ICHTHYOFAUNA AND SOCIO-ECONOMIC STATUS OF MALLAH COMMUNITY IN THE KOSHI RIVER BASIN, BHARDAHA VDC, SAPTARI, NEPAL

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A thesis submitted
In partial fulfillment of the requirements for the award of the degree of Master of Science in Zoology with special paper Fish and Fisheries

Submitted to

Central Department of Zoology

Institute of Science and Technology

Tribhuvan University

Kirtipur, Kathmandu

Nepal

April, 2017

DECLARATION

I hereby declare that the work presented in this thesis has been done by myself, and has not been submitted elsewhere for the award of any degree. All sources of information have been specifically acknowledged by reference to the author(s) or institution(s)

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RECOMMENDATIONS

This is to recommend that the thesis entitled **"ICHTHYOFAUNA AND SOCIO-ECONOMIC STATUS OF MALLAH COMMUNITY IN THE KOSHI RIVER BASIN, BHARDAHA VDC, SAPTARI, NEPAL"** has been carried out by **Mr. Praveen Kumar Singh** for the partial fulfillment of **Master's Degree of Science in Zoology** with special paper **Fish and Fisheries.** This is his original work and has been carried out under my supervision. To the best of my knowledge, this thesis work has not been submitted for any other degree in any institutions.

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On the recommendation of supervisor **"Assoc. Prof. Dr. Archana Prasad"** this thesis submitted by Mr. Praveen Kumar Singh entitled **" ICHTHYOFAUNA AND SOCIO-ECONOMIC STATUS OF MALLAH COMMUNITY IN THE KOSHI RIVER BASIN, BHARDAHA VDC, SAPTARI, NEPAL "** is approved for the examination and submitted to the Tribhuvan University in partial fulfillment of the requirements for **Master's Degree of Science in Zoology** with special paper **Fish and Fisheries.**

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ACKNOWLEDGEMENTS

It gives me immense pleasure to express my heartfelt appreciation to all the people who helped me in one way or another to complete this research work.

I am very grateful and deeply indebted to my supervisors Assoc. Prof. Dr. Archana Prasad, Lecturer, Central Department of Zoology, Tribhuvan University and Basudev Mukhiya, fisherman of the Koshi River Basin for their inspiring encouragement, continuous guidance, active cooperation, constant supervision, valuable suggestions, constructive criticism and help in carrying out this work successfully.

I would like to express my deepest regards and gratitude to Prof. Dr. Ranjana Gupta, Head of Central Department of Zoology, Tribhuvan University for her support.

I am equally grateful to my all dear friends and to all the people who directly or indirectly helped me in completing this work.

Finally, I express my gratitude to my parents, who always inspired me for higher studies and are my constant source of inspiration and encouragement in every step of my life.

Praveen Kumar Singh

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LIST OF ABBREVIATIONS

Abbreviated form	Details of Abbreviation
ADP	Aquaculture Development Project
AGDP	Agricultural Gross Domestic Production
BHC	Benzene Hexachloride
CBS	Central Bureau of Statistics
DoFD	Directorate of Fisheries Development
DDT	Dichlorodiphenyltrichloroethane
FAO	Food and Agriculture Organization
GDP	Gross Domestic Production
ha	hactares
HSEB	Higher Secondary Education Board
IUCN	International Union for Conservation Nature
mt	metric ton
MoWR	Ministry of water Resources
MoAD	Ministry of Agriculture Development
NAPP	Nepal Agriculture Perspective Plan
NARC	Nepal Agricultural Research Council
Sq. Km.	Square Kilometer
SLC	School Leaving Certificate
UNDP	United Nations Development Program
VDC	Village Development Committee
WECS	Water and Energy Commission Secretariat

ABSTRACT

The present study entitled" Ichthyofauna and socio-economic status of Mallah community in the Koshi River Basin, Bhardaha VDC, Saptari, Nepal "deals with the distribution and frequency occurrence of fishes in the Koshi River Basin. The study also includes the socio-economic status of the Mallah of the Koshi River Basin. In the present study the field work was carried out for two months i.e. month of February and month of June 2016. Altogether 12 species of fish fauna under 10 genera, 7 families and 4 orders were recorded. The fish sampling was performed by local fishermen with gear like cast nets, gill nets, Tapi. The most abundant family within catch was Cyprinidae. *Labeo dero* and *Aspidoperia morar* were the most abundant fishes in all the study sites during the month of February and June respectively. The dominant species of fish recorded was *Labeo dero* with highest frequency occurrence of 25.24% in the month of February and *Aspidoperia morar* with highest frequency occurrence 36.29% in the month of June. The most common species were cyprinids comprising altogether 6 species. The highest estimated catch was recorded in June and lowest in February. The fishermen belong to a number of ethnic groups such as Godhi, Mallah, Mukhiya, Bahardhar. There are about 85 household fishermen in Bhardaha VDC-1 to 6, Saptari of which 65 household are solely dependent on the fishing while the rest of the families have source of income from government job, agriculture and abroad employment. The socio-economic status of the fishermen communities is the lowest in the society. On the basis of age distribution data shows that the economically most active group represents only 17.83% at the age of 15-25 years and they support the rest of the family members by fishing. Similarly, the age group illustrates 35.03% at the age of 26-35 years considered as dependent group. But the age group above 35 reveals 47.13% regarded as less active group whose economic status was low as comparisons to the most active and dependent group Above 3,00,000 represents High income of the respondents income per annum. From the data it is found that 10.88% of people were low income (above NRS 3,00,000) and 60.89% people with high income (NRS 1,00,000-3,00,000). About 4.81 % of the respondents were illiterate even though most of them were found to pass 4 or 6 class. Among literate only 1.60 % passed SLC and only 1.20% attended HSEB. The urgent attention is to be needed to improve the socio-economic status of the fishermen communities is the lowest in the society.

1. INTRODUCTION

1.1 General Background

Nepal is home to most of the world's highest mountains, including Mt. Everest. Terai regions close to India have a hot, humid climate and make up 18 % of Nepal. Nepal is prone to annual floods and landslides. Nepal occupies 2.8% of fresh water resources of the total area of 147,181sq.km.These resources offer excellent habitats for aquaculture production. So, a large population of Nepal has adopted the fish production and fishing as their sole employment. The water surface area of Nepal covers 0.1 percent of the total world water systems and fish diversity accounts 0.21 percent of total global fish diversity (Shrestha, 1995). The river system is one of the major habitats on earth which plays significant role in establishment and maintenance of rich biodiversity. They are good home for autotrophs, phagotrophs, saprotrophs, periphyton, nekton, neuston etc (Odum, 1971).

1.1.1 Water Resources of Nepal

Nepal is rich in water resources. There are about 6000 rivers in Nepal having drainage area of 1,91,000 sq.km, 74 % of which lies in Nepal alone. There are 33 rivers having their drainage areas exceeding 1000 sq. km. If this natural resource is properly harnessed, it could generate hydropower; provide water for irrigation, industrial uses and supply water for domestic purposes (WECS, 2011). Rivers in Nepal can be classified into three types depending on their discharge. The Mahakali, Karnali, Gandaki and the Koshi are the four main river systems. They originate in the Himalaya and carry snow fed flows with significant discharge even in the dry season. These rivers are perennial and have tremendous potential as a source of irrigation and hydropower development (MoWR, 1985). The natural water resources consist of rivers, lakes and reservoirs, comprising of approximately 54 percent of the total existing water area of Nepal. It is estimated that some 500,000 ha of water surface may be available to fish production, of which approximately 100,000 ha would be lakes, reservoirs and village ponds (Pradhan and Pantha, 1995).

Nepali is endowed with several types of wetlands. The total estimated wetland resources consists of permanent fast flowing rivers to seasonal streams, high altitude glacial lakes to lowland on low lakes, gholes to swamps and marshy lands, river flow plains to paddy fields and man-made reservoirs to village ponds (Prajoo, 2007). Wetlands are rich in biodiversity. Since the sustainable utilization and the conservation of wetland resources depend on the degree of involvement of local communities (Shrestha, 2011).

1.1.1.1 Rivers

The rivers are the major constituents of water resources. There are more than 6,000 rivers in Nepal with a total length of 45,000 km. All these river systems constitute the 48 water area of Nepal and their tributaries drain into the Ganges system in India (Abbas, 1982 and Shrestha,1992).

1.1.1.2 Lakes

There are uncountable numbers of ponds and lakes. The estimated area of lake is about 5,000 ha that is 0.6% of the total existing water areas. The lakes can be categorized into % of the total 3 types on the basis of their origin viz. 1) Glacial, ii) Oxbow and iii) Tectonic. The lakes are classified on the basis of limnology as oligotrophic, mesotrophic and eutrophic. The Kathmandu valley, Banepa, Panchkhal, Mariphant (Palpa), Dang, Surkhet, valleys are the good examples of such basins (Devkota, 2011).

