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A study on the present status of fish in a perennial wetland (beel) of central Assam, India

Un estudio sobre el estado actual de los peces en un humedal perenne (beel) del centro de Assam, India

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ABSTRACT

The permanent wetlands of Assam, known as Beels, are crucial in regulating the functions of natural ecosystems and harbor coveted Bioresources such as fish. On the majority of the occasions, these wetlands provide essential nutrition in the form of varieties of fish species while generating primary and secondary sources of employment and income to sustain the livelihood of large socio-economically vulnerable sections of the society. However, fish diversity is slowly decreasing in most wetlands over time, primarily due to anthropogenic stresses. For conservation measures, ichthyofaunal diversity is a good indicator of the health of the aquatic ecosystem. We studied the Ichthyofaunal diversity and its prospectus in one such wetlands of central Assam (Morigaon), known as Kuji Beel. We recorded a total of 35 inhabited fish species the Beel and most of them belong to the order Cypriniformes followed by Siluriformes, Channiformes, and Perciformes. We also identified certain invasive species, particularly common carp, which become the dominant species in a short period at the cost of the drastic exhaustion of three native fish species, such as Barali, Pabda, and Chitala, falling into the IUCN classification of vulnerable to near-threat. The Mahaldar of the Beel and local fishermen also confirmed a significant decline in fish diversity and availability over the last decade, regardless of species. This reduction in diversity and availability can be attributed mainly to four reasons: (i) Destructive fishing like indiscreet fishing and killing of juvenile and brood species during the peak breeding season, (ii) The use of different types of fishing gear, the mesh of which is small enough to hold fry, (iii) Loads of sediment deposition and siltation along with pollution (agro-chemical) from cultivation practices in the vicinity, and (vi) Uncontrolled growth of aquatic plants such as water hyacinth and increased biological oxygen demand, hampering the growth of fish species. Finally, we have suggested appropriate conservation measures to maintain fish diversity whilst preserving the rich fish population of Kuji Beel and other similar permanent wetlands of Assam.

Keywords: Kuji Beel, Fish diversity, Anthropogenic activity, Destructive fishing, Aquatic weeds

RESUMEN

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Los humedales permanentes de Assam, conocidos como Beels, son cruciales para regular las funciones de los ecosistemas naturales y albergan codiciados recursos biológicos como los peces. En la mayoría de las ocasiones, estos humedales proporcionan nutrición esencial en forma de variedades de especies de peces, al tiempo que generan fuentes primarias y secundarias de empleo e ingresos para mantener el sustento de grandes sectores socioeconómicamente vulnerables de la sociedad. Sin embargo, la diversidad de peces está disminuyendo lentamente en la mayoría de los humedales con el tiempo, principalmente debido a tensiones antropogénicas. Para las medidas de conservación, la diversidad de ictiofauna es un buen indicador de la salud del ecosistema acuático. Estudiamos la diversidad ictiofaunal y su prospecto en uno de esos humedales del centro de Assam (Morigaon), conocido como Kuji Beel. Registramos un total de 35 especies de peces habitados el Beel y la mayoría de ellos pertenecen al orden Cypriniformes seguido de Siluriformes, Channiformes y Perciformes. También identificamos ciertas especies invasoras, particularmente la carpa común, que se convierten en la especie dominante en un corto período a costa del drástico agotamiento de tres especies de peces nativos, como Barali, Pabda y Chitala, que caen en la clasificación de la UICN de vulnerables a casi amenaza. El Mahaldar del Beel y los pescadores locales también confirmaron una disminución significativa en la diversidad y disponibilidad de peces en la última década, independientemente de la especie. Esta reducción en la diversidad y disponibilidad puede atribuirse principalmente a cuatro razones: (i) Pesca destructiva como la pesca indiscreta y la matanza de especies juveniles y reproductoras durante la temporada alta de reproducción, (ii) El uso de diferentes tipos de artes de pesca, cuya malla es lo suficientemente pequeña como para contener alevines, (iii) Cargas de deposición de sedimentos y sedimentación junto con la contaminación (agroquímica) de las prácticas de cultivo en las cercanías, y vi) el crecimiento incontrolado de plantas acuáticas como el jacinto de agua y el aumento de la demanda biológica de oxígeno, lo que dificulta el crecimiento de las especies de peces. Finalmente, hemos sugerido medidas de conservación apropiadas para mantener la diversidad de peces mientras se preserva la rica población de peces de Kuji Beel y otros humedales permanentes similares de Assam.

