

An Observation of the Socio-Economic and Aquatic Parameters of the Modhumoti River in Kalna, Narail

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Abstract: Modhumoti River is an important socioeconomic and ecological resource for the people of Kalna region. Thus, it is important to observe the water parameters in the river and its impacts on the community. The study aimed to evaluate the socioeconomic status of the rural community near Kalna Ferry Terminal in Gopalganj district, covering area along the Modhumoti River. A total of 100 participants were selected, with 25 households sampled randomly from each kilometer. Key areas of investigation included religious affiliation, age distribution, education levels, access to drinking water and healthcare, housing quality, sanitation, monthly income, and species diversity in the region. In the research region, 91% of families are Muslim, and 9% are Hindu. Regarding education, over 13% of homeowners hold graduate degrees, 15% have higher secondary education, 42% have secondary education, 32% have primary education, and 13% are literate enough to sign only. Families with 4–6 members account for 61%, 20% are large, and 19% are small. Livelihoods are sustained through local businesses (25%), agriculture (16%), government and private jobs (20%), and fishing (10%). Monthly incomes show 18% earning below 10,000 Taka, 66% between 10,000–20,000 Taka, 12% between 20,001–30,000 Taka, and 4% above 30,000 Taka. For healthcare, 55% rely on village doctors, 16% use upazila health complexes, and 29% go to zilla hospitals. The Modhumoti River's aquatic parameters analyzed at five stations from Bhatiagara Bazar to Char Jajira. The findings revealed an average pH of 7.54, TDS at 223 ppm, EC at 0.216 mS/cm, and salinity at 0.1 ppt. Improving the socioeconomic standard and protecting the aquatic habitat of the Modhumoti River, in the Kalna region should require developments in education, sanitation, healthcare, and resource conservation.

Keywords: Housing; Livelihood; Rural Community; Sanitation; Socioeconomic.

INTRODUCTION

Bangladesh's major contribution comes to the economy from agriculture and serves as one of the world's most populous countries. Bangladesh is one of the most vulnerable countries on earth due to things such as falling water table, intrusion of salty water, rising river bed salinity, water contamination by arsenic and iron and so on, which poses a great threat to human and other fauna and flora besides having a negative bearing on the economic and social development of the country (Hossain, 2017). There are 230 rivers in Bangladesh, and Modhumoti is one

of them. The Gorai-Modhumoti River is also one of the longest rivers of Bangladesh and a distributary of the Ganges River. It's an essential element that is required by everyone, human being, plants, animals and any other living creature (Razo et al., 2004).

Due to human activity, river water contamination has already reached catastrophic levels in Bangladesh (Alam et al., 2007). The atmosphere and the crust of the planet contain natural substances called heavy metals. Metal contamination in surface water bodies makes them unsafe for drinking, cooking, growing fish, and irrigation (Kibria et al., 2010). Metal contamination may affect the

biodiversity of aquatic ecosystems and decrease species diversity by impairing reproduction (Kibria et al., 2012). Because of our nation's increasing urbanization, industrialization, poor economic situation, lack of knowledge, and natural disasters, surface water contamination is a severe environmental issue (Sarker, 2005). Metals are non-degradable and perhaps essential for plant growth at certain concentrations, but when they cross a specific threshold, they turn toxic (Qishlaqi and Moore, 2007). Volume and density of pollutants from numerous industries, agricultural chemicals, fluctuations in water runoff throughout the year and the ability of the river system to disperse chemicals all influence the quality of water in the river (DHV, 1998).

Sustainable socioeconomic circumstances are possible when a system or a country is capable of coping with the pressures and shocks and enhance and build up sustainably the demographic, physical, human, financial, social and natural capital holdings of today and tomorrow without eradicating natural capital (Chambers and Conway, 1992). In most countries, especially developing ones like Bangladesh, poverty has taken on a variety of forms and has emerged as one of the main issues. In most rural areas of the world, especially in Asian nations, population pressure has made poverty and hunger widespread among rural communities. Seventy percent of the population, on average, is thought to reside in rural regions. Therefore, it is essential to acknowledge poverty reduction as a fundamental element of rural development programs, where the first step is to meet the basic minimum requirements, or BMN, of the impoverished (Setty, 1992).