1.1.1.3 Reservoirs

There are few reservoirs with a total area of 1500 ha. comprising 0.2% of the total existing water area of Nepal. These reservoirs are mainly constructed for hydroelectric and irrigation purposes. Among the existing reservoirs, The Indrasarobar reservoir, Kulekhani is newly impounded reservoir for producing hydroelectric power by damming Kulekhani River in the mid hill of Nepal. Other existing reservoirs are Trisuli (16 ha.), Marsyangdi (62 ha.), Panauti, Sunkoshi for irrigation & generating hydroelectric power. It is estimated that 50,00,000 ha. of water surface will be available for fish production; out of which approximately 100,000 hectares would be from lakes, reservoirs and village ponds (Pant, 1995).

1.1.2 Status of fisheries and aquaculture in Nepal

Fisheries is a small but important sub-sector of agriculture which contributes about 1.46 percent to agricultural gross domestic product which amounts to 0.8 percent of the gross domestic product (NARC, 1994). Aquaculture production reached 8,364 tons of AGDP and fisheries production 14,775 tons of AGDP in Nepal (Pradhan and Pantha, 1995). The fish production is expected to be 65.77 million kg i.e. 14.34% of AGDP by 2014.

Now a day's cage farming is also increasing in some lakes and there is very low data available on capture amount because they are not economically traded in market but consumed locally in community. The annual Trout production was about 16 to 17 mt. and increasing each year (Swar, 2008). Annual production of total fish in Nepal was only 3,530 tons in 1981/1982 which increases to 21,879 tons in 1995/1996 (Shrestha, 1999). There is continuous increase of fish production from 1970 to 2000.Total fish production was 42,463 mt. with 47 % from capture fisheries (Swar, 2008). Over 2 % of domestic gross production of agricultural product is contributed by aquaculture production in 2003/2004 (FAO, 2012).

Hence it needs an intensive operation. The NAPP has categorized Nepal fishery a small but important and promising sub sector of agriculture contributing about 2.47% of AGDP in the country (DoFD, 2005/2006). An estimated 7,50,000 people are directly or indirectly involved in aquaculture activities nationally and the number is increasing. Major aquaculture practices adopted in Nepal are carp polyculture in ponds, lakes, enclosures, in cages, paddy cum fish culture and integrated fish culture (Shrestha and Yadav, 2003). The per capita consumption of fish has increased significantly from 0.330 kg per person per year in 1982 up to 1.753 kg in 2006. Fish is acceptable to every segment of the population, but still Nepal has a low per capita consumption compared to neighboring countries despite the increasing trend (FAO, 2008).

1.1.3 Capture Fisheries

Fisheries have been an important occupation in many parts of Nepal. Capture fisheries in Nepal is widely scattered and unorganized. Scanty records are available on capture fisheries. However in view of fisheries importance a preliminary survey of a number of water bodies have been carried out by Fisheries Development Directorate to assess the level of capture fisheries. As being a landlocked country, capture fisheries have an important role. In 1983, it was estimated that 2,04,000 people were actively involving in capture fisheries (Yadav, 2001). The fishing based livelihood is one of the oldest systems in Nepal, as there are several ethnic communities adapted to occupy full time profession in fishing and other water-related activities (Gurung 2003, 2014). Such ethnic communities who are dependent on wetlands represent about 18% of the total population of the country (IUCN, 2004). In Nepal, the captured fisheries contribute 0.4% of the total GDP employing thousands of fishers for livelihood with majority composed of women. The estimated yield is 21,500 mt per year with a productivity of 18 kg/ha (CBS, 2014) (Gurung, 2016). Conventionally, sustainable fishery can be defined as harvesting of fish in a sustainable manner, where the fish population does not decline over time due to fishing practice (Krebs, 2007).

1.1.4 Description of the Study Area

The study will be conducted in the Terai region of Nepal. The specific study site includes Koshi River basin in the eastern part of Rajbiraj, Saptari district. Rajbiraj is situated in the eastern part of Nepal at latitude of 26°32’ North and longitude of 86° 44’East. Rajbiraj is one of the cities in Nepal that connected by East West Highway about 10 km to the north and 17 km to the east also known as Hulaki Rajmarg. It has tropical climate. The three main seasons, summer, monsoon and winter respectively. The summer season runs from early April to August and touches temperature ranging from of 23°C to 44°C. Monsoons arrive in the month of July heralded by dust and thunderstorms. The winter season prevails from the month of October till the month of March. Humidity, which prevails during monsoons, diminishes at the arrival of winters. The annual precipitation is about 1000–1500 mm in the tropical region (Chen *et al*., 2013).

1.1.5 The Koshi River Basin

Koshi river basin which is one of the largest river basins of Nepal has its headwaters in the northern Himalayan region of the country covered with perennial snow and glaciers. Increased warming due to climate change is most likely to impact snowpack of this Himalayan region (Khadaka, 2015). North of the India-Nepal border, the river is known as the Sapta Koshi or "Seven Rivers" in reference to its seven principal tributaries. Its three main tributaries join at Tribeni, only 60 km north of India. Downstream of Tribeni, the Sapt Koshi flows through a narrow gorge for 11 km, passing the gaging station at Barakhshetra, before spreading over the Gangetic plain below Chitale at 100 m elevation (Gole and Chitale, 1966). The Koshi is the largest river of Nepal and is the third largest in Asia after the Indus and Brahmputra. This river is formed by the rivers Indrabati, Tama Koshi, Likhu Khola, Sun Koshi, Dudh Koshi, Arun and Tamor. It is also called Sapta Koshi River. The Koshi basin occupies a large area in Tibet as well as in Nepal. The

length is 266 km whereas a width in Nepal is117 km. Its total catchment area is 60,400 sq. km. The total length is 50 km up to the Indian Border. The drainage area of Koshi in Nepal is 28,140 sq. km. (Sharma, 1997).

1.1.6 Climate of Koshi River Basin

It has tropical climate. The three main seasons, summer, monsoon and winter respectively. The summer season runs from early April to August and touches temperature ranging from of 23°C to 44°C. Monsoons arrive in the month of July heralded by dust and thunderstorms. The winter season prevails from the month of October till the month of March. Humidity, which prevails during monsoons, diminishes at the arrival of winters. The normal daily mean temperature of this basin varies from 16.5^0 C to 30.4^0 C in the plains. The maximum temperature observed in the basin is 32.2^0 C during the month of May whereas the minimum observed is 16^0c in the month of January. The annual precipitation is about 1000–1500 mm in the tropical region (Chen *et al*., 2013).

1.1.7 Fishery Activities in the Koshi River Basin

The Koshi River system probably represents the largest capture fisheries in Nepal, in terms of yield volume, fish species abundance and the number of fishers dependent for livelihood (Paudel *et al*., 2016 and Gurung *et al*., 2016). The fishing based livelihood is one of the oldest systems in Nepal, as there are several ethnic communities adapted to occupy full time profession in fishing and other water-related activities (Gurung, 2003, 2014). Such ethnic communities who are dependent on wetlands represent about 18% of the total population of the country (IUCN, 2004). Mostly, overfishing has been considered major causes of fisheries depletion (Hauge *et al.*, 2009). Paudel *et al*., (2016) mentioned involvement of 15 ethnic communities in fishing in Koshi Tappu area (Gurung and Sah, 2016). Fishing activity was noted maximum during autumn and winter seasons and minimum in summer (rainy) seasons engaging on collecting and selling the fishes from the contractor's and individual fish pond (Gachhadar *et al*., 2004).

1.1.8 Mallah Community

The Mallah community here in the Koshi River basin are the traditional fisher community that has been catching and selling fishes since ages and they still continue to do so in the present day. They are also called as Ghodi, Mukhiya and Bahardhar. There are about 85 different Mallah households residing near the study area. The community traditionally depending on fishing activities for their livelihood led a nomadic life along the rivers and lakes carrying cast nets to feed their families. Their main language is Maithili. Basically they are very poor group of people as their sole livelihood is dependent on selling captured fishes from the Koshi Rivers. They have mainly lived on the bank of Koshi River and have been traditionally dependent on fishing. Though few people of this community are literate and poor but nowadays, the awareness towards education is growing among these people. Therefore, most of them are sending their children to schools. Only some can afford boarding schools and others go to public schools.

