
**DEVELOPING SPAWNING AND INCUBATION TECHNIQUE FOR MIGRATORY
MAHSEER IN THE HIMALAYAN RIVERS OF NEPAL**

Tej Kumar Shrestha
Department of Zoology
Tribhuvan University
Kirtipur Campus
Kathmandu, Nepal
Phone: 977-1-279748

Abstract

Number of migratory mahseer *Tor putitora* is declining due to over-fishing, environmental pollution and habitat modification due to power dams. For conservation and management of this endangered game fish require special incubation techniques. Technique has been developed for spawning and rearing in natural and artificial substrata and introduction hatchery bred fries into depleted natural population. Fertilized eggs of mahseer up to fry stage has been studied in intergravel water. The field and laboratory results show that there is possibility of augmenting the mahseer population of the migratory mahseer by artificial breeding, releasing and replenishing the depleted stock. The paper also highlights need of developing novel type spawning channel or incubation and incubating facilities for increasing mahseer fry resources for faster propagation.

Introduction

The mahseer (*Tor putitora*) are large endangered cyprinid occurring in the snowfed Himalayan waters of Nepal, Shrestha (1990). The scientific literature of consists only a few fairly rudimentary remarks on natural and artificial breeding and incubation of mahseer eggs. A preliminary study on migration and spawning was furnished by Shrestha (1994). The literature on spawning and incubation of Salmonid eggs is voluminous (Baily and Taylor, 1974 and Bam and Simpson, 1976). But the published information on concerning spawning and incubation of mahseer eggs is scanty because mahseer is vary difficult to breed in captivity and yet no reliable incubation techniques have been developed for faster propagation of this species. In the present paper an attempt is made study incubation success of the mahseer eggs by using different incubating devices in the mountain stream condition of Nepal.

Material and Methods

In the past three years, I have tried to locate natural spawning sites of mahseer around feeder streams of Trisuli (feeder stream creeks such as Tadi, Sindurae, Khahare etc.). However, I found only one spawning site near Gadkhar fish farm at Chokedovan (Fig. 1) which was found to be utilized for spawning year after year. Field observation was carried out from 1993 - 1995 at this site and period and duration of spawning, size and number of individuals in each spawner group were recorded. The water quality and hydro-biological parameters of the study area were

noted. The migrants were also captured to determine their physical conditions and to study spawning behavior in captivity. The propagation of the mahseer is detailed in my previous studies (Shrestha 1990, 1992).

