in addition to this, the water bodies should not be polluted by any sources as the pollution of water has drastic effects on the life of man.

Two types of water pollution are as far as known- (i) groundwater pollution which is a change in the properties of groundwater due to contamination by microbes, chemicals, hazardous substances and (ii) other foreign particles. On the other hand, surface water pollution is the natural water resources on the earth that are being polluted by point sources and non-point sources. Sewage, industrial effluent, synthetic detergent

and agrochemicals are the major sources of surface water pollution. Across India, an estimated 62,000 million litres per day (MLD) of sewage is generated in urban areas where there is treatment capacity for only 23,277 MLD. Due to operational and other infrastructural constraints, the actual amount of sewage treated stands at 18,883 MLD as only 522 out of 816 sewage treatment plants are listed across India. Thus, at least 70 per cent of sewage generated in urban India is being dumped in rivers, seas, lakes, and wells, polluting water bodies and contaminating freshwater sources. Partially treated or untreated sewage is responsible for a large part of the pollution in streams and water bodies (SANDRP, 2016). Where good waste management is lacking, urban areas are among the world's most life-threatening environments (UNESCO, 2003). Urban areas provide the economic resources to install water supply and sanitation systems but they also concentrate on waste. Some residential and industrial establishments are situated along waterways taking advantage of rapid urbanization and institutional failures and channeling waste into rivers causing river pollution thus, rivers and streams have suffered the worst effects of India's unplanned urbanization. Moreover, a river is considered to be polluted when the water composition or state is altered as a direct or indirect result of human activities, making it unsuitable or less suitable for its natural purposes. This definition leaves no room for ambiguity, and it confidently asserts the conditions under which a river can be classified as polluted.

Relevance of Water Pollution, Environment and Society: As a social being, humans are the only animals who are confronted with the effects of environmental problems both physically as well as socio-psychologically. The behaviour of an individual towards nature and another individual depends on the way he or she has been nurtured from childhood which varies from community to community based on their social institutions and the effectiveness of regulations. These regulations are dynamic and interdependent with the changing surrounding environments. "Human environmental interactions can be defined as interactions between the human social system and (the "rest" of) the ecosystem. Human social systems and ecosystems are complex adaptive systems"(Marten, 2001). Therefore, human beings are a part of the environment. According to Salzman and Attwood (1996), "The environment refers not just to biophysical context, but also to human interaction with, and interpretation of that context which is culturally perceived; the environment, therefore, is not just a set of things to which people adapt, but also a set of ongoing relations of mutual adaptation between culture and material context". Thus, it indicates that the social dynamics and changes in human action directly affect the environment and cause environmental issues. Contrariwise, changes in the surrounding natural environment

create a drastic effect on social beings as well as society. The word Environment comes from the French word "Environia" which means to surround which indicates it is a sum total of conditions in which an organism survives or maintains its life process according to Herskovits (1956), the environment has two parts i.e. natural environment and social environment. The social environment includes all the personal and societal relationships, institutions, cultures, and values which are very much specified to a particular society and this social environment is somehow or other related to the natural environment. For example, Malinowski's analysis of the 'Kula Ring' is one of the most famous anthropological studies where water plays a holistic role by maintaining its complex cultural, social, and psychological meanings. This passage depicts an illustrative example of how the political structure is sustained based on geographical location, which regulates and maintains prestige, technology, trade, myth, ritual, and friendship. The geographical location of a place plays an instrumental role in creating a common media for the people to connect with each other. It further emphasizes the significance of water in their lives in an entire form.**"**Society is a system of usages and procedures, of authority and mutual aid, of many groupings and divisions, of controls of human behaviour and liberties. This ever-changing, complex system we call society. It is the web of social relationship" (MacIver and Page, 1950: 5). In every society, the system of social regulations is followed as per the correspondence rules of social institutions. According to Landis, "social institutions are formal cultural structures devised to meet basic social needs." Malinowski in his book, 'Scientific Theory of Culture and Other Essays' (1944) defines need as the system of conditions in the human organism, in the cultural setting and in the relation of both to the natural environment, which is sufficient and necessary for the survival of group and organism." According to him, there are three levels of needs of which derived or instrumental needs relate to the requirements of maintenance of the cultural structure, rules of human behaviour, etc. which are very specific to a particular society. Therefore, for the maintenance of those age-old cultural traditions as a part of their social sustenance, the proper contribution of natural resources as well as the environment is required. Thus, it indicates any kind of changes in one's surrounding natural environment affect the supply of natural resources on which they are dependent for continuing their livelihood. "As we have seen, there are many different environmental issues confronting the contemporary world. Some are local or regional in character, while others have an impact on the global human population. However, what they all share and what makes them specifically environmental issues is that they involve both social relationships and interactions and non-human, natural phenomena. In this sense, they are hybrid issues of society and

