Asian J. Exp. Sci., Vol. 36, No. 2, 2022 & Vol. 37, No. 1, 2023; 1-9

Online available on : www.ajesjournal.com, ISSSN : 0971-5444

Beel Fishery in Assam: Methods and Scope

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Received: May 2, 2022; Revised: June 12, 2022; Accepted: June 21, 2022

Abstract : The present paper is aimed to discuss the status of beel fisheries in Assam with special reference to the methods used for the production and its scope in the state through certain measures. The study is based on the investigations done in Kamrup district of Assam on Dipar Beel and Dighali beel. It was found that various indigenous methods are in practice in both the beels.

Key words: Beel Fisheries; Ox-bow beels; Live beels; Katal Fishing; Banas Fishing.

Introduction

Assam has a large numbers of wetlands covering the floodplains of the two main river systems, the Brahmaputra and the Barak. The floodplain wetlands are commonly known as 'beel' (Sarmah and Biswas, 2014). The physico-chemical parameters of soil and water of these beels are very suitable for fish growth.

Beels of Assam are the basic sources of inland fisheries as they are natural resources available for use by man. Certain geo-hydrological and biologic processes decide their birth, life and death history. In Assam, beels can be divided into two major groups: 1) Beels produced by the fluvial actions of rivers. These are lake like or lacustrine. They are wide, shallow and have an irregular contour and connected to rivers through channels and receive water therefrom; and 2) Beels produced by tectonic activities. Ox-bow beels are relatively narrow, long and have either bent or straight shapes or are formed from isolated lops of meandering mature streams or rivers. They are usually deeper because they occupy old segments of river. A new set of terminologies have also been added to the beels. Beels are also termed as dead beels (those whose connecting channels no longer function); and live beels (which have a functional link with water).

Beels of Assam are mostly associated with old river courses. Presently, there are 1198 beels in Assam (Kashyap, 2021). Among them, only about one-third beels are registered. These beels are connected to two major rivers of Assam, namely, Brahmaputra and Barak and their tributaries. Some of the beels are interconnected by means of channels. All these beels support a rich fauna comprising many good species of fish and form one of the most potential sources of fisheries of the state. The present paper deals with nature, methods and scope of beel fisheries in Assam. The present paper is aimed to discuss the status of beel fisheries in Assam with special reference to the methods used for the production and its scope in the state through certain measures. In view of above, a study was conducted in Kamrup district of Assam.

Material and Methods

The present study was based on the twelve-month observations from January to December 1987 in Kamrup district of Assam. The wetlands selected for the study were - (a) *DiparBeel*- a live beel having a connection to the Brahmputra river, and (b) *DighaliBeel*- a dead beel.Fish landings, species composition and fishing methods were observed in the sample beels. Fish catch of the beels were collected from the records of cooperative societies. The records were supplemented by the frequent visits to the fish landing centers. Fish landing data was updated in 2017. Fish species were segregated into the following six commercial groups – (i) Major carps, (ii) Minor carps, (iii) Catfish, (iv) Feather backs, (v) Live fish, and (vi) Miscellaneous groups. The species were morphologically and morphometrically studied and identified from various authoritative sources, including (Day, 1878; Day, 1889; Mishra, 1959; Menon, 1974). Fishing methods were observed through visiting the sites and conducting one-to-one interviews with the

fishermen. Liberal help in these aspects were taken from the Assam Fisheries Development Corporation (AFDC), Govt. of Assam, Guwahati, India and Central Inland Fisheries Research Centre (ICAR), Guwahati, India.

Results

Fishing Gears of Beels

Fishing in the beels is traditional yet interesting (Saha *et al.,* 2015; Haque, 2017; Baruah *et al.,* 2013). Reliance is more on traps, snares and lures rather than seining, gilling or dragging. Fishing methods keep on changing from month to month, yet a distinct seasonal categorisation can be done. Starting from monsoon which is also the lean fishing period, only hooks and lines and to some extent dip nets are used. The cat fishes and smaller varieties are normally caught by this method. Post monsoon witnesses the use of '*Banas*' in exploiting the current flowing back to the river, resulting in the catch of spawn and large fishes migrating back to the river. This method was particularly observed in *Dipar* beel which has a functional link with the river Brahmaputra. The '*Katal*' fishing generally installed in monsoon season. Harvesting of 'Katal' is done from December to February. Apart from these two major fishing methods, gill nets and drag nets are also used in winter season. Indigenous hand operated triangular nets and traps are operated by the community mainly during post monsoon and winters (Fig. 1 & 2).

