Asian Fisheries Science 6(1993):23-29.
Asian Fisheries Society, Manila, Philippines
https://doi.org/10.33997/j.afs.1993.6.1.003

Cyclic Changes in the Gonads of *Rhinomugil corsula* (Hamilton) from the River Yamuna, India

MASROOR FATIMA and ASIF A. KHAN

Section of Ichthyology and Fisheries
Department of Zoology
Aligarh Muslim University
Aligarh 202002, India

Abstract

Five stages of gonad maturity in both sexes of the fish *Rhinomugil corsula* were identified on the basis of morphological characteristics of the gonads. Ova diameter revealed the release of only one batch of mature ova in one spawning, which extends from July to October. The overall sex ratio favored females; males were dominant in small size groups, while the biggest fish were all females.

Introduction

Although Hora (1939) made a few observations on the spawning habit of the South Asian freshwater mullet *M. corsula* (Syn. *Rhinomugil corsula*), the first concerted attempt to understand its maturity and spawning habits and to delimit the spawning season was by Qasim and Qayyum (1961). Following this, Ranganathan and Natarajan (1969) and Sugunan and Vinci (1981), while confirming some of the earlier findings, provided more information on spawning. However, their studies do not indicate any clear trend with regard to the reproductive biology of *R. corsula*.

Materials and Methods

Monthly samples of *R. corsula* were collected from the River Yamuna, near Mathura in U.P., by cast net. Samples were brought to the laboratory where total length, fresh weight, sex, stage of

gonadal maturity, and gonado-somatic index were recorded using standard methods. Ova diameter was measured using an ocular micrometer from ovaries preserved in 5% formalin.

Results

Figs. 1a and 1b give the size and monthly distribution of the sexes in catches. In small fish, males outnumbered females whereas in the largest size groups there were no males. Overall, the sex ratio favored females.

Table 1 shows the observed gonad stages of *R. corsula.*

The gonads showed a regular seasonal development with a little overlap between different maturity stages in different months. (Fig. 2). The cycle of maturation and depletion of gonads suggest a breeding season for *R. corsula* of four months (July-October).

The gonado-somatic index in females was highest during April to June indicating full development of the ovary during these months. Identical patterns were observed in both the sexes except in the month of July (Fig. 3).

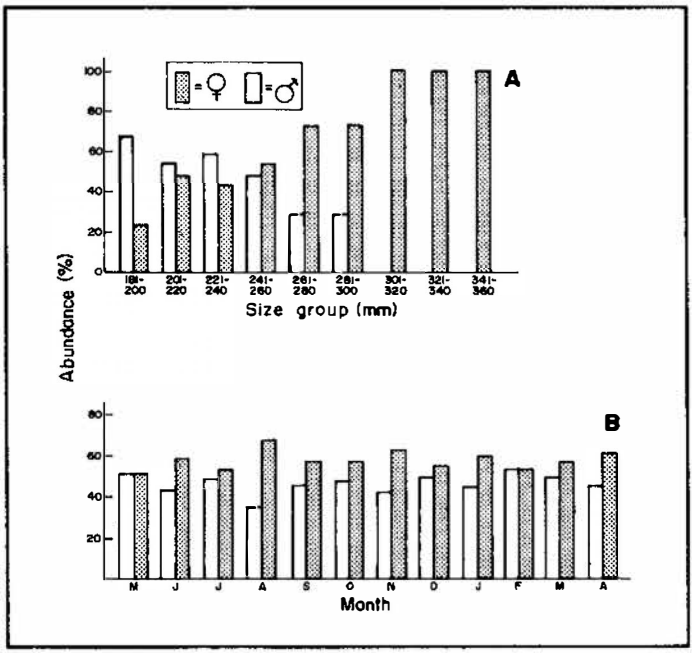

Fig. 1. A. Variations of sex ratio with size in *R. corsula.* B. Variations of sex ratio with months in *R. corsula.*

