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Research Paper

Determination of Condition Factor (K) Somatic Condition Factor (Ks) Hepatic and Gonado Somatic Indices in The Fresh Water Fish *Notopterus Notopterus*

Zoology

KEYWORDS :

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ABSTRACT

The condition factor (K) of the fish N.notopterus was determined for different phases of the reproductive cycle. The ' K ' value increased in in preparatory and pre spawning phases, indicating that the overall condition of the fish seems to get improved towards the approach of maturing and mature stage of the gonads during pre spawning phase. The reduction of ' K ' value in spawning phase may be because of the fish exhausted due to spawning activity. The KS value is also increased during preparatory and pre spawning phase indicate the improvement in the condition of the fish during these phase and is found to be decreased in spawning and post spawning phase. The Ganado Somatic index (GSI) value is slightly increased from preparatory to pre spawning and the maximum decrease is found during spawning and post spawning phase. The Hepato Somatic index (HSI) value was high in preparatory phase and decreased in all other subsequent phases

INTRODUCTION:

Maturation in fishes follows a cyclic pattern with spawning adjusted to the most propitious time of the year there by ensuring maximum survival and faster growth of the young so as to establish the young of the year for the successful independent existence before unfavorable ecology prevails.

Expectedly the Indian, freshwater fishes conform to an annual calendar of gonadal development resulting in synchrony in maturation of ovaries and testes. This synchrony of ecological set up operative in different habitats. A species based breeding season (throughout the range of distribution of a species) may in the light of this become an erroneous concept because it is observed that the same species at different latitudes and altitudes may breed at different times in response to different ecological conditions.

Male reproductive cycle: The testes of Indian teleosts undergo cyclic changes both in their morphology and histology. *Heteropneustes fossils* is an exception to this but even in this fish testicular cycle has been subsequently reported (Sundararaj. 1958). The cycle initiates with the appearance of spermatogonial cyst in the lobules. Each cyst is a result of mitotic divisions of resting spermatogonia.

It can be safely deduced from the available literature on reproductive biology of male fresh water teleosts of India that spermatogenesis is essentially a cyclic feature and on the basis of distinct variations in the timings of spermatogenesis, these teleosts can be grouped into following gametogenic groups, (1) showing late spring and early summer gametogenesis, (2) showing late summer and autumn gametogenesis, and (3) showing winter gametogenesis.

Interestingly, in majority of Indian teleosts the testes cease their activity and enter a period of winter quiescence or gonadal diapauses either at spermatid or at spermatogonial stage (Jyoti, 1973; Agarwal, 1982; Abrol, 1986). In none of the Indian teleosts higher summer temperature have so far been linked with cessation of spermatogenetic activity.

Female reproductive cycle: Among fishes of Indian fresh waters the first ever consolidated account of ovarian cycle appears to be that on *H. fossilis*. The ovarian cycle in all these fishes follows a more or less identical pattern of maturation starting from a transparent infantile ovary followed by a growing ovary in which vitellogenesis is initiated and completed with gonado somatic index (GSI) recording highest values. A rapid decline in GSI and concomitant appearance of corpora lutea indicates spawning activity.

MATERIALS AND METHODS:

The freshwater fish, *N. notopterus* was selected for the study as this fish is available in good numbers in the fresh water ponds, tanks and rivers around Gulbarga. The fish were collected from Sirnoor nala, which is 10 kms away from Gulbarga city. The fish were brought to the laboratory every month from January to December and kept in plastic pool tanks having size 90 cm in diameter and 70 cm in height. These fish were fed with boiled egg and earthworms. The fish of different size were measured for total length as well as total weight of the body and in every phase fifteen fish were sacrified by decapitation and sexed after dissecting them because this fish don't exhibit sexual dimorphism.

Six fishes of each sex provided with the material for further processing. At sacrifice the gonads and liver were removed and weighed with the help of Anamed electronic balance and fixed for histological studies.

Morphometric studies:

The total length of the fish, total weight of the fish, total weight of the gonad and liver were used to determine the Fulton's Condition Factor (K), the somatic condition faction (KS), gonadosomatic index (GSI) and hepatosomatic index (HSI) of each fish by using the following formula.

1) Fulton's condition factor (K) = $\frac{W \times 100}{L^3}$

Where as W = Weight of the fish

L = Total length of the fish

2) Somatic condition factor (Ks) = $\frac{\text{Body weight - Gonad weight}}{L^3}$

3) Gonadosomatic index (GSI) = $\frac{\text{Weight of the ovary}}{\text{Weight of the fish}} \times 100$

4) Hepatosomatic index (HSI) = $\frac{\text{Weight of the liver}}{\text{Weight of the fish}} \times 100$

RESULT AND DISCUSSION:

The feeding of *N. notopterus* comprises of insects, their larvae, small fishes and weeds which has been identified on their presence in the stomach after opening viscera. This fish can be considered as corni-omnivorous preferring aquatic insects.

Condition factor (K):

The data presented on the condition factor of the fish *N. notopterus* show that fish the 'K' values increased from preparatory to prespawning phase indicating that the overall condition of

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the fish seems to get improved towards the approach of maturing and mature stage of gonads during prespawning phase. The decline of condition factor of the fish during spawning phase may be related to fish being exhausted due to spawning activity. This decline in condition was probably partly due to release of the gametes from the gonads and partly because of utilization of energy source for spawning activity. A decline in the 'K' values denotes the beginning of spawning as this downward trend may be due to increased metabolic strain. Spawning is a critical stage in the life cycle of fishes, often involving a substantial energistic investment (Jobling, 1994). The condition factor (K) of adults usually reaches its lowest value during the immediate postspawning period, and it take several weeks or months to recover form the energistic expenditure imposed by gamete production and spawning activity (Mann, 1974; Jobling, 1994).

