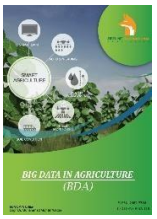
ZIBELINE INTERNATIONAL™ PUBLISHING

ISSN: 2682-7786 (Online)
CODEN: BDAIDR

Big Data in Agriculture (BDA)

DOI: http://doi.org/10.26480/bda.01.2022.22.27



RESEARCH ARTICLE

AN OVERVIEW OF FISH BIODIVERSITY AND SOCIOECONOMIC SITUATION OF THE PADMA RIVER'S FISHER COMMUNITY IN BANGLADESH

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ARTICLE DETAILS

Article History:

Received 11 March 2022
Accepted 15 April 2022
Available online 22 April 2022

ABSTRACT

The current study focused on the status of fishing and livelihood status of fishers through employing household interviews, Focus Group Discussions and key informant interviews at Sujanagar Upazila under the Pabna district. The catch was quite substantial during the period of the study, and fishing operation was especially intense from early hours to midday. There were three main types of gears recorded in this study namely nets, traps, and wounding gears and the most used gear was Thela jal (push net). The result of this research indicates that a total of 33 fish species were identified where 18% of catfish, 31% of carp, 9% of snakehead, 6% of eel, 12% of barbs, clupeids and minnows, 18% of perch and 6% of crustaceans were identified. Fishing is the primary source of income for 68% of the fishermen, which has a serious influence on their livelihood. According to the study's findings, the majority of fishers (62%) had tin-shaded dwellings and 82% of the fishermen had tube well as the source of drinking water. The fishers' healthcare facilities were poor. About 66% of fishers got electricity and 54% of them belonged to the medium income (TK. 41,000-70,000/year) group. The overall livelihood condition of the fishers was unsatisfying related to socioeconomic obstacles such as an increase in the number of fishers, limited income, a lack of credible revenue-producing activities, credit issues, infringement, price inflation, and resource disputes among stakeholders. So the comprehensive strategies and their efficient execution are essential for improving fishermen's livelihood.

KEYWORDS

Fish Biodiversity, Fishing Gear, Socio-Economic Status, and Padma River

1. INTRODUCTION

Bangladesh has a long history of sustained prosperity within a stable economic framework in which fisheries play a significant role in protein production, employment creation, and foreign currency gains (Mome et al., 2007). Bangladesh has been referred to as the "Country of a Hundred Rivers" from ancient times and has approximately 800 rivers including tributaries that flow through the country and make a waterway that spans 24,140 kilometers (CEGIS, 2003). The Padma River is one of the longest rivers and is thought to be a significant breeding and feeding area for Bangladesh's riverine fish species. The Padma is 366 kilometers long and a section of the Ganga that enters Bangladesh from India (Murshidabad district) in Chapai Nawabganj district's Shibganj Upazila (Manakosha and Durlavpur unions) (Hossain et al., 2005). Padma flows southeast over 120 kilometers (75 miles) till it meets the Meghna River in the Bay of Bengal, and the main channel of the broader Ganga River in Bangladesh is 4 to 8 kilometers wide incorporating Nawabganj, Rajshahi, Pabna, Kushtia, Faridpr, Rajbari, and Chadpur.

Bangladesh is also home to a diverse range of fish species and other important aquatic animals, in addition to its potential water resources and by this way the river serves as commercial fisheries. Small and large-scale fishermen catch a variety of fish throughout the year, including some commercially important species (Hossain et al., 2009). The Padma River is known for its abundance of a variety of fish and shellfish, with the carps and minnows of the family Cyprinidae, a variety of catfishes, and the migratory Hilsa being the most renowned. Fish biodiversity is influenced by the socioeconomic status of the fishermen and so the fishing community is vital to Bangladesh's fish biodiversity and economy (Afrad et al., 2019). However, the majority of fishermen are poor and lack many necessities and must fight for their lives all the time and the socio-economic situation of the fishermen is not good at all. Due to economic, social, and technical constraints, they do not have unrestricted access to water bodies to collect fish and are unable to catch fish effectively. The fisherman's annual per capita income is BDT 2,442, which is almost 70% lower than the per capita income of the country and that's why they are considered as the poorest of the poor (Alam and Bashar, 1995).

