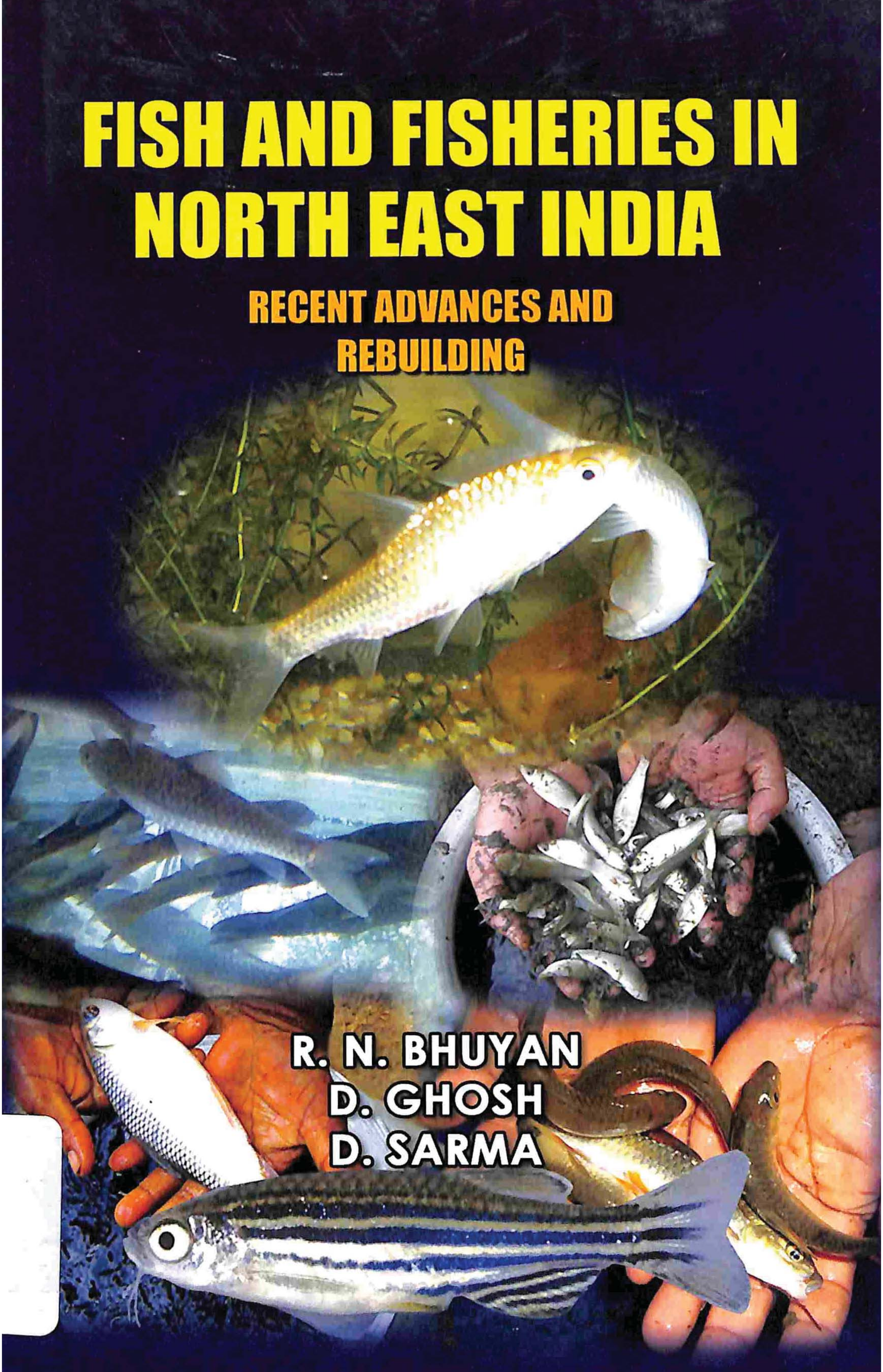
FISH AND FISHERIES IN NORTH EAST INDIA

RECENT ADVANCES AND REBUILDING



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About the Book

The North-Eastern part of India, has its unique topography, diverse geographical features and varied watershed patterns. The region is fed by the Brahmaputra river system and its various tributaries crisscross different states and ultimately join the Brahmaputra. These make the area a favourable site for development of fisheries and fish biology studies. Innumerable hill streams, rivers, wetlands and perennial water sources abound in the area. In Meghalaya, diverse climatic conditions make it conducive for its floral and faunal wealth. The entire region mostly depends upon capture fisheries. The state abounds in numerous man-made water bodies, which have not been adequately exploited for its fishery potential. Vast lentic water bodies can be utilized for fish production catering to the needs of increasing demand of fish protein in the state.