Palabras clave: Kuji Beel, Diversidad de peces, Actividad antropogénica, Pesca destructiva, Malezas acuáticas

INTRODUCTION

The North Eastern region of India, in general, and Assam, in particular, is endowed with a number of lentic systems, locally called Beel, Haor, Anua, etc., which alone constitute around 81% of the total lentic area (0.12 x 106 ha) in Assam and the fish diversity of many of them have not been reported yet. In Assam, there are around 1,392 wetlands having a total of around 22,896 fisheries of different categories, out of which, the number of registered wetlands is only 394 (30.38%) covering an area of around 70,000 ha, according to Directorate of Economics and Statistics, Government of Assam, 2006.

"Beel" may be defined as perennial wetlands, which contain water throughout the year (Kar D, 2007a). They are unique habitats which represent an essential aspect of ecologically healthy, economically viable and socially inclusive resources that contribute to economic prosperity, the well-being of fishes and fish farmers, and even the food and nutritional security of a country. These lentic systems are generally shallow and open, with a

size from 35 to 3458.12 ha and a depth from 0.25 to three metres (in some, however, the maximum depth may exceed six m) at full storage level (FSL) (Agarwala, 1996; Deka *et al.,* 2001; Kumar & Meenakumari, 2002; Goswami & Goswami, 2006).

Beels are primary fishery resources contributing to about 25% of the total fish population in Assam which hold immense potential for the development of inland fisheries (Talwar and Thingram, 1991). About 217 fish species belonging to 104 genera, 37 families and 10 orders have been recorded from the water bodies of Assam, including wetlands (Bhattacharjya et al., 2003). Fishes serve not only as an important food resource but are good indicators of the ecological health of the waters they inhabit. Therefore, it is important to evaluate the status of fish diversity in a wetland. Less known than the other beels of Assam, the Kujee beel is an important aquatic ecosystem as it not only harbours aquatic species but is also home to many resident and migratory water birds. This study is a first report on the fish diversity of Kuji beel.

MATERIAL AND METHODS

Study area: The Kuji Beel is located near the 'Bordua Thaan', the birthplace of Sri Sankara Deva, in the district of Morigaon. It is about 20 km from the town of Nagaon, while 3 km from Bordua Thaan. The beel extends from Shantijan up to the Dewar Beel. The water from the Sonai River flows to Shantijan, connected to the Kuji Beel. From the Kuji Beel, the water then flows to the Dewra, which is again connected to the Sonai River. The total area of the beel is 70 hectares, while presently only 50 hectares are water-covered. The villages of Shantijan, Dhunia Bheti, Kubaikata, Gusai khanda, and Boribazar are located south of the beel. Kuji Satra, Bogori Aati, Boa logari, Adarsha Gaon, Borshila, Haldi aati, Katoh guri, Gasajia are some of the villages which are situated towards the south of the beel. Sil Pukhuri , Goshai kanda, Kuwai kata, Dhania Bheti, Namapara are located towards the west. Lalung Gaon is situated in the east. Geographically the area is located between latitude 26°20'N to 26°22'N and longitude 92°26'E to 92°30'E. The climate is characterized by a highly humid atmosphere throughout the year. The cold season is found from December to February, followed by the pre-monsoon season of thunderstorms from March to May. From June to about the beginning of October, the period constitutes the south-west monsoon season while October and November form the hot monsoon period. The average annual rainfall of the beel area is approximately1860 mm. Rain generally increases from the south toward the north. About 60 per cent of the annual rainfall is received from June to September, while the maximum precipitation occurs during July. The maximum and minimum temperatures experienced are 39 °C from July to August and 10 °C during January. The soil temperature regime is hyperthermic.

