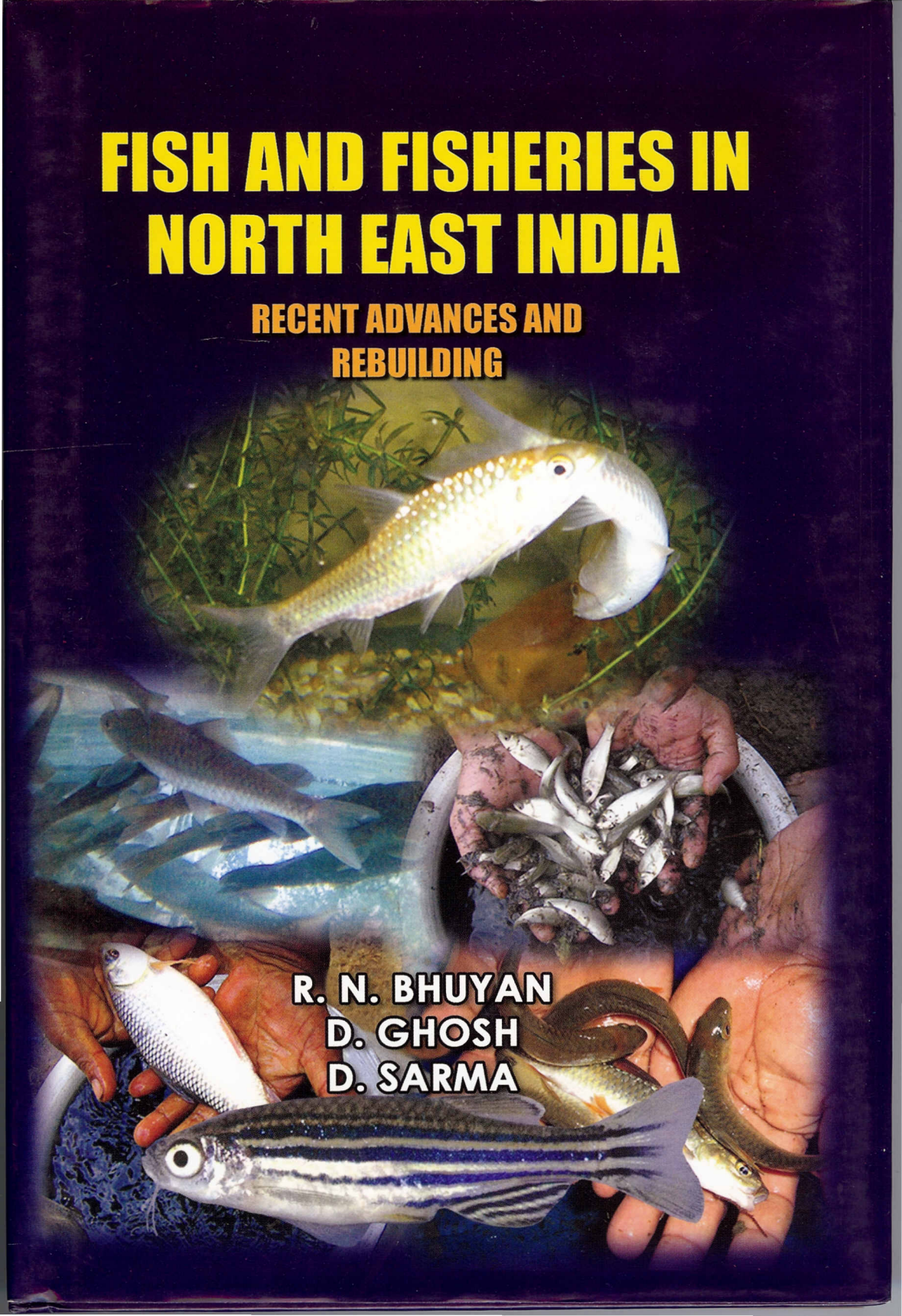


FISH AND FISHERIES IN NORTH EAST INDIA

**RECENT ADVANCES AND
REBUILDING**



**R. N. BHUYAN
D. GHOSH
D. SARMA**

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Editors

R.N. BHUYAN

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FOREWORD

The book “*Fish And Fisheries In North East India, Recent Advances & Rebuilding*” collection of scholarly papers edited by Dr. R. N. Bhuyan, Dr. D. Ghosh and Dr. Sarma, is the result of the hard work of the learned scientists who shared their knowledge in the seminar organised by the *Department of Pisciculture of St. Anthony's College*. The suggestions and findings of the Seminar which are the results of sharing and discussion on the researches of the scientists who have done a lot of surveys, experiments, thinking, coupled with their innovative initiative are of immense value. I am sure that the book will be a treasure for all scholars and lay persons, students and farmers.