Fig. 1 - Katal fishing.

Fig. 2 –Beel Fishery in Assam.

A brief account of the methods employed in beels of Assam is presented below:

1. **Nets:** The nets used for fishing in beels are mainly of two categories: i. Moving nets; and ii. Stationary nets.

   Moving nets are further categorised into three types:

a. *Drag nets*-locally known as *Mohari Jal*, *Ber Jal*, *Horhori Jal*, *Moi Jal, Panti Jal.* These nets are also made up of cotton and these are mainly used in winter season (Fig 3).

a. *Dip nets*- locally known as *Jata Jal, Dharma Jal, Ghoka Jal.* These nets are made up of cotton and these are mainly used in winter season.

b. *Cast nets*- locally known as *Khewali Jal* are also made up of cotton and these are used in winter seasons.

Stationary Nets:

Gill nets, *Fansijal*, *Puthilangi, Kaoolangi*, *Goroilangi* etc. are included under this category. These nets are operated throughout the year. While *fansi jal* accounts for medium to large sized carps/catfishes, the other three chiefly entangle smaller varieties consisting *of Puntius spp., Rasboraelanga, Nandus spp., Ompoka spp.*, live fishes and species belonging to the air-breathing group (Fig. 3 & 4: Gill nets).

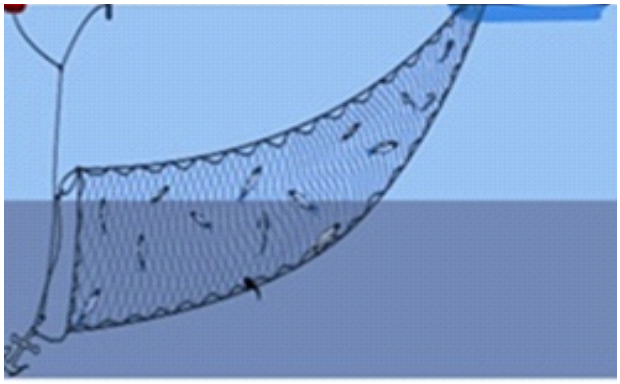


Fig. 3 – Gill Net.

Fig. 4 – A gill Net about to be used.

Hook and Lines

Iron and split bamboo hooks are used round the year in beels for fishing. Iron hooks set apart at an interval of 2050 cm in a row extending from 20-250 m is a common sight in both *Dipar* and *Deghali* beels. Earthworms, small fish, prawns, toads and frogs are commonly used baits. Catch composition consists mostly of carnivorous fish.

Split bamboo hooks are made of soft and rigid bamboo cut into small pieces of around 10 mm to in length and 1mm in girth. These pieces are neatly folded in the middle and the two ends are joined together with earthworm/prawn baits. The hooks are subsequently tied to threads in the middle and set in water, when fish devours the bait, the hook opens sharply and keeping the mouth of the fish wide open and holding it from escaping. *Anabas* and *Nandus spp.* are mainly caught by bamboo hooks.

Traps

Exploitation of fishes from swampy derelict water is difficult to accomplish due to hindrance created by the profuse growth of weeds in netting operations. Hence traps are suitable alternatives for fish capture in beels. Cover baskets, spindle cages and box traps with valves are the commonly used traps in the beels.

I. Polo: This is a cover basket, conical, opens at both ends and is made of bamboo strips laced together by cane or ropes. The opening at the top is 15-25 cm and the circumference at the bottom is 65-90 cm. the height of the trap is 0.7-1.0 m. One man carries the trap in hand, slowly wades and plunges it into water where fishes are suspected. Pressing the trap firmly, one hand is placed through the narrow top opening and fishes inside are searched and taken out. All kinds of fishes are caught by the trap. The bottom dwellers, however, dominate the catch (Fig. 5).

