DEVELOPING SPAWNING AND INCUBATION CHANNELS

FOR RIVER RUN MIGRATORY MAHSEERS IN NEPAL

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Abstract

Number of river run migratory Deep-bodied mahseer *Tor tor* is declining due to over-fishing, environmental pollution and habitat modification due to 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 Deep-bodied mahseer (*Tor tor*) is popularly known as Himalayan Salmon and is an endangered cyprinid occurring in the snowfed running 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 environment of Nepal.

Methodology

In the past three years, I have tried to locate natural spawning ground of Deep-bodied 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 which was found to be utilized for spawning year after year. Field observation was carried out from 1995 - 1999 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).

River run 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.

Table 1: Water quality of Mahseer spawning incubation channel at Gadkhar creek

Factors	Values
Temperature	30 ^{o}C
Color	Brown
Visibility (m)	0.38
Compensation depth	0.89
pH	7.5
Oxygen	11
Dissolved solids	159
Hardness	46
Specific conductance	280
Chloride	19
Sulphate	15
Calcium	23
Magnesium	2.6
Iron	0.10

Observation

A series of incubation channels were fed by creek water and constructed in a creek nearby the Gadkhar fish 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/ft^2) of surface area yield high survival in fry stage. A variety of incubators both wooden or plastic incubators of different sizes were also 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 mahseer eggs 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. 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 2 and 3).

Table 2: Gravel Incubators Mahseer Eggs Subjected to Incubation at Different Temperature and Velocity

Field Sites	**Upper reaches or mouth of creek**	**Middle reaches of creek**	**Confluence site of creek and stream**
No. of Gravel Incubators	5	5	5
Incubating Temp. ^{o}C	30	28	22
No. of eggs Incubated	21500	21500	21500
Gravel size (mm) (mean)	50	28	12
Average current vel. m/sec	1.2	0.8	0.5
Dissolved O_2 (ppm)	9	7	10
Time taken for hatching	48	60	72
Time taken for emergence as fry (hrs)	240	232	215
No. of eggs hatched (Mean)	21428	21395	21223

Table 3: Comparative Table Showing Incubation Success in Different Incubators

Type of Incubators	Wooden Incubator	Plastic Incubator	Turf Incubator
Gravel Size in Inch	0.5 to 2	0.5 to 2	0.5 to 2
No. of Egg Incubated	2000	2000	2000
No. of Egg Hatched as Sacfry	1898	1848	1945
Hatching Time (hrs.)	72	70	72
Hatching Temperature (^{o}C)	25	28	30
Time taken for emergence as fry (hrs)	216	210	192
Dissolved Oxygen (ppm)	10	10	10
Current velocity m/sec	0.5	0.5	0.5

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.

Conclusion

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 ^{o}C), (iv) high level of dissolved oxygen and conductivity (8 to 12 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.

Due to remoteness and inaccessibility hatchery system in Nepal is in developing stage. In fish hatchery of Nepal, mahseer sac fry is prone to infection of molds *Saprolegnia* because sacfry 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 Gadkahar 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.

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