the environment" (Irwin 2001, 26). Moreover, water is an essential non-living part of the environment required for all living organisms. Throughout history, man's progress has relied upon access to clean water and the capability of societies in the utilization of water as a worthwhile resource. Thus, any kind of threats to it such as pollution, the crisis of existence, etc. would be dangerous for all living organisms including human beings where a very limited amount of it is usable for us. "As societies have begun to realise that the world is facing a human-made ecological crisis, water has become the focus of intense research in multiple disciplinary areas. Anthropology brings to this a vitally important capacity to illuminate its diverse social and cultural dimensions" (Hastrup 2011, Hastrup & Hastrup 2015, de Wolff et al. 2019, Wagner 2013 cited in Strang 2019). Man is a biological and as well as social being and every constituent of the society is deeply associated with one another, therefore the ways in which water is associated with every context of the human being in their social life signifies the importance of water and the in-depth connection of it in of social settings of human life.

Review of Literature: In order to have a base of knowledge relevant to this study, it is important to go through some of the previous works related to it. This topic presents a review of literature that is carried out in a systematic manner and significantly provides an analysis of current information that is relevant to my subject. Several studies have been conducted on the subsequent subject and some of them are intensified here.

Water pollution is one of the significant research areas that include social, cultural, physiological, environmental, economic, demographical, political, and lots of disciplines associated with human life and sustainability. The impact of water pollution may differ based on its usage, territory and availability, and other social and infrastructural facilities. Urban Civilization requires more water as compared to rural and also the quality of discharged water in the urban area is chemically more toxic (Bandy,1984). Khatri and Tyagi (2015) show the divergent effects of water pollution in rural and urban areas by natural and anthropogenic causes and the subsequent impacts on surface water and groundwater. Dwivedi (2017) pointed out the different responsible sources of water pollution and explained various categories of parameters of inland water and the potentiality of several components in polluting the water. Pandey, Ranjan, Srivastava, and Prasad (2017) studied the health issues and environmental degradation due to water pollution in Ahmedabad as it has a mixed land use pattern resulting in different areas of difficulties related to it. They have highlighted infrastructural problems of housing and drainage in that area and discussed the unplanned urban

development and inadequate industrial setting as a profound genesis of pollution in water. Mozumder, Pramanik, Mandal, and Rohatgi (2015) tested the physio-chemical parameters of the Mahananda River in Siliguri that are causing unsuitability to the people of Siliguri Municipal areas. Thakur (1997) in his work clearly mentioned that the problem of freshwater is in existence throughout the world. Water pollution is becoming acute in several regions in India. Vaghela, Shukla, Mishra, and Jain (2017) studied the impact of pollution on the aquatic fauna of the river ecosystem. They have discussed anthropogenic effects on biotic and abiotic factors resulting in structural and functional change in the river ecosystem. Mallick (2015) demonstrated the sincere relativity among civilization, livelihood, and water/river. He examined the insufficiency of river/water in correspondence with the increasing population resulting in the competitive rate of increment in polluting the water. Simultaneously, the lack of traditional occupation resulting in the separation of natural resources and the way it is being destroyed and thus affecting the traditional, cultural and physical well-being of humans were discussed. A study on Anthropological influence in coastal water and its impacts on the biological lifecycle of a sea turtle (*Lepidochelys olivasia*) which is an endangered species was conducted jointly by Bramha, Panda, Rath, Mohanty and Satpathy (2011) at Rushikulya which is a mass nesting site of the olive ridley turtle and the way it is affected the ecology. Bassem (2020) shows the relationship between water pollution and aquatic biodiversity and its connection with the well-being of humans. This article also discussed the way of effect of ecological communities and the loss of biodiversity. Liyanage and Yamada (2017) evaluated the correlation between the growth rate of the population in watershed areas and the water quality parameters of a river ecosystem followed by the impact of population on water quality and the direct effect of natural water bodies. Orlove and Caton (2010) studied how over time water has become an urgent issue in Anthropology as a substance that joins many realms of social life. They trace the different forms and availability of valuing water and different perspectives on the water as a resource. They provided ethnographic perceptions about important water sites.

Weiner and Matthews (2003) in a portion of their book "Environmental Engineering" (4th edition) describe how the ecosystem is getting under different types of risk through water pollution and describe the different measurements of water quality and its effect on streams, oceans, lakes, etc. They have made a detailed analysis of wastewater treatment and water supply management. This book provides a detailed understanding of the role of water in everyday life and its effect on society. Agarwal (2009) in his book "Water Pollution" describes the different sources of pollutants in

water such as organic pollution, inorganic pollution, sewage pollution etc. He has elaborated on the way in which aquatic lives are being destroyed due to pollution and provided control measures by using biotechnology. Simultaneously he had stated about the water quality standard and the way of management of it.