1.1.9 Marketing System

Marketing is the process related with the exchange of goods or services. In broad sense, all the activities to be performed before buying and selling the goods while buying, selling even after buying are the subjects concerned with marketing. Generally, the producers sell their product directly through retailers, wholesalers and middlemen (Shrestha, 1994).Marketing of fish involves all those activities by which fish from its production site is collected and through different channels reaches the hand of consumer brought to the fish market by contractor or fishermen are sold to the wholesalers the wholesalers sell the fish to the local fishmongers or export it to Kathmandu and India.

Channel of distribution

Marketing provides the channel of communication between the producers and consumers which passes through a number of following intermediaries:

a. Fishing Lot Owners

Lot owners control the fish product and function as fish suppliers to wholesalers/traders, fish processors, fish collectors and exporters at fishing lot or landing site.

b. Fishers

Fishers are classified as small-, medium- and large-scale, depending on the size of catch potential and type of fishing gear. Small-scale fishers consist of 1-3 persons who fish primarily for family subsistence and income. Medium-scale fishers are extended families and village level partnerships (3-6 persons) who catch fish for family income and processing.

c. Fish Collectors

Fish collectors collect fish directly from fishers at the fishing ground. Fish collectors are specialized operators who proceed with fish buying throughout the year, buying fish from fishers and bringing these to the landing site. They set prices with fishers, depending on fish quality, supply situation and daily fish market demand.

d. Wholesalers/Traders

Wholesalers/traders represent an important part of the fish marketing chain in that often, major quantities of fish are channeled through them. They usually buy fish from fishers, lot owners, collectors or middlepersons and sell these to exporters, retailers and restaurants.

e. Semi-wholesalers

Semi-wholesalers are those fish traders who have a permanent stall inside/outside a market, where fish are brought by middlepersons or wholesalers and sold to them at the market.

f. Retailers

Fish retailers are those who sell fish in markets directly to consumers or restaurants. In many cases, they have a permanent stall inside or outside the market.

g. Fish Processors

Fish processors mainly buy fish from fish lot owners or traders/middlepersons/fish collectors, produce fish paste, salted dried fish, fermented fish, smoked fish, etc. Processed products are usually sold to domestic markets.

h. Exporters

Exporters export fisheries products to neighbors and other countries. They generally purchase fish directly from fishing lot owners or traders/middlepersons, store them with ice in containers and export them by land or air as live fish.

i. Transporters

Fish transporters provide only transportation service to fish traders/wholesalers and do not buy or sell fish. They are important in the fish trade channel. The transportation means differ from one area to another. Fish are usually transported by boat, motorbike, mini truck or pick-up car from fishing ground to landing site, local market and fish distribution center. Transporters own trucks and boats that transport fish from the fishing ground to the landing site, fish processors and markets in Nepal.

1.2 Justification of the Study

The Koshi River Basin is endowed with immense social, cultural and scientific values. It plays significant role to provide suitable habitat for an aquatic animals. It is rich in fish diversity including large number of indigenous fish species. The large numbers of fish species are decreasing due to rapid population growth, poverty and illegal fishing by fishermen around the Koshi River Basin. Mallah is one of the minority tribe found close to the Koshi River Basin. They sustain their livelihoods and house requirement only by fishing from the Koshi River Basin. Fishing for Mallah becomes an indispensable occupation for the prosperity of their life. Therefore, present survey is conducted at different sampling station of the Koshi River Basin to assess the sources of income from fish and fisheries that would improve the socioeconomic status of Mallah society. The present work about Mallah supports as base line data for further research.

1.3 Objectives

1.3.1 General objective

This study is to examine the fish fauna and socio-economic status of Mallah community in the Koshi River Basin, Bhardaha VDC, Saptari, Nepal.

1.3.2 Specific objectives

The present investigations are as follows;

- To study the fish fauna of the Koshi River Basin
- To study the fishing gears implemented by the fisher folks
- To study the socio-economic status and recommendations for uplifting their status in the society

2. LITERATURE REVIEW

2.1 Historical review of fishes

The diversity of Nepal includes the works of Hamilton (1822) who was probably the first ichthyologist to give authentic information of fishes of Nepal. Afterwards, Gunther (1861) reported some cold-blooded vertebrates including fishes collected by Hodgson in Nepal. Day (1886) mentioned the distribution of some fresh water fishes of Nepal in his historical work "Fishes of India, Burma and Ceylon". Regan (1907) reported a small collection Nepalese fishes. Similarly, Boulenger (1907) reported a collection of Nepalese fishes and western Himalayan fishes. Hora (1937) obtained a collection of fishes from Nepal through Colonel Bailey which included 158 specimens of 22 species. Menon (1949, 1954) collected fishes from the Koshi Himalayan region belonging to 11 families comprising 26 genera and 52 species. Taft (1955) prepared a check list of the fishes containing 95 species and representing 13 families. De Witt (1960) examined the collection of Taft (1955) and Swan (1954) and prepared a checklist of 102 species of fishes belonging to 21 families collected during California Himalayan Expedition to Makalu. Majpuria (1969) introduced a paper on socio-economic condition of fishermen of Kathmandu valley. Swar (1980) estimated that there were about 80,000 fisher populations in the country. Similarly, Shrestha (1981) included maps of the distribution of only 26 out of 37 fish families in Nepal.

John and Dhewajoo (1989) reported 23 species from Pokhara valley. According to Shrestha (1990) the Koshi river harbor 108 species of fishes and he feared that in long run exotic may replace indigenous species such as Golden mahseer and Deep-bodied mahseer and many other species. Furthermore, Shrestha (1995) enumerated 185 fish species believed to occur in Nepal, and included maps with an indication of these species' approximate distribution in the country. Shrestha (1995) reported that the Nepal Himalayas are well known for their running and standing waters supporting about 200 species of fish was described from the Himalayan drainage system of Nepal. Besides, Pokharel (1999) reported 25 species fishes from water bodies in Pokhara valley. Shrestha (2001) mentioned that Nepal is blessed by a very high diversity of fresh water fishes with 182 fish species belonging to 93 genera, under 31 families and 11 orders.

Gubhaju (2002) have studied on the contribution cold water fishes in the livelihood of mountain people of Nepal. Shrestha (2003) obtained 184 fish species belonging to 93 genera, 31 families and 11 orders existing in natural water bodies of Nepal. Recently, Pokharel (2004) reported 42 species of fishes from the lotic and lentic water bodies. Rajbansi (2005) has listed 186 species from Nepal. Similarly, Ng (2006) has listed 6 new species and 11 new records from Nepal which further increased the total number of fish species of Nepal. Consequently, 184 fish species of Nepal has increased to a total of 199 species till now.

Other important ichthyologists namely Jana (2007) and Shrestha (2009) described that the native fish decline is associated with poor knowledge, priority, investment and water

quantity and quality. Shrestha (2011), Gurung & Baidya (2012) and Cowx (2002) indicated that anthropogenic disturbance and ignorance are the most important factor for decline and extinction of fish worldwide. Fish are members of a paraphyletic group of organism that consists of all gills bearing aquatic craniate which lack limbs with digits. It includes living Hag fish, Lampreys and cartilaginous and bony fishes. Most fishes are ectothermic. They are considered as an important natural food resource, worldwide, especially that of animal protein.

The socio-economic status of fisher communities was studied by some workers. They carried out study of Majhi and Thapaliya (1988) also published "An introduction to Bote ethnic group". According to Swar (1980), there were about 80,000 fishers. However, it is estimated that there has recently been a three to five fold increase in the fishing population due to increasing population and deepening poverty in Nepal (Gurung, 2003a). Kaini (1996) had written an article recently on Bote tribal community belonging to three districts Gorkha, Tanahun and Chitwan. Similarly, Gyawali (1997) also studied about socio-economical aspect of Bote. Gubhaju *et al.,* (2002) reported that indigenous cold-water fishes have significant contribution as nutritional protein supplement and as a means of income source of the livelihood of local ethnic fisher communities.

2.2 Fish Fauna of the Koshi River basin

The Koshi river basin in the Nepalese lowlands plays a vital role and constitutes one of the principal sources of fish. Shrestha **(**2016) reported 48 fish species under 35 genera belonging to 17 families and 6 orders from Triyuga River. Some interesting fish species reported from this river are *Barilus shacra, Garra annandalei, Psilorhynchoides pseudecheneis, Badis badis, Olyra longicoudata, Tor putitora, Labeo dero* and *Anguilla bengalensis*. Fish diversity of Triyuga River is rich, thus further extensive study is essential for their conservation. An attempt, therefore, has been made to conduct a thorough survey of fish diversity of Triyuga River. Edds and Ng (2007) had also added seven fishes from Tamakoshi, Likhu, Bhotekoshi, Dudhkoshi, Arun, Indrawati and theirs hundreds of small and big tributaries. Thapa (2008) reported 92 fish species from the Koshi River of which 81 species were enlisted by Limbu and Subba (2011). Gurung (2016) had shown compilation of 135 native fish species and 7 exotic species. It is proclaimed that 200 fish species may occur in the Koshi River indicating that more detail studies are required to obtain a holistic inventory.