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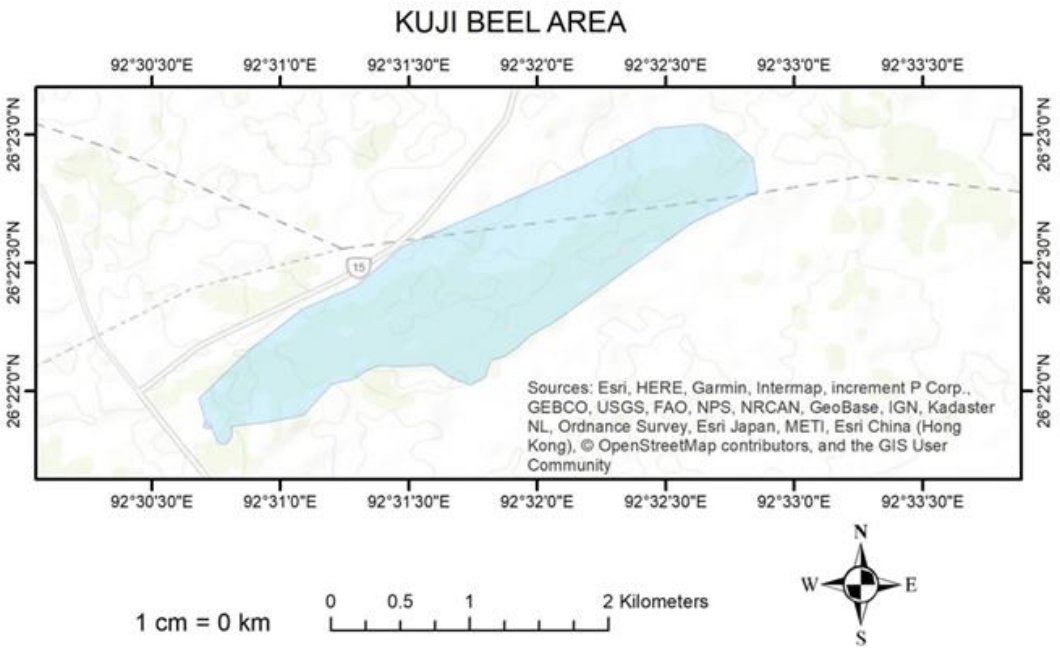

Fig 1: The map of the Wetland (Kuji Beel)

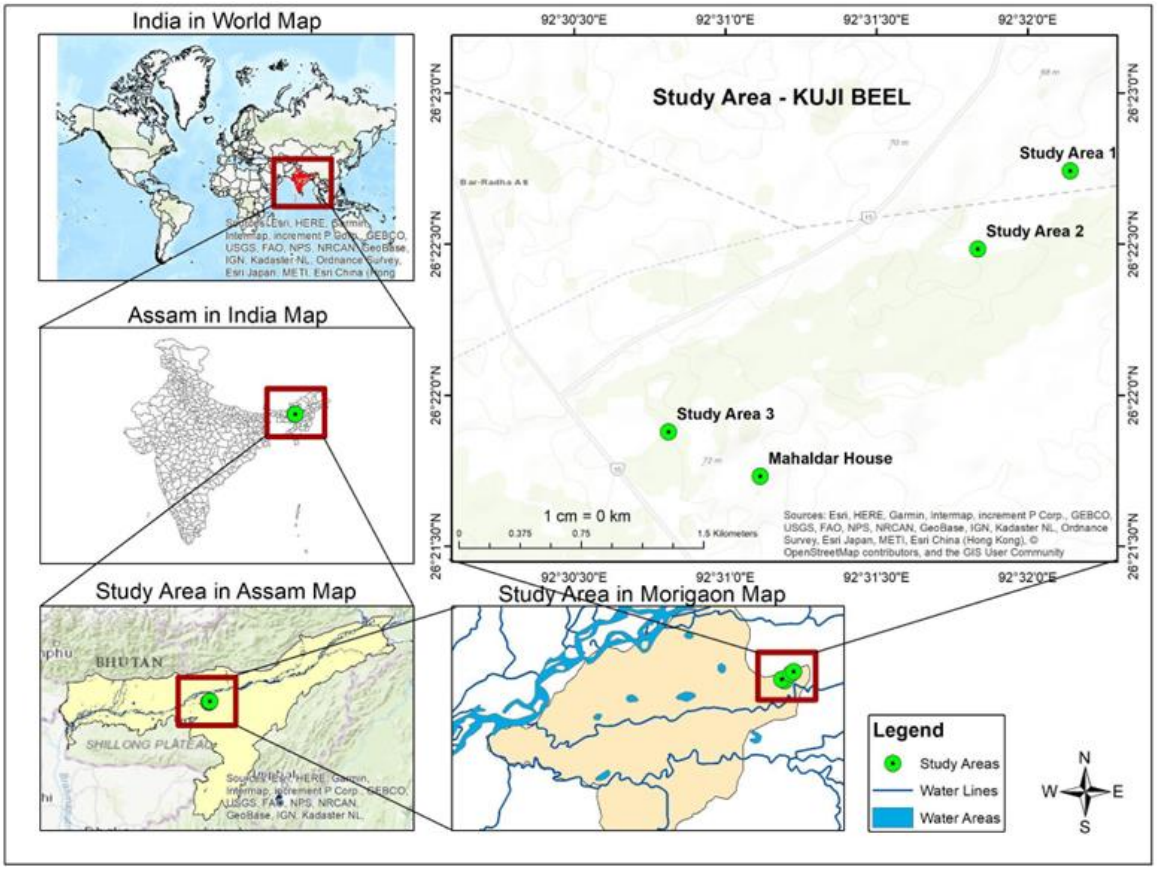

Fig 2: Map showing the location of the wetland (Kuji Beel)