Sustainable livelihood is one that is resilient to stress and shocks, or capable of recovery and enhancement and maintains or improves its resources even now and in the future without eradicating natural capital (Chambers and Conway, 1992). The sustainable livelihood strategy has gradually developed taking form of its own fundamental and principles in the context of poverty focused development interventions. Measures have been taken to make the rural development process sustainable and poverty eradication (DFID, 1998). The strategy is essentially based on a study of capital assets using fundamental principles in the context of the external environment. The idea of perspective of the sustainable livelihood can be used in terms of goals, scope, and priorities of development in order to end poverty faster (Scones, 1998). They all pointed out that regional rivers' water cannot meet most of the allowable limit of the national standard; mainly due to a large no. of pollutants, no regular water quality monitoring, weak and lax policies of the national surface water management authority and issues with climate change.

Consequently, a comprehensive appraisal of river water pollution status is important in enhancing management and conservation of the surface water environment. The purpose of the study was to determine the socioeconomic status and water quality justification of Kalna Ghat, a riverine hamlet located in the Gopalganj district along the Modhumoti River.

MATERIALS AND METHODS

Study area

The study was carried out in Kashiani and Alfadanga upazila. Kashiani is situated at 23.2167°N 89.7000°E while Alfadanga is situated at 23.2833°N 89.7167°E. It is bordered on the north by the district of Faridpur, the south by the districts of Pirojpur and Bagerhat, the east by the districts of Madaripur and Barisal, and the west by the district of Narail.

Preparation of questionnaire and collection of data

A questionnaire that asked numerous questions about the socio-demographic situation, age, education level, religion, income, and family members who made a living was created in a logical order and contained aspects that affected the life of the Kalna community. In time the data was collected from 100 single householders and some information was whole family condition perspective, which was helpful to understand the whole family's socio-economic status.

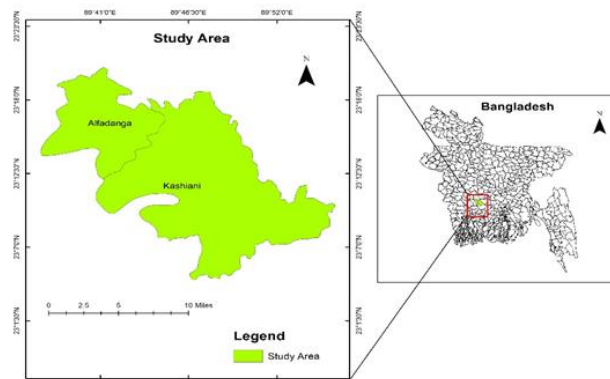


Figure 1: Map of the study area

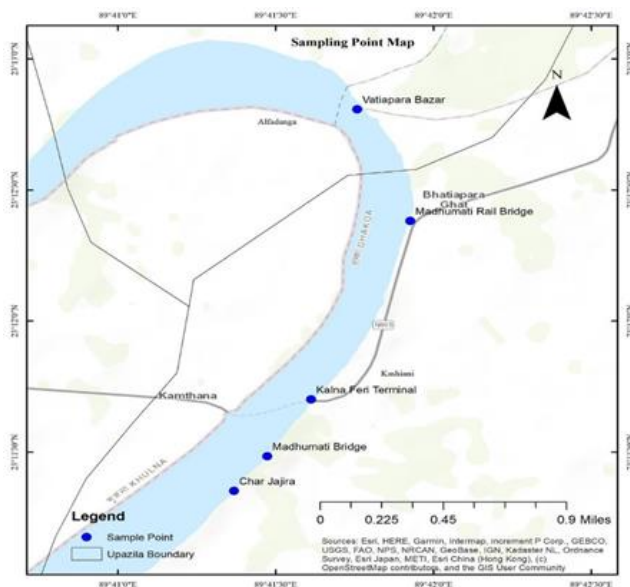


Figure 2: Selected water sampling station of Modhumoti River

Water sample collection

Five sites in Modhumoti River were chosen and water samples were collected; their quality characteristic was analyzed and compared with one another. Surface water samples were taken from the Modhumoti River in dry season in the two days of January 14, 2023 and were analysed for the Elements of water Physical/Water Quality Parameter as well as the chemical composition. Throughout time, water sample collection was done using 0.5-liter polypropylene bottles.

