

Indigenous Technical Knowledge (ITK) of fish farmers at Dhalai district of Tripura, NE India

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Fisheries in Tripura form an integral part of the economy of the state. Indigenous technical knowledge in the field of fish farming is a practical knowledge of the local farmers of this district. This is based on intimate experience accumulated over generation after generation. Such traditional practices were sustainable in terms of land use, utilization of local available materials, labour, money, and could be easily operated without any specially skills. The study was conducted in the villages of Balaram and Maracherra clusters of Dhalai district of Tripura to collect the indigenous technical knowledge in fish based farming system, to characterize and catalogue the available bio-resources in the locality and to protect the IPR issues for future uses. Information was documented by using Participatory Rural Appraisal (PRA) like observation and discussion. In this study, the traditional knowledge of fish farmers were identified and described on integration of animal and plant component in fish based farming system, protection of fishes from enemies, ponds used for the protection of bamboo from damage and fishing methods. The ITKs on fish-cum-vegetable (bottle gourd) culture, paddy-cum-fish culture, fish-cum-duckery, practice of protection of fishes from enemies, ponds used for the protection of bamboo from damage, and different types of bamboo made fishing traps were recorded in the present paper.

Keywords: Dhalai district, Fish, Garo tribes, *Lau macha*, Duck house, *Ushas*

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North Eastern region has been ranked 6th among the top 25 biodiversity spots in the world¹. Tripura is one of the border states of North East India and it is almost surrounded by Bangladesh except the Northeastern part which is bounded by Assam and Mizoram. The state lies between 22°55'N and 24°32'N latitudes and 91°21'E and 92°16'E longitudes². Out of the four district of Tripura, Dhalai is the most backward and youngest. Total area of the district is 2312.29 km² where 70 % land is covered by hills. According to the census report of 2001 total population of the district is 3, 36,491 where 54.02 % belongs to tribal community. Socio-economic conditions of the people are very poor. Dhalai district is mainly a valley between two hilly terrains namely Atharamura Range and Shakhan Range, it was created in 1995. The strengths of the district are its huge natural resources, conducive to climate as well as adequate and well spread rain fall, huge human resources, vast water areas including 4 major rivers, high literacy rate, and strategic location of the district

specially connected by national high way. If all these resources could be utilized properly, rapid development could be achieved but for lack of required infrastructure, the district is lagging behind. The total demand of fish in the district is 3445.255 MT against the total production of 2971.499 MT. With a gap of 473.756 MT. Total 1,516 ha area are being used for fisheries in this district and current fish productivity is 1, 839 kg ha⁻¹ y⁻¹. The basic source of income is mainly from agriculture and allied sector. Natural water bodies for fishery are very few in numbers and as such development of pisciculture is restricted to tanks, ponds and swamps² but a variety of Ichthyofauna is available in this region.

Despite such a rich resource potential, the region is lagging behind in its exploitation and management due to biotic, abiotic and socio-economic constraints. Still a substantial part of the resources in this region remain unutilized and unavailable. A substantial part of the resources in this region comprises capture of fisheries, the management and identification of ITK in fish culture activities. Selection of fishing methods and gear are influenced by various factors such as

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physiography of the water body, nature of fish stock, characteristics of the raw material from which gear are fabricated and standard of living³.

Keeping the above statements in view the present programme has been undertaken to identify the ITK and their utilities in the fishery sector by the local farmers of Dhalai district. The study has been conducted during the year 2008-2009 among two clusters, viz. Balaram and Maracherra of this district.

Methodology

The study was conducted in the selected villages of two clusters, viz. Balaram and Maracherra in Dhalai district of Tripura (Fig. 1). The study was carried out as a part of National Agricultural Innovation Project on Livelihood Improvement and Empowerment of Rural Poor through Sustainable Farming System in North East India in this district. Participatory Rural Appraisal (PRA) methodology was adopted to identify and description about the traditional practices of fish farmers that are prevalent in the selected villages. Field surveys were conducted through direct observation method of PRA by recoding the operational activities of the villagers regarding their knowledge involved in fishery sector. Questionnaire was made in local language to communicate with the fishers after the direct observation in field. Secondary data on this traditional fishing practice and the knowledge system associated with it were also collected from fishers through focused group discussion^{4&5}. By contracting the discussion methods the indigenous practices used by the fish farmers were documented. To conduct the study we have visited total five villages of Dhalai district, viz. Balaram, Jormonjoy Para, Chotosurma, Kuchainala and Thalbari. The visit was conducted fortnightly for two years (2008 & 2009). Total 100 farmers of age group 30 to 70 years were contacted for present study. However, information and outputs came from 10 farmers only and for this purpose prior information consents were also taken. The name of the farmers with village name and age are given below:

