MAHSEER CONSERVATION — PROBLEMS AND PROSPECTS[1]

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INTRODUCTION

Mahseer, well known as an anglers' delight, has numerous adjectives to its credit; colourful, fascinating, elegant, noble, aristocratic and prized being some of them. Besides its status as an outstanding Game-Fish, it also finds mention in the Vedas and Smriti, the two epics of Hindu mythology. The Vedas consider it as a privileged fish used by Brahmins to propitiate the souls of their deceased ancestors. A fish so well known for the delicacy and pleasure provided during sport, is now in trouble .

No single cause can account for the current situation, which is an impact of several factors functioning together magnified at one or other stage of its life-history. This paper describes such factors which have been termed as 'Constraints'

Natural Constraints: In the case of the Garhwal Himalayan Mahseer (*Tor putitora*), the phenomenon of migration provides the necessary link between nature's food supply and reproduction and is thus of adaptive signficance. The fish lays its spawn where the young will have ample food, comparatively less danger of being predated upon and overall congenial environment for the eggs and young to survive. A tri-phased migration has been observed in *T. putitora* attributed mainly to maintenance of food supply in nature (Nautiyal and Lal 1984).

The first phase of the migration commences during March - April when the semi adults (which have not yet attained the size- at-first-maturity) alongwith a few broodfish ascend from their feeding grounds in the foothill stretches into the snow-fed tributaries of the Ganga namely the Alaknanda and the Bhagirathi. This is in response to general rise in water temperature of the Ganga from 16°C during December to 20°C during March - April, attributed to melting of snow. The tributaries being comparatively cool during spring (14 - 16° C) provide congenial surroundings for overwintering. As the ice cover continues to recede, a gradual increase in the turbidity is registered which may be considered as a stimulus for their gonads to mature.

The second phase is marked by movement of the brood fish during July to the spawning grounds. The third phase involves descending migration of the pre-recruits alongwith the juveniles and the immature adults (which had ascended with the commencement of the first phase) from their feeding grounds firstly into the 'snow-fed' hillstreams and then into the Ganga. The water temperature starts decreasing during July and the streams get flooded and turbid. Both turbidity and temperature act as stimulus for brooders. The temperature of the spawning grounds ranged from 21°- 25°C.

Mahseer exhibits great diversity in food and feeding habits. They have been reported to be 'Herbivorous' (Desai 1970), 'Herbi- omnivorous' (Das and Pathani 1978), 'Carni-omnivorous' (Badola and Singh 1980), 'Insectivorous' (Khanna and Pant 1964) and 'Carnivorous' (Nautiyal and Lal 1984 a). They may feed extensively on one type of food (monophagic) throughout their life-history or may feed on variety of food (steno - and euryphagic) and exhibit transition from animal to plant matter or vice versa. Interestingly enough the fingerlings of Kumaun Mahseer are zoophagus in nature (Pathani and Joshi 1979) as compared to their adults which switch over to more of a herbivorous diet (Das and Pathani 1978). Contrary to its euryphagic nature the Garhwal Himalayan Mahseer is monophagic, feeding exclusively on insect diet as compared to their fingerlings and fry which subsist on plant matter only. The versatile nature is in response to food available at different times in same as well as different environs. According to a review on Mahseer Fishes of India (Sen and Jayaram 1982) *T. tor* juveniles feed on insects and the adults switch over to herbivorous diet.

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A glance at its feeding ecology reveals that the water temperature and current considerably influence the food habits and supply (Nautiyal and Lal 1985). A temperature range of 12° —27°C prevailing in the spring-fed streams, supporting the juvenile stages, alongwith low to moderate current (0.2426 - 1.4529 m/sec) except monsoon, accounts for flourishing entomofauna. These two factors also exert significant influence on the feeding intensity. The intensity was observed to be maximum when water temperature and current were recorded to be low, 12° - 14°C and 0.2426 - 0.2874 m/sec, respectively. These two alongwith high turbidity act in a complex and thus become inmical to feeding intensity which thereby registers a considerable decline. The fry and fingerlings inspite of high turbidity feed voraciously. Although, water current and temperature regulate the food-supply to a certain extent, turbidity plays a pivotal role in maintaining the supply. The turbidity also governs the feeding intensity and is hence a limiting factor. These factors govern the food habits to a certain extent only.