2.3 Mallah community residing near area of the Koshi River Basin

The traditional fishers belong to a number of ethnic groups such as Ghodi, Mallah, Mukhiya and Bahardhar of the Koshi River basin. The fishermen community inhabitant in Koshi River and all of them depend basically on the capture fishery. The Koshi River system probably represents the largest capture fisheries in Nepal, in terms of yield volume, fish species abundance and the number of fishers dependent for livelihood (Paudel *et al.,* 2016 and Gurung *et al.,* 2016). They are landless and illiterate. They possess only a small mud made thatched roof hut. They have mainly lived on the bank of Koshi River and have been traditionally dependent on fishing. The main season for high

fish catch was surveyed to be in October and November. March and April were the slack season.

Buckton *et al.,* (2009) mentioned that fish from the wetlands in Koshi Tappu ranked the first among other collected or gathered food for consumptive and non-consumptive use, implying that fish is one of the most important source for food, income and livelihood. About 20 ethnic communities, particularly the inhabitants of Terai region, are traditionally dependent on wetlands for their livelihood (IUCN, 1998). Approximately twelve different ethnic communities, representing about 18% of total population of the country, are involved directly or indirectly in fisheries (Gurung *et al.,* 2005). An estimated 87.3% of the economically active population in the buffer zone of the Koshi Tappu Wildlife Reserve is involved in the agricultural activities (DNPWC, 2000). Paudel *et al.,* (2016) mentioned involvement of 15 ethnic communities in fishing in Koshi Tappu area. The high human population pressure along the Koshi river bank has exerted pressure on forest resources. The indiscriminate deforestation in the buffer zone area of the Koshi Tappu Wildlife Reserve (DNPWC, 2000) and change in land use from forest land into agricultural land have resulted in siltation in the Koshi River. Agreement on the Koshi project between Nepal & India, Kathmandu, April 25, 1954, no fishing will be permitted within 2 miles of The Koshi Barrage and Headwork. Fishing activity was noted maximum during autumn and winter seasons and minimum in summer (rainy) seasons engaging on collecting and selling the fishes from the contractor's and individual fish pond (Gachhadar *et al.,* 2004). Conventionally, sustainable fishery can be defined as harvesting of fish in a sustainable manner, where the fish population does not decline over time due to fishing practices (Krebs, 2007). Mostly, overfishing has been considered major causes of fisheries depletion and collapse; however the global fish stocks depletion cannot be simply attributed to fishing alone (Hauge *et al.,* 2009). Instead, other anthropogenic activities causing habitat destruction, pollution and climate change play a substantial role on fish depletion (Gurung, 2013) as well as natural factors such as preying of fish by aquatic mammals such as Dolphin in Koshi River (Paudel *et al.,* 2016).

2.4 Fish marketing of Nepal

Gubhaju (2001) studied the strategies for the conservation of fish in Nepal. Wagle, Gurung and Sharma (2001) described indigenous fishes and their contribution in rural livelihoods in Nepal. Pokhara city is a traditional market for fish products; however, market channeling must be improved.Given the national consumption rate of 1.5 kg per capita (Gurung 2003a) and Pokhara's population of about 300,000, approximately 1.5 mt of fish can be easily sold every day in the local market. Only a small portion of the total fish production of Pokhara valley is marketed in adjacent districts and Kathmandu, mostly during winter when yield surpasses local consumption. In summer, when fish catch is low, fish is supplied to Pokhara from outside sources (HJS, 2005). Panday (2007) studied the preservation of fish and it's market. Rijal (2007) studied the fish marketing system in Nepal and food and ornamental fish of Nepal. Shrivastav (2008) studied on fish and fisheries in Dhanusha district. The survey was done in kamala, Jallad and Rato River. Dhami and Dhami (2009) described the fish marketing and management in Nepal. According to Mishra (2013) carp seed was first transported from Bihar in India, 60 km

south of the Nepali border and subsequently transported on foot to Kathmandu. A recent survey showed that about 60% of the fish consumed in Nepal is imported from India Mishra (2013).

3. MATERIALS AND METHODS

3.1 Study Period

For the present study the field work was carried out for two months i.e. month of February and month of June 2016. The Mallah community was also interviewed within the same interval of time to get closer look on their economic status.

3.1.1 Selection of Study Area

Before the study was conducted, pilot survey was done which revealed the high importance of the Koshi River Basin for fisheries. It also curved my interest to study Mallah community living in the same area that has been catching and selling fishes since ages.

3.1.2 Sampling sites

The sampling sites were selected on the basis of dense populated area and the natural habitat of the river.

General description of the sampling sites

Station- I

The first station was selected at a distance of approximately 7.5 km north upstream of Koshi barrage. This station lies in Bhardaha VDC-1, north- west of Koshi barrage. This station is free from pollution because of local people are dwelling far from this station. It is the upper body of Koshi River from Koshi barrage.

Station- II

The second station was selected at a distance of about 2.5km south downwards from station-I. This station was located near to Hanuman Temple of the Koshi barrage, Bhardaha, VDC-1. More fishermen engaged to fish for their livelihood. There was small fish market near this station.

Station- III

The third station was located at a distance of about 5 km south and downwards from station-I. This station lies in Bhardaha VDC-1. This station was near to Mallah Tola Koshi barrage.

Station- IV

The fourth station was selected at a distance of about 7.5 km south and downward from station-I**.** This station lies in Bhardaha VDC-1.This station is free from pollution because of local people are dwelling far from this station.

PLATE- I
SHOWING SAMPLING SITES

Station-I

Station-II

PLATE- II
SHOWING SAMPLING SITES

Station-III

Station-IV

Figure 1: Map of Sampling Stations of the Koshi River

To study the socio-economic condition of the Mallah, the study area was confined to the places around the Koshi River Basin where the Mallah community has been living since ages. The study area includes Bhardaha VDC and the VDC are named as Bhardaha VDC-1, Bhardaha VDC-2, Bhardaha VDC-3, Bhardaha VDC-4, Bhardaha VDC-5 and Bhardaha VDC-6. Bhardaha VDC-1 is situated at an area of Koshi Barrage. This VDC-1 is called Mukhiya Tola because there is dense settlement of Mallah. Bhardaha VDC-2 and 3 is situated along the Mahendra Highway about 4 km North-west from Koshi Barrage. Bhardaha VDC-4 and 5 is situated at an area of Kankalini Temple which is at a distance of 5 km North -West from the Koshi Barrage. There is also dense settlement of Mallah in VDC-4 and 5. Similarly Bhardaha VDC-6 is situated near to the west irrigation canal and about 5 km west from Koshi Barrage. Bhardaha VDC is an eastern part of Terai which is about 25 km away from the district headquarter, Rajbiraj, Saptari, Nepal (Figure 1, 2, 3).

Figure 1: Map of Nepal

Figure 2: Map of Bhardaha VDC

Figure 3: Map of sampling area of Bhardaha VDC, Saptari, Nepal

3.1.3 Fish sampling

The fishes were collected from each site. Fish collection with the help of local fishermen using different types of gears such as cast net, gill net and tihari etc. was done. Cast net was mostly used to collect the fish during field visit from each site. Fishes were preserved in 10% of formalin in fresh condition for taxonomic identification. Identification was done following standard taxonomic books: Shrestha (1981, 1994), Shrestha (1990), Talwar and Jhingran (1991) and Jayaram (1999).

3.2 Source and types of data

Qualitative as well as quantitative methodology has been used to make the research successful. Both primary and secondary data have been used in the study. Around 70 houses (out of 85 houses) were selected using the simple random sampling. Mainly, the questionnaire, interview and observation were used to collect the quantitative information. The result was descriptively analyzed. The primary data was collected from Mallah community through direct observation to identify fishing role and Secondary source of information through the institutional analysis of Mallah community.

3.2.1 Household level survey

Around 70 households (Out of 85) were interviewed during the study. Household survey questionnaire was based on the status of the communities and was conducted at household level. All together twenty five questions were included in the questionnaire (ANNEX-II).

3.2.2 Structured interview

Interview with the member of each family was taken with the help of predesigned questions on their ethnoichthyological knowledge. In this method, head of the sampled households were selected for structured interview. Such knowledge is important especially to get information about indigenous fish resources (ANNEX-II).

3.2.3 Direct Observation.

Participatory observation was the main method for collecting primary data. In this regard the researcher participated in a number of village activities during the study period to get a feel of their lifestyle and also to be familiarized with Mallah community. This type of observation was very helpful in collecting correct information.

