

AQUACULTURE INDICES OF DECCAN MAHSEER, *TOR KHUDREE* TRANSPLANTED TO THE LOW LANDS OF KERALA WHILE STOCKED WITH INDIAN MAJOR CARPS

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Abstract: The Deccan Mahseer, *Tor khudree* is an important sport and food fish distributed in the rivers of the Western Ghats. In Kerala, the species is reported from 14 river systems with varied population status. Since the species is mostly restricted to the up-stream mountain regions of the river systems, it is mainly caught and consumed by the tribes occupying the forest. As the Mahseer landings are negligible and uncertain, there is no organized marketing system. Though, it has been widely recognized as a food fish of high consumer preference, fetching almost three times higher price than that of Indian Major Carps, its culture has not been picked up commercially due to unavailability of seeds and the reported low growth rate of the species. Since *Tor khudree* is essentially a 'high lander', there has been uncertainty whether it could be cultured in the pond system of the plains and could be successfully adopted by the farmers. An experiment was conducted to evaluate the potential of the species to thrive in the ponds of the plains under culture conditions along with cultivable carps using seeds collected from the River Chalakudy. This is the first aquaculture trial of Mahseer done in the State of Kerala. The trial was carried out in the Instructional Farm of the College of Fisheries, Kochi. Twenty fingerlings of *Tor khudree*, 30 nos. each of *Catla catla* and *Labeo rohita* and 20 nos. of *Cirrhinus mrigala* were stocked in a pond of 200m². The fishes were fed with formulated feed twice a day for 3 months and later with commercial carp feed. The percentage survival and specific growth of the fish were recorded for a period of two years in the trial.

INTRODUCTION

Even from nineteenth century, Mahseer (Genus *Tor*) had been identified as an ideal candidate species for aquaculture not only because of its sporting quality but also for the excellence of the flavour of its flesh. David (1953) indicated the possibility of culturing *Tor mosal mahanadicus* recording a growth of 170 - 200 mm in four months. But, no attempts were reported on the culture of the group for the next two and a half decades, the major constraint encountered might have been the non availability of the stocking material. There has been an apprehension that these fishes could be reared only in cold waters which was contradicted by Karamchandani (1972). He concluded that though *Tor khudree* is an inhabitant of hill

streams, it thrives well in waters with high temperature ranges also. Badapanda and Mishra (1992) have reported the transplantation of *T. khudree* to Sonapur, Orissa during 1987 for a culture trial. Kulkarni (1971) highlighted the value of Mahseer in pisciculture and conducted pioneering attempts in the commercial seed production of the group while National Bureau of Fish Genetic Resources (NBFGR) has identified *T. khudree* as a potential cultivable species. The constraints identified have been the lack of standardized seed production technique, dearth of information on the biology especially on the reproduction as well as scarcity of spawners and seed. Now, the technical knowhow are available on breeding and larval rearing of many species of Mahseer and it has been prioritized as a group not only for aquaculture but also for ranching. The Copper Mahseer is reported to be suitable for culture in ponds and is used for stocking in Tamil Nadu (Pisolkar, 2000). Since *T. khudree* generally shows a slow growth in the ponds and reservoirs, its culture trials were carried out in floating cages in open waters by Kohli *et al.* (2002). Raina *et al.* (1999) grew *T. putitora* in manured ponds, for a year, with artificial supplementary feed and obtained a survival rate of 55%. Islam and Tanaka (2004) after conducting pond culture trials it was concluded that *Tor putitora* is a highly promising indigenous species for commercial aquaculture and the fish performs well if proper dietary conditions are provided. Ogale (2002) reported that in Village ponds near Lonavala, Maharashtra *T. khudree* has grown between 600-900g in one year and in Bhatnagar reservoir near Pune the fish has been reported to have grown even faster. From the above account, it is quite clear that there have been very few attempts for assessing the aquaculture potential of the different Mahseer species in India. Other than the NRCCF and College of Fisheries, Mangalore no research organizations have come up with encouraging results on Mahseer culture. Since the freshwater aquaculture sector of the country has been mainly revolving around the Indian major carps and the Chinese carps since its initial days, the other endemic fishes especially the Mahseers had not received due attention in the aquaculture scenario. Illegal introduction of exotics like African cat fish must also have played a significant role at this context. Naturally, the higher production rates of exotics might have more intensely attracted the farmers abandoning the efforts on endemic fish culture. So, the need of the hour is to take up aquaculture programmes of different endemics like Mahseer in pond environment and popularize their culture for the sustainable development of aquaculture and effective conservation of the endemic species.

