

Livelihoods and Wetland Resource Use: A Study on Selected Wetlands of Malda District, West Bengal

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Abstract : *The present study has been conducted in four wetlands under the Tal and Diara physiographic divisions of Malda district. The study aims to assess the livelihood of the villagers through multipurpose utilization of wetlands. However, surrounding villages are categorised into two types; 1. Bed village (at immediate vicinity of wetland) and 2. Belt village (a bit far-off). A descriptive survey is used and a semi-structured questionnaire is administered to 1242 number of households, selected randomly (5 % of universe). The findings show that, the households, residing in bed villages are comparatively found more dependable as well as utilizing the wetland water for irrigation and cultivation of diverse crops (paddy, jute, pulses, maize, makhana etc.) followed by fish cultivation, fish catch (Baata, Kalbaush, Katla, Koi, Maagur, Prawn, Rohu, Tangra etc.), duck rearing and wetland products (macrophytes - thankuni, kalmi, hingcha; aquatic fauna - gugli, molluscs etc.) gathering. The study also found that the belt villagers are chiefly dependent on wetlands for commercial purpose, especially for makhana cultivation within wetland bed, to sustain the socio-economy of the poor mass in Malda district.*

Key words: : Livelihood, Bed and belt village, Economic benefit, Wetland potential, Human well-being.

Introduction

Ramsar Convention (1971) on wetland of international importance uses a particular broad definition of wetlands in Article 1: “.... areas of marsh, fen, peat land or water, whether natural, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine waters the depth of which at low tide does not exceed six meters [20 feet]” (Ramsar Convention, 1971). The wetlands are among the world’s most biologically productive ecosystem which have been analysed as ‘*biological supermarkets*’ (Mitsch & Gosselink, 2015) because of the extensive food webs and exceptionally rich biodiversity they promote (Ramsar Convention Secretariat, 2016). These are the places where water accumulates for sufficiently long periods of time and contribute significantly to sustain life processes (plants and animals). It provides year-round habitats for a wide range of vertebrates and invertebrates and wintering sites for migrants. There are some studies available on the wetland valuations. For example, Ramachandra et al., (2005) have discussed the linkage between use values and ecosystem functions of wetlands in

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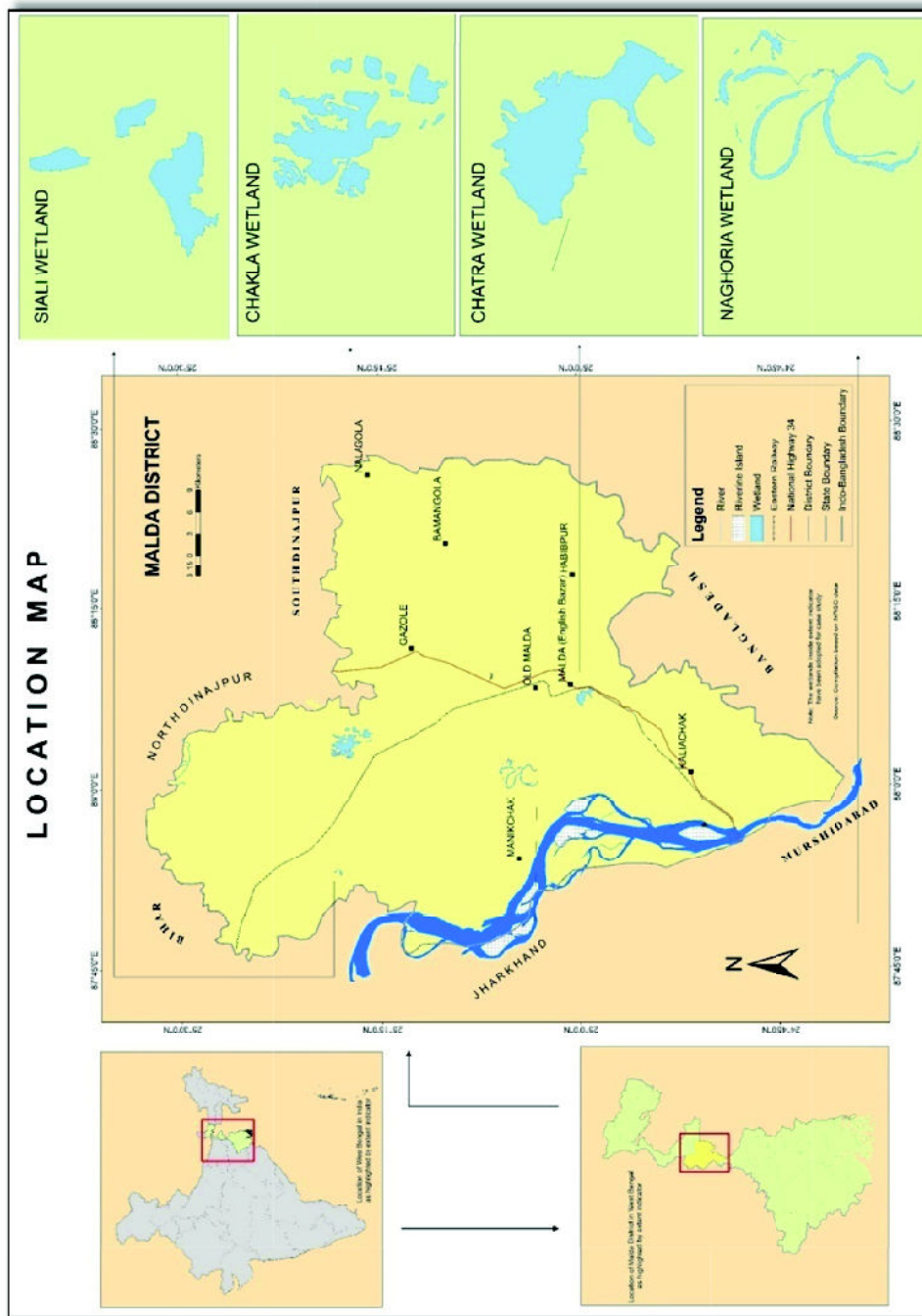
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terms of its direct and indirect benefits as a catalyst for wetland conservation in Bangalore. Similarly, Das et al., (2000) have described the uses of ten non-coastal wetlands in terms of fishing, irrigation and other benefits and estimate their values in the Gangetic flood plain in Bardhaman district of West Bengal. Similar study has been undertaken by Ntupwa and Munishi (2010) to assess the livelihood and economic benefits of wetland utilization to household income and food security in a sub-catchment of Tanzania. Moreover, a particular aspect on how wetlands benefit agriculture and contribute to human well-being has been articulated in a survey made by Department of Environment, Australian Government. Similarly, the wetland agriculture interaction in association with various livelihood and other activities have been undertaken by Srinivasan (2010). Further, MacCartney et al., (2005) have provided an approach, underpinned by wise use of wetland utilization to evaluate the suitability of wetland potential for specific agricultural uses. Apart from agriculture, broader non-agricultural utilization of wetlands is focused by the authors to assess the impact on livelihood of fisher community and management of wetland fisheries in Assam and Bihar (Chandra, 2014); (Chandra & Das, 2019). Similar work on utilization of wetland ecosystem through fish-crop diversification is made by Puste et al., (2007). On the contrary, the prospect and value of wetlands related to numerous aquatic faunas, reptiles and amphibian family and associated livelihoods of pronounced tribes of Nigeria is evaluated by Olalekan et al., (2014). In addition, Sarma and Saikia (2010) have assessed the socio-religious and cultural attachment of rural poor of Assam with wetlands. Furthermore, Baker (2008) has studied alternate wetland resource utilization and management strategies through the propagation and promotion of ecotourism. After discussing all the benefits which wetlands deliver, Robert McInnes (2013) advocates a conservationist guideline to ensure the wise use of urban and peri-urban wetlands.