One aspects of the book, which can be easily seen, is the application possibility. The gems of knowledge are not and will not be confined only to the library but they will be translated into practical realities. It is clear examples of the possibility of fast transformation and application of scientific findings. Even a lay person can see that it is possible to journey “*from idea to reality, from theory to practice, from seminar to the fields, from paper to farm tools.*”

I congratulate the *Department of Pisciculture, St. Anthony's College*, for publishing the book. I thank the scientist and scholars for their contributions. I thank North Eastern Council for financial support.

God bless

24.06.2008

Fr. I. Warpakma SDB
Principal
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PREFACE

The importance of freshwater aquaculture has assumed the status of a fast expanding industry not only in India, but also in several Asiatic Countries over the recent years. Various research organizations and NGOs have contributed to a great extent to this development process, blending the traditional practices with scientific data bases and techniques. In recent years, however, the main problem faced by the fisheries sector is not the culture of fishes for food purposes, but the destruction of the natural ecosystems and thereby loss of precious gene pool. In this context it may be mentioned that the North Eastern States of the country have a unique ecology and is considered as one of the mega biodiversity hot spots of the world, for both flora and fauna, among which fishes have an important place. The North Eastern States of India have bountiful aquatic resources like many species of indigenous ornamental fishes and game fishes especially the Chocolate Mahseer.

In recent years the country has been witnessing a great spurt in research activities in different disciplines of the fisheries sector. There is need for documentations of these new developments and recent advances that have taken place in the fisheries sector, particularly in North Eastern India. It is with this view that the Department of Pisciculture had organized a National Seminar on "Recent Advances and Rebuilding of Fish and Fisheries in North East India" to bring together all the researchers, NGOs, Institutes working in different fields and establish close linkage and exchange methodologies and other recent developments made so far in the country, particularly in N E region. The objective of this seminar

was a comprehensive documentation of recent fishery technology, conservation and sustainable use of resources available, which is yet to be carried out for the development and food security of the region in particular, and the country in general. Secondly, it was felt that the seminar would open new avenues to needy fisheries entrepreneurs and educate rural fish farmers on the recent technologies involved in fish culture, breeding and training so that more and more people can start fish culture as their vocation and join the blue revolution of the country. We hoped that the seminar would also identify the scientists working for the development of fisheries in the region and form a common platform for the further development of the fisheries sector.

The North-Eastern part of India, comprising of seven sisters and one brother, is a part of Eastern Himalayan region and is one of the global hotspots for flora and fauna biodiversity. Each state 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.

The seminar was inaugurated by Smti. M.K.H. Marak, Secretary, Fisheries, Government of Meghalaya and attended by many other dignitaries including Principals of different colleges of Meghalaya. The seminar was a great success with more than eighty participants taking part in the deliberations. The papers presented in the seminar were discussed in four different sessions and there

were two theme papers in each session presented by distinguished scientists in each field. At the end of the deliberations in the technical sessions, there was a panel discussions and a 12 (Twelve) point recommendations are presented for reference in research and development of the aquaculture, implementation of recent advances in the field and conservation of threatened fish species from the NE Region of India. The valedictory function of the seminar was graced as Chief Guest by Mr. P. Kharkongor, Commissioner of Fisheries, Government of Meghalaya.

Admittedly, bringing out of the proceedings has been delayed, as great efforts had to be made get the contributed papers and regrettably some papers have been omitted and some could not be collected.

We hope, the proceedings 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.

We take this opportunity to thank NEC for their sponsorship without which it would not have been possible to organize this important event. We wish to place on record our appreciation to the Principal and Vice-Principal of St. Anthony's College, Shillong and the national advisory committee as well as others who directly or in any other way helped to make the seminar a success.