3.2.4 Case study

Case study was done on a few household heads for depth knowledge on their family history and their active participation on fish and fisheries.

3.2.5 Key informant interviews

Key informants survey was conducted to generate and substantiate information about the socio-economic status of fishermen. It was conducted in an informal way with open-ended questions with the local people. Structured interviews were mainly employed for knowledgeable local fishermen who spend most of their time in Koshi River. Twenty five

questions related to Mallah and the inclusion issues with varied interrelation were included in the questions.

3.3 Statistical analysis.

In Koshi River, distribution of fish species was calculated by using Mean

Mean: It can be defined as the sum of observations divided by the number of observations.

The formulae to calculate Statistical analysis are given below:-

$$\text{Mean } (\bar{x}) = \frac{\text{Total no.of fish collected in different station}}{\text{No. of stations}}$$

4. RESULTS

4.1 Fisheries Resources

A total of twelve species belonging to 4 orders, 7 families and 10 genera are recorded in the Koshi River during fish catch. *Aspidoperia morar, Clupisoma garua, Labeo dero, Puntius sophore, Mystus tengra,* were the most abundant fishes in the Koshi River. *Labeo dero* are caught abundantly during February while *Aspidoporia morar, Clupisoma garua* are caught abundantly during August. Among Carp Mrigal (*Cirrhina reba* and *C. mrigala*) are the best represented in this area. Best game fishes of this region are Mahseer (*Tor putitora*), Sahar (*Tor tor*) but these Carp Mrigal and game fishes were not caught during fish catch (Table 1: PLATE-III).

Table 1: List of fishes found in the Koshi River Basin

S.N.	Scientific name	Local name
1.	*Aspidoperia maror*	Bhegna
2.	*Channa orientalis*	Chenga
3.	*Channa punctatus*	Garai
4.	*Labeo dero*	Pausi
5.	*Clupisoma garua*	Jalkapur
6.	*Clarias batrachus*	Magur
7.	*Heteropneustes fossilis*	Singhi
8.	*Labeo rohita*	Rahu
9.	*Mastacembelus pancalus*	Kath Gainchi
10.	*Mystus tengra*	Tengri
11.	*Botia lohachata*	Baghe latta
12.	*Puntius sophore*	Pothi

PLATE-III
FISH FAUNA OF KOSHI RIVER BASIN

1. ***Aspedoperia morar***

2. ***Channa orientalis***

3.*Channa punctatus*

4. ***Labeo dero***

5. ***Clupisoma garua***

6. ***Clarias batrachus***

7. ***Heteropneustes fossilis***

8. ***Labeo rohita***

PLATE-IV
FISH FAUNA OF KOSHI RIVER BASIN

9. ***Mastacembelus pancalus***

10. ***Mystus tengra***

11. ***Botia lohachatas***

12. ***Puntius sophore***

Table 2: Systemic position of Ichthyofauna of The Koshi River Basin

Order	Family	Sub family	Genus	Species
Cypriniformes	Cypinidae	Cypininae	*Aspidoperia*	*A.maror* (Hamilton-Buchanan.1822*)*
			Puntius	*Sophore (*Hamilton-Buchanan.1822*)*
			Labeo	*rohita* (Hamilton-Buchanan.1822)
			Labeo	*dero* (Hamilton-Buchanan.1822*)*
	Cobitidae		*Botia*	*Lohachatta* (Chaudhary.1912)
		Bagridae	*Mystus*	*Tengri* (Hamilton-Buchanan.182)
Siluriformes	Clariadae		*Clarias*	*Batrachus* (Linnaeus.1758)
	Heteropneustidae		*Heteropneustes*	*fossilis* (Bloch.1785)
	Schilbedae		*Clupisoma*	*garua* (Hora.1921)
Channiformes	Channidae		*Channa*	*punctatus* (Bloch.1785)
			Channa	*orientalis* (Bloch and Schneider.1808)
Synbranchi Forms	Mastacembelidae		*Mastacembelus*	*pancalus* (Hamilton-Buchanan.182)

4.2 Fish distribution pattern and frequency occurrence in Koshi River Basin

4.2.1 Frequency occurrence of fish in the month of February

During the month of February, a total of 103 fish specimens were recorded and observed family wise (Table 3) where the maximum number was 26 *Labeo dero* and minimum number was 2 of *H. fossilis*. Similarly the highest frequency occurrence was for *Labeo dero* (25.24%) and lowest for *H. fossilis* (1.94%).

Table 3: Frequency occurrence of fish in the month of February

S.N.	Scientific Name	Total catch	Frequency (%)	Sampling station			
				I	II	III	IV
1	*Aspidoperia morar*	3	2.91	-	1	2	-
2	*Channa orientalis*	8	7.77	4	-	2	2
3	*Botia lohachatas*	10	9.71	5	-	2	3
4	*Labeo dero*	26	25.24	5	6	8	7
5	*Clupisoma garua*	5	4.86	2	1	-	2
6	*Clarias batrachus*	4	3.88	1	2	-	1
7	*Heteropneustes fossilis*	2	1.94	1	-	1	-
8	*Labeo rohita*	3	2.91	-	2	1	-
9	*Mastacembelus pancalus*	6	5.83	2	-	1	3
10	*Mystus tengra*	13	12.62	6	3	2	4
11	*Channa punctatus*	7	6.80	4	3	-	-
12	*Puntius sophore*	16	15.53	3	5	4	4
	Total	103	100	33	23	20	26

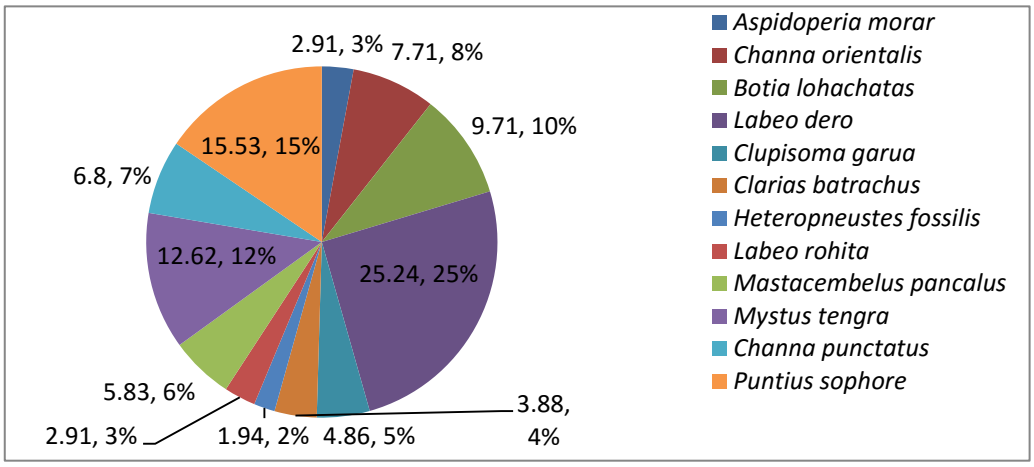

Figure 3: Frequency occurrence of fish in the month of February

4.2.2 Frequency occurrence of fish in the month of June

During the month of June fish catch, a total of 124 fish specimens were recorded and observed family wise (Table 4) where the maximum number was 45 of *A. morar* and minimum number was 1 of *Labeo dero* and *H. fossilis*. Similarly the highest frequency occurrence was for *A. morar* (36.29%) and lowest for *Labeo dero* and *H. fossilis* (0.80%).

Table 4: Frequency occurrence of fish in the Koshi River Basin

S.N.	Scientific Name	Total catch	Frequency (%)	Sampling station			
				I	II	II	IV
1	*Aspidoperia morar*	45	36.29	15	10	13	7
2	*Channa orientalis*	7	5.65	2	4	1	-
3	*Botia lohachatas*	4	3.22	-	1	3	-
4	*Labeo dero*	1	0.80	1	-	-	-
5	*Clupisoma garua*	14	11.29	5	3	2	4
6	*Clarias batrachus*	3	2.42	2	-	1	-
7	*Heteropneustes fossilis*	1	0.80	-	1	-	-
8	*Labeo rohita*	2	1.61	1	-	1	-
9	*Mastacembelus pancalus*	10	8.07	2	4	1	3
10	*Mystus tengra*	10	8.07	3	4	1	2
11	*Channa punctatus*	15	12.10	-	6	8	1
12	*Puntius sophore*	12	9.68	6	3	1	2
	Total	124	100	37	36	32	19