This book will help all concerned in the development of fisheries, research in various fields and in the conservation of many important fish species of the country particularly from the North East India.

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Artificial Propagation, Breeding and Hatchery Management of *Tor khudree* (Sykes), *Tor mussullah, Tor tor* (Ham) and *Tor putitora* (Ham)

S. N. Ogale

Abstract

Breeding of fish is an integral part of aquaculture and dates back to 473 B.C., Fanlii of China produced his first document on common carp culture. In India too, fish culture appears to be in practice even before 300 B.C. because Kautillya, the famous author of "Arthashastra" had detailed the method of leasing out the fishing rights of govt. fish ponds and exemption of octroi duty on fresh fish. Whatever be the historical background, the methods of culture and breeding fish differed according to the natural behavior of the brood fish, it's original habitat, the nature of eggs and the other genetic factors. Natural breeding of Indian major Carps was known to occur in marginal waters of the flooded rivers. Induced breeding of carps (Hypophysation) has been comparatively, of recent origin but stripping of eggs and there artificial fecundation such as in the case of Salmon and Trout has been known over the century. In India, Artificial propagation of the imported trout was practiced in Nilgiries (Tamilnadu), Himachal Pradesh and in Kashmir. But as far as Indian fish is concerned it was Nazir Ahmed who first stripped and artificially fertilized the eggs of pond raised Katli (*Accrossochielus hexagonolepis,* McClelland) and obtained some semi fingerlings. However artificial fecundation of eggs of True Mahseer (*Tor khudree* & *Tor mussullah*) was successfully carried out on a large scale

for the 1st time in 1970-71 (Kulkarni Ogale 1971) at the Fish farm at Lonavla,Dist. Pune (Maharashtra). *Tor tor* species was also introduced in Walwhan and Shirwata lakes of Tata Power in 1972 and same procedure was used to breed *Tor tor in* the year 1977, and further the Hybrids were produced between the Deccan Mahseer, *Tor khudree* and Narmada Mahseer *Tor tor* and the hybrids could breed in captivity on the farm without injections. Further The Mahseer Farm at Lonavla has successfully demonstrated breeding of all the valid species of Mahseer including pond raised Golden Mahseer *Tor putitora* in captivity. Conservation of Mahseer by Tata power, is probably the biggest conservation effort after the Project Tiger in India. Tata Power has produced over 10 million fry and fingerlings of 4 valid species of Mahseer out of which over 3 million fry and fingerlings were distributed for Mahseer Conservation programme of Central and state Governments. This paper deals with Tata Power's efforts in breeding and conservation of Mahseer species and the latest information on the spawning season, spawning habits and hatchery management as far as we know them at present.

Spawning Season

Before 1939 most of the information about the spawning of Mahseer species was available only through the reports or books published by the anglers (Thomas, Skene dhu & MacDonald etc.) and their observations in the field. Since they referred to all the types of Mahseer as 'The Mahseer' the species wise information from the Anglers could not be sorted out.