Mr. Nirmal Debnath, Age -31 yrs, Village – Balaram, Mr. Bimal Debnath, Age- 36 yrs, Village- Balaram, Mr. Pradip Debnath, Age- 45 yrs, Village- Balaram, Ms. Theuri Marak, Age- 38 yrs, Village- Jormonjoy Para, Mr. Tiresa Marak, Age- 52 yrs, Village- Jormonjoy Para, Ms. Namita Debbarma, Age- 30yrs, Village- Thalbari, Mr. Bhagirath Debbarma, Age- 70yrs, Village- Thalbari, Mr. Nikunja Malakar Age- 35yrs, Village- Kuchainala,

Mr. Sudarshan Satnami, Age- 42yrs, Village- Chotosurma and Ms. Subhadra Marar, Age -45yrs, Village- Chotosurma

Results and discussion

Indigenous methods practiced by fish farmers of Dhalai district were identified and described below:

Integration of animal and plant component in fish based farming system

Fish-cum-vegetable (bottle gourd) culture: The farmers belonging to Bengali community of Balaram cluster cultivated bottle gourd along with practicing fish culture (Fig. 2). The gourd planted on the embankment of the pond and one bamboo platform made above the pond water which was fixed by the bamboo poles for climbing the gourd. The platform is locally known as *Lau macha*. The lower part of the bamboo poles fixed in the soil below the pond water. The size of the platform varies depending on the size of the pond and the number of the bottle gourd plant though the breadth of the platform from 1.5 – 2 m. The height is maintained approximately the height of the pond embankment. The bamboo poles and twigs under the pond water have facilitates the growth of periphyton/biofilm which minimizes the cost of fish feed. Bottle gourd platform provides the shed to the fishes during hot days.

Paddy-cum-fish culture: Traditional rice fish farming may be considered to derive solely from the farmer based technology. Since the water logged rice field forms natural habitat for wild fish so it is believed that it appeared first only as the simple capture. The fish communities of rice fields were exploited as common property resources for rice growers as a whole in the earlier days. The water body is commonly known as *Duba*, which means a natural or man made depression usually dugout which is a smaller version of ponds (Figs. 3-5). Farmers dig the *Duba* at the lowest point of the rice field for other purposes also. The normal size usually varies between 3-6 m². The whole rice plot is bounded by earthen *bundh*. The depth of the *Duba* is maintained around 1.0 – 1.5 m depending on the gradient.

Duba is used for various purposes such as (i) Source irrigation during occasional drought period, for instance during the flowering or grain stage of rice crop. (ii) A natural fish trap- Fish enter the field and breed there till the water level in the field is sufficient. Some local varieties of fishes like murels

(*Channa* spp.), climbing perch (*Anabas testodeneus*, Bloch) and cat fishes (*Clarias batrachus* (Linnaeus); *Heteroneustes fossilis* (Bloch)) help in controlling the weeds and loosening soil near the roots of the rice plant. It is harvested 2-3 times in season depending up on the rain water or over flow. During winter, this supplements the food supply. (iii) Farmers used the *Duba* as a store for up rooted paddy seedlings before transplanting. Some times after transplanting the excess seedlings are kept in the shallow water of the *Duba*. The roots of the seedlings do not get damaged but cleaned in the process. (iv) The ducks reared in the *Duba* also help in loosening the soil around the root zone of the rice plant. However, ducks are allowed in to the field only after the rice plants are established well in the soil.

The system of raising fish from the rice fields probably started in the Northeast with the beginning of rice cultivation itself⁶. The rice fish culture is a viable, environmentally friendly, low cost, low risk additional economic activity with multiple benefits including increased income and greater availability of fish to the rural farming community⁷. Production varies from 2,100 - 2,300 kg ha⁻¹ of rice and from 400 - 450 kg ha⁻¹ of fish in Assam⁸. Greater benefits from rice-fish culture have been derived through collective management instead of individually managed small installations. The Northeastern region of India is recognized as the best zone for organic farming due to its negligible usage of chemical fertilizers, pesticides, and other chemicals⁹.