Methodology: The fishes were collected from the Kuji beel at different sites., namely Kuji Satra, Katahguri and Gusai khanda. To study the ichthyofauna of Kuji Beel Marathwada region, fish species were collected from three sites (site I, site II and site III) of the beel which represent the ichthyofaunal diversity of the region. Fish samples were collected twice every week during the study period from the fish landing centers with the help of skilled local fishermen by various fishing crafts, gears with variable mesh size in early morning during the study period. Sampling points were distributed throughout the site to cover its whole area and location was changed for the collection of fish fauna according to the season. Fish species which were collected on the field (landing center) were preserved in 10 % formalin bags. These fish samples were brought to the laboratory for further study. Identification of fishes was done up to species level to get its natural colour, pattern of scales, fins, mouth pattern, identification marks like black spot, bloach on operculum, paired and unpaired fins and body parts with the help of standard literature by Datta Munshi and Srivastava, (1988) and Talwar and Jhingran (1991). The length, breadth and body weight of the fishes were also recorded. The study was conducted during the monsoon season and the catch included mostly surface and column feeders. Information regarding the beel was obtained by personal interview with various stakeholders based on a structured questionnaire. Formal consent was taken from all the volunteers participating in the study.

RESULTS AND DISCUSSION

In the studied wetland, 37 species were recorded belonging to 18 families under 7 orders. Of these, the Cyprinidae family belonging to the order Cypriniformes dominate with about 12 species (Figure 3). An account of the ichthyofaunal diversity of the beel is depicted in table 1. The ichthyofauna of this region, have been found to belong to the following categories:

(A) Primary FW Fish Genera-wise break-up of the species under this group include, among others: *Notopterus, Chitala, Labeo, Cirrhinus, Catla, Cyprinus, Puntius, Amblypharyngodon, Esomus, Botia, Lepidocephalichthys, Wallago, Ompok, Clupisoma, Clarias, Heteropneustes, Nandus, Anabas, Trichogaster, Mastacembelus and Macrognathus* (Kar, 1990; 2003a, b, 2007a).

(B) Peripheral FW Fish Genera-wise break up under this group include, among others: Xenentodon and Glossogobius (Dey and Kar, 1990).

On the basis of Indian and extra-Indian fish distribution (Motwani et. al., 1962), the following 11 ichthyospecies of this region could significantly be incorporated under the following two groups: (a) Widely distributed species: Genera-wise break -up under this group include: *Esomus, Puntius, Ompok, Wallago, Clarias, Xenentodon, Channa, Glossogobius, Anabas, Macrognathus,* and *Mastacembelus.* (b) Species of Northern India Species: under this group include, among others *Botia dario* and *Lepidocephalichthys* guntea,

b) Of the 37 ichthyospecies of Kuji Beel, 32 species belong to the Primary FW group, while 2 species belong to the category of Peripheral FW group (Nichols, 1928; Darlington, 1957). One species of fresh water

prawn *Macrobrachium rosenbergii* and *Scylla serrata* (Indian crab) are also abundant in the water besides a host of other arthropods.