The current study was undertaken with the following objectives:

1. To understand whether *Tor khudree* could be transplanted to the plains for culture

2. To analyze the growth rate and % survival of the species in ponds
3. To compare the performance of the species with Indian Major Carps.

METHODOLOGY

Since *Tor khudree* is basically an inhabitant of the up-stream riverine habitats, there has been uncertainty that whether it could be cultured in the pond system of the plains along with other carps. So, an experiment was conducted to evaluate the potential of *Tor khudree* to thrive in the ponds of the plains under culture conditions with other cultivable carps. The culture trial was carried out in the Instructional Farm of College of Fisheries, Kochi, Kerala, India. 20 fingerlings collected from the river were stocked along with the Indian Major Carps in a pond of area 200m². The percentage survival and growth of the fish were recorded for a period of two years.

Experimental animals

Nearly 100 Mahseer fingerlings were collected from Peringalkuthu region of Chalakudy river using a surf net. 30 fishes with uniform size and weight were segregated from the lot and the others were released back. They were oxygen packed in two PE bags and brought to the College and reared in a 10t round FRP tank for 3 days. The fishes were fed with powdered carp feed during the period. 20 fishes selected from the lot with an average length of 11.5 cm (av. weight-18.5g) were used for the study.

Experimental pond

The fingerlings were stocked in a well prepared freshwater pond after ensuring that they take feed normally and are healthy. The pond was earlier manured with 12 kg cow dung and fertilized with 2kg super phosphate and 1 kg urea to develop natural food in the pond. 15 kg lime was applied to maintain the water pH at 7.5. The average depth of water in the pond was 1.2 m. The pond was fertilized and limed periodically during the culture period.

Feed

For feeding, a formulated pellet feed was used in the experiment for the first three months and a commercial carp feed (24% protein) later.

Feed ingredients

The necessary ingredients *viz.* clam meat, tapioca and GOC were purchased from the local market and powdered after sufficient drying. They were then passed through a 50 micron sieve and stored in air tight plastic containers for use.

Proximate composition of feed ingredients

Proximate composition of all the feed ingredients except the vitamin mixture and the mineral mix was analyzed prior to feed formulation. Estimation of the moisture level was done by Boyd's (1979) method. The crude protein content was estimated by Microkjeldahl's method (AOAC, 1990). The nitrogen content was then multiplied by the factor 6.25 to arrive at the crude protein content. Crude fat was extracted using petroleum ether (B.P. 40-60° C) in a Soxhlet extraction apparatus for 16 hours. Method of Pearson (1977) was used to estimate the crude fibre. The ash content was estimated by burning the sample at 550°C± 10°C for 6 hours in a muffle furnace. The carbohydrate content was found by Hasting's (1979) difference method as Nitrogen Free Extract, using the formula,

$$\text{NFE} = (100 - \% \text{crude protein on dry weight basis} + \% \text{crude fat on dry weight basis} + \% \text{crude fibre on dry weight basis} + \% \text{ash})$$

Formulation and preparation of feed

The feed was formulated by keeping its protein level constant at 30%. The proportion of various ingredients used for the formulation of the feed is given in Table 1.

Table 1. Proportion of various ingredients used for the formulation of the feed

Ingredients	Weight (g/100g feed)
Clam meat	56
G.O.C.	39
Tapioca powder	5

The ingredients (except vitamin mix and mineral mix) for the feed were mixed thoroughly and the mixture then mechanically kneaded using water (1:1.25 W/V) to get a soft dough. It was cooked in a pressure cooker for 30 minutes, cooled and then the vitamin mixture to a level of 1.5 % and the mineral mixture to a level of 0.05 % were added. The dough was again mixed thoroughly and then pelletized and dried in the sun light until the moisture content was reduced to less than 8%.

Stocking

Along with Mahseer, 30 catla, 30 rohu and 20 mrigal were also stocked in the pond for making the SD of 5000/ha. The age of *Tor khudree* was assumed as 150 days and Indian Major Carps as 90 days.