Human influence has resulted in habitat loss and degradation in riverine ecosystems and as a result, many fish species particularly in rivers have become severely endangered. Because of their high sensitivity to changes in the aquatic environment, both quantitatively and qualitatively, freshwater fish are currently one of the most threatened taxonomic groups (Darwall and Vie, 2005). As a result, maintaining fish biodiversity and related ecosystems is a significant issue today (Laffaille et al., 2005). Despite the importance of the Padma River for fisheries resources, the fisher community's socioeconomic condition is poor and climate change impacts affect a wide variety of rural livelihoods which poses a key problem for fisheries resources as well as their livelihood status. To properly manage fish biodiversity, it is vital to determine the reasons for the species' decline and this study tried to collect information on fish biodiversity in the Padma River. Every year, the government takes steps to protect the well-known fishery, but little is known about the fishing community who are involved in fishing practice along the Padma River.

Quick Response Code	Access this article online	
	Website: www.bigdatainagriculture.com.my	**DOI:** 10.26480/bda.01.2022.22.27

Cite The Article: Rabeya Akter, Sohel Hasan Sharif, Mujibur Rahman Khan (2022). An Overview of Fish Biodiversity and Socioeconomic Situation of The Padma River's Fisher Community in Bangladesh. *Big Data in Agriculture, 4(1): 22-27.*

Taking into account the foregoing facts, the study investigated some specific objectives to determine the present status of fisheries resources in selected areas of the Padma River, to measure the diversity of fishing gears used, to assess current fish market and marketing channels and to understand the livelihood of fisher communities along the Padma River.

2. Materials and Methods

2.1 Selection of The Study Area

This study was conducted in the Sujanagar Upazila of Pabna district (Figure 1) where a large number of fishermen were found to be involved in fishing and rely on the Padma River as their main source of income. The entire study was performed over 16 weeks, from July to October of 2018.

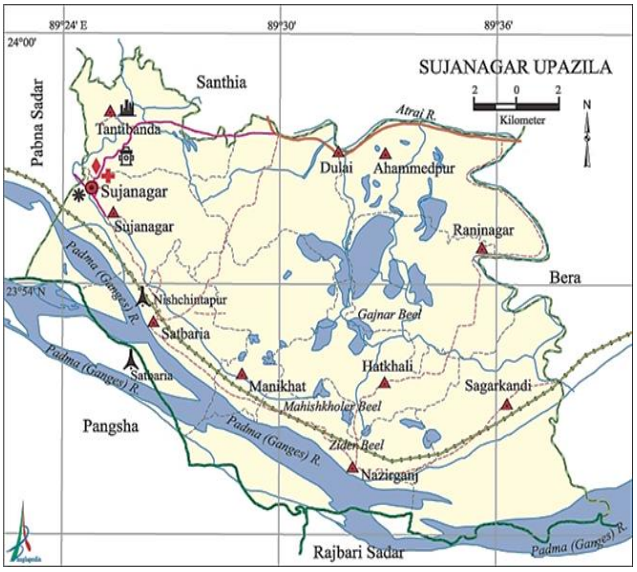

Figure 1: Schematic diagram of the study area, Sujanagar Upazila (Source: Banglapedia)

2.2 Data Collection

The majority of the information was obtained by observation and sampling, which were used as the primary methods of data collection. Personal interviews were supplemented by concerning the various Participatory Rural Appraisal (PRA) tools such as Focus Group Discussion (FGD) and Crosscheck Interviews (CI) with important informants.

2.3 Secondary Data Collection

Secondary sources of information included published publications such as journals, books, and theses, as well as BFDC documents. Furthermore, relevant government and non-government organizations, such as the Department of Fisheries (DoF) and local non-governmental organizations (NGOs), contributed information regarding the research.