Fish-cum-duckery: The fish farmers (belongs to *Debbarma* community) of Maracherra practices fish culture along with duck (Fig. 6). The size of duck house varies from 4 – 6 m² for 8 – 10 birds whereas the height is 1- 1.5 m. The duck house is constructed on the pond water by locally available bamboo which has sufficient air space. The roof made by plastic or polyethylene sheet which can protect the birds from excess sunlight or rain. The platform made by the bamboo in the shed to take rest. The excreta of birds directly throws in the ponds which minimize the cost of fish feed. The swimming performed by the ducks facilitates the aeration in the water which gives excess oxygen in the water.

Integrated livestock/fish farming systems provide the livestock manure used as organic fertilizer for the fish ponds, which also function as waste stabilization ponds¹⁰.

Protection of fishes from enemies

The farmers of Maracherra practice the use of bamboo and tree twigs in the pond (Fig. 7). The twigs fixed in the water mainly at or near the embankment which protects the fishes from fish eating animals (enemies), from pouching and also provides the foods grown to the under water parts of the twigs to the fishes. The bamboo and tree twigs also facilitates as a substrate to produce of periphyton.

Carp such as *rohu* (*Labeo rohita* (Hamilton)) and *calbasu* (*Labeo calbasu* (Hamilton)) are known to feed heavily on periphyton and growth is increased by 40–60% in ponds with substrates. The Northeastern states are blessed with green vegetation throughout the year. The biodegradable leaves, stems, and branches of plants and trees, especially bamboos, can be used to provide substrates for periphyton growth. In states such as Tripura where poaching is a major problem, substrates are used to prevent casting of nets⁶.

Ponds used for the protection of bamboo from damage

The bamboo plant after harvesting kept in pond water (Fig.8). The split of bamboo plants make bundle tightly by cane or rope and wet in the pond water. This process protects the bamboo from damage and maintains its freshness for few weeks.

Fishing methods

Different fishing traps are used by the local farmers. Size and shape of the bamboo made gear depends on their nature of application. The shape of fishing traps used by the *Garo* community of Balaram cluster may be conical, basket type or cylindrical (Figs. 9-11). The traps are so designed that once the fish is entered it cannot escape. Various names are given to different designs of traps but commonly all of these are known as *Usha*. These are generally operated for some time or some days depending on the design, season and place of the operation. All the family members mainly the women are involved in manufacture and marketing of such fishing devices which has high market value.

Significant results and conclusion

The study revealed that there are different ethnic fisherman communities who are practicing technical knowledge in their day to day life. They are practicing integrated fish based farming system where the integration of plants and animals they have incorporated. These include *Fish-cum-vegetable*



Fig. 1-11—Location of study site; Bottle gourd cultivation along with fish; *Duba* (natural); *Duba* (natural); *Duba* (man-made); Integrated fish culture; Use of bamboo and tree twigs in the pond; Ponds used for the protection of bamboo from damage; Bamboo made fishing trap (conical); Bamboo made fishing trap (cylindrical); Bamboo made fishing trap (basket type)

(bottle gourd) culture, Paddy-cum-fish culture and Fish-cum-duckery. They are also practicing the method of protection of fishes from enemies where the use of bamboo and tree twigs in the pond which protects the fishes from fish eating animals (enemies), from pouching and also provides the foods grown to the underwater parts of the twigs to the fishes. The farmers also invented the method of keeping the freshness of bamboo for which they are using ponds water for the protection of bamboo from damage. Regarding fishing methods the Garo community has made bamboo based different fishing traps which are locally known as *usha*.

All the traditional methods in fish based farming systems being followed by the farmers of Dhalai district since time immemorial which can be modified and recommended scientifically for sustainable fish farming. The traditional knowledge of fish farmers in the development of fish production by using low cost inputs may be benefited in the field of the development of fish based farming system. If the knowledge is documented properly the production of fish along with animal husbandry may be increased. This present scenario presents an excellent opportunity to utilize vast tracts of rice fields to culture a variety of fishes to augment fish production in the region. The fishing gear used by the local people can be achieved by modifying the existing methods in scientific manner and introducing new methods.

Significance of study to the farmers/researchers

The above findings may be helpful for the researcher as well as the local farmers in different ways. It will help the researcher to make database on indigenous technical knowledge in fish based farming system. It can also help to categorize the available bio-resources in local area. It may also help for the preparation of people's biodiversity register which can protect the IPR issues for future uses.

Furthermore, the study may help the improvement of livelihood of the rural farmers of this district, if it would be encouraged in a scientific manner. These traditional knowledge based practices of this area are low cost, more profitable and eco-friendly sustainable.

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