Feeding

The animals were fed with formulated feed twice a day for three months and later on shifted to carp feed.

Water quality management

Water temperature of the pond was monitored daily in morning and evening hours using a mercury thermometer of accuracy 0.1°C. The pH of the water was measured once in a day with Universal indicator solution. Other water quality parameters were determined by using standard methods.

Sampling

Sampling was carried out after a period of 6 months with a cast net to determine whether the Mahseer can survive in the culture condition. In the first haul itself 3nos. of Mahseer were caught along with 8 other carps. Further samplings were done on a monthly basis.

Recording of observation

The observations were recorded accurately. The survival rate, specific growth rate (SGR) and normalized biomass index (NBI) were determined as follows:

Survival rate

$$\% \text{ survival} = \frac{\text{Initial number} - \text{final number}}{\text{Initial number}} \times 100$$

Specific growth rate (SGR)

$$\text{SGR} = \frac{\log_e W_2 - \log_e W_1}{t_2 - t_1} \times 100$$

where, W_1 =weight at time t_1 ; W_2 =weight at time t_2 .

It gives the average percentage increase in body weight per day of fish over the experimental period.

Normalized biomass index (NBI)

$$\text{NBI} = \frac{(W_f \times N_f) - (W_i \times N_i)}{100}$$

W_f = Final av. weight in g

N_f = Final number

W_i = Initial av. weight in g

N_i = Initial number

FINDINGS AND DISCUSSION

The culture trial carried out in the Instructional Farm of the College has proved beyond doubt that the *Tor khudree* which is basically a fish of the up- streams can survive well even in the ponds of the plains which shows a bright future for its culture for sport and food. At the same time, it has to be accepted that the growth rate of the species is slower compared to the cultivable carps of India. The results of the above trial are discussed below.

Proximate composition of the ingredients and feed

Feed ingredients

Proximate composition of ingredients used in the formulation of the feed on dry weight basis is given in Table.2.

Table 2. Proximate composition of ingredients used in the formulation of the feed on dry weight basis

Ingredients	Crude protein %	Fat %	Ash %	Fibre %	NFE %
Clam meat	55.84	10.57	8.72	2.95	21.91
G.O.C.	35.62	7.78	6.42	3.92	46.16
Tapioca	7.67	0.99	6.14	2.39	82.81

Feeds

The proximate compositions of the two feeds are given in Table 3. No significant loss of nutrients was observed in the feed even after the storage of 3 months.

Table 3. Proximate composition of the feed

Contents	Formulated feed (%)	Carp feed (%)
Crude protein	30.29	24.05
Fat	14.97	11.85
Carbohydrate	36.55	43.23
Crude fibre	4.15	5.21
Ash	7.64	8.67
Moisture	8.4	6.99

Water quality management

Temperature

The water temperature ranged from 23.1 to 30.8°C during the culture period.

pH

The pH of the water fluctuated from 6.5 to 9 during the experiment.

Dissolved oxygen

The dissolved oxygen content of water varied from 4.7 to 8.15 ppm.

Total hardness

Total hardness of water recorded was between 60 to 120 ppm.

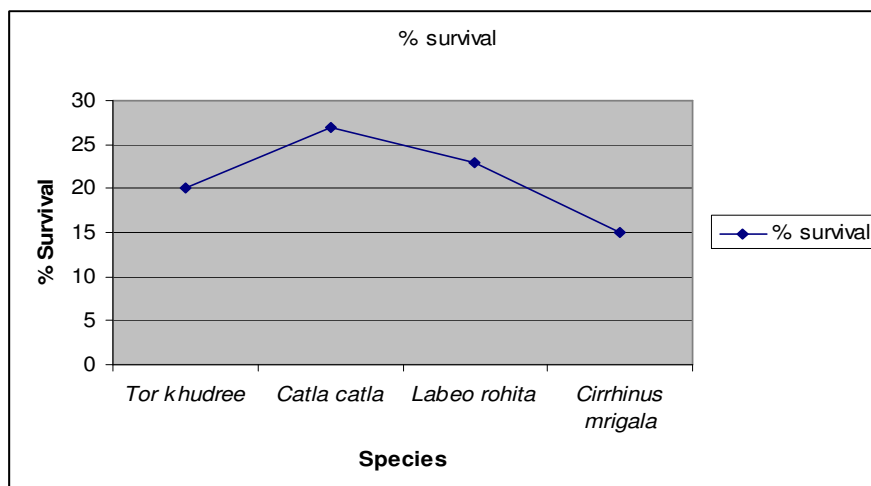
Ammonia

The ammonia content of water varied from 0.24 to 0.44 ppm.