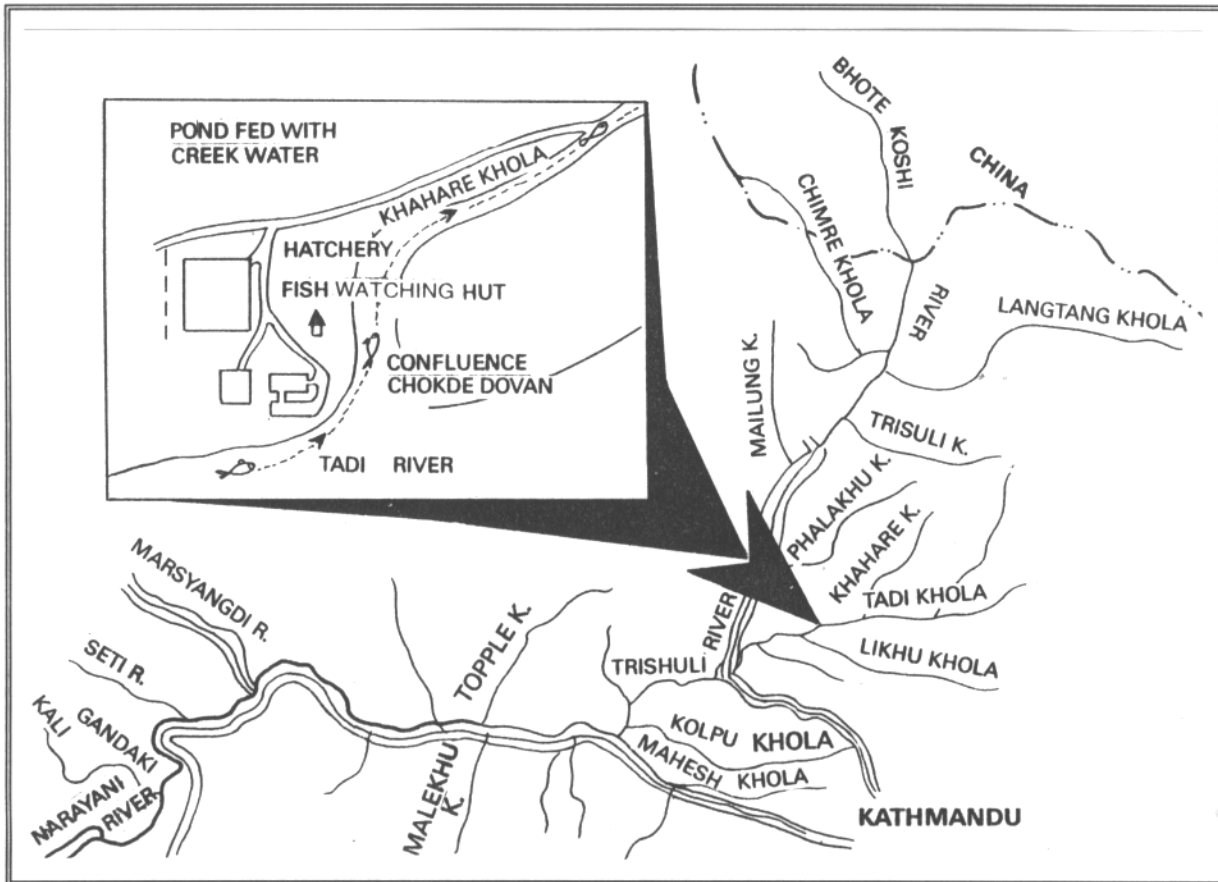


Figure 1. Showing Study Area

Adult mahseers were also trapped from the creeks at night by means of gill nets. They were put in a large cloth tank or happa (size 4X3X2m) for acclimatization. The happas were suspended in the flowing creek water. Inside happa male and female fishes were put in a ratio 3:1 and were administered with carp pituitary extract injection (0.4gm/body weight of fish). Fishes were fed twice daily with rice bran, oil cake etc. Stripped eggs from breeders were fertilized with wet and dry methods and reared in a series of incubators by putting them safely in semi-natural incubating channel.

Observation

Incubation channels were constructed in creek nearby the Gadkhar hatchery where fertilized fish eggs are artificially buried rather allowing the fish to deposit eggs naturally. In the incubation channels fish eggs can be stocked in higher densities. Densities (2000 eyed eggs/ft²) of surface area yield high survival in fry stage. A variety of incubators both wooden or plastic incubators of different sizes were used to incubate mahseer eggs in the incubation channel. Dead eggs were removed or siphoned. The advanced fish fry after hatching drops from the egg incubator and work their way into gravel substrate. Preferred flow mahseers are considered to be 1.0-1.5 cfs. The riverside incubation channel is effective for golden mahseer eggs.

The experimental incubation channels do need sophisticated hatchery operation, simple facilities available near water mill (Ghatta) was used to build incubation facilities 1) Requires less space 2) increases survival of eyed egg and fry over natural production because of

controlled flow and clear water from spawning creek 3) less capital cost. Transfer of Salmonid incubation technology developed in USA found to be useful on mahseer living in ecological condition of mountain rivers of Nepal.

Use of Artificial Incubators for Incubation

A typical incubation channel constructed in Gadkhar at embankment of creek (Khahare Khola) is of 6 ft wide, 50 ft long and 12 inches deep. The gravel size varied 0.5 to 2 inch in size. Fertilized eggs were placed in turf or plastic incubators with small orifice at top for allowing rapid dispersion of swim up fries. The fries development in the gravel substrate and their emergence time was recorded (Table 1, 2 and 3).

The water was supplied to the channel from Gadkhar creek. The silt free spring water was also tried and had been very much successful and insured higher survival than natural water of the river. For incubation, besides plastic incubators and metal or wooden turf incubators having 4 X 4 X 4 ft were used.

An experimental natural spawning channel at the confluence of Tadi river and Khahare Khola (creek) was selected due to optimum gravel bed and water flow condition for spawning and incubation. The gravel size in the creek was 0.5 to 0.6 inches. The gradient of creek was 0.2 to 0.5 percent which promoted good interchange between surface and intergravel water. During the peak spawning season (September) water depth as 1.5 feet was present. To study natural incubation under natural condition freshly fertilized eggs were put into freshly prepared gravel beds with controlled flows of water or regulated flow condition was allowed to run naturally over the spawning assembly of the gravel beds or fertilized egg produced by stripping male and female mahseer is manually buried in an incubation channel. The hatching development and remission of the fry took 240 hrs.