Hence, a large number of studies have been made all over the world on the goods and services, provided by the wetlands. The present study, undertaken in Malda district, is endowed with wetlands, ranging from palustrine (floodplains, seasonal waterlogged, marsh), lacustrine (Lakes) and riverine wetlands. These wetlands provide intrinsic values (direct values) to the people, especially those, whose lives and customs are intimately linked with wetland functions (Bhattacharya et al., 2000). The wetland water is chiefly used as a source of irrigation for cultivating food crops. Further, cash crops like betel leaf, jute and makhana are cultivated in the wetlands. Furthermore, the wetlands under study facilitate better opportunities for fishing practice, which has immense socioeconomic values, attached to it. However, the extent, productivity and the socio-economic role of wetlands in Malda district is scanty. Therefore, the present work pertains to identify different socio-economic activities of wetlands, which can sustain the livelihood of not only the local population living in its periphery, but also to the communities living outside the wetland area.

Study Area

Malda district is centrally located between 24°40'20" N to 25°32'08" N latitude and 87°45'50" E to 88°28'10" E longitude in West Bengal (Fig. 1). Spreading over an area of 3,733 sq. km with



Source: Compilation based on NRSC data

Fig. 1: Location Map showing Case Study areas

population 39,88,845 (2011), the district covers 4.2 % of the total landmass of West Bengal and is the home to 4.37 % of the total state population (Census of India, 2011). Malda district exhibits unique fluvio-geomorphic set-up with strong evidences of complex hydrological activities (recurring shifting of river channels, massive bank erosion along with often dereliction of rivers etc.) which facilitates the formation of natural inland wetlands like cut-off meanders, seasonal waterlogged areas, lakes, and marsh etc. (Development Planning Department, 2007). As per the Institute of Wetland Management and Ecological Design, Malda district comprises 562 wetlands (≥ 2.25 ha), covering 29,416 ha (Bhattacharya et al. 2000), whereas National Wetland Atlas (2010), sponsored by Ministry of Environment and Forest (MoEF) has incorporated 502 wetlands (≥ 2.25 ha), covering 20,725 ha (Space Application Centre, Indian Space Research Organization, 2010). However, after analysing the status of wetlands of Malda district the present study has been carried out in four wetlands namely: *Siali*, *Chakla*, *Naghoria* and *Chatra wetland*, considering two criteria: a) different categories of wetlands (riverine, cut-off meander, seasonal waterlogged) and b) the agro-economic and biological potentials as well as possibility of wetlands (Fig. 1).

Siali Wetland: This is a unique representation of natural fresh water wetland system, lies between 25°18' N to 25°19' N latitudes and 87°53' E to 87°54' E longitude, in Harischandrapur 2 block under Chanchal subdivision of Malda district (Fig. 1). The area extent of Siali wetland is 18.74 ha. Mean depth of water in wetland varies from 1.5 metre in pre-monsoon to 3 metre in post-monsoon season. The wetland is surrounded by the seven villages namely; Jagannathpur, Fatepur, Bhaluka and Degun, which are considered as bed villages with 5,665 households and population size of 27,474; whereas, three villages namely Talgachi, Par bhaluka and Kariali are considered as belt villages with 2,508 households and 13,544 population.

Chakla Wetland: This wetland is located between 25°16'30'' N to 25°18'30'' N latitude and 88°02'20'' E to 88°04'30'' E longitude in Chanchal 2 block (Fig. 1). The water spread area of the wetland is 1137.13 ha. The mean depth of wetland varies from 2 meter in pre-monsoon to 2.5 meter in post-monsoon. Chakla wetland is surrounded by bed villages; namely Gangadebi, Gopalpur, Damaipur, Kaliganj, Shimultala and Hazaratpur (households 4,749 and population 24,110) and belt villages; namely Jalapur and Khanpur (households 2,357 and population 12,520).

Naghoria Wetland: The extreme bend of the River Kalindri has cut off from main stream and rejected channel forms an oxbow lake, known as Naghoria wetland. The wetland lies between 25°01'30'' N to 25°05'45'' N latitude and 87°59'45'' E to 88°04'30'' E longitude (Fig. 1). The area extension of Naghoria wetland is 228.13 ha. The mean depth of wetland varies from 2 meter in pre-monsoon to 2.5 meter in post-monsoon. This ox-bow lake is enclosed with three bed villages namely; Nagharia, Lakshmighat and Uttar Lakshmipur containing 3,309 households and 15,910 populations whereas two belt villages namely; Phulbaria and Koklamari with 2,438 households and 11,020 populations encompass this cut-off at relatively distant location.

Chatra Wetland: It is a peri-urban wetland in the south-western fringe of English bazar municipality. It is located between 24°58'30'' N to 25°00'30'' N latitudes and 88°0' E to 88°08' E

longitudes (Fig. 1). The water spread area of Chatra wetland is 295.73 ha. The average depth of water in wetland varies from 1.8 meter in pre-monsoon to 3.0 meter in post-monsoon. The villages namely; Uttar Ramchandrapur, Uttar Jadupur, Dilalpur and Arazi Dilalpur as bed villages with 2,672 households and 8,986 populations whereas Sonatala, as belt village with 2,241 households and 10,589 populations surround this peri-urban wetland.

Objectives

The objectives of the present study are -

1. To identify different socio-economic activities undertaken by local communities
2. To assess the livelihood of wetland utilization to both the peripheral settlers and the communities living outside the wetland area.

Materials and Methodology

To fulfil the mentioned objectives, the methodology and database has been obtained by authors. The entire study is based on both the primary and secondary data and information that have been collected from different sources.

Data Source

A. Primary database

The relevant data and information have been collected from intensive field survey and interviewing the households to estimate the “provisioning services” of wetlands (agriculture, aquaculture, and gathering wetland products) as well as ascertain their socio-economic livelihood. In the present study, a total number of 1242 households from the peripheral bed and belt villages of the wetlands under study has been taken by random sampling method. A total number of 408 households around Siali wetland, 354 households in Chakla wetland, 287 households in Naghoria ox-bow Lake and 193 households in Chatra wetland have been undertaken.

Probability Sampling

At household survey, random sampling (5% of universe) procedure has been followed to select sample households, who directly and indirectly utilize the wetlands and associated resources. In this regard, the habitats surrounding the wetlands are classified into two categories: (a) *Bed village* and (b) *Belt village*. *Bed villages* are located at the immediate vicinity around the wetlands whose whole lives and customs are intimately linked with the wetland functions. On the other hand, *belt villages* are located beyond the surrounding community, outside the wetland area who exploit wetlands especially for major commercial purpose (Seshavatharam, 1992) as well as sustain their livelihoods. However, in the present study, the distance of bed and belt village in terms of providing “provisioning services” vary according to the nature and location of wetlands. However, in all the case studies, bed villages are considered to be located at the adjacent

vicinity of water body up to an average distance of 650 metre, whereas the average extension of belt villages are recorded from the immediate vicinity of bed village up to 1.5 km.