The quality of food in essential quantity as compared to quantity only has a greater impact on the reproductive activity by significantly influencing the growth rate. Consequently the scarcity of quality food may retard the rate of growth to the extent that it may effect a delay in the attainment of sexual maturity, for in fishes, the latter is associated to size rather than age of the fish (Monastryskii 1940). Putitor Mahseer, being a rheophilic species (in Garhwal Himalaya), attains a large size and faces food problems. In foothill stretches the 'basic food' gets scarce, not because of its density decreasing, but owing to the size of the fish and the volume of food consumed by it which naturally falls short of the required diet. This assumption is supported by the observation that the feeding intensity declines in later stages of life as compared to young stages which feed voraciously (Nautiyal and Lal 1984 a). The impact on the growth rate becomes quite evident from Table 1. During first year the fish attains a length of 162. 58 mm. As the fish grows in size the rate records a decreasing trend from 110.74 to 108.71 mm in second and third years respectively. The feeding intensity was observed to decline after the fish attained a length of 220 mm and age of 1+ (Table 2). the decrease in growth rate is obviously due to decline in the feeding intensity during the second year when the fish is of about 235.5 mm in length.

The Mahseer populations in the various lakes too have suffered a set back due to ever increasing pollution load. The latter naturally hampers both, the feeding and breeding activities. The phenomenon of successful breeding as already mentioned, most essential for the survival, is affected by food habits of the fish and like feeding habits differs in different environs. It spawns once in a year in Garhwal waters (Nautiyal 1984), twice in Himachal (Sehgal *et al.* 1971), thrice in Punjab (Khan 1939) and even throughout the year intermittently in certain reservoirs (Bhatnagar 1964).

Attainment of maturity is the threshold to reproductive capacity and since it is directly associated to attainment of a particular size,

TABLE 1

GROWTH RATES AS EVIDENCED BY BACK—CALCULATED LENGTHS AND EXPECTED WEIGHTS

	1+	2+	3+	4+
Average				
Observed length (mm)	175.50	235.50	355.50	535.50
Back—calculated length (mm)	162.58	273.09	381.80	515.65
Annual Increase				
Length (mm)	81.21	110.74	108.71	133.85
Weight (gms)	234.15	321.10	315.21	359.70

TABLE 2

VARIATIONS IN THE PERCENTAGE FREQUENCY IN THE CONDITION OF FEED FOR DIFFERENT SIZE-GROUPS

Size-groups	State of Intestinal Bulbs (%)						Age-groups
	Empty	Poor	1/4	1/2	3/4	Full	
41—100	5.38	2.15	8.60	20.43	37.63	25.81	0+
101—160	5.48	8.22	16.44	31.51	17.81	20.55	0+
161—220	2.94	17.65	20.59	55.88	20.59	11.77	0+, 1+
221—280	—	50.0	—	30.00	20.00	—	1+, 2+
281—340	33.33	16.66	33.33	16.66	—	—	1+, 2+
341—400	—	66.66	33.33	—	—	—	2+, 3+
401—460	—	50.00	25.00	25.00	—	—	2+, 3+

the growth rate of the species matters much which in turn is governed by the nourishment available. The Kumaun Mahseer has been observed to mature at a size less than half to that of the Garhwal Himalayan Mahseer (Nautiyal 1984). Apparently the size and nature of the water body influences the biota which in turn governs the growth rate and eventually the size-at-first maturity. Various species of Mahseer attain maturity at different lengths in different environs, the Narmada Mahseer at 360 mm (Desai 1973), the Garhwal Himalyan Mahseer at 700 mm (Nautiyal 1984), but none mature at a size smaller than the common carp or other commercially important food fish.

The fecundity of Mahseer as compared to the commercially exploited species, is very low. While the fecundity of the Garhwal Himalyan Mahseer of 780 mm is 26,977, the Narmada, the Deccan and the Kumaun Mahseer have 30,420, 20,000 and 7076 ova for specimens measuring 625 mm, 620 mm and 390 mm respectively (Desai 1973, Kulkarni and Ogale 1978, Pathani 1981). The Narmada Mahseer has 6000 eggs/kg body weight as compared to 2,61,000 eggs/kg body weight of the rohu and 1,33,000 eggs/kg body weight for catla. Evidently the Mahseer have a low reproductive capacity which with the delayed maturity may have impact as far as their survival is concerned.

After spawning the problem of fertilization and survival of the larvae, arises. The Deccan Mahseer has been reported to have a long hatching period of 80 hours and a 6-day semi-quiescent stage which proves to be very disastrous (Kulkarni and Ogale 1978).