2.4 Primary Data Collection

Primary data was utilized to double-check the secondary data and using the survey method to collect data, a questionnaire is quite successful. To achieve the study's goals, a questionnaire was created to acquire a thorough picture of the fisheries and the fishermen's socio-economic situation. A total of 50 fishermen were chosen at random for questionnaire interviews, with five chosen from each kilometer of the research region and thus it covers a wide range of socio-demographic issues, as well as the income of fishermen and their families, as well as other significant aspects of the riverine fishery.

2.5 Crosscheck Interviews

In light of the Padma River's fisheries and socioeconomic circumstances, crosscheck interviews with Upazila fisheries officers in Sujanagar Upazila, Pabna, were conducted after the information from questionnaire interviews was gathered. Data was also collected from Char khalilpur, Najirgonj, and Kamarhat Upazilas in terms of local regions for justification. The primary survey's results were used to reach the study's conclusion.

2.6 Data Analysis

Data were summarized and processed for analysis before being tabulated. The processed data was moved to an Excel sheet and displayed in textual, tabular, and graphical formats to better understand the socio-economic obstacles and difficulties faced by fishers in the Padma river's surroundings.

3. Results and Discussion

3.1 Fishing Period

Fishing might be done at any time of day or night, but the activity was high from morning to noon and low from noon to evening. During the night, fishing activity was moderate. Based on the fishing season, the fishermen were divided into three categories. The first group comprised of individuals who caught fish for 1-2 hours, the second group for 3-4 hours, and the third group for 5-6 hours. The majority of fishermen fall into the second category, which had the highest proportion (52%), while the first group had the lowest (22%). As a result, the average length of time spent fishing was between 3 and 4 hours (26%). These three types of fishing duration are shown in Figure 2.

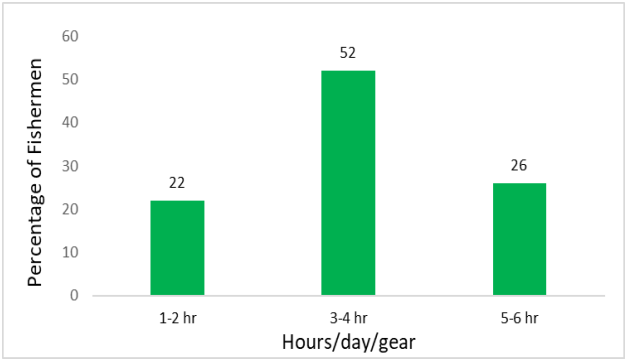

Figure 2: Fishing duration of the fishermen in the study area

3.2 Gear Diversity and Fish Harvesting

The majority of the Padma river is dry during the pre-monsoon, that's why the fishing gear was severely restricted at that time. The river's water level raised owing to rainwater during the monsoon season and usage of all sorts of fishing gear also increased. However, during the post-monsoon season, the river's water level began to drop and for this, the number of nets and traps utilized was also lower. During the monsoon season, current jal and Jhakijal continued to function in increasing numbers in the river's surrounding canals. The various types of fishing gear used by the fishers in the study region were documented and they were categorized by the specifications, modes of operation, and catch compositions. Most of the gears were typical, but some of them were unique since they were specifically utilized in the research region and they selected the gear type, design, and mesh size for capturing specified kinds and sizes of fish. In these findings, 16% of the fishers caught fish using Jhaki jal (Lift net); about 12% of the fishers caught fish using current jal (Gill net); 4% of the fishers fished using Berjal (Seine net); 24% of the fishers fished using Thela jal (Push net) that was the highest proportion of the fishing gears used; 6% of the fishers fished using Moiya jal; 8% of the fishermen caught fish using Chandibair (Trap); 12% of the fishermen caught fish using Bair (Trap); 18% of the fishers fished using Borshi (Wounding gear) (Table 1).