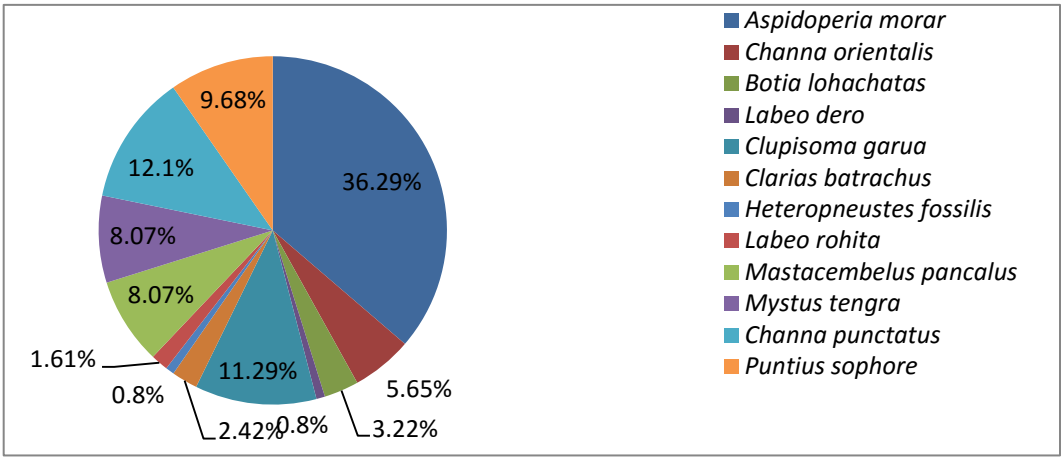

Figure 4: Frequency occurrence of fish in the month of June

4.3 Short description of fishes in the Koshi River Basin

I. *Aspidoperia morar*

It is locally called Bhegna. These fishes are sufficiently found in the Koshi River. The color of the body is light yellow and fin is dark yellow. The body is flatted from right and left. The mouth is small and elongated at the front. The upper lip coincides with the lower lip. They are found up to 144mm in length. Bhegna is found in large number during study period**.**

II. *Clarias batrachus* (Linnaeus, 1758)

This fish is commonly known as Magur or Mungri in Nepali. There is splash of yellow brown color with vertical head and laterally compressed tail. The caudal fin is separated from dorsal and anal fins. It has long dorsal and anal fins. Four pairs of barbels are present. This fish breeds in monsoon (May to August). The maximum size is 175mm.It is found in the Koshi River at altitudinal range76-120m.

III. *Clupisoma garua* (Hora, 1921)

It is also called jalkapur in Nepal. Dorsal fin with a slender spine serrated minutely and internally. Adipose-dorsal fin is absent in adult but present in young. Caudal fin is deeply forked. Lower lobe is longer. Body color silvery grey above and lighter below. Fins tinged grey. It is found in Koshi, Bagmati, Bheri zones.

IV. *Puntius sophore* (Hamilton – Buchanan, 1822)

Puntius sophore is also known as Pothi in Nepali. There is one black blotch on caudal peduncle and another on dorsal fin base. Barbels are absent, complete lateral line system. The body color is uniform silvery on sides and dark color in back. The color is faint black band on a lateral line. The maximum length of *Puntius sophore* is 100mm.This fish may breeds from May to July. It is found in Terai and Hill at altitude of 76-1350m.This species could not be available abundantly in the Koshi River because it grows at low land river with very slow water flow.

V. *Botia lohachata* (Chaudhary, 1912)

Botia lohachata is commonly known as Bhaghe latta. The body color is distinct dark 'v' shaped bands on yellow ground of the body. It has two spots posterior to eye and fins with black stripes.It has pointed mouse like head, broad caudal peduncle.The maximum size 100 mm. It is found in Koshi, Janakpur and Narayani zones at altitude of 76-1350 m.

4.4 Fishing practices and fishing implements

Fishing is the main occupation of fishermen inhabiting around the Koshi River. They follow different fishing practices depending upon different seasons. Most of fisherman had their own boat while only some Musahar had to depend on other rented boat. They generally use boat for fishing and for transportation in the river. Those who did not have their own boat, they shared boat of relatives for fishing. Fishing activity was noted maximum during autumn and winter seasons and minimum in summer (rainy) seasons. The gears used for fishing are traditional and there are no available statistics relative to number of fisherman dependent on traditional fishing. Nets, bamboo traps, rod and line are some traditional way of fishing but some non- indigenous method like poisoning and blasting explosives have been practice for capture fisheries.

4.4.1 Conventional method of fishing

Fishermen were found to use different types of traditional fishing implements. Most of them are made from locally available materials bought from market. Most commonly used fishing implements are follows:

I. Dip Fishing Net

This net is constructed of two long bamboo flanks about 4.5 each which crosses one another in the middle and the two long bamboo flanks are tied with ropes in the center. One side of the net is tied with rope. Such type of net is used during summer months to capture all sized fishes by the lifting the net with a jerk for collecting the fish from the net. This type of net can be operated by a single person.

II. Local net

This net is made up of mosquito net tied on two wooden sticks, used in rapid flow of water for collecting all type of fishes.

III. Tapi

Tapi is commonly used in ponds of the Terai region of Nepal. It is made of two bamboo flanks crossed each other and tied fast at the midpoint. A square net is loosely at the four ends of bamboo flanks. A fisher dips the net in water and lifts it up. Small sizes fishes are caught with this net.

IV. Gill Nets

Gill Net is locally known as Maha jaal and is especially used for catching all sizes of fishes. It is a rectangular shape with varying length ranging from 2.5 cm-14 cm. One end of it has floating device and other side has fixed sinking device like iron nails. It is made from nylon thread. But commonly used mesh size is 6.5 cm-7.5 cm. It is casted by two or three fishermen.

V. Cast Net

It is made from nylon thread. It is used for catching fishes throughout the year. The net which is cast for fishing by a single fisherman, is called Cast Net. The human hand is the main gear of a collecting fishery. This method is very simple and is widely used all over Nepal. This net once can collect 6-10 kg fishes.

VI. Tehari or Tiyari Net

It is similar to Gill net used in the Koshi River. The indicators are made of wood "Bhakti Amilo". This net is especially used in Phewa Lake of Pokhara and it is also used in the Koshi River.

PHOTOGRAPHS

Photo 1: A fisherman with Tiyari

Photo 2: Stick put across in Koshi to stop downward migration of fish

Photo 3: A fisherman with Local net

Photo 4: Cast net observing fisherman

Photo 5: Sticks and Jal

Photo 6: A fisherman with cast net

PHOTOGRAPHS

Photo 7: Investigator collecting information from local Mallah man

Photo 8: Men participants

Photo 9: A typical house and another modern house of Mallah community

4.4.2 Non-conventional method of fishing

I. Poison

Traditionally, different plants have been used for killing fish. In the Koshi basin in lakes, swamps, streams and oxbows the plants *Agave americana*, *Sapium insinge*, *Dioscorea deltoidea*, *Euphorbia voyelana* are, as reported by the fishermen, commonly used. Aldrin, thiodine, BHC, Malathion, DDT etc are used as fish poison. This method is applied in the month of October and November. Similarly, destructive devices like dynamite, electrofishing were common.

II. Electrofishing

Use of electricity to catch fish in small shallow rivers and streams is yet another way of destructive fishing. It is usually not selective method for killing fish in all stage.

III. Use of Explosive / Blasting

Before using explosives fishermen throw rice and oil cakes into the pools to attract and concentrate the fish. They wrap the explosive in thick cloth, ignite it and throw it in the pool. The killed or stunned fish are collected by scoop net. This method catches predominantly *Glyptothorax, Garra* and *Noemacheilus*.

4.5 Fish Markets

Fish markets are located in villages, district headquarters or at a cross roads are considered primary markets. They are usually near areas where fish are caught. Fishermen bring a variety of fishes to the primary markets. There are many small hat bazaars present in Saptari district without any particular name. Most of these hat bazaars are situated along with the Rajmarg. Fish from the village of other district are also transported to the fish market of Saptari district.

Photo 10: Catching Magur and Singhi

Photo11: Selling fishes in market

Table 5: Price rate of different fish species in the month of February

S.N.	Local name	Average Rs. / kg
1	Pothi *(Putius sophore)*	30
2	Chenga *(Channa orientalis)*	100
3	Garai *(Channa Punctatus)*	100
4	Bhaghe latta *(Botia lohachata)*	120
5	Mungari *(Clarias batrachus)*	120
6	Bhegna *(Aspidoperia maror)*	200
7	Rohu *(Labeo rohitha)*	200
8	Singhi *(Heteropneustes fossilies)*	200
9	Bhakura *(Catla-catla)*	260
10	Naini *(Cirrhinus mrigala)*	260
11	Pausi *(Labeo dero)*	400
12	Jalkapur *(clupisoma garua)*	500

Table 6: Price rate of different fish species in the month of June

S.N.	Local name	Average Rs./ kg
1	Pothi *(Putius sophore)*	20
2	Chenga *(Channa orientalis)*	80
3	Garai *(Channa Punctatus)*	80
4	Bhaghe latta *(Botia lohachata)*	100
5	Mungari *(Clarias batrachus)*	100
6	Bhegna *(Aspidoperia maror)*	180
7	Rohu *(Labeo rohitha)*	180
8	Singhi *(Heteropneustes fossilies)*	180
9	Bhakura *(Catla-catla)*	240
10	Naini (*Cirrhinus mrigala)*	240
11	Pausi *(Labeo dero)*	350
12	Jalkapur *(clupisoma garua)*	400

4.6 Facilities

4.6.1 Road facilities

Road facilities are not so good in Saptari. There are "coal tarred road" Mahendra Rajmarg for Rajbiraj. In some places gravelled road are also seen. Roads have been damaged at several places during the flood time.