Percentage survival

The percentage survival of the fishes in the pond is depicted in Figure 1.

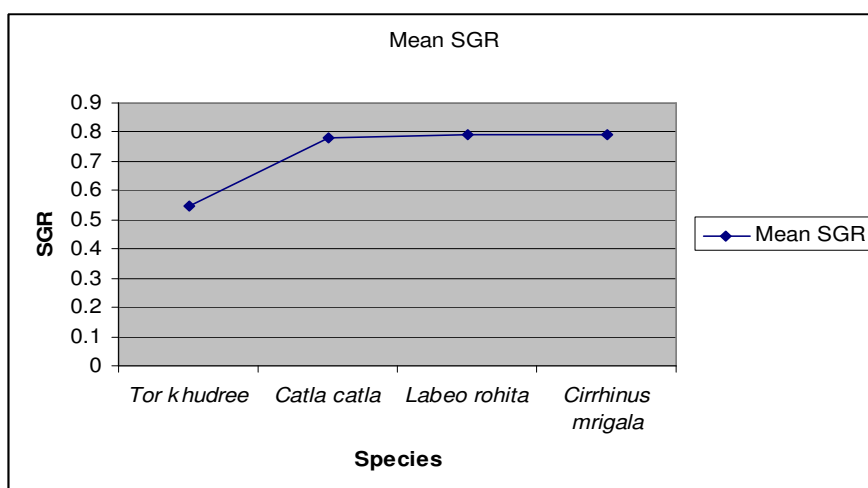
Figure 1. Percentage survival of the fishes in the pond



Specific growth rate

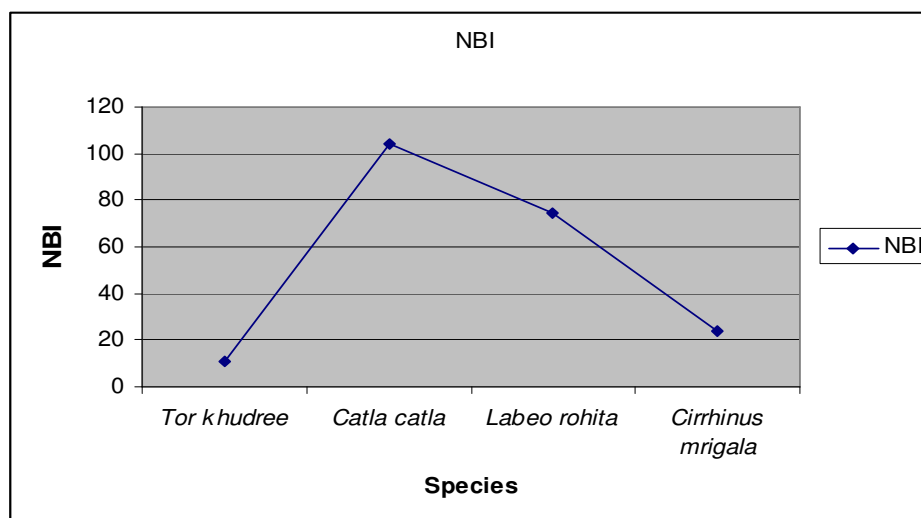
The mean specific growth rates of the fishes are depicted in Figure 2.

Figure 2. Mean specific growth rates of the fishes



Normalized biomass index

The NBI which gives the combined effect of survival rate and growth of the fishes is depicted in Figure 3.

Figure 3. Normalized Biomass Index**CONCLUSION**

The experiment clearly indicated that the percentage survival of the fish was comparable to the values obtained for the Indian major carps. The lowest SGR and NBI noticed can be attributed to the slow growth rate of the fish. Almost same pattern of growth rate has been noticed by others in the case of Mahseers (Srikanth, 1986; Keshavanath, 2000; Kohli *et al.*, 2002; Kohli *et al.*, 2005). The exorbitantly high growth rate (600-900g/year) obtained by Ogale (2002) in the village ponds of Maharashtra is interesting which may be further investigated in detail. May the very special water quality parameters and high rate of food availability might have contributed towards such a high rate of growth. There is reasonable scope for Mahseer culture in the low lands of Kerala while the price and sport value of the species are taken into account and so can be well adopted by farmers.