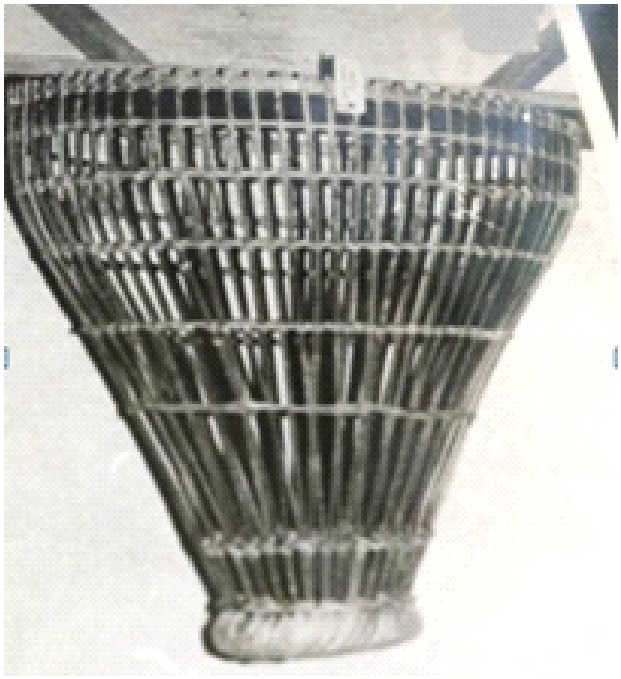


Fig. 5 – Polo Trap.

I. Sepa: It resembles a drum tapering at both the ends. These are normally two openings or values have bamboo strips extending inwards which permit an easy entry to the fish, but prevents them from escaping. The trap is set facing the opening against the current. All small size fishes and prawns are caught in the trap (Fig. 6).

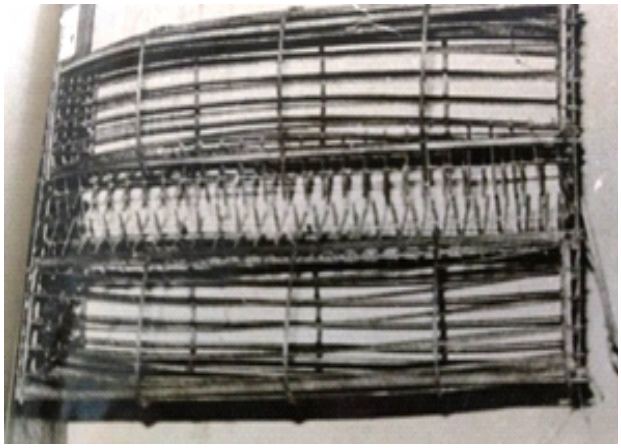


Fig. 6- Sepa Trap.

iii. Dingora: This kind of trap is used during monsoon months. It is a rectangular box trap made of bamboo strips, having a mouth at one side with the sieves directed inward, like spines. The trap is operated against the current and small sized fishes are mainly caught by this method (Fig. 7).

Fig. 7 – Dingora Net.

iv. Boldha: The structure is similar to Dingora but it is smaller in size and almost square in shape. It is operated round the year. Snail flesh bait is kept inside and *Channa spp. Heteropneustes fossilis. Clariasbatrachus* and seldom other small carnivorous fishes are trapped by Boldha.

v. Box Sepa: This box trap is rectangular in shape with 3 spindle values in the upper portion of the box. The values are oval in shape and prevent escape of the trapped fishes. These traps are kept immersed in water and account for small fishes and prawns (Fig 8).

Fig.8 – Box Sepa Trap.

vi. Bhart: This is also a rectangular trap with three values which are set in the lower portion of the trap. The upper portion of the trap is slightly curved in the middle with two opening in the corners. These openings are kept closed with straw etc. The tray is set in shallow water with fluctuating levels. Small sized species are mainly caught by this method. The trap is operated mainly during post-monsoon.