Table 1: Gears and Percentage of The Fishermen Who Used These Gears

Name of gears	Number of fishermen (50)	Percentage of fishermen
Jhaki jal (Lift net)	8	16
Ber jal (Seine net)	2	4
Current jal (Gill net)	6	12
Thela jal (Push net)	12	24
Moiya jal	3	6
Chandibair	4	8
Bair	6	12
Borshi	9	18

Depending on the number of fish harvested, the fishermen were separated into three groups. The first category contained 32% of the fishermen, who harvested roughly 1-1.5 kg of fish per day, the second category contained 46 %t of the fishermen, who harvested an average of 1.6-2 kg of fish each day and the third category included 22% of the fishermen, who harvested between 2.1 and 2.5 kg of fish each day (Figure 3).

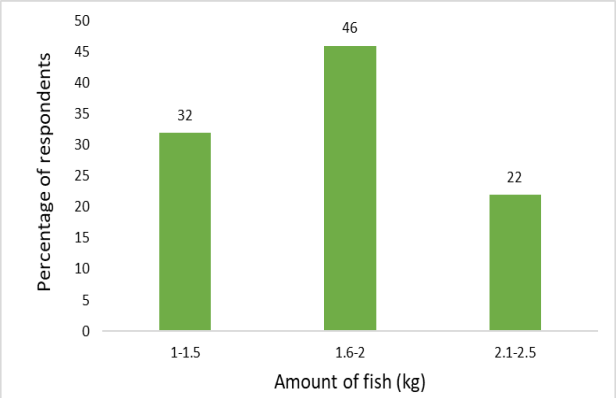

Figure 3: Amount of fish harvested by the fishers (kg/day/fisher) in the study area

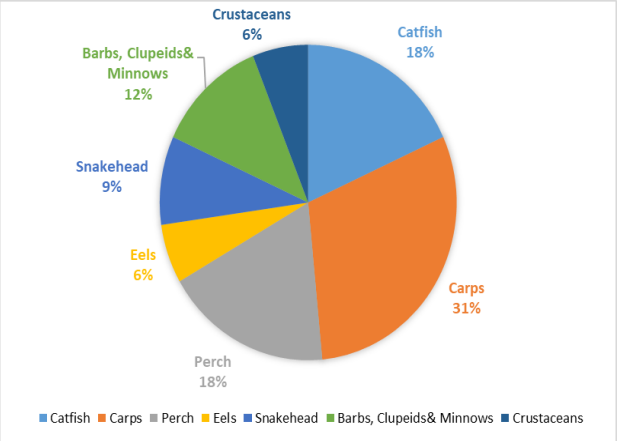

Figure 4: Percentage of major fish groups of the Padma river

3.3 Fish Biodiversity in The Padma River

Various kinds of fish were captured by fishers in the Padma River throughout the research period, including Carps, Barbs, Clupeids and Minnows, Catfish, Perch, Snakehead, Eels and Crustaceans which constituted 31%, 12%, 18%, 18%, 9%, 6%, and 6%, respectively (Figure 4).

Few species, such as Catla (*Catla catla*), Rui (*Labeo rohita*), and Hilsha (*Tenualosa ilisha*), were extremely prevalent among the 33 species of fish and crustaceans found in this river. The availability of some fish species was reasonable while others such as Pangus were quite rare (*Pangasius pangasius*). There are 33 fish species identified in the Padma River which have been displayed in Table 2.

Table 2: List of Fish Species as Recorded During The Study Period in The Padma River