In the present work, in *case study 1 (Siali wetland)*, out of the total households in bed villages (located at wetland edge up to a distance of 1 km) 283 households and 125 households in belt village (located beyond 1 km up to 2 km) (5% of the universe) have been surveyed (*Fig. 3*). In *case study 2 (Chakla wetland)*, out of total households in bed village (located at wetland edge up to a distance of 600 metre) 237 households and in belt village, (located beyond 600 m up to 1 km) 117 households have been surveyed (*Fig. 4*). In *case study 3 (Naghoria wetland)*, out of total households in bed village (located at wetland edge up to a distance of 350 metre) 165 households and in belt village, (with a distance beyond 350 metre up to 800 metre) 122 households are surveyed (*Fig. 5*). In *case study 4 (Chatra wetland)*, out of total households in bed village (located at wetland edge up to a distance of 650 metre) 193 households and 134 households in belt village, (located 3 km far off this water body) have been randomly taken and surveyed (District Census Handbook, Census of India, 2011) (*Fig. 6*).

Data Collection

1. The ground survey with conventional surveying instruments along with GPS (Global Positioning System) has been used to assess the geographical dimensions of the wetlands under study.
2. Field study has been conducted in 2016-17 from the household head of peripheral settlers of wetlands under study with the help of local dialect. Semi-structured questionnaire along with observation are used as data collection instruments on the socio-economic condition of the households and their dependence on wetlands for diverse livelihood activities.
3. The president and members of Gram panchayat offices, Block Development Officer (BDO) along with the owner of Fishing Co-operative Society of nearby wetlands have also been interviewed during study.

B. Secondary Database

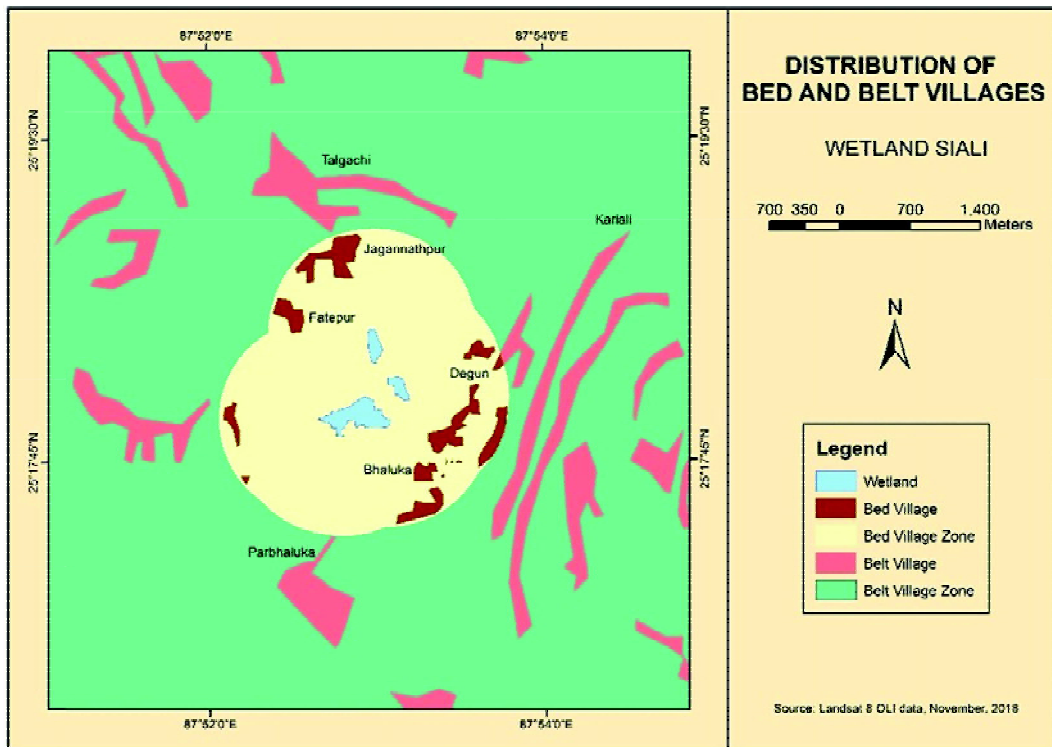
1. The basic areal data have been procured from the Survey of India (SOI) topographical maps (1:63,360 and 1:50,000) of Malda district and the Satellite imagery of Landsat 8 OLI (The Operational Land Imager) 2018 data of November (Earth Explorer; 2000; FS; 083-00; Geological Survey (U.S.).
2. The physical configurations of wetlands under study have been procured from different secondary sources including, Department of Fisheries, Govt. of West Bengal, Institute of Wetland Management and Ecological Design (IWMED), Space Application Centre (SAC), ISRO.

Data Analysis

The quantitative data is analysed using the Statistical Package for Social Sciences (SPSS) version 25 and Excel for windows software. The data, collected from the primary and secondary sources have been analysed using both qualitative and quantitative techniques and are interpreted accordingly. Descriptive statistics including percentages are used through cartography to estimate the utilization of wetlands under study and to assess its potentials to sustain the socio-economy of peripheral settlers.

Result

All the wetlands under study are utilized by the peripheral households (bed and belt villages) directly and indirectly through different livelihoods. There are four major direct economic functions of the wetland, viz., use for cultivation; use of wetland as a source of irrigation; wetland fisheries; wetland product gathering in the form of aquatic flora (macrophytes) and fauna.



Source: Landsat 8 OLI data, November, 2018

Fig. 2: Distribution of Bed and Belt villages around Siali wetland

Use of wetlands for irrigation and cultivation

In the present study, the major crops cultivated, with the help of wetland water are paddy (Aman, Boro) and Jute. The utilization of wetlands under study for Rice paddy cultivation is regarded as a staple diet of more than half the world's population, inclusive India (Schuyt & Brander, 2004). Aush and aman paddy are cultivated at wetland edge with the help of wetland water as zaid and kharif crop respectively. Aman paddy is considered mostly dominant kharif crop, cultivated in and around wetland during June to October by most of the cultivators and agricultural labourers from the bed village. Boro paddy is another key crop, which is cultivated at the wetland edge during November to February and is mostly remunerative for the cultivators as they could save money in terms of irrigation, fertilizer and labour costs (Mukherjee, 2008). Further, the settlers of nearby villages utilize the wetland water as their main source of irrigation through manual lifting devices for boro paddy cultivation. However, the wetlands under study are associated with low lands and contributed to a wide range of paddy species such as 'Digha', 'Kalabona', 'Kali Rai', 'Lalbona', 'Laxmi Digha', 'Mughi', 'Metegarol', 'Sada Bona' of aman varieties, 'Muktahar' of aush and 'Boali', 'Jagoli' of boro varieties (Sarkar and Roy, 2013). Besides major crops, cultivated by the households adjacent to wetlands under study includes wheat, corn, mustard, legumes and pulses such as Arhar (*Plate 1*), Kalai, Moong etc. Mustard is generally cultivated from October to December, whereas Kalai is cultivated during August to December at the agricultural field, adjacent to wetland. The entire cultivation surrounding the case studies are characterized with a good association of cereals (Motor, Chola, Kalai) as well as several vegetables (Brinjal, Cauliflower, Radish) etc. These agricultural crops are cultivated with the help of wetland water. Irrigation facility has also been developed with the help of shallow machine at the depth of 45 to 60 feet.