Table 1. Gonad stages of male and female *R. corsula*

Period	Stage	Gonad condition	
		Male	Female
Pre-spawning	I (Immature)	Testes: small, paired slender, distinguished microscopically from the ovaries G.S.I.,0.506.	Ovaries short, translucent, paired flesh colored thread-like structures. Extending 1/3 of body cavity. Eggs irregular-shaped, transparent and with central nucleus. No yolk. G.S.I.,1.318.
Pre-spawning	II (Maturing or recovering).	Testes white, occupying about 1/3 of the body cavity. G.S.I. 0.555.	Ovaries thin, extending to slightly more than half the length of body cavity. Ova spherical, opaque. Yolk deposition initiated in most ova. Translucent nucleus visible. G.S.I.,1.606.
Pre-spawning	III (Ripening)	Testes ivory colored occupying about 1/2 the body cavity. G.S.I.,0.921.	Ovaries yellowish, elongated, slightly lobulated, ovarian blood vessels visible, extending almost the entire length of the body cavity. Eggs visible to the naked eye. G.S.I.,3.308.
Spawning	IV (Full mature or ripe)	Testes flabby, massive, dull pink or creamy white.G.S.I.,1.698	Ovaries yellow white, occupying whole body cavity, enclosing the intestine by lateral extensions. The ovarian wall very thin. Eggs opaque, very distinct. G.S.I.,5.786.
Post-spawning	V (Spent)	Testes shrunken, occupying only 1/4 of the body cavity. G.S.I., 0.380.	Ovaries flaccid, occupying about 1/5 of the body cavity. In recently spawned fish the ovary has few remnants of mature ova. Majority of ova were small, transparent, invisible to naked eye. Resembles stage II but differs from it in the relatively smaller size and loosely packed mature ova. G.S.I.,0.614.

(G.S.I. = Gonado-somatic index)

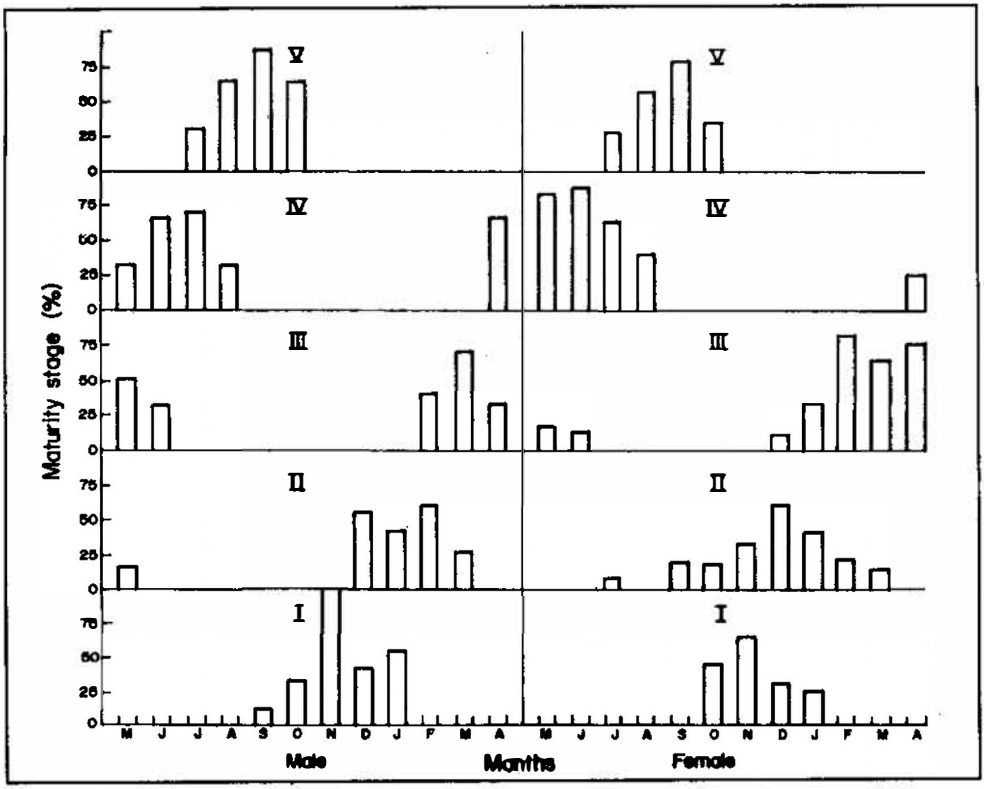

Fig. 2. Monthly percentages of *R. corsula* at each of the five maturity stages.