Order	Family	Local Name	Common Name	Scientific Name
Cypriniformes	Cyprinidae	Mrigal	Mrigal	*Cirrhinus Mrigala*
		Catla	Indian Major Carp	*Catla Catla*
		Kalibaus	Black Rohu	*Labeo Calbasu*
		Rui	Indian Major Carp	*Labeo Rohita*
		Bata	Minor Carp	*Labeo Bata*
		Silver Carp	Silver Carp	*Hypophthalmichthys Molitrix*
		Mola	Barb	*Amblypharyngpdon Mola*
		Puti	Small Fish	*Puntius Sophore*
	Botiidae	Bou	Small Fish	*Botia Dario*
	Cobitidae	Gutum	Gimtea Loach	*Lepidocephalus Giuris*
Clupeiformes	Clupeidae	Hilsha	Indian River Shad	*Tenualosa Ilisha*
		Kachki	Ganga River Sprat	*Corica Soborna*
Perciformes	Channidae	Shol	Snakehead Murrel	*Channa Striatus*
		Taki	Spotted Snakehead	*Channa Punctatus*
		Chang/Raga	Asiatic Snakehead	*Channa Orientalis*
	Anabantidae	Koi	Climbing Perch	*Anabas Testudineus*
	Nandidae	Veda	Gangetic Leaf Fish	*Nandus Nandus*
	Ambassidae	Chanda	Glassy Fish	*Chanda Ranga*
	Osphronemidae	Kholisha	Striped Gourami	*Colisa Fasciatus*
	Mastacembelidae	Guchibaim	Striped Spiny Eel	*Mastacembelus Pancalus*
	Gobiidae	Baila	Bar-Eyed Goby	*Glossogobious Giuris*
Siluriformes	Bagridae	Gulsha Tengra	Catfish	*Mystus Gulio*
		Tengra	Catfish	*Mystus Tengra*
		Air	Long Whiskered Catfish	*Mystus Aor*
	Siluridae	Boal	Fresh Water Shark	*Wallago Attu*
		Pabda	Pabda Catfish	*Ompok Pabda*
	Pangasiidae	Pangus	Cat Fish	*Pangasius Pangasius*
Synbranchiformes	Mastacembelidae	Tara Baim	One Striped Spiny Eel	*Macrognathus Aculeatus*
Osteoglossiformes	Notopteridae	Foli	Feather Back	*Notopterus Notopterus*
		Chitol	Humped Feather Back	*Notopterus Chitala*
Beloniformes	Belonidae	Kankila	Pipe Fish	*Xenentoden Cancila*
Decapoda	Palaemonidae	Golda Chingri	River Prawn	*Macrobrachium Rogenbergii*
		Gura Chingri	Monsoon River Prawn	*Macrobrachium Lumarre*

3.4 Socio-Economic Conditions of The Padma River's Fishing Community

3.4.1 The Social Profile of The Village

There are 68% of the fishers were involved with fishing as their main occupation and 32% of the fishers were involved with other occupations. Other professions include crop cultivation, day labor, rickshaw pulling, van pulling, selling clothes etc. and they had to depend on secondary occupations due to insufficient income derived from fishing (Table 3). A group researchers found that fishing is the most common occupation of the fishers in the Dengar beel and 46% of fishers were engaged in fishing as their primary occupation (Islam et al., 2021).

Table 3: Socio economic conditions of the Padma river's fishing community

Characteristics	Category	Frequency of respondents	Percentage of respondents
Social profile (occupation)	Fishing	34	68
	Others (crop cultivation, van driving, day labor)	16	32
Age	Young (20-39 years)	31	62
	Middle (40-59 years)	14	28
	Old (above 60 year)	5	10
Education	Illiterate	16	32
	Can sign only	24	48
	Primary	10	20
Fishing experience range in the year	1-10	8	16
	11-20	14	28
	21-30	18	36
	31-40	10	20
Family size	Small (3-4)	21	42
	Medium (5-7)	26	52
	Large (above 7)	3	6
Housing condition	Mud-build	15	30
	Tin-shed	31	62
	Half-building	4	8
Sanitation facilities	Poor	27	54
	Moderate	18	36
	Developed	5	10
Drinking water facilities	Own tube-well	41	82
	Neighbor's tube-well	9	18
Health facilities	Village doctor	26	52
	Health community	11	22
	Others	13	26
Housing electricity facilities	Yes	33	66
	No	17	34
Annual income	Low income (30,000-40,000)	14	28
	Medium income (41,000-70,000)	27	54
	High income (71,000-1,00000)	9	18
Credit availability	Received loan	29	58
	Don't received loans	21	42
Training	Trained	185	36
	Not trained	32	64
Religious status	Muslims	37	74
	Hindus	13	26

3.4.2 Age

Age structure is a very important factor for evaluating the status and roles of the fishermen were categorized into three groups. These groups were young (20-30 years), middle-aged (40-59 years) and old (above 60 years) and in the study, 62% were young, 28% were middle and 10% were old respectively (Table 3). A group researchers found in their study that in the Padma river the maximum number of fishers (39%) belonged to the age group of 31 to 40 years, 21% belonged to the age group of 21 to 30 years (Sunny et al., 2019).