Water parameter test in laboratory

Samples were collected for the assessment of water quality of Modhumoti River. For the analysis of some physiochemical parameters the method described in Standard Methods for Water and Wastewater Inspection APHA (2005) has been adopted. The entire laboratory test was conducted in the BSMRSTU Environmental Science and Disaster Management laboratory. pH was measured by pH meter, HANA meter, Model no. HI9813-6, EC measured by EC meter, HANA meter, Model no. HI9813-6, TDS measured by TDS meter, HANA meter, Model no. HI9813-6 and salinity measured by HANNA salinity meter, Model no. HI98319.

Data analysis

After being collected, the data were edited and coded. All of the facts were compiled, thoroughly examined, and documented. Eventually, pertinent tables that matched the study's goals were created. Due to its simplicity in computation, popularity, and readability, tabular data is typically presented. Microsoft Excel 2016 has been utilized for processing and analysis.

RESULTS AND DISCUSSION

General Demographic Characteristics of Respondents

Respondents' demographic features are given in the following Table 1. The majority of farmers interviewed were Muslim (i.e., 91% of Muslim families and 9% of a Hindu family). Every family was located very close to the Modhumoti River and most Hindu families are depending on the river, such as fishing work. In the study area, the maximum numbers of the householder are young and middle age. The study identifies that the householder's age limit is 51 to 60 years and the householder's number is 25%. Then the smaller number of householders is 23% and their age limit is 41 to 50 years. In the same way 20 to 30 years, householders are funded 20% in the area. There have found some families where the householder's age is more than 60 years and the number is 5% and their age limit is 61 to 70. In the last 71 to 80 years householders' number is 5%, which is very difficult to maintain a family condition. Inquiries were made to understand the marital status of the Kalna community. It was found that 96% of married and 4% of the unmarried person as householders. In this study area majority of the family size was small (i.e., Small 19%, Medium 61%, Large 20%).

In the study areas, 13% of householders were illiterate,

32% were primary level, 27% secondary school level, 15% were higher secondary level and 13% of the householders were graduates. In the studied area, the literacy rate was increasing day by day and the new generation was educated properly but in some low-income families, children connect with income to support their family at the child age. Three types of houses were found in the studied area, it was found that 40% of the house is Tin shed, in which the wall and roof are made of tin, the Semi-pacca house was found also 40%, which is made of bricks and tin. This area has 20% of Pacca house, which is completely made of bricks (Figure 3).

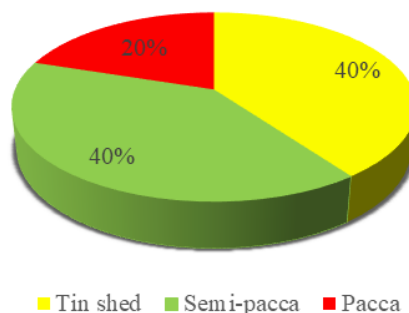


Figure 3: Housing condition

The study identifies the major health problem of the householders and these are 11% of Hypertension patients, 10% of Cardiovascular and 6% of Diabetes patients. In the study area, a huse number of households suffer from different problems. This number is 41% and the problems are body pain, hearing problems, etc, on the other hand, 32% of householders are not suffering from a long-term problem. These persons are of maximum young ages (Figure 4).

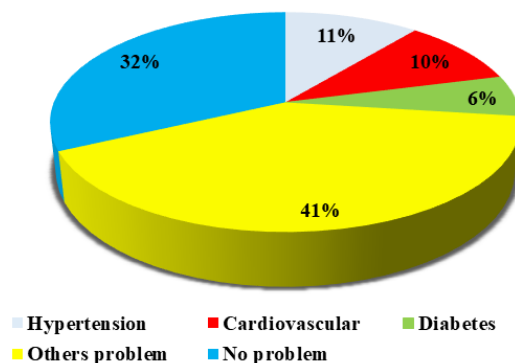


Figure 4: Health condition

The two primary forms of cooking fuel used in the research region are LPG and firewood. In the study area, 76% of the respondents use firewood as cooking fuel and 24% family use LPG. In the whole area is taken electric facility (Figure 5).

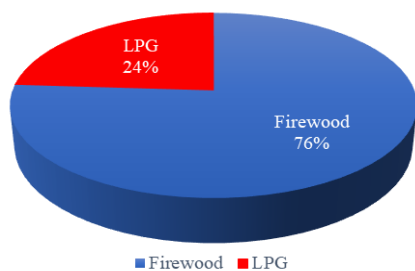


Figure 5: Source of energy

In the present study about 25% of the respondents reported that they were in business, and 16% of the total householders were completely dependent on agriculture production. This area has found 9% of government job holders and 11% of private job holders, their main income source is monthly salary. There also found 10% of fishermen, who catch fish from the Modhumoti River and family costs depend on the fishing, some fishermen are attached to the fish business (Table 1).