Golden Mahseer has been reported to spawn twice a year. May –June and August – September (Sehgal 1972). Johal and Tandon (1981) Observed spawning of Mahseer in May – June and July – October. Sunder & Joshi (1977) observed the spawning of T. putitora in Anji river stream during August – September. In rivers in Kumaon (Kali, Kosi & Ramganga) Three spawning seasons are Closely followed, May – June, July – August , and September – October (Pathani 1982). The same author observed only four batches of interspread eggs with variable sizes of ripe eggs. The putitora Mahseer according to to Hora(1940) breeds in August and September as also reported by Sehgal (1972) . Though earlier he had reported two breeding seasons. Nautiyal

(1984) on the basis of ripe gonads and presence of fry and fingerlings had concluded that the species spawns during the monsoon months extending from July to September. The spawning periodicity of the *T. putitora* was always controversial as evident from the above account.Tata power undertook a study at Mahseer farm Lonavla Dist. Pune of Maharashtra to establish the spawning season and periodicity of spawning of *T. putitora*. Observations made at Lonavla during 1995 – 2005 on pond raised Mahseer indicated that though the spawning season of this species February - March, June – August & September-November with a peak in August. It was also observed that Males are oozing through out the year and even pond raised females have responded to stripping 12 months in a year(Ogale 2005).

Kulkarni (1971) reported that *Tor khudree* spawns in July and August (peak period) and sometimes in September in Walwhan and Shirwata lakes at Lonavla. This observation has been confirmed over the last 30 years by actually collecting the eggs at TPCL Mahseer Farm. In the case of *Tor tor* introduced in Walwhan, Shirwata and Telco lakes at Lonavla and Pune, gravid females and males were available for stripping generally in July, August and September and in one exceptional case in April in the Telco Lake, Pune. At Lonavla, *Tor putitora*, like other species, is observed to spawn naturally in lakes from July to September. Kulkarni and Ogale (1986,) were also able to breed *Tor khudree, Tor tor, Tor mussullah* and *Tor putitora* with hypophysation of the pond-raised stock from July to December.

Tor putitora females have responded to stripping, with hypophysation or even without it during twelve months in a year. It would be worthwhile to try and breed putitora Mahseer in the other farms also.

From the above observations it could be said that the breeding season of all Mahseer species extends from July to September with a peak in July - August and in exceptional cases to October, and even beyond, which has been observed by the author at Lonavla from 1997-2001. This has shown the adaptability of the species to different environments.

In the case of *Tor tor* Desai (1970) summarizes that in the Narmada river, breeding commences in July and continues intermittently till February and March. The peak period was observed to be from July to September. This observation was based on the gonado somatic index and ova-diameters of eggs of specimens collected in different seasons. Never the less in case of *T.tor* introduced in walwhan Lake gravid males and females were met with generally at the same time as *T.khudree* & *T. mussullah* that is in July - August and September and few females even in April which is probably the commencement of the next breeding season.

At Lonavla, after the hatchlings are grown into fry and fingerlings in nursery and rearing ponds, the grown-up fingerlings are released into the Tata Power Company's lakes. About 4 to 5 hundred thousand eggs are obtained in the above manner every year. Thousands of fry and fingerlings have also been supplied gratis for some years to different State Governments and Angling Associations in the country wherever there was commitment and opportunity to rehabilitate the fish. A consignment of Mahseer fry has been sent to Laos PDR for stocking the Mekong River basin in that country.

Spawning Behaviour

All the Mahseer species are known to have similar spawning behaviour. Adults of both the sexes when they are about to reach maturity or egg laying period in the case of older specimens, they keep on feeding in the river pools or reservoirs but do not migrate till the onset of monsoon which brings fresh rain water from the surrounding areas . Brood fish gets activated by the fresh water and start migration in the direction of flow of streams. Their gonads mature further during this ascent and they keep on ascending till they meet a comparatively calmer and slow moving patch of water by the side of the stream with bottom having by the side of the stream with bottom having small pebbles or sand. Here the mature fish stop and mill round apparently trying to select suitable spot for laying eggs as well as a partner. Males usually outnumber the females and keep chasing the parteners. Some pairs swim very close together. This is probably

the final stage of their nuptial play and after a while the female twists her body slightly and shades her eggs in the water. The male also twisting its body simultaneously sheds its milt (semen) over the ejecting stream of eggs which get fertilized when they come in contact with the sperms. Despite the abundance of the semen only part of the eggs get fertilized as the whole process takes place in open waters. Being heavy the eggs sink to the bottom which if covered with sand or pebbles survive but if there is loose mud they sink into it and perish.