Apart from the food crops, cash crops namely betel leaf and jute are cultivated in and around wetlands by the peripheral households. Jute is the important commercial crop, cultivated during February to May in the uplands, surrounding wetland (*Plate 2*). Jute is also cultivated in substantial area under wetland bed at the time of water logging period, as it can withstand the water, which is essentially required for jute retting purpose (Mukherjee, 2008) and as a source of fodder. The field study reveals that near about 80 % of the cultivators are engaged traditionally from a long period, with betel leaf (*deshi*/ indigenous) cultivation (*Plate 3*) in combination with other crops. Another cash crop is makhana which is cultivated on a mass scale in the wetlands under *tal* and *diara* physiographic regions of Malda district (Chaudhuri & Dutta, 2006). Varied pockets of *Siali* and *Chatra* wetland (*Plate 4*) are progressively roofed with this hydrophyte at the monsoon months when the water is at its peak. The wetlands are leased out from the Gram Panchayat for 3 years to the cultivators for makhana practice within wetland water. Irrespective of bed and belt village, the households are massively engaged in makhana practice which eventually sustains their livelihood.

Table 1: Utilization of Siali wetland resource by surrounding households

Village type	Village	Cultiva- tor	Wetland Utilized	Makhana cultiva- ting	crop cultiva- ting	Fishing	Wetland Utilized	Product collec- tion	Cultiva- tor+ Fishing
Bed	Jagannathpur	45	25	0	25	8	2	0	3
Bed	Fatepur	62	59	10	49	14	11	0	6
Bed	Bhaluka	37	21	14	7	44	29	0	8
Bed	Degun	38	38	0	38	9	7	4	0
Belt	Talgachi	18	2	2	0	19	0	0	2
Belt	Parbhaluka	22	4	4	0	29	10	0	3
Belt	Kariali	5	0	0	0	4	0	0	0
Total		227	149	30	119	127	59	4	22

Source: Primary Census Abstract, Census of India, 2011 Field study, 2016-17



Plate 1: Arhar cultivation with wetland water during post-monsoon



Plate 2: Jute cultivation during pre-monsoon

In the present study, the majority of the peripheral households are marginal labourers. They cultivate different food as well as cash crops, which are considered main source of income for the settlers around wetland. In *Siali wetland*, out of the total number of surveyed households, bed village accounts 182 households (64.3%) and belt village accounts only 45 households (36%), who are engaged in cultivation, including both the agricultural labourers as well as cultivators (*Fig. 6*). Out of these cultivator households in bed villages, 143 households (78.57%) utilize the wetland water for irrigating fields and grow varieties of greens in various seasons. On the contrary, in belt village, out of the total cultivators, only 6 households (13.33%) utilize this wetland for irrigating their agricultural fields. The total area under cultivation is 104.42 ha out of which 10.12 ha (9.69%) containing

paddy, pulse and jute are irrigated with the help of Siali wetland water . Furthermore, 24 (16.11%) cultivator households in bed village and all the 6 households residing in belt village intensively cultivate makhana on lease basis under the Fisheries Co-operative Society. Makhana is cultivated as a seasonal annual crop collected in the last week of July or the first week of August.

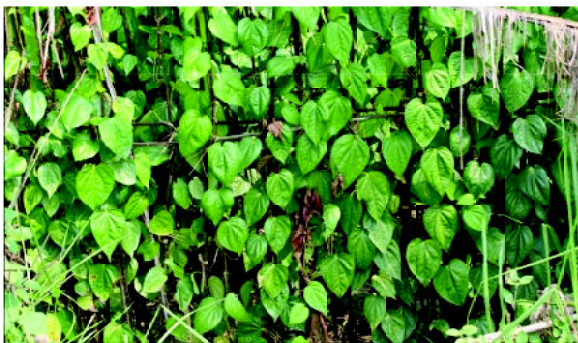


Plate 3: Betel leaf cultivation with the help of wetland water

In *Chakla wetland*, out of the surveyed households 154 number (64.98%) in the bed village are engaged in cultivation as well as use the wetland water for irrigating their farm lands (*Fig. 7*). Whereas, out of 33 (28.2%) cultivator households 21 (63.64%) use wetland water for irrigation purpose. Out of the total 93.5 ha land under cultivation, 10.74 ha (11.49%) containing paddy, pulse and jute are irrigated with the help of Chakla wetland water.

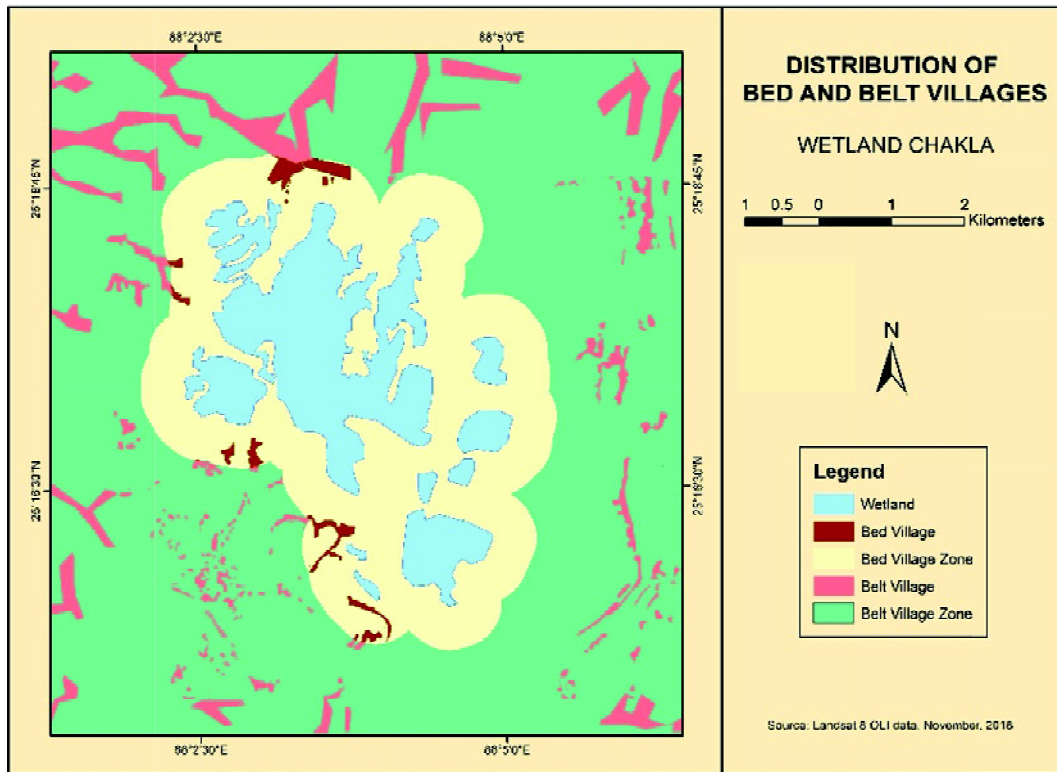


Plate 4: Makhana cultivation in wetland bed

Table 2: Utilization of Chakla wetland resource by surrounding households

Village type	Village	Cultivator	Wetland Utilized	crop cultivating	Fishing	Wetland Utilized	Product collection	Cultivator +Fishing
Bed	Gangadebi	33	33	33	5	5	1	5
Bed	Gopalpur	18	18	18	6	7	2	4
Bed	Damaipur	32	32	32	8	8	0	5
Bed	Kaliganj	18	18	18	1	0	0	0
Bed	Shimultala	22	22	22	5	2	0	4
Bed	Hazaratpur	31	31	31	10	4	0	1
Belt	Jalalpur	11	4	4	6	1	0	3
Belt	Khanpur	22	17	17	13	4	0	5
Total		187	175	175	54	31	3	27