3.4.3 Education

The fishermen can be grouped into 3 categories according to their education status. The categories are 32% of the fishermen were illiterate or on education, 48% capable sign only and 20% had education up to the primary level of education in the study area (Table 3). In terms of socioeconomics in Char Atra adjacent to Padma River, found that, although 41% of the inhabitants were completely illiterate, unable to sign but the literacy rate among young children was 85%, indicating that the educational quality in the study regions was increasing day by day while the majority of them (46%) had only completed basic school (Sunny et al., 2019).

3.4.4 Fishing Experience Range in The Year

In the survey area, 16% were in the experience range of 1-10 years, about 28% were in the experience range of 11-20 years and 36% of the respondents were in the experience range of 21-30 years which belonged

to the highest number of respondents and 20% of the respondents were in the experience range of 31-40 years (Table 3).

3.4.5 Family Size

Three types of families were identified in the research area such as small family, medium family and large family. During the period of study, small family constituted 42%, medium family 52% and large family 6 % of the total surveyed fishermen (Table 3). A group researchers described in their study that both the nuclear and joint families are prevalent, and also stated in their study that 78% had an average family having five members among the Padma rivers fisher's community that support the current findings (Sunny et al., 2019; Rahman et al., 2017).

3.4.6 Housing Condition

In the study area, most of the fishermen had tin-shaded houses and very few had building houses. The data tells that the majority (62%) of the fishermen had tin-shaded housing facilities, 30% had mud-build and 8% had half-building facilities (Table 3). Faruque and Ahsan mentioned four types of housing systems and the majority of fishermen had poor housing conditions (more than 80%) and they were unable to make a house with brick or wood which is relevant to the current findings (Faruque and Ahsan, 2014).

3.4.7 Sanitation Facilities

Sanitary conditions of fishermen were very poor in this region and categorized as poor, moderate and developed the poor type of sanitation system was made with bamboo splits shaded by leaves with inadequate drainage disposal which comprised 54% while the moderate type made with tin or wood with inadequate disposal system comprised of 36% and the last one made with brick and adequate drainage system named developed type of sanitation system comprised of 10% (Table 3). Faruque and Ahsan observed that in Godagari Upazila about 92% of fishermen's sanitary systems were poor while the rest 7% had moderate sanitation systems and 1% had no sanitary facilities (Faruque and Ahsan, 2014).

3.4.8 Drinking Water Facilities

In the research, the principal source of drinking water was tube-well water from one's tube-well or a neighbor's tube-well. The percentage of fishermen who had their tube-wall was 82% and the other 18% collected water from neighbor's tube-wall (Table 3). Most of the people in this region used safe tube-wells water for drinking and also for cooking and bathing which is resembled the findings of who were also found that 100% of fishers of the Padma River used tube-well water as a source of drinking water (Sunny et al., 2019; Rahman et al., 2017).

3.4.9 Health Facilities

When all of a family's members have consistent access to medical treatment and have their health concerns treated by competent health care professionals, the family is considered to be well serviced in health facilities. The fishermen's health facilities in this research region were quite inadequate. The fishermen were found to be 52% reliant on the village doctor, 22% using health services from the health community, and 26% using other sources (Table 3). The research findings matched those of another study with who found that majority of people who lived along the Padma River were dependent on village doctor and the percentage were estimated as more than 70%, 68% and 72% respectively (Sunny et al., 2019; Rahman et al., 2017; Khan et al., 2018).

3.4.10 Housing Electricity Facilities

There were about 66% of fishermen got electricity facilities and the rest of 34% had no access to electricity (Table 3). A group researchers said in their study that only 30% of people had access to electricity facilities but the majority used a solar system which is quite different from this research (Sunny et al., 2019).