In case of lakes and reservoirs also when the monsoon sets in, small rivers and rivulets forming the main lacustrine bodies swell with early freshlets and this activates the resident Mahseers to commence migrating in the same manner as in open river, as much as they can ascend and breed if suitable conditions prevail. But the topography of the different water bodies and sources of water differ from each other. In the habitat of Tata Power's lakes in Lonavla which are surrounded by hills on all the sides the small streams draining the adjoining the hills cascade in to main lake. The ripe Mahseers attracted by the sound of the flowing and oxygen rich water congregate near the streams but finding the hill streams difficult to ascend, they stop and mill round the area. These spawners are useful for stripping and artificial fertilization. This situation indicates that configuration of the marginal areas of the lakes have to be of appropriate nature to enable capture of spawners.

At Walwhan fish farm the above favorable conditions were simulated to get the similar results like chasing and final capture of the brooders with drag nets 1-2 hours after the chasing starts for stripping and artificial fertilization in ponds.

Collection of Spawners

Collection of spawners of appropriate maturity is the key factor in artificial propagation of Mahseer or any other fish for that matter. In case of *Tor khudree*, *Tor mussullah* and *Tor tor* ripe spawners were available early during mid July to mid August although the rains commence in mid-June. The spawners require sufficient inducement due to sufficient quantity of oxygenated fresh water and lowering of the water temperatures to $22^0C - 24^0C$ for final maturation of the

gonads. It takes 3-4 weeks to develop affore said environmental conditions to develop since the commencement of the monsoon. This may vary a bit from place to place but in any case spawners in fully ripe condition are essential for stripping and artificial fecundation. In Tata's lakes such spawners are collected by using wide mesh gill nets. These nets are usually spread at dusk in the area near streams and are inspected every hour. Some of the spawners which are attracted by the inflowing water are caught in these nets . They are carefully removed from the net sometimes by even cutting the gill nets to avoid injury to the fish. The ripe ones are selected for stripping and the rest are released back in to the lake alive. Better results are obtained if it rains during the day and the streams swell up in volume. This is true in case of all the four species which are released in Walwhan Lake the only difference is Golden Mahseer *T. Putitora* attains maturity in mid August where as all the other species mature in July-August. This can shift slightly depending on the rains.

At Walwhan Farm Lonavla it is observed that the brooders mature in captivity in the farm conditions and could be seen chasing each other. Drag net is used to collect the spawners. *T. khudree* & *T. mussullah* could be stripped in July – September, *T. tor* could be striped in August and April and *Tor putitora* could be stripped twelve months in a year proving that it is easiest to breed in captivity.

Since the spawning habits of *T. tor* and *T. putitora* are also similar to those of *Tor khudree* & *Tor mussullah* TPCL's methodology was used to collect spawners in the Kumaon lakes of Uttar Pradesh by the National Research Center for Cold Water Fisheries (NRC-CWF) & Department of fisheries. Fisheries Department of Jammu and Kashmir could collect brooders from Anji River.

Induced breeding

In places where collection of spawners for stripping and artificial fertilization of eggs is not possible, induced breeding can be carried out. Matured fish are induced to breed by hormonal injections or just by environmental manipulation. Females require two doses of injections at the rate of 6 mg and 12 mg / kg body weight where as male requires

only 1 dose of 6 mg / kg body weight. The pairs rarely breed normally they have to be stripped.

The sex ratio of female and male is very abnormal sometimes 1: 20 and is the biggest constraint.

Natural Breeding in ponds

The Tata Power Company achieved a major breakthrough by breeding(stripping) pond raised Deccan Mahseers, *T. khudree*, *T. mussullah*, and *Tor tor* at Lonavla fish farm in captivity in 1986-87. They could successfully produce hybrids between *T. Khudree* & *Tor tor* during the same period. And all this without Hypophysation. This encouraged Tata Power to take up the breeding of Himalayan Golden Mahseer *Tor putitora* at Lonavla in 1995. The earlier observations made at Lonavla during 1995-2000 on the pond raised Golden Mahseer confirmed that it breeds at least 3 times in a year. Further studies revealed that males are oozing through out the year in ponds and females also carry the eggs. A steady flow of water with protein reach diet facilitated the breeding of Golden Mahseer 12 months a year. This was again a major breakthrough making seed available through out the year.