(D) *Katal Fishing*: Katal fishing (also called as *Jeng* fishing in upper Assam) is an indigenous method in beel fishery (Fig 9). *Katals* are basically lures since the motive behind is to entice fishes in accumulated mass of bushes, weeds and tree stumps for a period of 2-3 months. *Katals* are set during August to September by dumping tree branches and stumps, bamboo shoots and water hyacinth in the form of a circle. In suitable places with depth varying from 1.5-3 meters, the *Katals* are arranged and several *Katals* lie dispersed all over the beel. The fishes makeshelter in such *Katals*. During late November to February, the *Katal* is encircled by the drag nets and bamboo screens. The vegetation and other objects from inside the circle are thrown out and the circumference is slowly reduced by dragging the nets and screens inwards. Cast nets are operated simultaneously within the reduced circle. The foot ropes of the nets are finally brought together to form a bag and fishes are caught.

Fig. 9 – Katal.

Catch composition of *Katals* comprises of medium and large sized major carps, cat-fishes, featherbacks and miscellaneous varieties. Each *Katal* depending upon the area of the circle provides a good catch and many fisherman are engaged in its harvesting.

(E) *Banas Fishing*: *Banas* fishing is done during post monsoon i.e. September to November in beels having a live connection with the river Brahmaputra or its tributary. The *Banas* are set barriers erected from bank to bank in the channels connecting the beel to its riverine source. The channel plays a pivotal role during monsoon, when, with the current, adults and juveniles of various species enter the beel for breeding, feeding, temporary migration etc. With the waning monsoon the current starts receding towards the river and many speciesundertake their back journey and at this stage the *Banas* fishing commences. Of the two beels studied, this method was practiced only in *Dipar* beel.

The method comprises of erection of bamboo screens (*Banas*) across the channel with the help of bamboo poles. The portion of the *Banas* inside water is further lined by gill nets folded to trap fishes. In the centre of the channel a gap of 3-4 meter is left, where a dip net is installed. Behind the dip net another obstruction of *Banas* is arranged from bank to bank giving a similar 'V' shape in the centre. In this 'V' a gill net is placed which is tied with bamboo sticks in the broader end of the 'V' and at the narrow end the net is tied to poles.

The enclosure is also known as '*Bharal*' or the storehouse. One or two dip nets are also placed in-between the two bamboo periphery. Fishes are trapped in three ways, (1) by dip nets; (2) 4-5 men position themselves at the anterior of the 'V' and lift the gill net and (3) Fishes attempting to jump over the *Banas* are caught in the pockets of the net lining in the submerged portion of the *Banas*. The catch includes medium to large sized major carps, minor carps, catfishes, featherbacks and migratory species.

Scope

Fisheries management practices on large rivers and their tributaries have remained basically unchanged for several decades.Increasing use of river for water supplies, flood control, transportation, food production,energy production,assimilation of waste products among others,poor soil control measures have already affected the water quality and physical environment that support fish and other aquatic life.Man-made degradations on the Brahmaputra drainage are however restricted to changes affected by the irrigation and flood control measures and poor soil conservation programmes in the catchment area of the Brahmaputra basin.These have adversely reflected on the fish production trend in several ways.The foremost reason being poor recruitment in the river due to gradual deterioration of breeding grounds.Besides areas in the river proper beels also provide excellent breeding grounds for Indian major carps (Yadava,1987),but in most cases the accessibility of brooders to such prospective breeding sites is severally hampered.Excessive silting of the connecting channels,construction of embankments and sluice gates,wanton killing of gravid specimens and later fingerlings are some of the reasons for poor recruitmentLack of soil conservation measures in the hill regions perpetuates soil erosion.As a result the heavy silt discharge badly hampers the breeding and subsequently the hatching processes.

The nature of soil erosion is different on north and south bank of river Brahmaputra.The north bank consists of vast tracts of marshy terai lands of Bhutan hills filled up by alluvialand colluvial deposits forming light textured soil with a loose starts.

The soil is, therefore, very susceptible to erosion. The natural drainage system has also been impeded due to human interference like extension of cultivation into the drainage channels itself, construction of bunds, embankments and roads. Human habitation and cultivation extended into these areas have further exposed the soil to the vagaries of erosion (Das *et al.,* 2009).