REFERENCES

- [1] AOAC. 1990. Official Methods of Analysis of the Association of Official Analytical Chemists, 15th edition. Merlich, K. (ed.). Association of Official Analytical Chemist INC. Arlington, Virginia, 1298p.
- [2] Badapanda, H.S. and Mishra, S.C. 1992. Observations on rearing of *Tor khudree* (Sykes) at Sonapur, Orissa. Pb. Fish. Bull. Volume XVI (1): 27-29.
- [3] Boyd, C.E. 1979. (ed.) Water quality in warm water ponds. *Agric. Exper. Stn.*, Auburn University, 359p.
- [4] David, A. 1953. Notes on the bionomics and some early stage of the Mahanadi Mahseer. *J. Asia. Soc. Sci.* 19(2): 197-209.

- [5] Hastings, W.H. 1979. Fish nutrition and fish feed manufacture. In: Pillay, T.V.R. and Dill, W.A. (eds.). Fishing News Books Ltd., Farnham, Surrey, England pp. 568-574.
- [6] Islam, S.M and Tanaka, M. 2004. Optimization of dietary protein requirement for pond-reared mahseer, *Tor putitora* Hamilton (Cypriniformes: Cyprinidae). *Aquaculture Research*, 35: 1270-1276. Karamchandani, S.J., 1972. Mahseer- a sport fish of India. In: Central Inland Fisheries Research Institute, Silver Jubilee Souvenir, Barrackpore, India, 132-137.
- [7] Keshavanath, P. 2000. Nutritional studies on Mahseer, *Tor khudree* (Sykes). *Coldwater Fish and Fisheries*: 219-228. (eds. Singh, H.R. and Lakra, W.S.) Narendra Publishing House, New Delhi. 337p.
- [8] Kohli, M.P.S., Ayyappan, S., Ogale, S.N., Langer, R.K., Prakash, C., Dube Kiran, Reddy, A.K., Patel, M.B. and Saharan, N. 2002. Observations on the performance of *Tor khudree* in floating cages in open waters. *Applied Fisheries and Aquaculture*, II (1): 51-57.
- [9] Kohli, M.P.S., Langer, R.K., Ogale, S.N., Prakash, C., Dube Kiran, Chandra Prakash and Reddy, A.K. 2005. Conservation of endangered Mahseer through cage aquaculture in open waters. 178-182. In: (Eds. Mahanta, P.C. and Singh, A.K.) National Symposium on re-assessment of Fish Genetic Resources in India and need to evolve sustainable methodologies for conservation Organized by National Bureau of Fish Genetic Resources, Lucknow, 26 and 27 April 2005.p.190.
- [10] Kulkarni, C.V.1971. Spawning habits, eggs and early development of Deccan Mahseer *Tor khudree* (Sykes). *J. Bombay Nat. Hist. Soc.* 67 (3): 510-521.
- [11] Ogale, S.N. 2002. Mahseer ranching. p. 225-229. In: Riverine and Reservoir Fisheries of India (Boopendranath, M.R., Meenakumari, B., Joseph, J., Sankar, T.V., Pravin, P. and Edwin, L. Eds.) 458 p.
- [12] Pearson, D. 1977. *The Chemical Analysis of Foods*. 7th ed. Chem Publishing Co., New York. 9-11.
- [13] Pisolkar, M.D. 2000. Mahseer fisheries in Maharashtra. In: *Coldwater Fish and Fisheries*: 187-202 (Eds. Singh, H.R. and Lakra, W.S.) Narendra Publishing House, New Delhi. 337 p Raina, H.S., Sunder, S. Joshi, C.B. and Mohan, M. 1999. Himalayan Mahseer. *Bull.1. National Research Centre on Coldwater Fisheries*, Bhimtal, U.P., 29 p.
- [14] Srikanth, G.K. 1986. Growth response of *Tor khudree* (Sykes) to pelleted feeds containing different sources of protein. Thesis submitted to the University of Agricultural Sciences, for the Master Degree, Bangalore. 144p.