Artificial fertilization

The selected matured males and females collected earlier either from the lakes or the ponds are then carefully kept in conditioning nets kept submerged in water or in plastic tubs. Egg collection is done first holding the female tail down and gently pressing the abdomen in usual way as in salmon or trout. The eggs easily ooze out in a stream and are collected in freshly washed wetted plastic trays. Immediately a male is taken and stripped in a similar manner ensuring the milt is spread on the eggs. Little water is added to dilute the milt and the tray is rotated to ensure that all eggs come in contact with the milt. After 2-3 minutes excess milt is washed away with two or three changes of water. The eggs are kept for water hardening for 30 minutes. If the female is in freely oozing condition the fertilization is usually 95 –

100%. The eggs are then measured volumetrically by measuring cylinder and then transferred to wooden hatching trays.

Hatchery management

Several systems of hatching fish eggs are being followed in different parts of the country, but the one developed at Lonavla (Kulkarni and Ogale, 1978) is the simplest. It involves cement cisterns, wooden floating trays and perforated pipes. The pipes have been specially punctured at regular intervals to provide oxygenated water directly into the trays and on the eggs.

The wooden hatchery trays used at Lonavla are 56 x 56 x 10 cm deep, with a suitable (1mm) plastic or velon mesh properly stretched and fixed to form the bottom of the tray. Eight such trays can be arranged and kept floating in a rectangular cement tank (hatchery), 2.5 x 1.2 x 0.75 m. deep. About 30 000 eggs can be conveniently accommodated in each tray, thus making a total of 240 000 for each hatching tank. More hatching tanks and trays can be arranged according to the requirement and the quantity of water available. TPCL Mahseer Hatchery at Lonavla has a capacity to hatch one million eggs at a time.

Water requirements for hatching

As mentioned earlier, water is sprinkled over the eggs placed in the hatchery tanks through perforated plastic pipes fixed on top of the sidewalls of the hatchery tank. The perforations are 1mm wide giving rise to jets falling directly but slowly into trays containing the eggs. Four such jets supply water to each tray at a rate of one liter per minute per tray. Thus, if eight trays are used at a time, 480 liters of water will be required per hour and 11 520 liters per day, the total quantity depending on the number of hatching trays being used.

The overhead tank supplying clean, silt-free water can be about three meters tall with a capacity of 10 000 liters. Water is drawn at a level of about 100 mm from the bottom to allow sedimentation of silt, if any. The tank is usually kept full to maintain pressure of water from the sprinkling jets. The outflow from the hatching tank is so arranged that only the bottom water is removed first by a siphon pipe

system commencing near the bottom. Adjustments can be made depending on the local conditions prevailing at a given place, the quality of water being the most important. The dead eggs are constantly removed with a pipette or an ordinary ink-filler having a wide aperture.

Inherent constraints & Larval Development

While considering large-scale propagation of the Mahseer, the natural spawning behavior and the inherent constraints in its early life cycle need to be understood. In nature, the spawners try to reach their favored spawning grounds which may be in the vicinity or far away, traversing smoothly or ascending the overflowing monsoon streams. The actual spawning area needs to be comparatively calm, having well-oxygenated water and a bed of sand or gravel. The journey to these grounds may be safe or fraught with risks and dangers, but their inner instinct drives the spawners to meet the challenges in order to breed.

Our observations on stripping, hatching and larval growth of the *khudree, mussullah, tor and putitora* Mahseer at Lonavla indicated that Mahseer species have very low fecundity of 10 000 to 15 000 per kg of body weight, though Desai (1970) had estimated a figure ranging from 7 000 to 106 500 from the ova count, depending on the size of the fish. The eggs of the Mahseer are demersal and if there is loose mud on the bed instead of sand or gravel, they perish.