3.4.11 Annual Income

The fishermen earn their annual income by their main occupation and secondary occupation but most of the fishermen take fishing as their main occupation. Their secondary occupations are crop culture, rickshaw pulling, pulling van and day labor etc. There were 3 categories of fishermen according to the level of their annual income from fishing. The income of 1st category fishermen fishing was TK. 30,000-40,000, the 2nd category income levels TK. 41,000-70,000 and 3rd category income levels TK. 71,000-1, 00000 respectively. In this study, most of them (54%) belonged to the medium income (TK. 41,000- 70,000/year) group, followed by 28% in low income (TK. 30,000-40,000/year) group and only 18% of the fishermen had income in the range of (TK. 71,000-1, 00000/year) (Table 3). According to the annual income of Padma River fishers differed from 32000 + 510 TK to 48000 + 750 TK whereas 10% had annual income 100,000 + 1120 BDT where maximum fisher's income was in the second category (75%) and the rest 10% and 15% in the highest and lowest category (Sunny et al., 2019).

3.4.12 Credit Availability

Non-government organizations like- ASA, Proshika and micro-credit banks like- BRAC, Grameen bank provided credit facilities to the fishermen but economic support and credit facilities from the government were insufficient throughout this area. Also due to various social conditions and bindings fishermen did not receive credits. In the study, 58% of the fishermen received credit facilities within the range of 5000-1000TK and the rest 42% did not receive credit facilities (Table 3).

3.4.13 Training

In the study area, only a few members of the fisher's community have got the opportunity to receive training and to attend the workshops. Training received by the fishers and their duration were shown in Table 3 and it is visible from the data in the following table that only 36% of the fishers have received training on different aspects of fish culture and fisheries management.

3.4.14 Religious Status

During the study period, the highest numbers of fishermen were from the Muslim community (74%) and the lowest numbers of fishermen were from the Hindus (26%) community (Table 3). Faruque and Ahsan said in their study that the majority of the fisherman who lived along the Padma river were Muslims and the number of Muslim fishermen increasing day by day (Faruque and Ahsan, 2014).

3.5 Marketing of Fish

In the study area, fish marketing was occupied by the private sector and a large number of people were involved with the fish distribution and marketing of fish because of their livelihood. The result of the study has shown that there were many intermediaries in the market chain from fishermen to consumers. All market participants especially intermediaries obtained a considerable amount of profit in each step of the marketing chain. There were two types of fish marketing channels found in the study area. They are presented below-

Channel 1: Fishermen------- ► Consumers (2steps)

Channel 2: Fishermen------- ►Retailer ------- -► Consumers (3steps)

42% of Fishers sold fish directly to the consumer in the two steps marketing channel and others sold fish to the retailer and fish reaches the consumers from the retailer in three steps marketing channel. Islam also observed two types of fish marketing channels exist in his study area (Kali River) (Islam, 2009).

4. CONCLUSION

The biodiversity of fish in the Padma River is declining due to a range of natural and man-made factors. The available fish diversity is described together with some pertinent statistics such as the type of fishing gear used in this location, as well as the fishing time and the number of fish caught in this study. Therefore, it will assist to take necessary actions to maintain the possibility of fisheries biodiversity in the river. The socioeconomic status of riverine fishermen communities was provided in terms of age structure, religion, family type, family size, housing condition, and so on. The socio-economic situation of the Padma rivers fisher's community is being impeded as the livelihood situation was dissatisfactory and they were deprived of many services and facilities. The majority of them found to be marginalized and landless with poor house and sanitation system and this terrible social as well as poor economic condition had a great impact on their livelihood and sometimes they were unable to send their children's to go to the school. As most of the fishermen took fishing as their main source of income so some important steps need to implement like resource users during the banning period. Another critical component for the livelihood structure is electricity and due to a shortage of energy, no ice plant had been created in this area and fishermen were unable to preserve their fish. As a result, establishing an ice plant along the Padma River is crucial. They need more training on advanced techniques of fish culture and fisheries management as the Padma river deteriorated day by day and for this, the biodiversity of fish

is also in a declining process. To reduce river pollution, the governmental and non-governmental organizations along with the local community should work collaboratively. Unreasonable high transport cost, insufficient road and communication facilities, shortage of ice, low capital and poor institutional support raise concern about the sustainable marketing systems and essential improvement may be necessary such as up-gradation of transport facilities, governmental provision, institutional and banking assistance, introducing fish quality control measures and training for fish traders on sustainable marketing system.