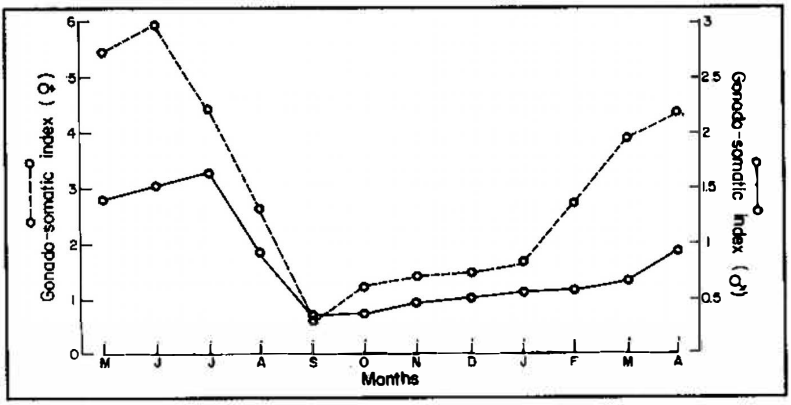

Fig. 3. Monthly fluctuation in the gonado-somatic index (G.S.I.) of *R. corsula*.

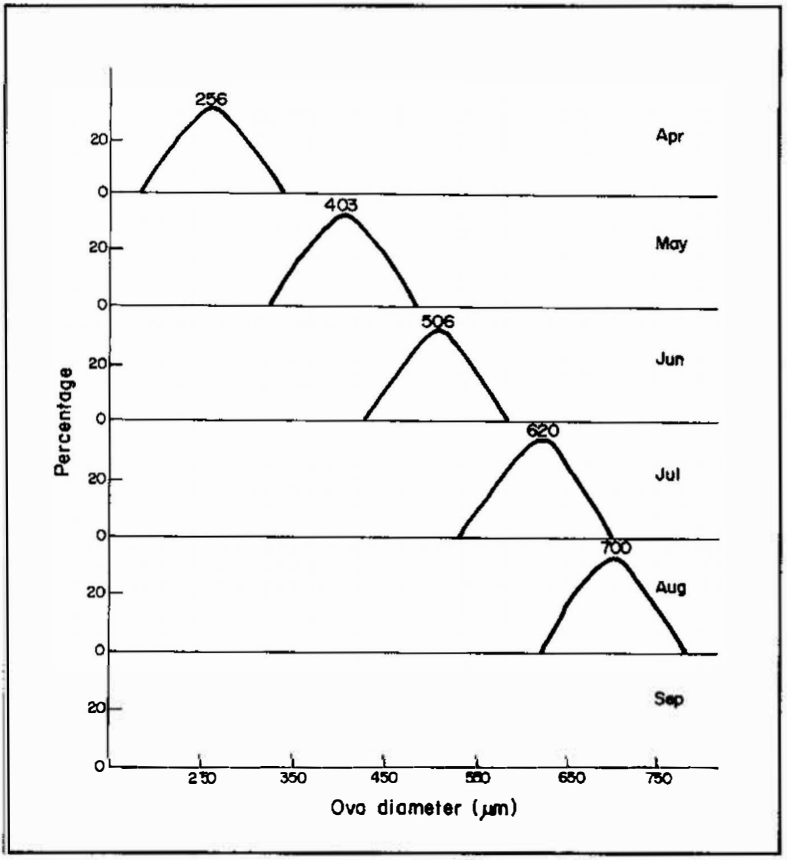

Fig. 4. Size-frequency distributions of oocytes of *R. corsula*. Numbers are sample sizes.

Fig. 4 illustrates the ova diameter frequencies from April to September. The modal size of ova ranged between 403 and 506 μm in the ripening stage (i.e., May and June). The fully ripe eggs, 620-773 μm in diameter, were recorded during July and August. By September, fish lacked this size class.

The presence of spent (stage V) specimens from July to October indicates the spawning season of the fish. Decline in the value of gonado-somatic index (G.S.I.) from July to October and the observations on the size progression of ova during different months further show that each individual spawns only once in the 4-month breeding season.

Discussion

R. corsula appears to spawn once a year like most other species of mullets (Sarojini 1957; Luther 1963; Abraham et al. 1966; Rangaswamy 1974; Wijeyaratne and Costa 1987, 1988; Gowda and Shanbhogue 1988). In general, all the catches that were analyzed showed high population of females. Such a heavily unbalanced sex ratio is not uncommon among grey mullets. Similar results have been reported for different species of mullets by Wijeyaratne and Costa (1988). Several reasons have been suggested for the dominance of one sex in the catches: segregration of sexes through various periods of the year; size differences; gear selectivity related to sex differences in morphology and physiological activity; and differences either by natural or by artificial mortality.