The hatching period of different Mahseer species is 60 to 96 hours in water temperature of 20°C to 28°C as described by various authors. If water temperature falls below 20°C, the hatching period extends beyond 96 hours. six to ten days for Tor species. In this stage, the Mahseer hatchlings tend to remain at the bottom, huddled in large numbers in corners and crevices as stated earlier. Their heads remain tucked away from light and their tails keep vibrating constantly. In this condition, they are highly vulnerable to all kinds of predators. The early hatchlings of Mahseer are golden yellow and pass through a semi-quiescent stage during which they remain huddled in corners and crevices with their heads tucked away from light, as if they were negatively phototropic. In this condition, they are exposed to heavy predation by other predatory animals. This condition continues for

about six days and forms the most critical period of its early life cycle. This mortality can be reduced by artificial fertilization of eggs, hatching them in trays and nurturing the hatchlings in a protected manner in nursery ponds.

Rearing of fry and fingerlings

The early free swimming fry are not released straight into the earthen lined nursery tanks but are reared in cement cisterns for about a fortnight or so at this stage they are fed with Zooplankton if available or with powdered groundnut nut oil cake and rice bran. Free flow of water is maintained at best for sometime during the day. About 100,000 fry can be maintained in a 200 sq. ft. cement tank for a month and then released in the earthen nursery ponds where normal nursery management practices are followed. This is applicable to all four species of Mahseer and has been successfully tried in Lonavla Farm of Tata Power.

Observations in Walwhan Lake of Tata power at Lonavla confirmed that the spawning habits of *T. khudree, T. mussullah, Tor tor* & *Tor putitora* appeared to be similar. All the fish migrate to the same area and behaved in the same manner as regards to the nuptial play etc. July – August is the peak breeding season of all the species. The method of collecting brooders from the lake and further stripping and fertilization is also similar. Similar Hatchery and process is used to hatch the eggs and hatching time taken is also similar 72 – 96 hrs depending on the prevailing temperature that is 21^{0}C -26^{0}C.The method of rearing the fry and fingerlings & feeding is same.

The pond raised Mahseers respond to Hypophysation but the results are not very encouraging. All the species mature in ponds to the stripping stage which is facilitated by flowing water and protein reach food. While the Golden Mahseer could breed 12 months in a year in captivity without Hypophysation the other species breed occasionally. Efforts have to be made to establish a breeding stock of all the species in captivity because collection of brooders from their natural breeding ground is very difficult. It is felt that acclimatization of the Mahseers to the captive conditions for a longer period than 4 years is the key to breed Mahseers in captivity.

Hybridization

Since 4 valid species of Mahseers are available at Lonavla various Hybrids within the Mahseers were tried and it was observed that any Mahseer species could be crossed with any other Mahseer successfully. It was further observed that Hybrids could be further crossed with the pure breeds successfully and there was hardly any difference seen in hatching time and survival rate etc.

Air Transport of Eggs

Tata Power could successfully transport the eggs by Air in moist cotton and the hatching was carried out at the destination. The transported eggs were hatched in a normal condition with over 75% success. This would reduce the cost of transport and facilitate the distribution of Mahseer seed to distant places in India and abroad for ranching.

Conclusion

The study of breeding habits of all the species of Mahseers over two decades suggests that all the species could breed in captivity in ponds. Since the Mahseers release eggs in batches breeding of fish by facilitating flow of water and protein reach food is a better option than induced breeding. Acclimatization of the Mahseer to captive condition is the key to successful breeding programme.

Air transport of eggs will reduce the mortality of fingerlings in transport and would also reduce the cost considerably. Ranching of Natural waters in any part of the country is possible.

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2

Ethno Zoological Practices of Lotha Naga Tribe of Wokha District, Nagaland Related to Fish and Fisheries.

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Abstract

Traditional method of treating various ailments using animals and animal parts, has been in practice among various Naga tribes since time immemorial. The present paper is on the traditional methods of using fishes for treating various ailments amongst the Lotha Naga tribe of Nagaland. Survey was taken up in different villages of Wokha district. Data was collected by distributing questionnaires and interviewing the people who actually prescribe and use these medicines. The study revealed that many of the villagers still depend on these traditional methods to cure many known ailments prevalent among the villagers. In this paper we present 10 fishes that are recorded to be in use mostly by the local people. These fishes are mostly hill stream fishes but some are found in riverine habitats.

Effort has been made to identify all the fishes used as medicine and to record their common vernacular names along with scientific names. Mode of treatment, frequency of use and possible cure also has been recorded. Though traditional in nature, these treatments are believed to produce miraculous healings and cure many known ailments such as general weakness of the body, sores, rashes and wounds.