Source: Primary Census Abstract, Census of India, 2011 Field study, 2016-17

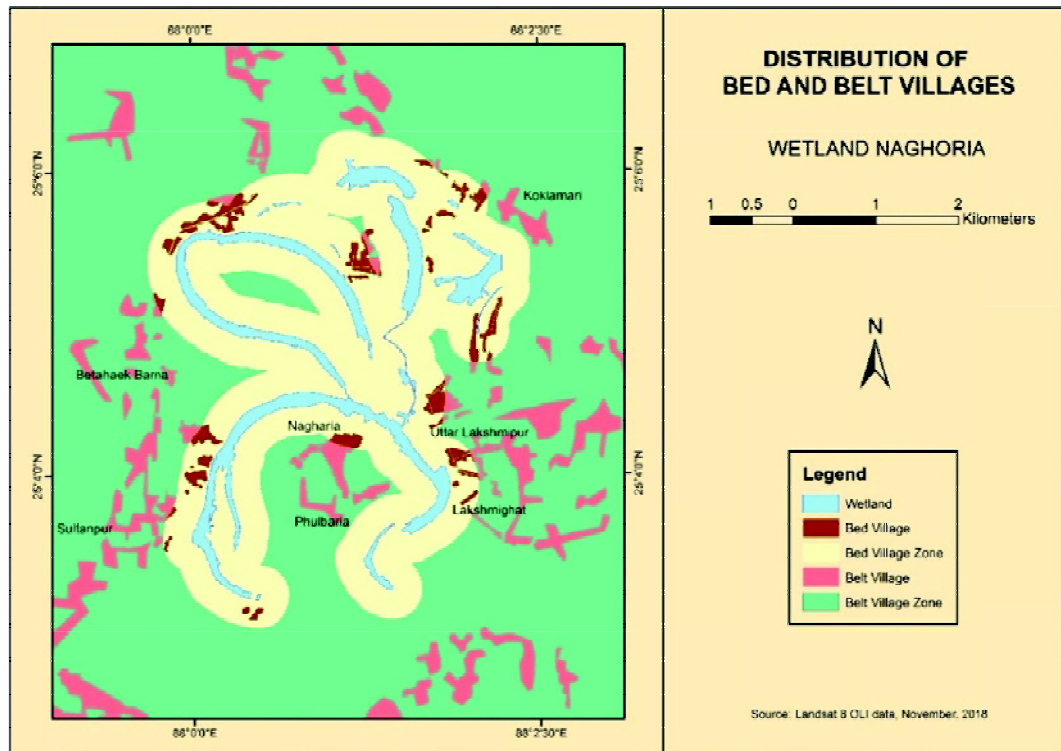


Source: Landsat 8 OLI data, November, 2018

Fig. 3: Distribution of Bed and Belt Villages around Chakla wetland

In the bed village surrounding *Naghoria wetland*, at the closest contiguity, 115 households (69.7%) are engaged in cultivation, out of which majority i.e., 87 (75.65%) households utilize this wetland water to provide food security and improve their livelihood (*Fig. 8*). On the contrary, out of 122 households in belt village, 45 households (36.89%) in spite of being engaged in cultivation do not utilize this particular wetland for irrigation purpose which is attributed to distant location. However, the total area under cultivation is 65.6 ha, out of which 6.23 ha (9.50%) containing paddy, pulse, maize and jute are irrigated with the help of *Naghoria wetland* water.

Out of the surveyed households in the bed village surrounding *Chatra wetland*, 42 households (31.34%) are cultivators and agricultural labourers in which 27 (64.29%) households utilize this wetland water for irrigation purpose. Whereas in belt village out of 40 households (67.79%) who are engaged in cultivation, 33 number (82.5%) directly rely on *Chatra wetland* for cultivation as well as use the wetland water in order to irrigate their crop lands (*Fig. 9*). Out of



Source: Landsat 8 OLI data, November, 2018

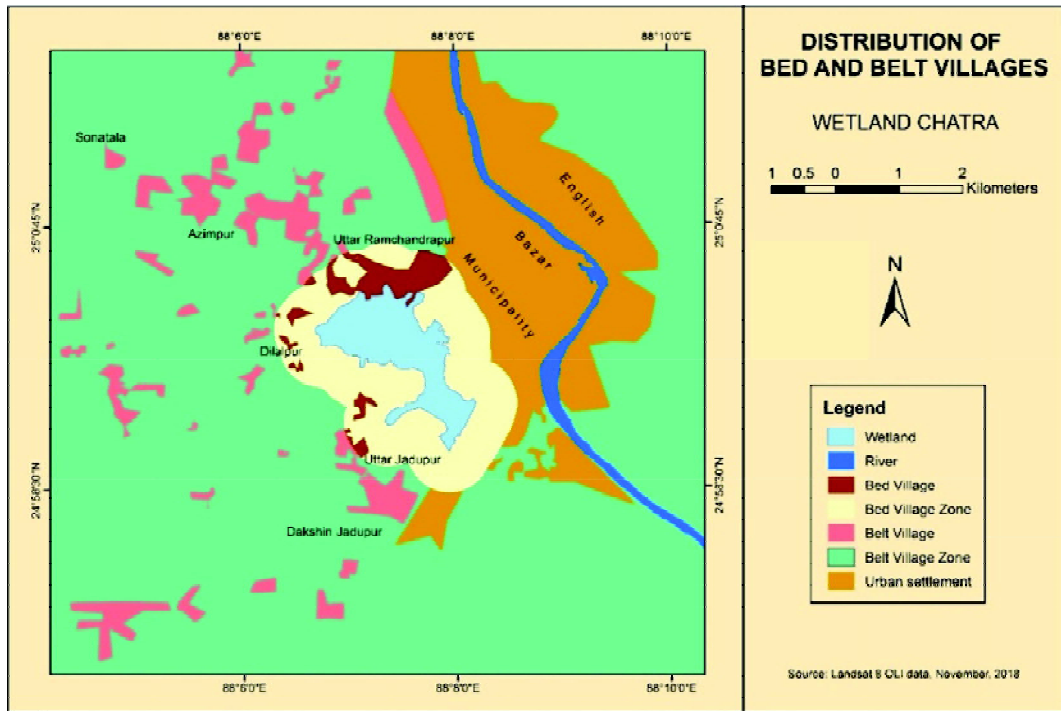
Fig. 4: Distribution of Bed and Belt villages around Naghoria wetland

Table 3: Utilization of Naghoria wetland resource by surrounding households

Village type	Village	Cultivator	Wetland Utilized	crop cultivating	Fishing	Wetland Utilized	Cultivator +Fishing	Duck rearing
Bed	Nagharia	43	37	37	10	8	2	5
Bed	Lakshmighat	39	28	28	5	4	2	3
Bed	Uttar Lakshmipur	33	22	22	10	7	4	1
Belt	Phulbaria	34	0	0	9	0	3	0
Belt	Koklamari	11	0	0	2	0	0	0
Total		160	87	87	36	19	11	9

Source: Primary Census Abstract, Census of India, 2011 Field study, 2016-17

the total cultivated area of 35.26 ha, this wetland acts as water source to irrigate a total of 1.82 ha (5.16%) area for cultivating principal crops namely aman and boro paddy. In the bed villages, a significant number of cultivator households (48.15%) are engaged in makhana cultivation, whereas in the belt village, the entire cultivator households are actively inclined to makhana cultivation within this particular water body.