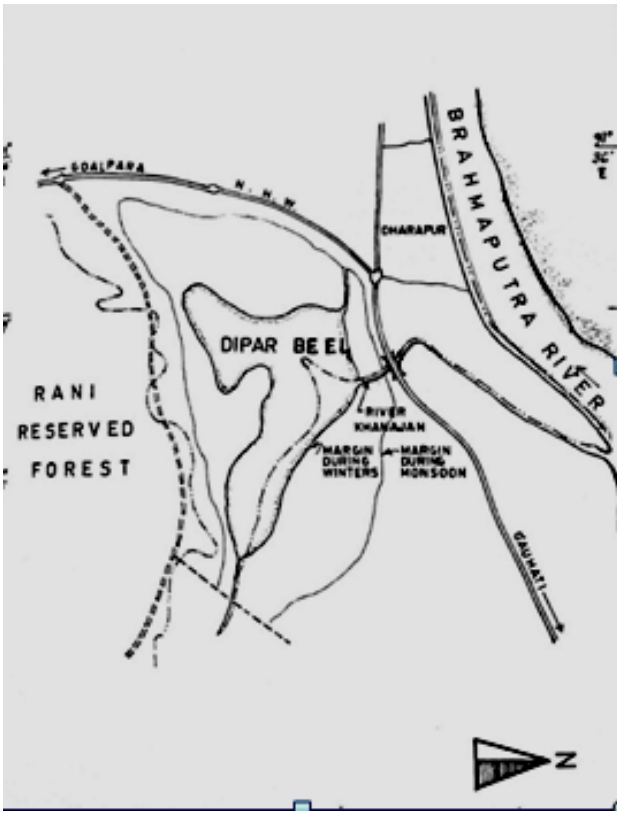
The soil erosion problem, particularly on the north bank, is very acute due to the heavy afforestation in the foot hills of Bhutan and the general condition of the land with 3-5 % slope towards the river Brahmaputra. In order to reduce soil and related problems, soil conservation measures are necessary. It is also important to consider impoundment of as much of rain water as possible in the numerous watersheds of the district through proper watershed management programmes. This would help in reducing the rate of run-off and sediment discharge apart from minimising the effects of uneven rainfall distribution.

It is known that 35% of the littoral zone containing only 6% of water produces majority of fish food needed in a lake within tropical conditions (Welch, 1952). As the two beels are mostly under 3M depth during most of the periods of the year, more than 90% of the total water area may produce maximum food over the year.

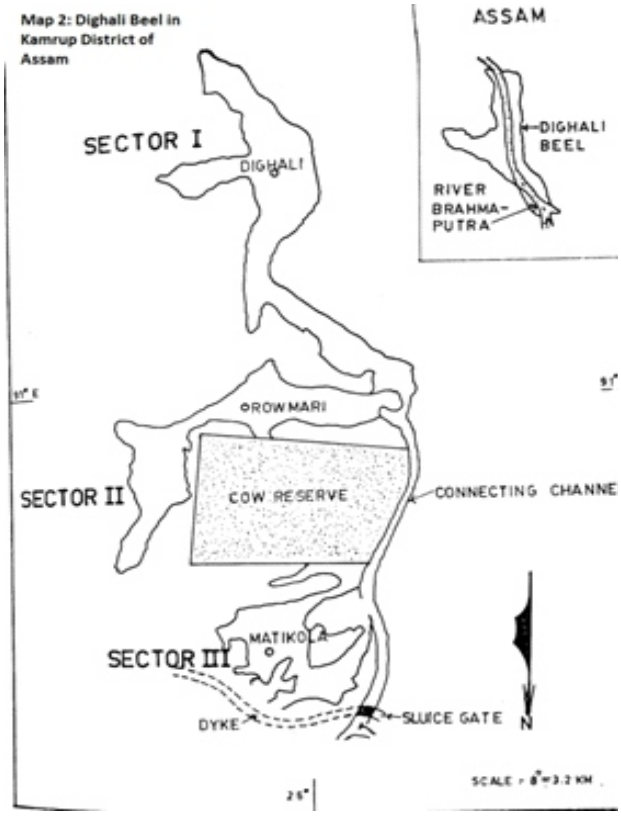
Beels support a rich fauna comprising many a good species of fish. The water is quite rich in nitrate and phosphate contents but bicarbonate values are by and large low. Although the soil is acidic, the PH of beel water is stated to have alkaline reaction. The deposits of decaying weeds at the bottom contribute to the richness of the soil which in turn supports a good bottom fauna comprising mainly of molluscs (Yadava, 1987). However, a combination of the processes of river bed evolution and the effects of extensive flood control and irrigation works have reduced the production levels of many of these beels through siltation and by isolating them from the seasonal floods and by natural sources of fish stock. While making an overall assessment on the present investigations both the problems and potentialities have been taken into consideration.