Introduction

Ethno-zoology generally refers to the traditional practice of treating diseases using animals and animal product, followed by ethnic tribal and aboriginal people. Ethno-zoology focuses at direct relationship of animals to mankind. Some workers have defined the term ethno zoology as a branch of science that deals with the role of economically important animals in life and socio-cultural aspects of tribal or aboriginal people. The most important aspect in this context ramifies on the traditional mode of treatments of various kinds of ailments using animal and/ or animal product in a tribal community.

Fauna based traditional knowledge of curing various diseases by Naga tribes is a continuous practice followed largely by the tribes dwelling in remote hilly belts of the state. This traditional knowledge are passed on from generation to generation. Some of this valuable information are lost because the local people do not keep written record and even if they do they are not revealed to outsiders.

The Lotha Naga tribe is one of the major tribe among the Naga community and like other Naga societies many local people still follow traditional method of curing many known ailments using animals and/ or animal products. Fish forms an important diet among the Lothas and many of them are considered medicinal and are used in treating ailments such as fever, general weakness of the body, rashes, etc.

Although inadequate, attempts have been made to elucidate the medicinal significance of the fishes used for medicinal purpose among the Lotha community.

Review of literature

The first report of work done on ethnobiology amongst the Naga community was by Jamir and Rao (1982a) dealing with medicinal plants of Nagaland. Jamir and Rao (1982b) recorded 54 medicinal plants reported to be in useby the Nagas. Jamir (1997 and 1999) made pioneering studies ethno-botany among the Nagas. Previous work on the traditional method of curing diseases using animals and animal product among the Nagas was first reported for the Chakesang tribe of Phek district, Nagaland by Kakati and Doulo (2002). Jamir

and Lal (2005) reported on the ethno-zoological practices amongst the 14 different tribes of Nagaland- Angami, Ao, Chakesang, Chang, Konyak, Khianmiungan, Lotha, Phom, Pochury, Rengma, Sangtam, Sumi, Yimchunger and Zeliang.

Brief description of the study area

Wokha district of Nagaland is situated on the western side of the state and is bounded by Mokokchung on the north, Kohima on the south, Zunheboto on the east and Assam on the west.

Altitude: 1313.69m MSL
Latitude: 25°55′-26°35′N ; Longitude: 94°10′-94°25′E
Highest peak: Mt.Tiyi at an elevation of 1969m MSL
Major river: Doyang river

Wokha district is divided into two regions, demarcated by the Doyang river-
1.Northern part called Lio Wokha; 2.Southern part called Nrung Wokha

Nrung Wokha is all hilly with cool and moderate climate; temperature rarely exceeds 28°C. Mt.Tiyi is situated in Nrung region. Lio Wokha is less hilly with low lying areas, plains and valleys. Climate is hot and humid and temperature sometimes exceeds 33°C. Lio shares its border with Assam.

Methodology

The information presented here is based on data collected from different villages through interview of the local people and by distributing questionnaires.

Villages surveyed

1. Akuk village
2. Elumyo village
3. Humtso village
4. Wokha village
5. Wokha town rural areas

The data collected is presented in the following tables (Table 1 and Table 2). Names are given in scientific, common English and vernacular names. Taxonomic identification of the fishes was done with the help of existing literatures (Talwar & Jhingran,1991; Jayaram, 1999; Vishwanath, 2002; www.fishbase.org, 2007; www.aquabase.org, 2007).

Findings are summarized below:

Table 1: Systematic list of fishes along with English names and local names

Scientific name	English name	Local name	Habitat
Order: Cypriniformes			
Family: Balitoridae			
Sub family: Nemacheilinae			
1. Schistura sp 1		Tseru	Hill stream
2. Schistura sp 2		Rhudong	Hill stream
Order: Siluriformes			
Family: Amblycipitidae			
3. Amblyceps apangi (Nath&Dey, 1989)	Indian catfish	Ngomen	Hill stream
Family: Claridae			
4. Clarius batrachus (Linnaeus, 1758)	Catfish	Magur	River
Family: Heteropneustidae			
5. Heteropneustes fossilis (Bloch)	Stinging catfish	Singhi	River
Order: Channiformes			
Sub order: Channoidei			
Family: Channidae			
6. Channa orientalis (Bloch-Schneider, 1801)	Snakehead	Nyiyum	
7. Channa punctatus (Bloch)	Snakehead	Nyiyum	River and pond
8. Channa marulius (Hamilton-Buchanan, 1822)	Snakehead	Nyiyum	River and pond
9. Channa stewartii (Playfair)	Snakehead	Nyiyum	Hill stream