Table 1: Fish fauna of Kuji Beel with their IUCN status

Sl.No.	Species	Common Name	Family	Order	IUCN Status
1	*Labeo catla*	Bhokua	Cyprinidae	Cypriniformes	LC
2	*Labeo rohita*	Rohu	Cyprinidae	Cypriniformes	LC
3	*Labeo gonius*	Kuhi	Cyprinidae	Cypriniformes	LC
4	*Labeo bata*	Bhagun	Cyprinidae	Cypriniformes	LC
5	*Labeo dero*	Silgoria	Cyprinidae	Cypriniformes	LC
6	*Cirrhinus mrigala*	Mirika	Cyprinidae	Cypriniformes	LC
7	*Cirrhinus reba*	Lachim	Cyprinidae	Cypriniformes	LC
8	*Puntius sophore*	Puthi	Cyprinidae	Cypriniformes	LC
9	*Puntius ticto*	Puthi	Cyprinidae	Cypriniformes	LC
10	*Puntius sarana*	Seni Puthi	Cyprinidae	Cypriniformes	VU
11	*Esomus danricus*	Darikona	Cyprinidae	Cypriniformes	LC
12	*Amblypharyngodon mola*	Moa	Cyprinidae	Cypriniformes	LC
13	*Salmostoma bacaila*	Selekona	Cyprinidae	Cypriniformes	LC
14	*Botia dario*	Balaboti	Botiidae	Cypriniformes	LC
15	*Lepidocephalichthys guntea*	Dhulbai	Cobitidae	Cypriniformes	LC
16	*Channa striatus*	Shol	Channidae	Anabantiformes	LC
17	*Channa marulius*	Sal	Channidae	Anabantiformes	LC
18	*Channa punctatus*	Goroi	Channidae	Perciformes	LC
19	*Trichogaster fasciata*	Kholihona	Belontiidae	Perciformes	LC
20	*Glossogobius giuris*	Patimutura	Gobiidae	Perciformes	LC
21	*Anabas testudineus*	Kawoi	Anabantidae	Perciformes	LC
22	*Macrognathus aral*	Tura	Mastacembelidae	Perciformes	LC
23	*Mastacembelus armatus*	Bami	Mastacembelidae	Perciformes	LC
24	*Nandus nandus*	Bhedengi	Nandidae	Perciformes	LC
25	*Polyacanthus sota*	Bheseli	Osphronemidae	Perciformes	LC
26	*Heteropneustes fossilis*	Singhi	Heteropneustidae	Siluriformes	LC
27	*Clarias batrachus*	Magur	Clariidae	Siluriformes	LC
28	*Sperata seenghala*	Aari	Bagridae	Siluriformes	LC
29	*Mystus vittatus*	Singorah	Bagridae	Siluriformes	LC
30	*Mystus tengara*	Tengorah	Bagridae	Siluriformes	LC
31	*Ompok pabo*	Pabda	Siluridae	Siluriformes	NT
32	*Walllago attu*	Borali	Siluridae	Siluriformes	VU
33	*Clupisoma garua*	Bacha	Aniliidae	Siluriformes	LC
34	*Xenentodon cancila*	Kokila	Belonidae	Cyprinodontiformes	LC
35	*Monopterus cuchia*	Cuchia	Synbranchidae	Synbranchiformes	LC
36	*Notopterus notopterus*	Kandhulee	Notopteridae	Osteoglossiformes	LC
37	*Chitala chitala*	Chital	Notopteridae	Osteoglossiformes	NT