4.6.2 Transport facilities

Bicycles are the most popular vehicle used for carrying fishes. Fishes from distance place are brought in Rickshaw, bull cart, bus and jeep. At some places, the vessel (containing

fishes) is tied at the middle of the bamboo pole and then two persons on their shoulder hold it. Local fishes are brought to the fish markets in the earthen vessels carried on shoulder or head of the fishermen. Fishermen use aluminium utensils (locally known as handies, tasala) and plastic boxes for taking the fishes to the market. They cover these vessels with clothes or plastics and tie it with the rope.

4.7 Socioeconomic Status

The data of Mallah communities residing in the VDC of Bhardaha were prepared on the basis of age, educational status, occupations and annual household income, family structure of data.

4.7.1 Age

Age is the period of human history which is an important demographic characteristic feature. Present study people below an age of below 15 have not been included because of immature to convey information. To analyze data, age groups the individuals were classified into three groups: 15-25, 26-35 and >36 year of age. From the data it is found that the highest percentage, i.e. 47.13% represented 36 year and above. Similarly, the lowest percentage is 17.83% represented in 15-25 year age group (Table 7).

Table 7: Age group of Mallaha community

S.N.	Age group (year)	Male	Female	Total	Total %
1	15-25	5	23	28	17.83
2	26-35	14	41	55	35.03
3	Above 36	41	33	74	47.13
Total		60	97	157	100

4.7.2 Educational status of Mallah community

Education is the process of transmission of heritage. It is synonymous with socialization. Education is the basic need for improvement of personality and development of country**.** Educational condition of Mallah community is poor. As observed during the study many girls were involved in caring their junior brothers and sisters at home. Number of school going girls were low because the girl child used to get married between the ages of 12 years to 16. From the data it is found that the highest percentage of Primary education was 78.31% but percentage of HSEB was low i.e. 1.20% (Table 8).

Table 8: Literacy Status of Mallaha community

S.N.	Education	Number	Percentage	Remarks
1	Illiterate	12	4.81	
2	Primary	195	78.31	
3	Lower Secondary	35	14.05	
4	Secondary	4	1.60	
5	HSEB	3	1.20	
Total		249	100	

4.7.3 Occupational and Household income

Mallah were traditionally regarded as a habitant of water. Fishing, boating and other activities related to river and water was the traditional profession of Mallah. But at present many youth of this community are not continuing this profession by their interest. Income determines the economic status of people. On the basis of gross family income per year of the respondents can be classified into three groups: Low income, Medium income and Low income. NRs.70,000- 1,00,000 represents as Low income. NRs.1,00,000 - 3,00,000 represents as Medium income and NRs. Above 3,00,000 represents High income of the respondents per annum. From the data it is found that 10.88% of people were low income and people with high income represented only 60.89% (Table 9).

Table 9: Respondents gross family income per year (VDC-1 toVDC-6)

S.N.	Income Per Year Rupees	Fishing	Agri culture	Gov ernment job	Abroad employ yment	Othe rs	Num ber	Percentage %
1	70,000-1,00,000	30	40	-	-	-	70	28.23
2	1,00,000-3,00,000	50	36	-	-	65	151	60.89
3	Above 3,00,000	20	-	3	4	-	27	10.88
Total		100	76	3	4	65	248	100

4.7.4 Family structure and size

Family is a universal as well as one of the oldest institutions of human society. The family system is categorized into several categories according to the purpose. However, in this research, family is divided into two main categories; nuclear family and joint family. In my study area, majority of Mallah families are nuclear family followed by joint family ones. The family size exhibits 2-15 members in that ethnic tribe. In most cases, the head of the family was the eldest active male with great responsibility of the family. About 78.57% of them had Nuclear Family structure followed by 21.43% in the Joint Family structure (Table 10).

Table 10: Family structure of Mallah community

S.N.	Family structure	Number	Percentage (%)
1	Nuclear Family	55	78.57
2	Joint Family	15	21.43
Total.		70	100

5. DISCUSSION

The rivers of Nepal are really rich in fish fauna which need to be explored scientifically and conserved them. Therefore, this investigation had been made to conduct a thorough investigation of fish Fauna of Koshi River Basin. The survey also emphasized on one ethnic community such as Mukhiya, Mallah who actively engaged in fishing and food fish gathering activities either full- or part-time fishers for their livelihood in the Koshi River Basin in Bhardaha VDC, Saptari.

A survey of the site (a ranging of 2.5 km) during the month of February and June 2016 in the Koshi River indicated a total account of 12 fishes species from 4 orders, 7 families and 10 genera. The most abundant family within catch was Cyprinidae. The Koshi River has a large and varied topographical diversity which harbors unique fish fauna. Shrestha (2008) have reported 217 native species from Nepal. Thapa (2008) reported 92 fish species from the Koshi River; 81 species were enlisted by Limbu and Subba (2011). Gurung *et al*., (2016) reported 135 native fish species and 7 exotic species in the Koshi River. A total of twelve species belonging to four orders namely Cypriniformes, Channiformes, Synbranchiformes and Siluriformes were recorded during the month of February and June. *Aspidoperia morar, Clupisoma garua* were the most abundant fishes in all the study sites during the month of June.

Occurrence of Cyprinidae in Koshi River as dominant species favours the result of Nepal (Shrestha, 2008, 2013 and Rajbanshi, 2012). They reported 86 Cyprinidae (Shrestha, 2008) from the Koshi River. *Labeo dero, Puntius sophore, Mystus tengra* were the most abundant fishes in all the study sites during the month of June.

During the month of February, a total of 103 fish species were recorded and observed family wise where the maximum number was 26 of *Labeo dero* and minimum number was 1 of *A. morar*. Similarly the highest frequency occurrence was for *Labeo dero* (25.24%) and lowest for *H.fossilis* (1.94%). Here, occurrence of Cypriniformes belonging to *Labeo dero* comprises the dominant group represented by one species belonging to Heteropneustidae family in the Koshi River during this investigation but *Anguilla bengalensis*, *Labeo dero, Labeo caeruleus* which were not reported from Koshi River (Rijal *et al.*, 2014) were reported in the present study.

During the month of June, a total of 124 fish species were recorded and observed family wise where the maximum number was 45 of *A. morar* and minimum number was 1 of *Labeo dero* and *H. fossilis*. Similarly the highest frequency occurrence was for *A. morar* (36.29%) and lowest for *Labeo dero* and *H. fossilis* (0.80%).

According to the local Mallaha, the catch frequency of occurrence of the local fishes such as *Tor putitora, Clupisoma garua* and *Heteropneustes fossilis* are decreasing day by day and exotic species like *T. mossambica, Clarias gariepinus* enter through different sources.

Similarly, Bhardaha VDC was visited by the use of random sampling method. The total population was estimated to be approximately 500 in around 70 households in Bhardaha village, of which 65 households are solely dependent on the fishing which is similar to Yadav (2001) the total population was estimated to be 2937 in 484 households in all ten villages, of which 445 households are solely depend on fishing in the Koshi River Basin. The rest of the families have source of income from government job, agriculture and abroad employment. All of them depend basically on the capture fishery. Till now Mallah are living in small houses made up of bamboo, wood and mud with thatched roof. Some of them have cemented house with Tiles on the roof and few of them have concrete cemented building with galvanized sheet on the roof. The socio-economic status of the fishermen communities is the lowest in the society.

On the basis of age distribution data shows that the economically most active group represents only 17.83% at the age of 15-25 years and they support the rest of the family members by fishing. Similarly, the age group illustrates 35.03% at the age of 26-35 years considered as dependent group. But the age group above 35 reveals 47.13% regarded as less active group whose economic status was low as comparisons to the most active and dependent group. About 4.81 % of the respondents were illiterate even though most of them were found to pass 4 or 6 class. Among literate only 1.60 % passed SLC and only 1.20% attended HSEB. This data illustrated that higher education of this community was very poor. At present most of the Mallah community are sending their children to the school for education and thus, it was found that the highest percentage of Primary education was 78.31% which was a good sign towards development. The unconventional method of fishing was not selective. So, it had devastating effect on the brood stock, spawning and nursery grounds. Illiteracy, high population growth, low risk bearing capacity and unskilled youth in the community bind them to go on with their traditional occupation even if it is no longer beneficial. They manage their every social need by fishing and marketing the catch.