The study area had found very low-income families at 18%, low-income family is 66%, middle-income family number was 12% and high-income family was found 4%. In the area total of 100 responded persons' average monthly income was 15,417 taka only. As indicated by responders of the study area 22% number of households were using kacha toilet which was made of bamboo with leaf shelter and educate drainage disposal, 41% of the family were used semi-pacca toilet which was made of tin or wood and had low drainage disposal system, in the study areas 37% of the family were using pacca toilet which is made by bricks and good drainage disposal.

Table 1. Socio demographic status of the study area (N=100)

Characteristics	Categories	Total Respondents (N=100)
Religious status	Muslims	91%
	Hindus	9%
Age structure	20 to 30 years	20%
	31 to 40 years	22%
	41 to 50 years	23%
	51 to 60 years	25%
	61 to 70 years	5%
	71 to 80 years	5%
Marital status	Married	96%
	Unmarried	4%
Family size	Small	19%
	Medium	61%
	Large	20%
	Illiterate	13%
Educational status	Primary	32%
	Secondary	27%
	Higher secondary	15%
	Graduate	13%
Housing condition	Tin shed	40%
	Semi pacca	40%
	pacca	20%
Monthly income	Less than 10,000	18%
	10,000 to 20,000	66%
	20,000 to 30,000	12%
	More than 30,000	4%
Sanitation facility	Kacha	22%
	Semi pacca	41%
	Pacca	37%

pH

pH values of 5 selected sampling stations on the Modhumoti River were examined. The highest values were found at Vatiapara Bazar and the other four stations showed the same values. The study revealed all of the samples were slightly alkaline. The pH level that is low than 6.5 and high than 8.5 is not appropriate or recommendable for drinking (WHO, 2017). Although pH has no effect on human health, it effects all the biological and/or chemical reaction (Subba et al., 2017). Therefore, the water of the Modhumoti River can be used not only for drinking but also for recreation, irrigation, and other pH-dependent purposes.

Total dissolve solid (TDS)

The highest TDS was found 230 ppm in Kalna Feri Terminal and Modhumoti Bridge, while the lowest TDS was found 212 ppm in Modhumoti Rail Bridge. All of the samples were found below to the standard limit of TDS recommended level (1000 mg L⁻¹) by WHO (2017) and desirable for drinking (Asif et al., 2023). The same way the value ranged between 210.0 and 500.0 mg L⁻¹ that exists at the surrounding areas of JUST campus Shaibur et al. (2019a) whereas the values oscillated from 32.9 to 211.0 mg L⁻¹ with a mean of 72.22 mg L⁻¹ in Dhaka city (Bodrud-Doza et al., 2020).

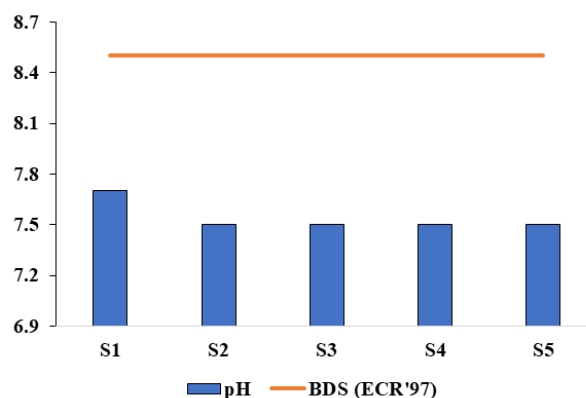


Figure 6: pH levels in study area

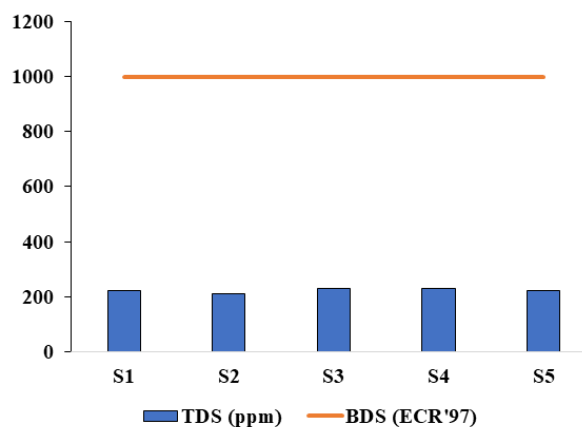


Figure 7: TDS level in Modhumoti River

Salinity

Every sampling station had the same value and the value is 0.1 ppt. According to the Water Science School, 2018, a slightly saline water range should be 0.50-0.70 ppt. As a result, the water of the Modhumoti River is safe for human consumption and consumption by animals and suitable for recreational purposes, for watering crops and for industrial usage.

