Indigenous fishing method used for catching spiny eels (*Macrognathus* spp.) in floodplain wetlands of Assam, India

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Abstract The present paper describes ITK associated with a unique indigenous fishing method used to catch mud-dwelling spiny eels (*Macrognathus spp.*) in floodplain wetlands of Assam by Bhatiya community in Lower Assam (locally called Akra mara) as well as by the Mising tribe in Upper Assam (Germe-Kenane). Here the spiny eels are caught by piercing them with a swift swinging motion of a curved pointed barbless iron hook with a long bamboo handle. The specialized fishing method and the ITK associated with it were studied in 25 villages located around 12 floodplain wetlands (beel/ pitoni) of the study area. In this paper, we discussed how the two communities made effective use of the narrow visual field of the spiny eels through their traditional wisdom to catch these bottom dwelling fishes, which are otherwise difficult to catch.

Keywords Indigenous Technical Knowledge, Akra mara, Germe-Kenane, Bhatiya community, Mising tribe, *Macrognathus* spp., Floodplain wetland (beel), Assam

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Introduction

The north-eastern state of Assam (89° 42′ E to 96° E longitude and 24° 8 N to 28° 2 N latitude) has extensive areas under floodplain wetlands (commonly known as beels) covering 1,00,815 ha area (Anon, 1997). These wetlands support livelihood of thousands of fishers and provide nutritional security to riparian populace. People living around these wetlands have acquired indigenous knowledge about the fish species occurring in the wetlands, their abundance, seasonality of occurrence and behavioural patterns of different fish groups. These traditional knowledge systems have been applied for evolving specialized fishing methods as well as for constructing/ fabricating specialized fishing gear to catch certain fish species/ group over long period of time. Indigenous knowledge is that knowledge accumulated over generations of living in a particular environment. It is generally passed by word-of-mouth through generations, across time, space and communities and is not often recorded in writing. Most of the early studies on fishing methods and /or fishing gear in Brahmaputra valley of Assam mainly focused on the technical aspects from the fisheries perspectives (Yadav et al., 1981; Yadav and Choudhury, 1986). Attempts have also been made in recent years to document the ITKs associated with the diverse fishing practices prevalent in the northeastern region of India (Bhattacharjya et al., 2004; Dutta and Bhattacharjya, 2008 & 2009; Dutta and Dutta, 2013; Baruah et al., 2013; Saud et al., 2015). The present study shows that a particular traditional fishing technique/ method may be used by two different communities of a geographical region with or without modifications under different local names,

which has been the case in Akra and Germe-Kenane. In the present paper we describing an indigenous fishing method practiced by the fishers belonging to Bhatiya community living around beels of Lower Assam as well as by those belonging to Mising tribe in Upper Assam to catch spiny eels (*Macrognathus* spp.).

Methodology

The present study was conducted in 12 floodplain wetlands (beel/ pitoni) located in three districts (Kamrup, Nalbari, Barpeta) of Lower Assam as well as two districts (Dhemaji and Lakhimpur) of Upper Assam during December 2014 to August 2016. In Lower Assam, the method was practiced by Bhatiyas whereas in Upper it was practiced by Mising tribe. A total of 12 field surveys were conducted in 25 fringe villages surrounding the wetlands of the five selected districts. Primary information on the fishing gear/ method was collected by participatory observation as well as through personal interviews with the fishers/villagers. A pre-structured interview schedule was developed for the study by incorporating queries to gather maximum possible information related to the ITKs associated with the fishing method. Key informants including active fisherfolk as well as village elders were interviewed during the process of data collection. A total of 19 and 16 fishers/ villagers from Bhatiya community and Mising tribe respectively were consulted through one to one interaction for detailed documentation of the fishing method and the associated ITK. Secondary information on gear was obtained from fishers as well as other villagers using focused group discussions (Townsley, 1993; Schonut and Kieveltiz, 1994). Sincere efforts were made to clarify the question by repetition to ensure and collect reliable data from the respondents. Prior informed consent (PIC) was obtained from the community leaders of both the communities (Bhatiya and Mising) of respective villages as per CBD guidelines in order to use and publish the recorded information on these indigenous fishing methods and ITK associated with it. Fishes caught using this fishing device was identified with the help of standard keys (Talwar and Jhingran, 1991).