Discussion

On the basis of my field observations in the incubation channel at Gadkhar creek, it was noted that the incubation of mahseer eggs in the creek was always associated with low water level, monsoon rain. Sinha, Jhingran and Ganapati (1974) indicated that no single factor could yet be recognized as the most important for spawning and early development major carp such as mahseer. The present study also suggests many factors as noted to be responsible for the successful spawning, development and incubation are (i) clean and continuous water flow and steady water level, (ii) increasing current velocity. High turbidity (low transparency), (iii) optimum water surface temperature (28 to 30 °C), (iv) high level of dissolved oxygen and conductivity (8 to 10 ppm), (v) slight acidic nature of water, (vi) presence of fine gravel with intergravel flow, oxygen retaining red and particles rich in ferro-magnetic or volcanic ashes protect embryo from infection of parasites. The interaction of all these factors provides unique hydrological conditions at the semi-natural incubation ground which might provide rheotactic effects for effective incubation.

In fish farm of Nepal, mahseer sac fry is prone to infection of molds *Saprolegnia* because sac fry undergo long periods of latency extending from 48 to 92 hrs. In future more effect incubation system suited in the ecological condition of mountain stream to be developed.

Mean incubation periods of fry in the Gadkhar hatchery were estimated at 6 to 8 days. But incubation periods in creek were estimated at 8 to 12 days depending on the temperature of creek water. In creek developmental rate is slower than in hatchery due to lower temperature and intergravel flow.

Table 1
Gravel Incubators Mahseer Eggs Subjected to Incubation at Different Temperature and Velocity

Field Sites	No. of Gravel Incubators	Incubating Temperature °C (Mean)	No. of eggs Incubated	Gravel size (mm) (mean)	Average current velocity m/sec (Mean)	Dissolved Oxygen (ppm)	Time taken for hatching	Time taken for emergence as fry (hrs)	No. of eggs hatched (Mean)
Mouth of creek	5	30	21500	50	1.2	9	48	240	21423
Middle part of creek	5	28	21500	28	0.8	7	60	232	21390
Confluence site of creek and stream	5	22	21500	12	0.0	10	72	215	21218

Table 2
Comparative Chart Showing Incubation Success in Different Incubators

Type of Incubators and Dimension	Gravel Size in Inch	No. of Egg Incubated	No. of Egg Hatched as Sacfry	Hatching Time (hrs)	Hatching Temperature (°C)	Time taken for emergence as fry (hrs)	Dissolved Oxygen (ppm)	Current velocity m/sec
Wooden Incubator	0.5 to 2	2000	1896	72	25	216	10	0.5
Plastic Incubator	0.5 to 2	2000	1843	70	28	210	10	0.5
Turf Incubator	0.5 to 2	2000	1940	72	30	192	10	0.5

Table 3 :- Water Quality of Mahseer Incubation Channel at Gadkhar Creek

Temperature	30 °C
Color	Brown
Visibility (m)	0.36
Compensation depth	0.82
pH	7.6
Oxygen	10.5
Dissolved solids	158.5
Hardness	47.0
Specific conductance	287.0
Chloride	18.5
Sulphate	14.5
Calcium	23.0
Magnesium	2.8
Iron	0.11

References

- Bailey, JE and Taylor, SG 1974. Salmon fry production in a gravel incubator hatchery. Auk Creek, Alaska, 1971-1972. NOAA. Tech. Memo. NMFS, ABFL. 3. 13 p.
- Bams, RA and Simpson, KS 1976. Substrate incubator workshop. Report on current state of Art Fisheries and Marine Service. Environment Canada.
- Shrestha, TK 1986. Ecology and behavior of Mahseer *Tor putitora* Hamilton in the Himalayan Water of Nepal. In J.L. Maclean, L.B. Dizon and L.V. Hosillos (eds.) The First Asian Fisheries Forum. Asian Fisheries Society, Manila, Philippines. 689-692 p.
- Shrestha, TK 1990. Rare Fishes of Himalayan Waters of Nepal. J. of Fish Biology 37 (Supplement A) Academic Press, London. 213-219 p.
- Shrestha, TK 1992. Propagation of Mahseer in the Himalayan Waters of Nepal. In: National Research Council. 1992. Aquaculture and Schistosomiasis: Proceedings of a network meeting held in Manila, Philippines, August 6-10, 1991. National Academy Press. Washington, D.C. 61-78 p.
- Shrestha, TK 1994. Migration and Spawning of Golden Mahseer in Himalayan Waters of Nepal. J. Freshwater Biol. 6(1): 71-77.
- Sinha, VRP, Jhingran, VG and Ganapati, SV 1974. A review on spawning of the Indian major carps. Arch. Hydrobiol. 73: 518-536.