Created Constraints: The constraints arising out of the activities of man can be broadly classified into (a) Indirect constraints and (b) Direct constraints. The former category is represented mainly by various hydroelectric projects whereby barriers in the form of weirs and dams are erected across the river, thus blocking the migration passage for ever, besides isolating the population and effecting a change in the riverine ecology which in turn disturbs the food supply as well as the breeding prospects. The fish is essentially a migrant, especially for spawning in warm shallow waters of spring-fed streams and any sort of barrier across the migratory passage will hamper the breeding prospects thus enhancing the possibilities of endangering the species. Use of explosives etc to exploit the fish population leads to mass mortality, resulting in indiscriminate overfishing, thus accounting for the created constraints. The same is being practised in the Indian uplands with great enthusiasm as they have no fear of being punished. Preventive rules, whatsoever, are non-existent in these parts of the country and use of explosives, chemicals etc. goes unchecked. The fishing stress on the population commences from the very moment fish attains an attractive size and that too, quite before it matures sexually. The stress is heavy on the brood fish.

To sum up, unsuccessful breeding is a biological and thus a 'Natural Constraint' which is further magnified by 'created constraints' mentioned above. This has resulted in endangering the Mahseer.

Attempts to rehabilitate the Mahseer: In 1976 the National Commission of Agriculture in its report on *Fisheries* had recommended extensive survey and detailed ecological and biological investigations to save Mahseer from the adverse effects of indiscriminate fishing and river valley projects. As a reaction a few isolated attempts were made to breed the Mahseer, but with limited success (Tripathi 1978, Pathani and Das 1979). So far the only rehabilitation measures on sizable scale have been undertaken by the Tata Electric Companies, Lonavala (Maharashtra) in their Lakes (Kulkarni & Ogale 1978) and by the Wild Life Association of South India and Karnataka Fisheries Department.

The plans to rehabilitate Mahseer can be chalked out only after the factors responsible for the decline are clearly distinguished. Sen and Jayaram (1982) have attributed stock depletion to;

1. Use of explosives. 2. Wanton Killing of brood fish in the spawning season. 3. Ecological changes in the riverine systems of the country and 4. continued constructions of dams and reservoirs on rivers and streams destroying their migratory routes.

These factors can be categorically included under 'Created Constraints', but none except Kulkarni and Ogale (1978) have mentioned 'Natural Constraints'. Similarly the author besides the factors mentioned above, has laid stress on *delayed maturity* in the Garhwal Himalayan Mahseer.

Conservation Measures: Having identified the handicaps, proper measures to rehabilitate the species have to be undertaken. Taking the case of the Garhwal Himalayan Mahseer the first hurdle to be overcome is the delay in the attainment of sexual maturity. If the fish matures at an earlier stage the vulnerability to human assault will be reduced consequently enhancing the chances of successful reproduction.

From the studies conducted on the Kumaun Mahseer (Pathani 1981a & b) it is obvious that sexual maturity in Putitor Mahseer is attained at an early stage in lentic environs i.e. at 300 mm as compared to 700 mm in case of Garhwal Himalayan Mahseer existing in lotic environment. The difference in growth is likely to be due to the lotic and lentic environment. Hence if the fish has to be conserved it has to be propagated in the lentic environment and these water bodies have to be kept safe and human encroachment avoided. Regular monitoring of water quality is also essential.

The Garhwal Himalaya is full of such water bodies which are still virgin and can serve the purpose of conservation. These alongwith the proposed new reservoirs of various hydroelectric and irrigation projects can be conveniently utilized for this purpose. Most important aspect thereafter is the job of the fish culture experts to breed the fish. The fish seed has then to be transferred to various lentic and lotic sites deemed fit for stocking them. I speculate that this target can be achieved within 5 years. Such water bodies at a later stage may be thrown open to enthusiastic anglers. Promoting recreational fishing should be one of the means to achieve success in conservation (Nautiyal and Nautiyal 1982). It will also enable the fish to retain its status of prized Game-Fish.

That a closed season must be promulgated with immediate effect and other conservation measures which can aid in checking the man made problems have been discussed earlier by numerous authors including the present author (Nautiyal and Lal 1982, Nautiyal and Nautiyal 1982 and Nautiyal 1984a). The need for Fish Sanctuaries is obvious.

The cause of Mahseer has to be fostered urgently. It is under active consideration that Mahseer should be declared as an endangered species but declaration of good intention do not solve the problem. Will conservationists help the Mahseer?

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