Conversion of exposed areas of beels to paddy fields during winters is an age old practice in Assam. While restricted marginal cultivation may enrich the beel fertilization, excessive cultivation in the beel proper may lead to organic pollution and accelerate the rate of eutrophication. Proper water management may effectively contain this problem by maintaining an optimum storage level.

In live beel (*Dipar*) where the anti-stocking is mainly through the connecting channel, blocking of the channel and excessive capture during monsoon (when both brood and juveniles enter the beel) should be prohibited with all seriousness (Map1; table 1).



Map. 1 – Dipar Beel in Kamrup District of Assam



Map 2 – Dighall beel in Kamrup District of Assam.

Table 1: Seasonal incidence on group wise landing (kg.) at Dipar Beel (2017)

Month	Major carps	Minor carps	Cat fish	Feather backs	Live fish	Misc.	Total
January							
February							
March							
April	-	-	-	-	-	-	-
May	-	-	-	-	-	-	-
June	-	-	-	-	-	-	-
July	-	-	-	-	-	-	-
August	-	-	-	-	-	-	-
September	-	-	-	-	-	-	-
October	62	54	28	-	40	135	319.0
November	90	28	84	40	61	145.5	448.5
December	92	10	76	32	68	120	398.0
Total	610	232	465	299	496	1028	3130.0

While *Dighali* beel is completely at the mercy of the co-operative society, *Dipar* beel is sub-leased by Assam Fisheries Department Corporation for fishing. Over exploitation coupled with indiscriminate fishing is commonly practiced to repay the revenue. The lessees try to harvest as much fish as possible during the lease period, resulting in near depletion of the stock. The recruitment especially in case of dead beels is meagre, hence live fishes, catfishes and miscellaneous varieties dominate. Once fishes of higher food chain dominate, the task of building up a population of commercially important varieties of feeding on lower food chain becomes almost difficult (Map 2; table 2).

Table 2: Seasonal incidence on group wise landing (kg.) at Dighali Beel (2017)

Month	Major carps	Minor carps	Cat fish	Feather hooks	Live fish	Misc.	Total
January	225	42	150	78	80	305	880.0
February	208	50	168	80	110	416	1032
March	185	46	170	56	102	541	1100
April	38	32	81	40	40	162	393.0
May	14	26	115	25	88	282	550.0
June	1	-	26	-	13	80	120.0
July	-	-	-	-	-	-	-
August	-	-	-	-	-	-	-
September	-	-	-	-	-	-	-
October	50	10	36	32	75	207	410.0
November	176	38	92	84	85	360	835.0
December	270	104	205	160	202	459	1400.0
Total	1167	348	1043	555	795	2812	6720.0

Closed season from June through September which is not rigidly enforced should be maintained with all earnestness. While control of overpopulated predators, catfishes and trash weed fishes are recommended, smaller mesh size should not be permitted in the deeper portions of the beels (Yadava, 1987).

The weed infestation, especially in *Dighali* beel has attained dynamic proportion. In some parts, the infestation is so severe that navigation gets difficult. They pose a serious problem in the restoration efforts. By their profession, needs appropriate large quantities of soluble nutrients and drastically curtail the productivity. Weed choking accelerates evaporation, promote accumulation of deposits leasing to siltation and provide shelter to predatory and weed fishes.

The simple exploitation of the studied beels by capture fisheries does not realize the full potential productivity of the system. The fish stock can benefit much from careful husbandry and intensive management techniques. The clearing and regularisation of beels, the implantation of drain-in ponds, the cutting of appropriate canals for inflow of water and the construction of dams/sluice gates to control the run-off can all have an impact, which cumulatively can raise the productivity above that of uncontrolled system.

The consumption of fish in the district is low and the prices which fluctuate seasonally, are relatively high (Rs180.00 kg^{-1} - Rs.250.00 kg^{-1} retail, Rs.100.00 kg^{-1} - Rs 200.00 kg-1 at landing). Fish is well accepted throughout the district and consumer demand is reported to be high. In addition to local supplies the market sell dried and dried salted fish as well as fresh fish an ice imported from neighbouring areas.