It is irrefutable that water pollution is a ubiquitous problem that plagues various locations in diverse ways. The aforementioned studies have unequivocally established that human beings are primarily accountable for this issue, which ultimately proves most detrimental to their well-being. As a holistic study of human beings, Anthropology deals with every issue that concerns human life and thereby for anthropologists, water is treated not only as a resource but also as a medium that helps to create a connection among multiple domains of social life. Therefore, for the requirement of our own purpose, the quality and availability of the water should be maintained in order to ignore any kind of water-based problems in the future. Water pollution is thus one of the global issues that create a threat to the existence of life on earth in the next decades as it controls the mortality rate of the population. In this regard, Siliguri is strategically located in the area known as the Chicken Neck Corridor, an important link connecting the states in North East India and the neighbouring countries with the rest of India (CRCAP 2020, 1), a city on the banks of the river Mahananda. However, given the above, the present study is an exploration of the levels of physio-chemical parameters of water and their respective consequences on human beings as well as society in the Siliguri area, West Bengal.

Research Aims and Objectives

The present research is an endeavour to explore the consequences of physicochemical water parameters on human health and society in the Siliguri area, located in the West Bengal region. The study aims to investigate the correlation between the levels of physicochemical parameters of water and their subsequent effects on human well-being and society. The research will delve into the various factors affecting water quality parameters and their impact on the surrounding community. By analyzing the collected data, the study seeks to provide vital insights into the problem and offer practical solutions to address the issue.

The objective of the present work is to collect information regarding the level of physio-chemical parameters of water of the river Mahananda in Siliguri City to highlight their impact on the social life of people living in the surrounding area. This study endeavours to comprehend the impact of water pollution on human beings, encompassing the environment and people as integral components. The significance of

this study lies in its holistic approach towards examining the impact of water pollution on the ecosystem and its inhabitants, and in identifying potential interventions to mitigate its adverse effects.

Research Methodology

This present study enquires about the impact on the environment by pollution of river water sources in the Siliguri area along with its effect on society. For conducting this study both primary and secondary sources of data have been used. The primary qualitative and quantitative data relevant to this study have been collected from the field by using conventional anthropological tools, techniques and methods, like observation, interviews, case studies, household census surveys, etc. Also, the relevant secondary sources of data have been collected from various survey results, census reports, books, articles, the internet etc.

Selection of Informants: In this research work two kinds of sampling methods have been used and these are purposive and snowball sampling methods. In the purposive sampling method, the researcher samples with a purpose in mind. It is also known as judgmental, selective, or subjective sampling which is a form of non-probability sampling in which researchers rely on their own judgment in choosing members of the population to participate in their study. Another method that has been used is the snowball sampling method or chain-referral sampling which is also a non-probability sampling technique used when the members of a special population are difficult to locate. In this method, research participants recruit another participant for a test or study. It is used where potential participants are hard to find. "Snowball sampling is a sampling technique in which the researcher samples initially a small group of people relevant to the research questions, and these sampled participants propose other participants who have had the experience or characteristics relevant to the research" (Bryman, 2012: 424). From the above statement, it is clear that this sampling method is used when it is difficult for the researcher to get direct retrieve from the entire population.

Moreover, to detect the variation of pollution levels and its corresponding effects on human life is very important to know about the physio-chemical parameters of water. Thus, for conducting this study, three water samples have been collected from three different sites of Mahananda River in Siliguri and undergone physiochemical tests to detect the level of pH, Turbidity, TDS, Colour, Iron, Res. Chlorine, Fluoride, Total Hardness, Total Alkalinity, Chloride, Nitrate, Copper; and the corresponding effects of these parameters on human society have been recorded. It is noteworthy to

mention that the Mahananda River is the prime source of natural water in Siliguri town and the drinking water which is supplied by PHE (Public Health Engineering) is purified under the control of the Mahananda Barrage project, therefore three water samples have been collected from different venue of Mahananda River and the physio-chemical test has been done with the help of the district laboratory at Fulbari, Siliguri to understand the consequences of water pollution on the people of Siliguri according to their pollution level. The parameters are Turbidity, pH, TDS, Chloride, Total Alkalinity and so on.

Further, to understand the corresponding effects of water pollution on human society, the people living nearer to the Mahananda River area and also throughout the entire city of Siliguri have been chosen through random selection.

For this study, case studies have been taken from the people who are engaged in different working sectors having connections with the polluted water sources to know the problems faced by them due to these reasons.