Source: Landsat 8 OLI data, November, 2018

Fig. 5: Distribution of Bed and Belt villages around Chatra wetland

Table 4: Utilization of Chatra wetland resource by surrounding households

Village type	Village	Cultivator	Wetland Utilized	crop cultivating	Fishing	Wetland Utilized	Product gathering
Bed	Uttar Ramchandrapur	10	3	3	7	7	9
Bed	UttarJadupur	21	15	7	2	2	0
Bed	Dilalpur	11	9	4	3	3	0
Belt	Sonatala (CT)	40	33	0	0	0	0
Total		82	60	14	12	12	9

Source: Primary Census Abstract, Census of India, 2011 Field study, 2016-17

Use of wetlands for fishing

The entire fishing practice in the wetlands under study is controlled by fishing cooperative society namely; Bhaluka Fisheries Co-operative Society, Rampur Fishing Co-operative, Ojitpur Co-operative, Goalpara Co-operative, Boalia Co-operative and Dhanga Co-operative society. The Co-operative Society has leased out different portions of the wetland for three to five years and fishing is done by the private ownership on leasing. The fishing practice is primarily dominated by *Labeo rohita*, *Arius arius*, *Heteropneustes fossils*, *Clarias batrachus*, *Labeo bata* (Plate 6), *Cirrhinus cirrhosus* and *Labeo catla* cultivation. Further, *Wallago attu*, *Mystus tengara* (Plate 5), *Amblypharyngodon mola*, *Chanda nama* are the ample species, which are cultivated in these wetlands throughout the year. All varieties of carps *Hypophthalmichthys molitrix* and *Ctenopharyngodon idella* are cultivated and caught from wetlands under the low-land region. Moreover, different types of fishes like *Cyprinus rubrofasciatus* etc. cultivating in this wetland is considered more profitable as well as utilized for commercial purpose (Plate 7).

Fish cultivation and fish catching are extensively carried out in the wetlands under study, which provides better opportunity for the inhabitants, residing in both bed and belt villages. Around *Siali wetland*, out of the surveyed households, 75 households (26.5%) in bed village are engaged in fishing practice in which 49 households (65.33%) are directly linked with this particular wetland. Conversely out of 52 fishing households (41.6%) in belt village only 10 households (19.23%) utilize this wetland for fish cultivation and catch, which is attributed to distant location (Fig. 7). And therefore, majority of the households are inclined to fishing at the nearby water bodies rather than this particular wetland.

Being a typical example of middle Ganga wetlands *Chakla wetland* is considered one of the very momentous water bodies of Malda district for the fish cultivation. Out of the total surveyed household, bed village contains 35 numbers (14.77%) and belt village contains 19 (16.24%) households, engaged in fishing practice including fish catch (Fig. 7). Out of the total fishing households in bed village, 26 households (74.29%) whereas, in belt village 5 households (26.32%) utilize this vast natural wetland exclusively for fish cultivation and fish catch.

The households, residing in bed village, at a close vicinity to *Naghoria cut-off* are engaged only in fish catching, along with crop cultivation throughout the year. Out of the total households in bed village 25 (15.15%) are engaged in fish catch (Fig. 8), in which 19 households (76%) are dependent on *Naghoria wetland*. A reverse picture is revealed in belt village, where only 11 households (9.02%) are found to catch diverse fish species in other scattered water bodies which is attributed to relatively distant location of belt villages.

In *Chatra* peri-urban wetland, fish is not cultivated due to absence of any fishing co-operative in English Bazar block, but still, promotes immense potential for fishing household in the form of employment generation and several other associated sources of income. Out of the

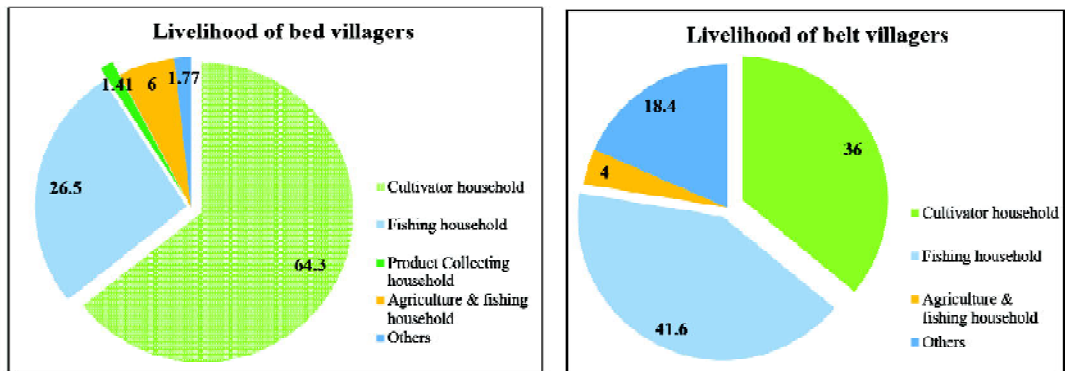


Fig. 6: Livelihood by households around Siali wetland

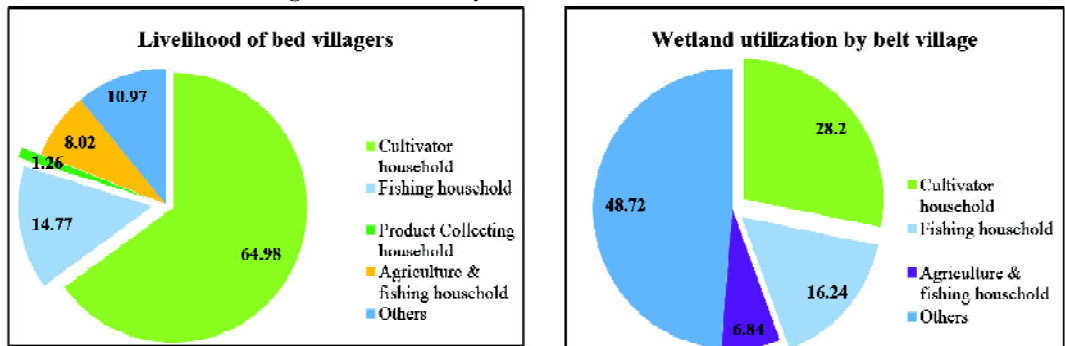


Fig.7: Livelihood by households around Chakla wetland

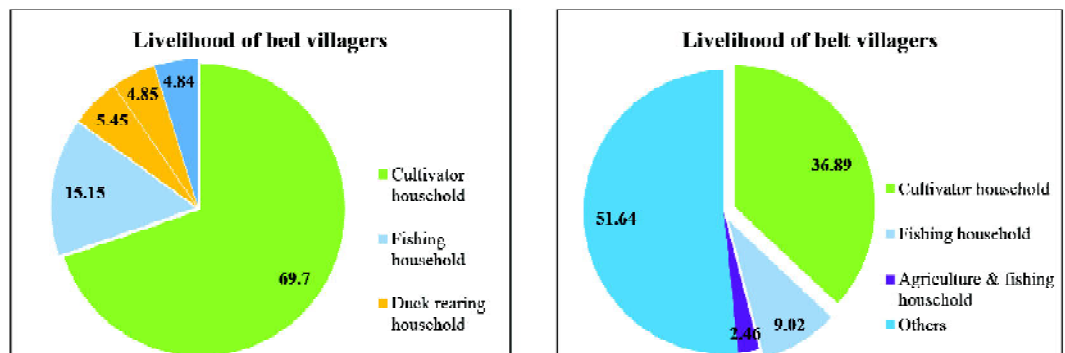


Fig. 8: Livelihood by households around Naghoria wetland

surveyed household in bed village 12 households (8.96%) are directly dependent on this water body for fish catch (*Fig. 9*). On contrary, no households of belt village are found in fish catch which is attributed to predominance of makhana cultivation among the peripheral settlers especially during last few decades.