**R. N. Bhuyan
Devjani Ghosh
Debajit Sarma**

Induced Breeding of the Endangered Chocolate Mahseer, *Neolissocheilus* *hexagonolepis* (McClelland) with Ovaprim

Th. Nilachandra Singh and B. B. P. Gupta

Abstract

Chocolate Mahseer, *Neolissocheilus hexagonolepis* is one of the endangered species of Mahseer group. In order to induce breed them under captive conditions, brooders were maintained in pond condition with compounded feed. The females were injected with only two doses of ovaprim before stripping. Mature males and ovaprim injected females were stripped simultaneously for artificial fertilization of eggs in dry condition. Fertilized eggs were incubated in a tray with spring water. Aeration of water during incubation was provided continuously till hatching using an aerator. Hatching of the eggs started after 88 hours of incubation, and completed within 96 hours. The hatchlings were fed with plankton. The temperature of water during incubation ranged between 22° C and 24° C and pH between 5.8 and 6. Dissolved oxygen level ranged between 6 and 8 mg/l. Hatching rate was 30% and survival rate of fry was 71%.

Introduction

Chocolate mahseer, *Neolissocheilus hexagonolepis* is one of the endemic fishes of northeastern region of India. It has been reported from Meghalaya, Assam, Arunachal Pradesh, Sikkim, Manipur,

Nagaland, Mizoram and Tripura (Nath and Dey, 1990; Sen, 1995, Vishwanath, 2002). This fish is a native of many neighboring countries viz. Nepal, Bangladesh, Myanmar (Burma), Thailand, Malaya, Sumatra and Vietnam (Jayaram, 1981; Sen, 2000). Chocolate mahseer is an endangered species of Mahseer group which is commercially important. It has enormous culture potential in captivity and has high market value as well for its good taste. This fish is a game fish because of its tremendous size and strength. It grows 6 ft in length and 28 kg in weight (Marwein, 2000). In Meghalaya some fish farmers are trying to culture chocolate mahseer in their ponds as a means of earning by organizing fishing competition and selling the fish in the market. For this purpose, the farmers collect the fingerlings of the chocolate mahseer from local rivers with great difficulties. This fish is also cultured in the terraced ponds of Darjeeling and Kalimpong hills, which is locally known as 'Johra' fishery (Singh and Raina, 2005). A large number of fingerlings of chocolate mahseer can be produced using induced breeding techniques for encouraging chocolate mahseer farming in the rural areas of the northeast region.

Induced breeding technique has been successfully utilized for conservation and commercial exploitation of some other mahseer species (e.g. *Tor putitora*, *Tor tor*, etc.) in the states of Maharashtra, Uttar Pradesh, Uttaranchal, Himachal Pradesh etc. The spawning behavior of the mahseer, *Tor putitora* and *Tor tor* has been studied by several investigators (Desai, 1973; Singh et al, 1985). Induced breeding of the golden mahseer, *Tor putitora* has been optimized at Bhimtal (Uttaranchal) (Tripathi, 1972; Joshi, 1982) and Lonavla (Maharashtra) (Ogale, 1997). Attempts have also been made earlier to study the reproductive physiology of the chocolate mahseer. Langdale-Smith (1944) made one of the earliest documented observations on the reproductive ecology of chocolate mahseer. Attempts were also made to collect and incubate the fertilized eggs of the mahseer to study the embryonic development (Ahmed, 1948). Morphometric and meristic characters, sexual maturity, spawning and fecundity of the chocolate mahseer have been studied in Pagladia river of Assam, Simsang river and Umiam lake of Meghalaya (Dasgupta, 1982; Lyngdoh, 1996) as well as in the

Indrasarobar reservoir and the Tadi river of Nepal (Swar and Craig, 1994). Unsuccessful attempts were also made for induced breeding by stripping eggs from mature chocolate mahseer captured from Trishuli river of Central Nepal (Rai, 1978). This paper focuses on the success of the induced breeding of the endangered chocolate mahseer with ovaprim in captivity.

Materials and Methods

Chocolate mahseer used for the experiment of induced breeding were collected from the Umiam river and other rivers of Meghalaya during dry seasons (November to March). The size of the fishes ranged from 150g to 400g. The fishes were stocked at the density of 1500/ha under monoculture in two ponds located in the Permanent Campus of North-Eastern Hill University (*Latitude: 25° 36' 53" N; Longitude: 91° 54' 30.1" E; Altitude: 1401 m above MSL*). The sizes of the ponds were 24 x 17 m² and 19x10 m², respectively. The ponds received water from a spring. The water temperature of the ponds ranged between 10° C and 27° C, dissolved oxygen level between 6 and 11.5 mg/l, pH between 5.4-6, and conductivity between 12 and 26 is/cm. The water remained mostly transparent during different seasons.