Results

Akra (Fig. 1) and Germe-Kenane (Fig. 2) can be classified as grappling and wounding gear usually operated in selected floodplain wetlands (beel/pitoni) of Assam. We observed that both these fishing gear are almost similar in shape, mode of construction, construction material and operation. Akra is operated by Bhatiya community (an Islamic fishing community speaking Bengali) in Lower Assam while Germe-Kenane is operated by Mising tribe in Upper Assam (an ethnic Hindu tribe). These are basically curved pointed barbless iron hooks fitted onto a long and slender bamboo handle. In case of Akra, the bamboo handle is made from mature Bijuli variety (Bambusa pallida) of 2.5-4.0 cm diameter whereas in Germe- Kenane branches of mature bamboo of species Bambusa balcooa (locally known as bhaluka bah) is used (usually 2.5 cm diameter at the tip and 5 cm at the grip). The frontal part the iron rod is curved in the shape of a small sickle with a pointed tip prepared with the help of blacksmiths in both cases (Fig. 1&2). Smooth round iron rods were used for making the hooks in both the cases even though the rod used is thicker in Akra (6 mm diameter) than that in Germe- Kenane (4 mm diameter). The curved iron hook is fitted and secured into the slender bamboo handle by blacksmiths with the help of a metal ring in Akra and in Germe- Kenane it is fastened onto the bamboo handle with the help of used bicycle rubber tube. The total length of the Akra is about 1.8-2.0 m, of which the length of bamboo handle is 1.4-1.5 m. In case of Germe-Kenane the length of the iron rod ranges from 0.31-0.33 m and that of the bamboo handle ranges from 2.17-2.2 m. The total length of Germe-Kenane ranges from 2.3-2.4 m. The approximate diameter of the sickle-shaped iron hook ranges from 4-5 cm in both the gear. The shape of the iron hook slightly differed between the two gear. It was roughly C-shaped in Akra, whereas it was more curved in case of Germe Kenane (Fig. 1 & 2). The tip of the sickle shaped iron hook is made into a sharp point so that it can pierce through the skin of the fish.

Both these fishing gear are specialized in catching mainly the species of spiny eels occurring in floodplain wetlands of the study area viz., Macrognathus pancalus and *M. aral* (locally known as 'Tura', 'Turi') from muddy bottoms. However, other benthic fish species like *Nandus nandus*, *Heteropneustes fossilis* and *Clarius magur* also reportedly get pierced/ caught in the hook occasionally. During operation the fishers move the pointed hook from left to right and vice-versa in an oscillating manner pace along the bottom (Fig. 3 & 4) in waist deep waters to get the spiny eel pierced in

Fig. 1 Akra of Lower Assam

Fig. 2 Germe-Kenane of Upper Assam

Fig. 3 Bhatiya fishers operating Akra

Fig. 4 Mising fisher operating Germe-Kenane

Fig. 5 A haul of spiny eels caught with Akra

the pointed hook. Since there is no barb in the iron hook used in this gear, it does not need much effort to unhook the fish manually. Fishers of Bhatiya community simply dropped the fishes caught in the hook to the bamboo basket (locally called polo) placed in a triangular floating platform made up of banana stems (Fig. 5), which is tied to the waist of the fisher with a rope, whereas fishers of Mising tribe collected the catch in a bamboo basket (locally known as khaloi), tied to their waist with the help of a rope. The fishing hook along with its handle is prepared by the fishers themselves with the help of local blacksmiths and cost only ₹30-40 per gear. The fishers generally operated the fishing gear for 2-3 hours a day since it is a strenuous activity to move the gear along the muddy bottom in high speed. Fish catches ranging from 0.5 to 2 kg/ fisher were observed during fishing operations.