References

Afrad, M.S.I., Yeasmin, S., Haque, M.E., Sultana, N., Barau, A.A., Rana, S., 2019. Fish biodiversity and livelihood status of fishermen living around the Titas River of Bangladesh. Journal of Bioscience, 27, Pp. 59-67.

Alam, M.F., Bashar, M.A., 1995. Structure of cost and profitability of small-scale riverine fishing in Bangladesh Agricultural University Research Program, 9, Pp. 235-241.

CEGIS, 2003. Ganges River: Morphological Evolution and Prediction. Center for Environmental and Geographic Information Services (CEGIS), Dhaka, Bangladesh, Pp. 11-13.

Darwall, W.R.T., Vié, J.C., 2005. Identifying important sites for conservation of freshwater biodiversity: extending the species-based approach. Fisheries Management and Ecology, 12 (5), Pp. 287-293.

Faruque, M.H., Ahsan, D.A., 2014. Socio-economic status of the Hilsa (*Tenualosa ilisha*) fishermen of Padma River, Bangladesh. World Applied Sciences Journal, 32 (5), Pp. 857-864.

Hossain, M.L., Mahmud, J., Islam, J., Khokon, Z.H., Islam, S., 2005. Padma, Tatthyakosh Vol. 1 and 2, Dhaka, Bangladesh, Pp. 182.

Hossain, M.Y., Jasmine, S., Ibrahim, A.H.M., Ahmed, Z.F., Rahman, M.M., Ohtomi, J., 2009. Length–weight and length–length relationships of 10 small fish species from the Ganges. Bangladesh. Journal of Applied Ichthyology, 25 (1), Pp. 117-119.

Islam, M.F., Haque, S.A., Islam, M.S., Das, P.S., Rahman, M., 2021. Socio-economic status of fisher communities in Dengar beel under Melandah Upazila, Jamalpur, Bangladesh. Asian Journal of Medical and Biological Research, 7 (2), Pp. 164-173. https://doi.org/10.3329/ajmbr.v7i2.54996

Khan, M.I., Islam, M.M., Kundu, G.K., Akter, M.S., 2018. Understanding the Livelihood Characteristics of the Migratory and Non-Migratory Fishers of the Padma River, Bangladesh. Journal of Scientific Research, 10 (3), Pp. 261-273. https://doi.org/10.3329/jsr.v10i3.34492

Laffaille, P., Acou, A., Guillouët, J., Legault, A., 2005. Temporal changes in European eel, Anguilla anguilla, stocks in a small catchment after installation of fish passes. Fisheries management and Ecology, 12 (2), Pp. 123-129.

Mome, M.A., 2007. The Potential of the Artisanal Hilsa Fishery in Bangladesh: An Economically Efficient Fisheries Policy. The United Nations University, Iceland, Pp. 1-10

Rahman, M.A., Pramanik, M.M.H., Flura, A.T., Hasan, M.M., Khan, M.H., Mahmud, Y., 2017. Impact assessment of twenty-two days fishing ban in the major spawning grounds of Tenualosa ilisha (Hamilton, 1822) on its spawning success in Bangladesh. Journal of Aquaculture Research and Development, 8 (6), Pp. 1-12. https://doi.org/10.4172/2155-9546.1000489.

Sunny, A.R., Ahamed, G.S., Mithun, M.H., Islam, M.A., Das, B., Rahman, A., Rahman, M.T., Hasan, M.N., Chowdhury, M.A., 2019. Livelihood Status of The Hilsa (Tenualosa ilisha) Fishers: The Case of Coastal Fishing Community of The Padma River. Bangladesh. Journal of Coastal Zone Management, 22 (2), Pp. 469.