Potentiality

- The wide gap in the demand and production can be met by proper development of the enormous potentiality in terms of aquatic resources in the district. In terms of potential,these beels are capable of giving an annual crop of more than 70,000 tonnes,while present production is 10,000 tonnes.
- Deposits of decaying weeds at the bottom contribute to the richness of the soil which in turn supports a good bottom fauna comprising mainly of molluscs.
- The fisheries of beels consists of major carps (50 %), cat fishes (35 %), and miscellaneous (15%).
- Besides these major fisheries, Hilsa also abounds in the beels situated on the lower stretches of the river Brahmaputra and Barak.
- Exotic species are altogether absent from the beels.

Suggestions

The beels have been neglected ever since their formation. There has been excessive silting up of beel proper, as well as the connecting channels, because of silt deposition by the incoming river water. The silt which is rich in nutrients has led to the spread of water weeds, chiefly water hyacinth floating weed; other forms of marginal and submerged vegetation are also present. The problem of weed infestation is so severe in winters. Due to silting of channels entry of river water in to beels restricted. All these factors are main

cause of decreasing productivity of beels. Management of beels should be of production oriented with the control of commercial aspects of fisheries. It will lead for an appropriate programme of water control, stocking (where necessary). Maintenance of *bundhs*, sluice gates etc. with liaison with the flood control, irrigation etc., authorities which are not existed in the present system of management. Apart from this, there should be control of the rate of exploitation and distribution of this catches. There should be check on illegal fishing. Investigation by officers of Fishery Department is also required. There is need to review with the following objectives by amending the existing acts and rules: To provide protection to the important species of fish; establishment of check post or barrier and inspection of fish while in transit; subsequent procedure for the offences; and duties of police officers to assist.

Although the fishery rules are there and agreement is made with the lessees with the conservation policies to be followed yet due to very little care for the policies by the lessees the depletion of fish stock in the beel fisheries are occurring.

Discussion

Beel fisheries in Assam is facing resource depletion due to over-exploitation and lack of scientific management practices. The soil and water quality of beels are indicative of better fish production (Banerjea, 1967) however, low production in many of the beels have been reported by (Lahon, 1983) in *Salsella* beel, (Kar, 1984) in *Sone*beel, (Bhagwati and Kalita, 1987) in *Rangai* beel. (Yadav *et al.,* 1987) reported decline of 9.06 percent annual catch in *Dighali* beel, while an increase of 42.27 percent of annual catch in Dipar beel. In 2017, the total annual landing (kilograms) at *Dighali* beel was reported to be 6,720, while in Dipar beel, it was 3,130. This shows that landing at *Dighali* beel was 50 percent more than that of *Dipar* beel. Group-wise seasonal fish landing data of both the beels incurred highest percentage of miscellaneous group, followed by Major carps. Minimum percentage observed was that of Minor carps. The dominance of trash fish at those feeding on the higher food chain reflected upon the poor fishery of the beels. The uneconomic minnows, demios, etc., predatory catfish, feather back affect the productivity of commercially important carps. During monsoon, the catch is low in all the beels because of higher water level and restricted fishing activities. Post-monsoon and winter facilitate the operation of almost all types of gears. Innovation in traditional methods, such as, '*Katal'* and '*Banas'* fishing fetches more landing.

Conclusion

In recent period, growth of population and diversified human activities has already destroyed the beels in to agricultural fields. To prevent human activities and to preserve it as natural resources some stringent legislation should be brought out. Presently, the illegal encroachments should be evicted and immediately after eviction the beels should be developed for inland fisheries. With a motto "Conversion of curse to crops and waste to wealth" the goal of providing cheap protein in terms of fish can easily be achieved from the vast wealth of both lotic and lentic waters of Kamrup district.

Acknowledgements: I am extremely grateful to Prof. Santosh Kumar and Prof. Manju Tembhre for their valuable suggestions and consistent guidance and support. I am also thankful to Prof. V.P. Singh and Ms. Vandita Singh for their assistance with improving the manuscript.

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