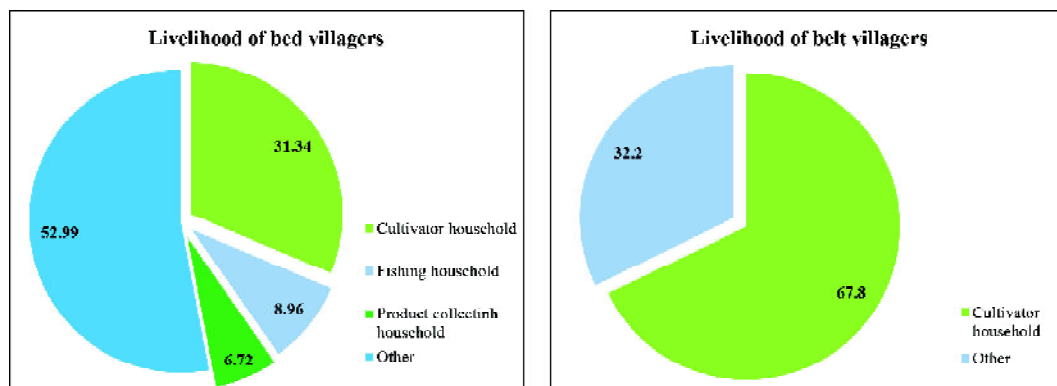


Fig. 9: Livelihood by households around Chatra wetland

Use of wetlands for cultivation and fishing together

The field study reveals that most of the settlers, residing in the bed villages cultivate diverse crops for subsistence and are engaged in fishing for commercial purpose alternatively for their livelihoods. The inhabitants of peripheral villages used to practice cultivation from long back and later have adopted practicing fish culture into that crop land as a form of fish pond (Irrinki and Irrinki, 2006-07). Around *Siali wetland*, out of the surveyed



Plate 5: *Mystus tengara*, Chakla wetland

households in bed village, 17 households alternatively practice cultivation and fishing, in which 14 households (82.35%) particularly depend on this wetland. Fish is mostly cultivated in the flooded field after the paddy harvest (Srinivasan, 2010). However, out of the total surveyed households in belt village, no households are recorded to be dependent on this particular wetland for cultivation and fishing together, which may be attributed to distant location of villages and in between existence of other scattered water bodies. Around *Chakla wetland*, out of the surveyed households in bed village, 19 households (8.02%) are direct beneficiaries are engaged in crop



Plate 6: *Labeo bata*, Naghoria wetland

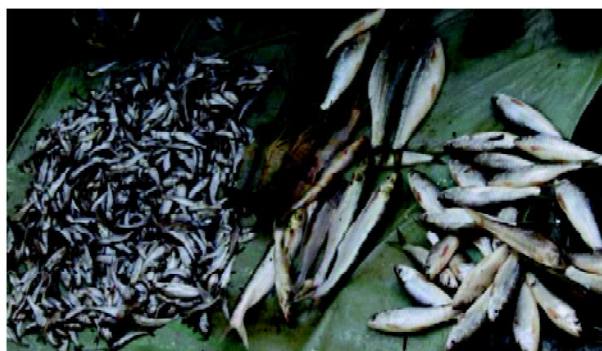


Plate 7: Heterogeneous fish species, Siali wetland

cultivation and fishing together on this wetland. On the other hand, 5 households (62.5%) are dependent on this particular wetland in the form of cultivation and fishing together. Around *Naghoria wetland*, most of the households (87.5%) sustain their livelihoods by both crop cultivation and fish catch together in this cut-off meander. On contrary, no households in the belt village are found to practice cultivation and fishing alternatively which may be attributed to the absence of any fishing cooperative society to run fish cultivation in an organised manner. Around *Chatra wetland*, most of the people's livelihoods in both the bed and belt villages are solely dependent on makhana cultivation on wetland bed and their processing. The present study finds no households are engaged in crop cultivation and fish catch together, which is attributed to major shifting of fishermen to more profitable crop cultivation in the form of makhana in this wetland bed.

Moreover, the study reveals makhana

cultivation and fishing practice together as ecologically vulnerable, which is attributed to the fact that the wetland water gets completely sterilized with insecticides of Endosulphun group before sowing makhana seeds. This sterilized water becomes harmful for fish cultivation and found unhygienic for the human health.

Use of wetlands for product gathering

In the present study, wetlands of Malda district exhibit diverse composition of aquatic flora (plants) and fauna which can be harvested on a sustainable basis to provide an economic return to number of villagers. In *Siali wetland*, out of the surveyed households in bed village 4 households (1.41%) at the closest proximity gather different wetland products (*Fig. 6*), whereas in the bed village surrounding *Chakla*, and *Chatra wetland* 3 households (1.26%) and 9 households (6.42%) respectively are engaged in gathering several wetland products throughout the year (*Fig. 7, 8, 9*).

However, all the wetlands under study display growth of several water edge macrophytes namely; *Polycarpon prostratum*, *Ipomoea aquatica*, *Heliotropium indicum*, *Enydra fluctuans*, *Hygrophilia auriculata*, *Centella asiatica* and open water macrophytes such as; *Trapa natans*, *Nelumbo Nucifera*, *Nymphaea Nouchali* etc. These macrophytes constitute an inevitable component of the entire ecosystem, and are used by local habitants directly for the food, fibre and fuel. Further, these aquatic macrophytes play substantial role in the local socio-economy i.e., edible plants, feed for livestock, green manure, and thatch cordage. Furthermore, the traditional uses of aquatic plants of *Centella asiatica*, *Hygrophilia auriculata*, *Enydra fluctuans* etc. possess known medicinal properties to the local people as well as are of immense potential. Moreover, diversified macrophytes such as *Marsilea*

quadrifolia, *Polycarpon prostratum* found in wetland bed and at wetland edge are considered very significant for the day-to-day human diet and of salubrious consumption. The inhabitants of bed villages at the wetland periphery collect several wetland products in the form of aquatic fauna viz., local oysters/molluscs, *gugli* (Plate 8), tortoises, shellfishes (Plate 9) and other available fishes.

As per the field study, wetland product gathering is not performed in *Naghoria cut-off* in an organized manner. Rather, duck keeping is often practiced by 9 households (5.45%), at the periphery of this wetland which is considered one of the important sources of duck eggs in nearby Bichitra market and Green Park market of Malda town. Apart from this, the wetland water is used for domestic purpose by a small number of households in the form of washing cloths and utensils. The rate of utilization of wetland water for the household purpose has presently been diminishing because number of shallow tube wells has been built up in the village premises. Moreover, the wetland water is presently beyond human use and any other consumption due to drastic water



Plate 8: Gugli collected from Chatra wetland



Plate 9: Shell fishes collected from Siali wetland

quality deterioration because of polluted and toxic chemical fertilizers from adjacent agricultural field and domestic sewage inflow into this water body.