The fishes were fed with compounded feed @ 5% of the body weight. The feed was prepared using groundnut oil cake, rice polish and fish meal in the ratio of 3: 3: 4. The experiment of the induced breeding was undertaken during the months of July to September. Ovaprim was injected in the female brooders twice at the dose of 1 ml/kg of the body weight. The gap between the "primer" and "resolver" injections of Ovaprim was maintained at 16-18 hours. After 24 hours of injection of the "resolver", the female brooders were stripped in dry condition. Simultaneously, milt from the mature males was poured on the eggs and they were mixed thoroughly with a feather. The excess milt was removed by washing with water. In the stripping process the male and female brooders ratio was 3:1. The eggs were incubated in polypropylene tray after completion of water hardening. Aeration of the water during incubation was done with the help of an aerator, and the water used for incubation was changed everyday. The temperature

of the water was maintained between 22° C and 24° C; pH from 5.8 - 6 and dissolved oxygen level from 6 - 8 mg/l.

Result

During the study, the chocolate mahseer survived well and could be maintained successfully by feeding compounded feed composed of rice polish, groundnut oil cake and fish meal. The fishes responded effectively to the artificial feed throughout the year except during winter (from the second week of November to February), when they remained inactive hiding under the aquatic plants, and rarely responded to feeding. The favorable and convenient timing for induced breeding of chocolate mahseer in captivity was found between July and the first half of September. The fecundity of pond-raised chocolate mahseer was found to be very low. It was only 3285 eggs/kg of the body weight. The colour of the egg of this fish was lemon yellow. The size of the egg ranged from 2.6 to 2.8 mm. After water hardening, egg size was 3 mm. Thus, the size of the egg remained more or less similar before and after water hardening. The eggs which were likely to hatch were pale yellowish. The new hatchlings are golden yellow in colour. The twisting movement of developing embryos started after incubation of 42 hours. Hatching started after 88 hours of incubation and it was completed within 96 hours. Only 30% of the hatching rate was recorded, while the survival rate of the fry was 71%. After 3rd day of hatching, the golden colour of the fry started disappearing. The yolk sac was completely absorbed within 10 days, and the fry started feeding on planktons.

Discussion

Our studies suggest that like other species of mahseer (e.g. *Tor putitora*, *Tor tor*, *Tor khudree* etc.) the chocolate mahseer, *Neolissocheilus hexagonolepis* can also be cultured successfully in small water bodies like ponds and lakes. Further, it can be successfully maintained on a diet of compounded feed. We have observed that some of the fish farmers feed the fish with green leafy vegetables such as cabbage, cauliflower leaf, turnip and radish leaves in addition to the

compounded feed. In our experimental ponds, the fish density was low and the fishes hardly responded to the artificial feeding during the winter months (water temperature range: 10° C – 14° C). These observations indicate that the fish chocolate mahseer can be maintained successfully at higher altitudes in the hilly areas of the northeast, and hence can be successfully exploited for cold water fish farming, angling and eco-tourism in the rural areas of the region.

The chocolate mahseer has been reported to breed in its natural habitats in the northeastern Himalayas during May - June and August - September (Marwein, 2000). At lower altitudes (Pagladia river and Simsang river), this fish breeds in April/May and October/ November (Dasgupta, 1982). Under captivity the optimum period for induced breeding of chocolate mahseer was observed only once in a year (i.e., from July to the second week of September). It is mainly due to the delay in gonad maturation of the female brooders maintained under captivity. Unlike females, the male brooders started producing milt in the month of April and it continued up to October, when slight pressure on the abdomen resulted in oozing of milt. Our observations indicate that the fecundity of chocolate mahseer under captivity is low (3285 eggs/kg of the body weight). The number of maturing (stage IV) and mature (stage V and stage VI) ova of 1-1.5kg female under natural habitat has been reported to range from 4500 to 9000 (Dasgupta, 1988).

To the best of our knowledge, this is the first report on successful induction of breeding in endangered chocolate mahseer involving the use of Ovaprim. The successful Ovaprim-induced breeding of the fish seems to be a breakthrough for artificial propagation and conservation of the chocolate mahseer to save it from extinction as well as for its commercial exploitation on large scale for high altitude fish farming and eco-tourism-related angling activities. In fact, further development and optimization of induced breeding can be of great help in promoting farming of chocolate mahseer in the ponds of local fish farmers in the rural and hilly areas of the region to improve their socio-economic conditions. Induced breeding of the fish will also be helpful in stocking this fish in the reservoirs and natural water bodies. Promotion of

chocolate mahseer farming using induced breeding technique will also help in increasing its declining population in the wild and in developing eco-tourism, which will be an additional source of income in the beautiful rural and hilly areas of the North-Eastern region.

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