Positioning in the Field by Insider and Outsider Approach: For the present work, the researcher is an insider researcher. The researcher is very familiar with the local communities, their culture, language, the lifestyle of the Siliguri area because the scholar was born and raised in Siliguri. However, in the research context, the researcher was new as well as unknown to some of the area's people and their ways of living. As most of the population of the area is Bengali, the investigator got the advantage of interacting with them freely, but some of the non-Bengali communities found it difficult to communicate with the researcher, especially with those who did not know Hindi or English. But with time the people who were previously unknown to the investigator, became familiar and easy to contact, later on, the scholar was able to collect more information regarding the work topic.

Data/Material

Study Area: The present work has been conducted in the city of Siliguri which is situated at the base of the Himalaya Mountains in the plains of Darjeeling district including some parts of Jalpaiguri district by the side of River Mahananda. It is the 2nd largest city in West Bengal and is known as the Gateway of North-Eastern India. Siliguri is located at the foothills of the eastern Himalayas at a location of 26.71^{o} N 88.43^{o} E. This city is spread over an area of 260 km^{2} within the Siliguri corridor which has an average elevation of 122 meters (400 feet) above sea level, having an average annual rainfall of 323 cm.

In an attempt to continue the proposed aims of the study, three sites were chosen for sample collection in the study area. Site-I (S-I) was selected from the area nearer to 'Air-View- More' which is a prime location within the city. The second site (S-II) was selected from the Dadabhai colony area nearer to Prakash-Nagar and the third site (S-III) was selected from the area nearer to Fulbari-barrage. Water samples have been collected from the above-said areas and information was taken from the people associated with or residing in this area. The collected water samples are tested in the district laboratory at Fulbari.

In addition, to find out the problems that are faced by the local people due to water pollution few questions were asked such as (i) Are they using river water? (ii) For which purpose they are using it? (iii) What kind of problem they are facing with polluted water? All the answers provided by them are enlisted.

An interesting observation may be noted from the following statement of an informant, "In my elder sister's marriage we didn't collect the river water as the river is so much polluted, we have collected water from wells of seven houses and by mixing it we completed the ritual although river water has a sacred concept in our religious belief however we have found a replacement over it. I have heard from my mother that, at the time of the collection of water from the river we had some rituals of worshipping the river but now we don't collect the water from the river, so we don't perform those and even I do not know about how those should be performed." Another informant who is a housewife residing at Kulipara said "The whole year people are throwing

Figure 1: Dead bodies of the domestic animal on the bank of the river

Figure 2: Dumping of waste at the river bank behind the residential houses.

garbage near the riverside. Even we are also throwing domestic waste into the river in our area as there is no facility for solid waste collection from houses which is available in other areas. So, we are bound to throw the waste into the river. During any kind of festival, the sides are partially cleaned but not the entire area, and after one occasion gets over, the situation becomes as it was before" ("*Amader thakar jaiga amrai moyla korchi, badhyo hoe, tachara felbo kothay. Ekhane amader moyla felar jonno kono jayga nai, poriskar o korena tai moyla ekhanei felchi*").

Results

As we know, being an essential part of the environment in respect of living creature's existence water plays a vital role. The quality of water that people use in daily life controls their social, economic, hygienic and communal movements as well as lifestyle either directly or indirectly. In regards to Siliguri city, the main river is Mahananda which passes through the heart of the town and is highly polluted in the town area whereas the level of stalked wastes from the household or industrial sources is not so far noticed in the outer side of the town. Therefore, it has a significant effect on people's lives. To detect the variation of pollution level and its corresponding effects on human life it is very much important to know about the physio-chemical parameters of water. Thus three samples have been collected from different venues viz. the prime location as the Airview more, nearer to the entry point at Dadabhai colony followed by at

Fulbari barrage of the river and undergone physiochemical tests by district laboratory at Fulbari, Siliguri under Siliguri Water Supply Division.

Table: Presenting the amount of physio-chemical parameters at different locations of the river Mahananda in Siliguri city

Sl. No.	*Parameters*	*Acceptable Limit*	*Cause of Rejection*	*Place with Source*		
				Airview More (S1)	*Dadabhai Colony (S2)*	*Fulbari Barrage (S3)*
1.	Turbidity (NTU)	1	10	27.08	7.10	0.46
2.	pH	7.0-8.5	<6.5 or >9.2	8.76	7.71	7.67
3.	TDS (ppm)	500	2000	268	99	69
4.	Colour (Hz)	5	25	23.12	17.53	0
5.	Iron (mg/l)	0.1	1.0	0.24	0.56	0.04
6.	Res. Chlorine (mg/l)	0.2	>1.0	0	0	0
7.	Fluoride (mg/l)	1.0	1.5	0.38	0.44	0.46
8.	Total Hardness (mg/l)	300	600	144	46	42
9.	Total Alkalinity (mg/l)	200	600	224	66	38
10.	Chloride (mg/l)	200	600	133.87	4.05	3.49
11.	Nitrate (mg/l)	45	45	3.20	2.68	4.58
12.	Copper (mg/l)	0.05	0.5	0.38	0.23	0.30

Source: Field data, 2020

Discussion

The following parameters were selected to be tested for the water sample and their levels are listed below with their significance.