Discussion

Comparing wetland dependent livelihoods

In the present study, a comparative analysis is done, which records maximum number of bed villagers to depend on the studied wetlands for diverse livelihoods. Around *Chakla wetland*, out of the total surveyed cultivator households, 154 households (82.35%) of bed villages are dependent on this particular water body, followed by 133 households (62.99%), 87 households (54.38%) and 27 households (32.93%) in and around *Siali*, *Naghoria* and *Chatra wetland* respectively (*Fig. 11*). This sole dependency on wetlands especially by the bed villagers are attributed to nearby proximity of inland perennial wetland. On contrary, in belt villages, relatively small numbers of households amounting 11.23% and 2.64% are dependent on *Chakla* and *Siali* wetland respectively, which is attributed to distant location (*Fig. 11*). *Naghoria cut-off* records no belt villagers to depend on for any kind of livelihood including cultivation, fishing and product gathering, which is attributed to maximum number of belt villagers are shifted from cultivators to mango orchard workers. *Chatra wetland* records 33 number of households (40.24%) from belt village to be dependent on this particular water body, which is attributed to maximum number of households, is engaged in makhana cultivation in different pockets of wetland (*Fig. 11*). Having

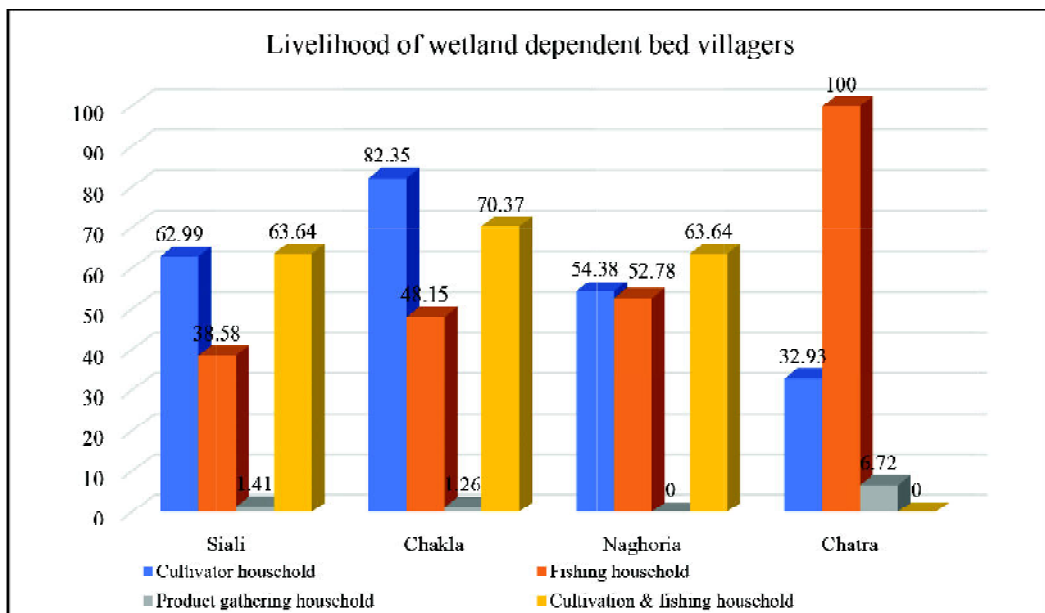


Fig. 10: Livelihood of Bed villagers on wetlands under study

organised fishing co-operative society, total number of 49 (38.58%) and 26 (48.15%) fishing households of bed villages in and around *Siali* and *Chakla wetland* are solely dependent on these water bodies respectively for both fish cultivation and fish catch (Fig. 10). *Naghoria* and *Chatra wetland* record 19 households (52.78%) and 12 households (100%) under bed villages to depend on wetlands respectively for fish catch (Fig. 10). Fish cultivation is not practiced in both *Naghoria* and *Chatra wetland*, which is attributed to having no organized fishing cooperative society. Conversely, belt villages around all the wetlands under study records relatively a smaller number of households to depend on, which is attributed to distant location and scattered water bodies in between (Fig. 11). Around 14 (63.64%), 19 (70.37%) and 7 households (63.64%) from bed villages of *Siali*, *Chakla* and *Naghoria* wetland respectively are alternatively dependent for cultivation and fishing practice which is attributed to conducive ecology in the form of water and food, maintained within these wetlands (Fig. 10). *Chatra wetland* records no bed villagers to practice both fishing and cultivation, which is attributed to dominance of remunerative makhana cultivation by the belt villagers, rather than fish catch. Moreover, due to thorny appearance of makhana, fish is not being cultivated. On the contrary, the belt villages record insignificant number of households to depend on these wetlands under study. All the product gathering households of bed villages are dependent on *Chatra*, *Chakla* and *Siali wetland*, whereas *Naghoria cut-off* do not record any such count (Fig. 10).

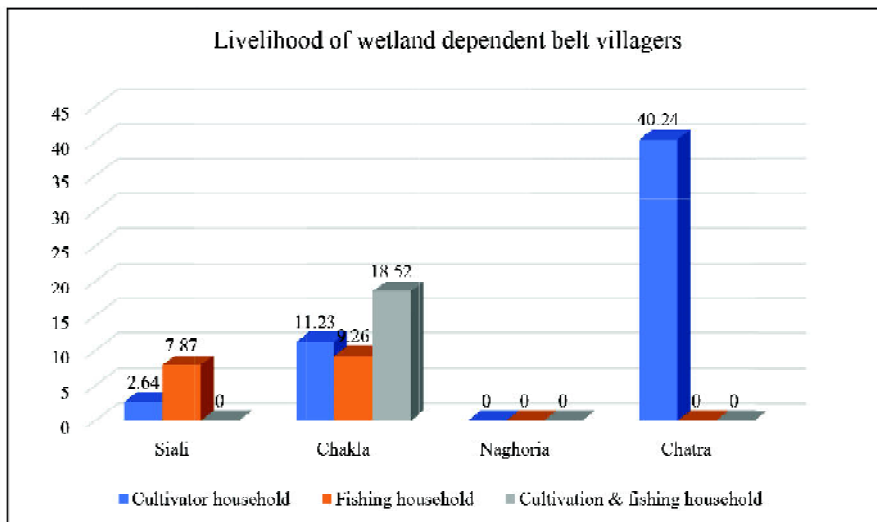


Fig. 11: Livelihood of Belt villagers on wetlands under study

Conclusion

The conclusion of the present study is based on a snapshot of available data, which is focused on the socio-economic utilization and aesthetic importance of the wetlands. The result

indicates that wetlands are considered a principal element to achieve poverty alleviation for the livelihood of marginalized sections of the community in Malda district. The locations of wetlands are considered as significant factor to determine the amounts of resources are being extracted by the households. The use of wetlands is dynamic in nature, which vary with space (e.g., across different physiographic zones) as well as time (e.g., across different seasons). The wetland utilization also changes across years depending upon the interest and capability of the stakeholders (Das et al., 2015). Further, the present study reveals that the bed village settlers tend to depend solely on wetlands and associated resources for their survival as well as for the improvement of their economic status whereas surrounding belt villages practically have less cohesion with wetlands under study. However, an attempt has been made to evaluate the extent to which agricultural activities, irrigation, fishing practice and aquatic product collection in wetlands have been carried out by the peripheral households. Therefore, governments at all levels, non-government organizations (NGOs) and other community-based organizations should make a concerted effort towards devising appropriate policy for equitable distribution of the benefits of the wetlands among different sections of the society. Furthermore, it is also necessary to provide clear guidelines to ensure sustainable use and management of wetland resources (Das et al., 2015) at local level involving poor and marginalized section of people.

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