LC Least concern NE Not evaluated NT Near threatened VU Vulnerable

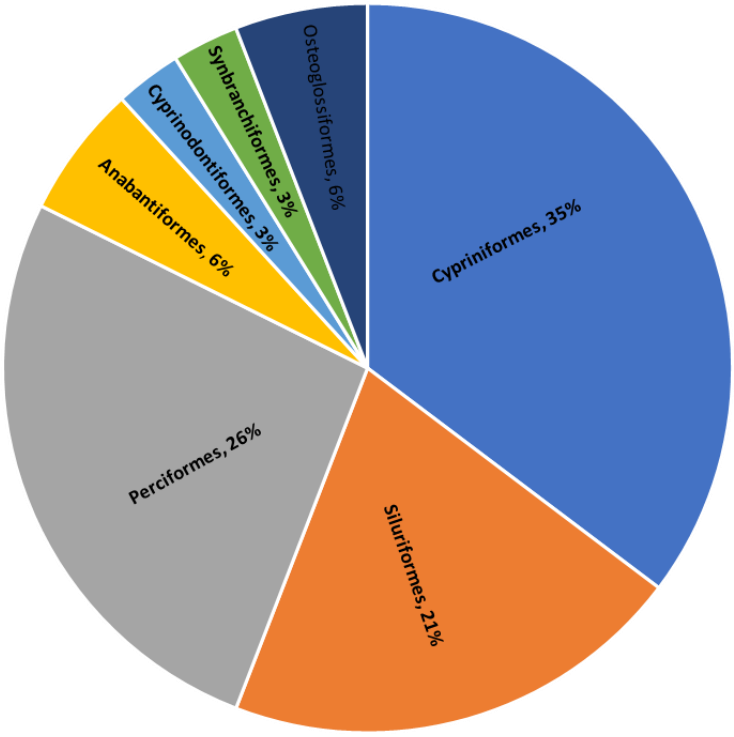

Figure 3: Abundance of different orders of Pisces present in the Wetland

The number of fish species is lower than that reported from large beels like the Sone beel but is more than other beels such as the Sat beel in Assam (Kar, 2007a). The study period falls in the rainy monsoon season when water level is high and fish sampling in the lower depth is restricted. This study is a first report on the fish diversity of the beel and hence it is difficult to study any changes in the composition and decline of fishes over the past few years. However, interviews with the local fisherfolks and other secondary data reveal a decline in population of Pabda and Chitala, which are enlisted in the near threatened category. The fish production from other beels of Assam has declined over the years due to various factors such as siltation, habitat destruction, macrophyte infestation, habitat modification, overexploitation and several other anthropogenic activities (Sinha, 1994; Sarkar & Ponniah, 2000).

The migratory water bird species include Fulvous whistling duck, Ferruginous pochard, Cotton pigmy goose, Grey headed Lapwing, Whiskered tarn etc. Few local water birds are Common Kingfisher, Common Moorhen, White-Breasted Waterhen, Indian Pond Heron, Cattle Egret, Little Egret, Osprey, Little Cormorant, Asian Open billed Stork, etc.

The beel is not free from problem. Soil deposition due to frequent flooding and eutrophication is a major concern. About 60% of the beel is now covered by water hyacinth. Some of the invasive species like common carp become overpopulated and harm the other species, which is may be a reason for the depletion of the fish population. The local fishermen use different fishing techniques, including Zeng Mara, Bheta, Puthilanji Jaal, Fansi Jaal, Ghat Jaal, Deep Jaal, Khewali Jaal, Goroilangi Jaal and Jakoi. This is a matter of concern as some of these fishing gears have mesh size small enough to retain young fish fry. Fishing by completely dewatering

parts of the beel, indiscriminate fish tug, use of illegal fishing gears together with use of chemical fertilizers and pesticides in agriculture & cultivation in the fringe areas of the beel cause organic pollution and gradual filling of the productive beds. Siltation of the Beel leads to diminution of depth and water-spread area rendering loss of breeding ground for the large growing fish (LGF). Siltation, habitat destruction, macrophyte infestation, and isolation from the seasonal floods restricting entry of riverine fish stocks adversely affect the fish production of a beel.

Even though such problems exist, there is a huge prospect of fisheries and fish farming, if some of the following suggested measures are taken into consideration.

Overfishing should be avoided. Excessive fishing in some beels in India has driven commercial species depletion. The killing of brood and juvenile fishes during the breeding and recruitment seasons badly hampers the exhibition in freshwater bodies as it is considered destructive fishing. Suitable measures need to be imposed to prevent the killing of brood fishes and juveniles. Fishing during breeding season should be banned.

Many problems need immediate attention from the government as well as the management teams to get better results in terms of steady growth in production, productivity, profitability and sustainability etc. Removal of aquatic weeds is one such problem which needs to be addressed.

Restriction should be imposed on the use of chemical fertilizers and insecticides used in agriculture in fringe areas around the beel to prevent the water pollution.

Awareness of the importance and role of fisheries and aquaculture for the rural development and nutritional value can motivate the younger generations that could result in greater participation of people in scientific fish farming. Awareness program on necessity of conservation of fishes for the village communities residing near the beel may be organised to promote a holistic approach for fish conservation.

We need to provide alternative livelihoods to fishermen during the breeding season. Fish is a highly perishable product, proper accessibility, cold storage, proper transportation and marketing facilities in the rural areas could foster this sector so that local fish can be easily stored and made available in the market thereby ensuring farmers are not out of livelihood even when they are not fishing. The use of modern technology and training for farmers can increase the level of production and productivity.

CONCLUSION

Kuji beel is an important ecosystem which is crucial for migratory and resident waterfowls and supports a rich faunistic diversity in plankton, macrophytes, benthic organisms, insects, and other macrophyte-associated fauna besides a variety of fishes; some of which are threatened ones.

Thus, conservation of this dynamic and productive habitat has become necessary for in situ preservation of threatened aquatic species, including fishes and waterfowls. A more in depth study on the avian and invertebrate population is also suggested. This study aims to form a knowledge base of information to different relevant stakeholders for improvement and development of the beel thereby augmenting the production of the fish and increasing the rate of adoption of sustainable fishing practices by the fish farmers. Therefore, active and sincere involvement of different stakeholders is essential not only to promote scientific fish farming practices but also to create awareness for conservation of the delicate and rich ecosystem.

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