Order: Synbranchiformes
Family: Synbranchidae

10. Monopterus cuchia (Hamilton-Buchanan, 1822)	Eel	Khongshia River
11. Monopterus albus (Zuiew)	Eel	Khongshia River

Table 2: Showing mode of use and mode of treatment

Scientific names	Mode of use	Mode of treatment	Remarks
1. *Schistura* sp 1	Fish sprinkled with salt, wrapped with banana leaf and roasted over fire.	Given to patients suffering from rashes, measles, sores on lips, tongue, etc.	Frequently used for treatment of the sai ailments; known on to locals of Wokha village; reported to be very effective.
2. *Schistura* sp 2	Mode of use as same as above	Same as above	Frequently used for treatment of the sai ailments; known to locals of Elumyo, Humtso, Wokha village and some residing in rural are of Wokha town.
3. *Amblyceps apangi*	Fish sprinkled with salt, wrapped with banana leaf and roasted over fire or dried over fire and used later	Used in treatment of measles, rashes, sores on lips, tongue, etc.	Frequently used in treatment of rashes and sores; known only to locals of Humtso and Wokha village; reported to be very effective in curing rashes and sores; also relished as a local delicacy.
4. *Clarius batrachus*	Flesh cooked with chilli, tomato, salt and ginger.	For general weakness of the body; given to sick patients who cannot have meat.	Frequently used; known to all; also relished as a delicacy.
5.*Heteropneustes fossilis*	Flesh cooked with chilli, tomato, salt and ginger.	For general weakness of the body; given to sick patients who cannot have meat.	Frequently used; known to all; also relished as a delicacy.
6. *Channa orientalis*	Flesh cooked with chilli, tomato, salt and ginger.	For general weakness of the body; given to sick patients who cannot have meat.	Frequently used; known to all; also relished as a delicacy.
7. *Channa punctatus*	Same as above	Same as above	Same as above

8. *Channa marulius*	Same as above	Same as above	Same as above
9. *Channa stewartii*	Same as above	Same as above	Occasionally used.
10. *Monopterus cuchia*	Fresh blood extracted; flesh cooked with chilli, tomato, salt and ginger.	Fresh blood given to drink to cure general weakness and anaemia; cooked flesh given to sick patients to cure general weakness of the body.	Frequently used to treat anaemia and sickness; given to those patients who cannot eat meat; known to all people
11. *Monopterus albus*	Same as above	Same as above	Same as above

Discussion

Although based only on few numbers of fish species, the present study reveals that these fish species used by the local might serve as potential source in curing a wide spectrum of ailments. Though traditional in nature, they are believed to produce miraculous healings and in relieving both common and severe kinds of ailments. Some fishes mentioned above such as *Clarius batrachus, Heteropneustes fossilis, Monopterus cuchia* and the fishes belonging to *Channa* group are known to all people, villagers and townfolks. They are usually sold in the market and their medicinal values are known to all. Fishes such as *Amblyceps apangi* and *Schistura* sp 1 & 2 are rare and not sold in the market. There are found only in the hill streams in remote areas and their medicinal values are known only to few people (villagers of Elumyo, Humtso and Wokha village). It was noteworthy to observe that some of the treatments particularly those related to treatment of rashes, sores and measles work miraculously but this however remains to be established as to what ingredients in the animal provide relief in curing the disease. The most appalling feature noticed during the study was the over exploitation of the fishes by the people, not for medicinal purpose but for satisfying their greed for the delicious flesh. This has posed a big threat to the existence of many rare hill stream fishes such as *Amblyceps apangi, Schistura sp., Channa stewartii*, etc.

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