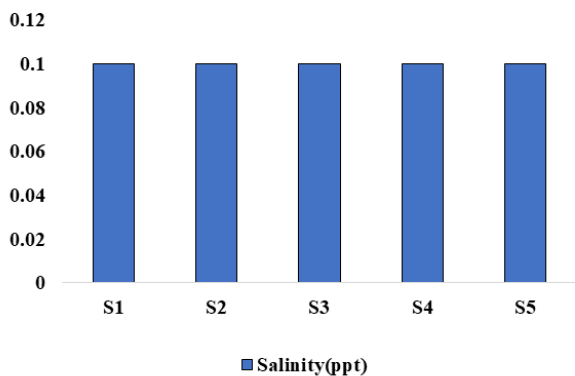


Figure 8: Salinity of Modhumoti River

Electric Conductivity (EC)

The highest values were measured at 0.22 mS/cm on the Kalna Feri Terminal and Modhumoti Bridge and the lowest values were measured at 0.21 mS/cm on the Modhumoti Rail Bridge and Char Jajira. The allowed BDS electric conductivity is 0.50-0.70 mS/cm for drinking water. Therefore, the water of the Modhumoti River is suitable for drinking purposes. As a result, it is clear that water of Modhumoti River is safe for drinking purpose. However, the EC should be analyzed if it goes beyond the value of 300 $\mu\text{S cm}^{-1}$ due to drinking water EC is an approximate measure of the salinity, or TDS. The high salt concentration the better is carrying out the current (Shaibur et al., 2012).

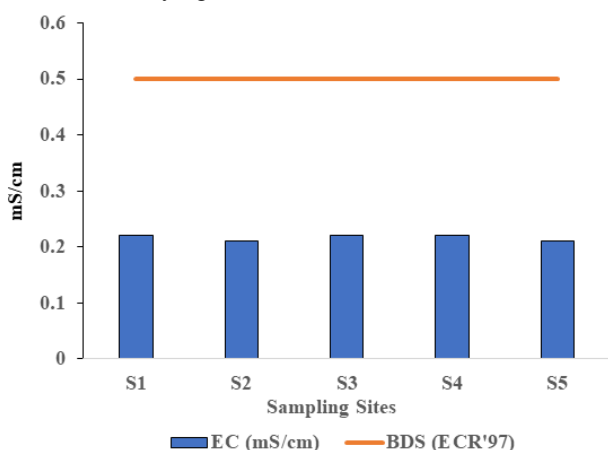


Figure 9: EC level in Modhumoti River

CONCLUSION

The Kalna region in Narail along the Modhumoti River reflects a community navigating a blend of opportunities and challenges. Predominantly Muslim (91%), the popular-

tion exhibits improving educational levels, with 42% completing secondary education. However, 13% remain illiterate, and many children from low-income families forgo education to support their households. Housing conditions are modest, with most families living in semi-pacca or tin-shed homes, while only 20% reside in fully pacca structures. Sanitation infrastructure remains inadequate, as 63% of toilets are either kacha or semi-pacca, contributing to environmental and health risks.

Livelihoods in the region are diverse but predominantly informal, with 25% engaged in local businesses and 16% in agriculture. Monthly incomes are modest, with the majority earning between 10,000–20,000 Taka, highlighting economic vulnerability. Access to healthcare is limited, with 55% relying on unqualified village doctors, reflecting the need for improved medical infrastructure.

The Modhumoti River, central to the community, offers high-quality water suitable for drinking and irrigation, with average pH, TDS, and salinity levels within safe limits. This resource presents significant potential for supporting sustainable development and industrial initiatives. While ongoing infrastructure projects, like the Modhumoti Bridge, are fostering connectivity and economic opportunities, investments in education, sanitation, and healthcare are essential for enhancing the quality of life and ensuring the region’s long-term growth.

Conflict of Interest

The author declares that there is no conflict of interest.

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