Discussion

Germe in Mising language refers to spiny eels, locally known as 'Tura' and Kenane refers to the fishing implement. The fishing method used by the two communities was found to be similar in construction and mode of operation with only slight variation in dimensions/construction of the gear used. The interviewed fishers from both communities informed that

they learned of the technique from their forefathers. It is possible that the fishing gear and associated ITK originated form either of the two communities or from a third community of the region. The fishing gear and the method was found to be simple, low-cost and yet very effective for catching bottom dwelling spiny eels in shallow floodplain wetlands (beels/pitoni), which are otherwise very difficult to be caught except by complete dewatering of the water body. Both the Bhatiyas and Mising tribe are experts in making and operating Germe-Kenane in beels and other muddy water bodies. Ethnic communities of Assam are specialized in making bamboo handles for various day to day implements, which are used to operate at sudden high speed (e.g., dagger). Fitting of iron hook makes the frontal part of the gear heavy and apparently helps in operating the gear in swift swinging action. We tried to validate the ITK associated with Akra and Germe-Kenane fishing in the light of existing scientific literature. We tried to find out why the spiny eels did not escape from the fast approaching curved iron hook. Past studies on the fish eye showed that its ability to resolve detailed images, while not as good as that of terrestrial animals, is adequate in view of the degradation of edges caused by suspended particles in the water. Contrast direction and hue may therefore, have become more important as a means of object recognition13. Since the curved iron hook does not resemble any of the natural predators/ enemies of the spiny eels, it is possible that the eels do not perceive it as dangerous. Interviews with the fishers from Bhatiya community and Mising tribe who are specialized in operating Akra and Germe-Kenane revealed that this specialized fishing usually took place during the winter and pre-monsoon seasons (December - April) when the water level in the floodplain wetlands and other shallow water bodies is reduced to less than one metre. Since such shallow water depth facilitates intense fishing around this time, the water becomes highly turbid and muddy/ yellowish in colour. The physical properties of natural water produce varying limitations on the visual signaling capabilities of fishes (Guthrie and Muntz, 1993). Such changes in turbidity and water color apparently led to changes in the spectral quality of light in the waterbody. Obviously, the spiny eels (as also other demersal fish species like *Clarias magur*, *Heteropneustes fossilis* and *Nandus nandus* that formed stray catches) could not effect corresponding changes in their visual systems, especially in their visual pigments. According to available reports, migratory fishes such as salmon show appropriate changes in their visual pigments when they enter or leave fresh water (Beatty, 1975). The retino-motor movements that lead to light and dark adaptations in fish will tend to follow a dial cycle, but there are several other modifications that influence the visual sensitivities of fish in different light intensities. The relative portions of the different visual pigments may also change due to shifts in spectral bandwidths that occur on a seasonal basis (Jobling, 1995).

The spiny eels are benthic fishes having elongate eyes. The light-gathering ability of the eye is improved due to the absence of the iris and the incoming light is focused on the retina at the bottom of the tube by the enlarged lens. Overall, these series of adaptations lead to an increase in light-gathering at the expense of narrowing of the visual field (Jobling, 1995). We observed that the fishers moved the curved pointed iron hook from side to side (in an oscillating manner) at a fast pace to pierce the body of the eels. Thus, narrow visual field of the spiny eels appears to be a limiting factor for the fishes in giving them sufficient time to escape from the fast-approaching hooks.

Conclusion

Indigenous technical knowledge accumulated by different fisher communities for many generations have resulted in development of low-cost and effective fish harvesting methods/gear for different fish groups. Such methods are crucial for ensuring livelihood security of the fishers including those who are dependent on the floodplain wetlands for their sustenance. The unique fishing method discussed above is simple, low-cost and yet found to be very effective in catching bottom dwelling spiny eels. There is need to document such techniques along with associated ITKs so that the fishing gear can be upgraded for the benefit of resource-poor fishers (including some form of intellectual property right for the evolving/user community).

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