***Turbidity (NTU)*:** Turbidity is a measure of the degree to which the water loses its transparency due to the presence of suspended particulates. The definition of Turbidity is the cloudiness or haziness of a fluid caused by suspended solids that are usually invisible to the naked eye. It is an optical characteristic of water and is a measurement of the amount of light shined through the water sample. Organisms like phytoplankton, construction, mining and agricultural wastes are the main causes behind the high level of turbidity in water. There are several units to measure turbidity such as JTU (Jackson Turbidity Units) and NTU (Nephelometric Turbidity Units) but the NTU is used mostly. High turbidity can significantly cause several diseases in the human body and

also affect aquatic diversity. The above table indicates that the sample collected from the Airview-More area has the highest turbidity that is 27.08 NTU, in comparison to the other two samples which is very much higher than the acceptable limit and the sample collected from the Fulbari Barrage area shows the comparative lowest amount of Turbidity which is 0.46 NTU and thus the water sample collected from the Airview more area is found mostly polluted in respect of turbidity.

pH: pH is most important in determining the corrosive nature of water. By definition, pH is the negative logarithm of the hydrogen ion in the concentration of a solution. The pH range of pH scale is 0 (very acidic) to 14 (very alkaline). The lower the pH value higher the corrosive nature of water. pH was positively correlated with electrical conductance and total alkalinity (Gupta 2009). The pH measurement indicates whether the water sample is acidic or basic. The above table indicates that the sample collected from the Airview-More area has the highest pH level that is 8.76, in comparison to the other two samples which is very much higher than the acceptable limit and the sample collected from the Fulbari Barrage area shows the comparative lowest level of pH, which is 7.67, nearer to standard pH level and thus the water sample collected from the Airview more the area is found to be most basic in nature in respect of pH.

TDS (ppm): TDS stands for total dissolved solids in water. The bulk of total dissolved solids include Bicarbonate, Carbonate, Sulphate, Chloride, Nitrate, and some other heavy metals and trace constituents are common. The WHO limit of TDS for drinking water is 500 mg/l. High concentrations of TDS may cause the water to be corrosive and salty. Gupta (2018) stated, "Chemical substances having a negative physical effect will have a mandatory limit that should not be exceeded. Some substances, such as iron and manganese, have no significant negative physical effect but may restrict the use of the water, such as for the laundering of clothes". The sample collected from the Airview More area shows the highest TDS that is 268 ppm, in comparison to the other two samples which is much higher than the acceptable limit and the sample collected from the Fulbari Barrage area shows the comparative the lowest range of TDS which is 69 ppm and thus the water sample collected from the Airview more area is found to have the highest amount of dissolved solids in the water.

***Colour (Hz)*:** Pure Water is colourless as we all know, therefore any kind of appearance of colour in the water is considered the presence of any kind of impurities in the water and thus the water is known to be polluted. Coloured water is not aesthetically acceptable and highly coloured water is often not suitable for laundering, dyeing, food production etc. Thus, the colour of water affects the marketability for

both domestic and industrial use. The above table indicates that the sample collected from the Airview More area shows the highest unit which is 23.12 Hz, in comparison to the other two samples which is very much higher than the acceptable limit and the sample collected from the Fulbari Barrage area shows the comparative lowest unit of Turbidity which is 0 Hz and thus the water sample collected from the Airview more area is found mostly unacceptable in respect of colour.

***Iron (mg/l)*:** The chemical symbol of the element is 'Fe'. Iron is an essential element in human nutrition but the excessive amount of it is also harmful resulting in several diseases. Chronic Iron overload may result in a genetic disease such as Haemochromatosis. In addition, this presence of Iron beyond the level may affect the laundry work by damaging the clothes and also it causes an unbearable smell in the drinking water. The above table indicates that the sample collected from the Airview More area shows the highest amount of Iron that is 0.24 mg/l, in comparison to the other two samples and the sample collected from the Fulbari Barrage area shows the comparative lowest amount of Iron which is 0.04 mg/l and thus the water sample collected from the Airview more area is found mostly unacceptable in respect of the amount of Iron.