The survey of fish market was conducted in the month of February 2016 and in the month of June 2016. The cost price of fishes varies from species to species and their consumption rate. The cost price of fishes was less during the summer season. According to local fishermen, varieties of fish could be available during summer season just before rainy season in the Koshi River Basin. Fishermen would therefore get more profit by catching their fish during this period and months of highest sales or effective demand of freshwater fishes. A species always sold for much less when it was the most abundant species than when it was a subsidiary item.

Lofvall (1998) finding revealed that the condition for operating the market changed overtime and the development was monitored so that management was adjusted accordingly. The improvement of fish marketing system in Saptari district was quite impressive. However, fisheries sector showed weakness in transportation facilities, unstable government policies, input of Indian fishes in low cost reduced local fish demand and big margin between prices of producers and traders.

6. CONCLUSION AND RECOMMENDATIONS

The Koshi River Basin has a large and varied topographical diversity which harbors unique fish fauna and to raise the socio-economic condition of Mallah community, the following suggestions are mentioned below:

- The Koshi River is rich in fish diversity. Altogether 12 fishes species under 4 orders, 7 families and 10 genera
- Economically important fishes are *P. sophore, B. lohachata, A. maror, C. orientalis and C. garua* are decreasing day by day due to increase of exotic species such as *Tilapia mossambica, Clarias garipineus* etc.
- The socio-economic condition of Mallah community uplifting due to fisheries activities but it would be better if they adopt other professions such as labor, shopkeeping and agriculture.
- The indigenous knowledge of Mallah community is important for conserving ichthyofauna.
- The knowledge concerning about socio-economic condition of Mallah community residing near river bank are poor and illiterate only few has an education up to 5-7 classes even though the fishing becoming vital for their living condition which resulting of decrease the productive fishery.
- The fishing methods used by them like Gill net and fishing with poison are major cause of decreasing fish species.
- The fish fauna of the Koshi should be studied and conserved to update the knowledge of the Koshi River.
- The reforestation of steep slopes in the catchment of the Koshi must be promoted to prevent from land erosion.

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ANNEX I

List of informants

Name	Age
1. Sukratee Mallaha / Resmi Devi	40 / 35
2. Bhim Mallaha / Rambati Devi	42 / 37
3. Garabi Mallaha / Late Chandra Devi	70 / 55
4. Arjun Mukhiya / Manjula Devi	24 / 19
5. Dukhi Mallaha / Runti Devi Mukhiya	35 / 30
6. Bechan Mallaha / Rambati Devi	30 / 35
7. Kamanand Mallaha / Senuka Devi	26 / 25
8. Pramanand Mallaha / Bechani Devi	30 / 25
9. Gulten Mallaha / Kumari Devi	25 / 20
10. Jaynath Mallaha / Gulmi Devi	55 / 60
11. Dhanay Mallaha / Kumari Devi	45 / 40
12. Sita Ram Mallaha / Babita Devi	35 / 30
13. Radheb Mallaha / Geeta Devi	30 / 25
14. Mahesh Mallaha / Dhanasari Devi	48 / 45
15. Laxmi Mallaha / Girja Devi	58 / 45
16. Laxmi Mukhiya / Mina Devi	40 / 36
17. Rudhan Mallaha / Jibachhi Devi	30 / 25
18. Hari Mukhiya / Aasha Devi	48 / 40
19. Umesh Mukhiya / Tetari Devi	50 / 40
20. Mahesh Mukhiya / Nirash Devi	25 / 20
21. Budhu Mukhiya / Kumari Devi	40 / 35
22. Sukha Mukhiya / Anita Devi	35 / 25
23. Dukhi Mukhiya / Kunti Devi	35 / 20
24. Sukhi Mukhiya / Anita Devi	40 / 30
25. Suresh Mukhiya / Punita Devi	35 / 24
26. Ram Dev Mukhiya / Remani Devi	55 / 45
27. Suka Dev Mukhiya / Siya Bati Devi	30 / 15
28. Jag Dev Mukhiya / Lukhi Devi	26 / 19
29. Dharmadev Mukhiya / Bhunti Devi	35 / 24
30. Badri Mukhiya / Jeetani Devi	45 / 36
31. Jogindar Mukhiya / Budhani Devi	53 / 46
32. Halchhal Mukhiya / Maliya Devi	55 / 50
33. Dharmendra Mukhiya / Medani Devi	46 / 38
34. Jagadish Mukhiya / Muniya Devi	48 / 35
35. Dhaneshawar Mukhiya / Akali Devi	55 / 46
36. Ganesh Mukhiya / Aasha Devi	35 / 27
37. Maneshi Mukhiya / Poonam Devi	40 / 36
38. Biku Mukhiya / Kamali Devi	35 / 27

39. Sukarati Mukhiya / Reshami Devi	42 / 37
40. Bhim Mallaha / Ram Bati Devi	70 / 65
41. Garabi Mallaha / Late Chandra Devi	70 / 65
42. Arjun Mukhiya / Manila Devi	24 / 19
43. Dukhi Mallaha / Runati Devi	35 / 30
44. Bechan Mallaha / RamBati Devi	70 / 60
45. Kamanand Mallaha / Senuka Devi	30 / 25
46. Parmanand Mallaha / Bechhani Devi	30 / 25
47. Badari Mukhiya / Dulari Devi	50 / 45
48. Shree Natai Mukhiya / Malati Devi	52 / 45
49 .Maha Dev Mukhiya / Gudari Devi	60 / 55
50. Jhulu Mukhiya / Phulya Devi	60 / 55
51. Upendra Mukhiya / Samundra Devi	35 / 30
52. Tara Chandra Mukhiya / Seela Devi	35 / 30
53. Sukamar Mukhiya / Sonita Devi	30 / 25
54. Raj Kumar Mukhiya / Phaugani Devi	40 / 36
55. Narayan Mukhiya / Phoolo Devi Mukhiya	40 / 30
56. Hem Narayan Mukhiya / Neel Devi	50 / 40
57. Ram Mukhiya / Ram Kumari Devi	30 / 25
58. Dev Narayan Mukhiya / Molahi Devi	60 / 55
59. Laxman Mukhiya / Chandra Kala Devi	40 / 35
60. Shiv Lal Mukhiya / Dulari Devi	45 / 40
61. Badari Mukhiya / Chandra Kala Devi	30 / 25
62. Rajindra Mukhiya / Phagani Devi	45 / 40
63. Shiv Mukhiya / Ranju Devi	50 / 45
64. Jitedra Mukhiya / Rubi Devi	25 / 19
65. Birasat Mallaha / Binu Devi	35 / 20
66. Bikau Mukhiya / Preeti Devi	40 / 35
67. Ajay Mallaha / Sarda Devi Mallaha	50 / 40
68. LaxmiKanta Mallaha / Rita Devi	35 / 27
69. Sujan Mallaha / Rinku Devi	25 / 23
70. Parbesh Mallaha / Pooja Devi	50 / 46

ANNEX – II
Household Questionnaires

Respondent's identification
Name:
Age :
Marital status:
Caste:
Place/village name:
Household size: **no. of male:** **no. of female:**
No. of children:
Experience :
Education: literate/illiterate
Fishing information

1. What kind of fishing practice are you involved in?
2. How much time is spent for collecting fish per day?
3. What amount of fish do you generally catch per day?
4. Which species of fishes are caught abundantly from the river?
5. What type of fishing gears do you use?
6. What is your occupation?
7. Why do you choose fishing occupation?
8. Do you get fish in all the season?
9. Are you full timer or part timer fisherman?
10. Do you have active members in your family participating in fishing?
11. From how long been involving in fishing?
12. What do you do besides fishing?
13. How many days do you spend in fishing per year?
14. Do you use modern method or traditional method for fishing?
15. What kinds of technique do you use during fishing?
16. How much money do you earn from fishing?
17. How much fish do you catch per day?
18. Which time is best for fishing?
19. Which species is generally caught during fishing?
20. Which season is the most appropriate for fishing?
21. Are you educated?
    I. Below S.L.C.
    II. S.L.C.
    III. HSEB
    IV. Bachelor level
    V. Master level
22. Can you explain educational status of your family?
23. What kind of help do you expect from government for your livelihood improvement?
24. How do you sell fish in the market?
25. What types of obstacle do you face during fishing?