Cyclic changes in the maturation, depletion of gonads, intraovarian oocytes and G.S.I. in *R. corsula* clearly indicate a breeding synchronous with the onset of the monsoon. High values of gonado-somatic index in May and June and low values from October to January may be due to high and low values of light and temperature, respectively. These changes showed that physical parameters also influence the cyclic development of gonads. This has also been stressed by Avanesov (1972) and Wijeyaratne and Costa (1987) for different species of mullets.

It is reasonable to infer that this species spawns when the river floods with the commencement of rain in the first half of July. The present findings are similar to the findings of Qasim and Qayyum (1961) who observed the duration of the breeding season of *R. corsula* extending from July to September. Earlier authors described the breeding season of *R. corsula* extending from July to August at Contai coast, West Bengal (Pillay 1949) and June to July at Barrackpore, Krishnagiri and Sathanur reservoirs (Pakrasi and Alikunhi 1952; Ranganathan and Natarajan 1969) based on the appearance of large numbers of fry in these months.

Acknowledgements

The authors are grateful to the Chairperson, Department of Zoology, Aligarh Muslim University, Aligarh, for providing necessary laboratory facilities to carry out this work. One of the authors (MF) is also thankful to UGC for providing financial assistance during the course of work.

References

Abraham, M., N. Blane and A. Yashouv. 1966.Oogenesis in five species of grey mullets (Teleostei, Mugilidae) from natural and landlocked habitats. Israel J. Zool. 15:155-172.

Avanesov, E.M. 1972. Present spawning conditions of mullets (genus-*Mugil*) in the Caspian Sea. J. Ichthyol. 12:419-425.

Gowda, G. and S.L. Shanbhogue. 1988. On the reproductive biology of grey mullet, *Valmugil seheli* (Forskal) from Mangalore waters. Mahasagar 21:105-112.

Hora, S.L. 1939. Notes on the biology of the freshwater grey mullet, *Mugil corsula* (Hamilton) with observations on the probable mode of origin of aerial vision in fishes. J. Bombay Nat. Hist. Soc. 40:61-68.

Luther, G. 1963. Some observations on the biology of *Liza macrolepis* (Smith) and *Mugil cephalus* Linn. (Mugilidae) with notes on the fishery of grey mullets near Mandapam. Indian J. Fish. 10:642-665.

Pakrasi, B. and K.H. Alikunhi. 1952. On the development of the grey mullet, *Mugil corsula* (Hamilton). J. Zool. Soc. India. 4:123-140.

Pillay, T.V.R. 1949. On the culture of grey mullets in association with commercial carps in freshwater tanks in Bengal. J. Bombay Nat. Hist. Soc. 48:601-604.

Qasim, S.Z. and A. Qayyum. 1961. Spawning frequencies and breeding seasons of some freshwater fishes with special reference to those occurring in the plains of Northern India. Indian J. Fish. 8:24-43.

Ranganathan, V. and V. Natarajan. 1969. Studies on the occurrence and biology of *Rhinomugil corsula* (Hamilton) in Krishnagiri and Sathanur reservoirs, Tamil Nadu. J. Bombay Nat. Hist. Soc. 66:519-532.

Rangaswamy, C.P. 1974. Maturity and spawning of *Mugil cephalus* Linnaeus of Lake Pulicat, p. 47-60. *In* R. Natarajan (ed.) Recent researches in estuarine biology. Hindustan Publishing Corporation, New Delhi.

Sarojini, K.K. (1957). Biology and fisheries of the grey mullets of Bengal. I. Biology of *Mugil parsia* (Hamilton) with notes on its fishery in Bengal. Indian J. Fish. 4:160-207.

Sugunan, V.V. and G.K. Vinci. 1981. Length-weight relationship and food study of *Rhinomugil corsula* (Hamilton) with a note on its spawning and fecundity from Nagarjunasagar reservoir (A.P.). J. Inland Fish. Soc. India. 13:25-35.

Wijeyratne, M.S.J. and H.H. Costa. 1987. The food and feeding and reproduction of the Borneo mullet, *Liza macrolepis* (Smith) in a coastal estuary in Sri Lanka. Indian J. Fish. 34:283-291.

Wijeyratne, M.S.J. and H.H. Costa. 1988. The food, fecundity and gonadal maturity of *Valamugil cunnesius* (Pisces: Mugilidae) in the Nogombo Lagoon, Sri Lanka. Indian J. Fish. 35:71-77.

Manuscript received 2 September 1992; accepted 10 January 1993.