Residual Chlorine (mg/l): Chlorine is a chemical element with the symbol of 'Cl'. Residual Chlorine is the low-level amount of Chlorine remaining in the water after a certain period or contact time after its initial application. It plays a significant role in ensuring the protection of water from any microbial contamination. So, by testing its level it can be sum-up whether the water has undergone any purification process or not. All three samples from the above table show the amount of Residual Chlorine is 0 and thus indicates that none of the water sources has undergone any purification process.

***Fluoride (mg/l)*:** The chemical symbol of this is F^-. The additional Fluoride in levels above leads to a reduction in tooth decay in growing children. Dental fluorosis is another side effect that comes from an excessive amount of Fluorine consumption. The use of Fluoride water for a long time may lead to bone cancer, arthritis and even kidney disease. Out of the various sources, man-made origins such as phosphate fertilizer plants, and steel plants are much more responsible for increasing the amount of Fluoride in water, especially in the case of urban areas. Therefore, it is one of the significant parameters for testing the physio-chemical properties of water. The above table indicates that the sample collected from the Airview More area shows the lowest amount of Flouride that is 0.38 mg/l, in comparison to the other two samples and the sample collected from the Dadabhai colony area shows the comparative highest

amount of Fluoride which is 0.44 mg/l and thus the water sample collected from the three of the sampling sites found to be within the acceptable limit in respect of Fluoride.

***Total Hardness (mg/l)*:** Total Hardness is the expression of the results of direct measurement (principally of Calcium/ Magnesium) expressed as mg/l $CaCO_3$or Calcium Carbonate (WHO, 1993). Hardness can be connected with the risk of cardiovascular disease, growth retardation and reproductive failure and also with the mortality rate. Thus, it is an important water quality parameter to find out the effect of water pollution on the lifestyle of people living in this city. The above table indicates that the sample collected from the Airview More area shows the highest level of hardness, that is 144 mg/l, in comparison to the other two samples and the sample collected from the Fulbari Barrage area shows the comparative lowest level of hardness which is 44 mg/l and thus the water sample collected from the three of the sampling sites found to be within the acceptable limit in respect of total hardness.

Total Alkalinity (mg/l): The buffering capacity of a water body; a measure of the ability of the water body to neutralize acids and bases and thus maintain a fairly stable pH level, is known as total alkalinity (https://www.usgs.gov/...-water). Therefore, it is the balancing capacity of the water body itself that helps to maintain the ecosystem of the water. In a way, it is significant that it helps to survive aquatic plants and animals and also provides an idea regarding the presence of a certain chemical in water with an accurate level. The above table indicates that the sample collected from the Airview More area shows the highest level of alkalinity, that is 244 mg/l, in comparison to the other two samples and the sample collected from the Fulbari Barrage area shows the comparative lowest level of hardness which is 38 mg/l and thus the sample collected from Airview more area shows the alkalinity level more than the acceptable limit while the rest of the two samples are found to be within the acceptable limit of alkalinity in water.

***Chloride (mg/l)*:** The chemical symbol is 'Cl^-'. Chlorides are not usually so harmful to human health but a high level of it affects the aquatic ecosystem as aquatic plants and animals are unable to survive with an excess amount of it resulting in the loss of diversity and also affecting the economic perspective of those who are depending upon the aquatic animals for financial survival. The above table indicates that the sample collected from the Airview More area shows the presence of the highest amount of Chloride, that is 133.87 mg/l, in comparison to the other two samples and the sample collected from the Fulbari Barrage area shows the presence of comparatively the lowest amount of Chloride which is 3.49 mg/l and thus the sample collected from Airview

more area shows the highest amount of Chloride present in the water which is more than the acceptable limit while the rest of the two samples are found to be within the acceptable limit of the presence of Chloride in water.

Nitrate (mg/l): Its chemical symbol is 'NO_3^-'. Excess amount of Nitrate is a source of fertilizer for aquatic plants and algae and a large amount of it causes Eutrophication. This typically promotes excessive growth of algae thus resulting in a lack of oxygen in the water for the survival of other animals. In the case of human health, excessive amounts of Nitrate in water may harm the oxygen transportation of blood cells. Through several fertilizers, an excess amount of Nitrate is mixed in the groundwater and those who use it well as a source of drinking water have a high chance of being affected. The above table indicates that the sample collected from the Fulbari barrage area shows the presence of the highest amount of Nitrate, that is 4.58 mg/l, in comparison to the other two samples and the sample collected from the Dadabhai colony area shows the presence of the comparatively lowest amount of Chloride which is 2.68 mg/l and thus the sample collected from three of the sites are found to be within the acceptable limit of the presence of Nitrate in water.

***Copper (mg/l)*:** The chemical formula of this element is 'Cu". Copper is an important trace element that is required to maintain good health however, it is toxic to aquatic organisms at higher concentrations. Over amount of its presence in the aquatic environment may lead to damage to survival growth, reproduction enzyme activity and several other irregularities to human health, especially for those who are having regular contact with the aquatic system. Hence it is an important parameter that has a significant effect to detect the water quality based on different levels of its appearance. The above table indicates that the sample collected from the Airview More area shows the presence of the highest amount of Nitrate, that is 0.38 mg/l, in comparison to the other two samples and the sample collected from the Dadabhai colony area shows the presence of the comparatively lowest amount of Chloride which is 0.23 mg/l and thus the sample collected from three of the sites are found to be within the acceptable limit of the presence of Nitrate in water.

Anthropological Perspectives: Throughout the field observation and data it has been found that not only people and their lifestyle, who are living on the riverside are found to be affected by the pollution of water, but also somewhere the overall activity of the total city has contributed by random negligent attitude towards the river as a result of which it has been found that pollution of water is affecting people's lives in such a way that water seems to act as an agent to control the point of the compass of social motion of an individual as well as society. While having a conversation with the local

people one of them, who was a 45-year-old female wage labour residing in Ward No. 1 at Kuli para, said "It has almost been twenty-five years we have migrated to Siliguri and from then we are residing over here. As I have shifted with my family, at that time this area was not so much polluted. I am not blaming the administration, because in our area there is no regular waste collection process as it is provided to other wards of Siliguri but if we want we can keep our area clean. But we are randomly throwing the garbage into the river body and that is being stalked over here. We don't have any organizing capacity to keep the area neat and clean. For a long time we are residing here we took it as our destiny as we are habituated with the situation but the main problem is the spreading of bad smell from the stalked garbage" ("*moyla besi jomle khub baje gondho choray seta vison biroktikor"*). She further stated that "the pollution of water and the garbage become a part of our daily life and thus we are habituated with this and so far no more skin or other problems due to water is noticed. And we are poor people, and as we know poor people don't face disease or sickness" ("*Ei sob moyla to amader niyei cholte hobea r amra gorib manush tai goriber to serokom kono rog hoyna*"). By residing for a long time near the polluted region people are found to be in a helpless condition. In addition, during the rainy season when the water level of the river increases, the river water along with stalked garbage enters the nearby houses, one of the informants Labani Sarkar, stated that "last year due to rain the water enters into our houses and we have an E-rickshaw within which the polluted water enters and as an outcome the battery was fully damaged and due to this reason my father got hampered a lot."

Another informant, Shefali Rajbanshi, who is 38 years old, the wife of a fisherman residing in the Siliguri area said "My husband by profession is a fisherman. He collects the fish from the local river such as Mahananda and other water bodies and sells it to the market. Previously our income was sufficient and when I got married to him we were a happy family. But when my daughter was in class VI or VII, it was about ten years ago, day by day, his source of income seemed to be insufficient to our needs. He cannot get a sufficient amount of fish from the river and this affects him very much psychologically. Whatever he earned was not sufficient for us to run the family and day by day, he left that work. Now, he purchases fish from the wholesale market and sells it but this is not sufficient for us as the amount of profit is not as much as it was previously. Due to a lack of economic resources, I could not provide both of the children required books and other necessary things and as a result, they dropped their schools even before Madhyamik (class X). Till now I'm working as a maid and due to lack of income my husband is upset most of the time" ("*Ager moton nodite to akhon mach e nei, age olpo jolei shawye shawye mach paoa jeto, seisob mach e akhon bajar theke*

lok a kine khay. Dine dine mac her bikri teo temon luv korte parena sei jonno chele- meye duto kei to valovabe porateo parlam na).

The above discussion reveals the immense ramifications on man's life as they are tremendously affected by means of pollution of water. From the anthropological perspective to understand one society and the mode of its development, it is very much essential to observe people in the field and to find out their social set-up and status, which is found to be very much specific in the context of their identity. Through this study, it has been found that water is not only used as a source of natural resources but it has a significant role in controlling the livelihood of man. As a holistic approach, anthropology is also found to be concerned with the availability of economic resources as without proper economic sources the supply of a minimum livelihood is much harder. From food to education, in every aspect of today's life, a proper supply of income is much needed as without this, life seems to be miserable. In addition, kids who are growing up in such conditions, suffer a lot due to an unhealthy social atmosphere as not fulfilling the minimum requirement results in random conflicts in families. Thus, as the livelihood of man is affected, the entire society is suffering due to the pollution of water. Moreover, where, sustainability is one of the important issues for the survival of our own existence, random pollution from the stalked garbage creates a severe question towards the existence of natural river water in the near future.

Observation and Remarks

The study has been conducted to find out in what ways the polluted water is affecting the livelihood of people living in the city and to find out if the ground on which the people are getting influenced is related to the venue and pollution level along with its accountable parameters. From the laboratory report of the water samples, it has been found that among the three venues from where the water samples have been collected, the most affected area of the Mahananda River is- the venue of Airview-More where maximum parameters have been found higher than the safety level of use, then the area of Dadabhai Colony found to maintain a moderate level between them, followed by the area of Fulbari Barrage where the water is quite clear and also recommendable for drinking due to proper maintenance by the water supply division. But the impact of this water pollution is affecting the people of those places not only in the aspect of health, rather as the pollution of water and the waste material is found more in the area nearer to Airview More. It has a significant outcome on the social life of people residing in that area. According to E. J. Ross "Environment is an external force which influences us." These forces include socio-cultural, political and legal, technological,

economic and many more. Three of the constituents, of the environment viz. physical, biological and social are getting affected by them. This indicates that, as a biological being man is associated with the environment, rather man is a significant constituent of the environment. The study of the interaction between living things and their environment is called 'Ecology'. It is defined as "The total relationship of an organism to its organic and inorganic environment" by Ernst Haeckel who coined this term in 1866. During the 1950s, Julian Steward proposed a theory called 'Cultural Ecology' based on the concept of adaptive interaction between man and environment which expresses a symbiotic relationship to each other in their sustainable existence. Steward suggested a systematic way to study the dynamics of man-habitat interaction so as to get a process and at the same time to provide cross-cultural generalizations. In this regard, Upadhyay and Pandey mentioned in their book (1993:76), that the methodology which was proposed by Steward, is premised on the understanding that certain features of a given habitat or ecology are not necessarily relevant to a socio-cultural system and that not all systematic elements, including religion, politics, technology, and kinship, are equally affected by the interaction between humans and their habitat. The analyst is tasked with determining which aspects of the habitat bear upon the productive patterns of the system by focusing on systematic features empirically shown to be most closely involved in the culturally prescribed utilization of the habitat. Steward (1968: 337) stated, "Cultural ecology is broadly similar to biological ecology in its method of examining the interactions of all social and natural phenomena within an area, but it does not equate social features with biological species or assume that competition is the major process. It distinguishes different kinds of sociocultural systems and institutions, recognizes both cooperation and competition as a process of interaction, and postulates that environmental adaptations depend on the technology, needs and structure of the society and the nature of the environment. It includes analysis of adaptation to the social environment". Thus, it gives a conception that how the surrounding ecological environment predominates over the cultural existence of a community or vice-versa. The relationships between material culture and natural resources have been highlighted by Steward as the primary step of his cultural-ecological investigation. The material aspect of a culture may be called a material culture which is represented through one's technological attainments regulated by various techniques devised by man for his very existence on the earth and which is very much group-specific by culture. So, any kind of interference in the natural resources surely creates an impact on human beings that is an essential constituent of the environment. Moreover, how the regular lifestyle of "behaviour patterns entailed in exploiting the environment affect other aspects

of culture" (Steward, 1973: 37), indicates the transparency of correlation among the population, their pattern of behaviour and its reflection on their own culture by way of the environment. During the period of data collection, it was found that water plays a sacred role in numerous locations, with several age-old traditional practices attached to it. It is observed that the escalation of pollution in water sources has caused multiple traditional rituals to undergo modification. As traditional practices are an inherent component of the culture, it is having a significant impact on the culture itself. Therefore, it is essential to ensure that adequate measures are taken to preserve traditional practices while also addressing the issue of water pollution. Again Hoebel (1958) stated, "Culture is not determined by heredity, but it is a result of the total social environment." The social milieu surrounding an individual signifies the social groups to which they belong, in addition to their organizational and institutional backdrop. Herskovits says "Culture is the man-made part of the environment" and here the rise in water pollution has led to the gradual disappearance of cultural practices that are deeply ingrained in society. The unique nature of culture, intertwined with community sentiments, has had a profound impact on the social and environmental fabric of individuals. This article aims to present the social and environmental consequences of water pollution on the lives of those residing in Siliguri. The negative outcomes of this contamination, which has become a widespread problem, are examined in detail in this study.

Remarks: In order to obtain an in-depth understanding of the water quality in the Mahananda River located in Siliguri City, it is recommended to conduct a comprehensive monitoring and analysis of the river over a prolonged period of time. Furthermore, it is advisable to test other microbial parameters of the water to gain a more accurate assessment of its quality. In addition, it is crucial to explore and analyze the interconnection between water pollution and health, as well as other aspects of social life, to fully comprehend the impact of water quality on the community.

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