The increase in the 'K' value during preparatory and prespawning phases indicates active feeding of the fish such studies in relation to feeding and reproductive state in the fishes have been observed and found that 'K' values increase after approach of breeding and decline after spawning with recovery in the post spawning (Gupta, 1975, Settels and Hoyt, 1976; Patzmer, 1983; Cambray and Boruton, 1984; Milton and Arthington, 1984; Rimmer, 1985)

Somatic condition factor (KS):

The KS values also found to be increased during preparatory and prespawning phase, the increase in the KS values is the indication of improvement Cambary and Brutoon, (1984) have suggested, based on the results of somatic condition factor of the fish *Barbus anoplas* that the lowering of KS following spawning was due to spawning activity and cessation of feeding during spawning. Hence, attainment of higher values of KS during prespawning phase indicates that the gonadal maturation did not occur at the expense of somatic weight. This suggests that availability of food was good and fishes may be actively feeding during prespawning phase. Such conclusion was also made for the fish *Barbus anoplus* (Cambray and Brufon, 1984), *C. reba* (Gupta, 1975), *Chrossomus erythrogaster* and *Dromitator latiforms* (Chang and Navas, 1984) and *Melanotaenia splendida fluviatilus* (Milton and Arthington, 1984). The reduction in the KS values following spawning the *N. notopterus* in the present study may be due to less feeding activity because of the spawning exhaustion.

Gonado somatic index (GSI):

The gonadosomatic index studied in the fish *N. notopterus* during four different reproductive phases. The GSI found to be increased on approaching to breeding period during preparatory and prespawning and decline during spawning and post spawning indicates that the gonads undergo seasonal growth of gonads and depletion. It is also considered as a sensitive 'parameter to monitor gonad maturation (Hong-Yang and Jong-Man, 1992). Gonads undergo regular seasonal cyclical changes in weight especially in females (Neelakantan *et al.,* 1989). Such changes are indicative of the spawning season (Qasim, 1973). The gonadosomatic index which indicates the state of gonadal development and maturity. A number of workers have used the GSI for variety of fishes (gonad weight expressed as percentage of total body weight) as a total to establish the breeding period and reliable measure of gonadal state (Skryabin, 1993).

Thus pattern of change in GSI is similar to that reported in other Indian fishes such as *H. fossilis* (Singh and Singh, 1979; Verma *et al.,* 1985); *Wallago atto* and *Mastacemblos armatus* (Sexena, 1986) and *P. sarana* (Gopal Dutt, 1989). Hence, in the present study the fall of GSI value during post spawning phase indicates the discharge of gametes (Neelakantan *et al.,* 1989).

Hepatosomatic index:

The hepatosomatic index was calculated by dividing weight of the fish to weight of liver by 100 giving percentage of liver weight in the total body weight. The relationship of HSI with GSI in the fish, *N. notopterus* studied during four different reproductive phases indicates marked difference.

The HSI value was high during beginning of preparatory phase and gradually declined to lower levels in the prespawning phase. The highest values of HSI indicates heavier liver. The correlation of HSI and GSI in *N. notopterus* indicates inverse relationship such a rhythm of changes have been reported in some other fishes and suggested that hepatic tissue store large amount of nutrients during preparatory phase as HSI increases. The decrease in HSI during prespawning phase indicates the stored hepatic contents are made available to the gonads for development. Singh and Singh (1979) studied the relationship between HSI and GSI in the fish *H. fossilis* and found that high HSI during preparatory and post spawning and low levels during prespawning and spawning.

Table-3.2

Showing condition factor (K) somatic conditions factor (KS), hepatic and gonado somatic indices in the fish ***N. notopterus*** during different reproductive phase

Phases	K	KS	GSI	HSI
Preparatory	0.68 ± 0.01	0.70 ± 0.07	0.52 ± 0.01	0.98 ± 0.01*
Prespawning	0.65 ± 0.01	0.78 ± 0.01	0.62 ± 0.01*	0.54 ± 0.4*
Spawning	0.59 ± 0.01	0.75 ± 0.07*	0.50 ± 0.08	0.48 ± 0.01
Post spawning	0.61 ± 0.01	0.66 ± 0.01	0.49 ± 0.02	0.51 ± 0.01

Tissue expressed as mg/50 gm.

Each value is expressed as mean ± SE, N = 6.

NS = Not significant; * = significant P < 0.05 when compared between the phases.

Fig. 3.2(a) Showing hepato-somatic (HSI) and gonado-somatic (GSI) indices in the fish *N. notopterus* during different reproductive phases

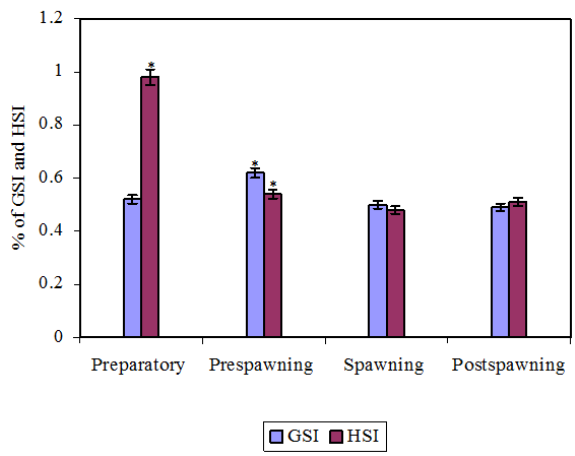
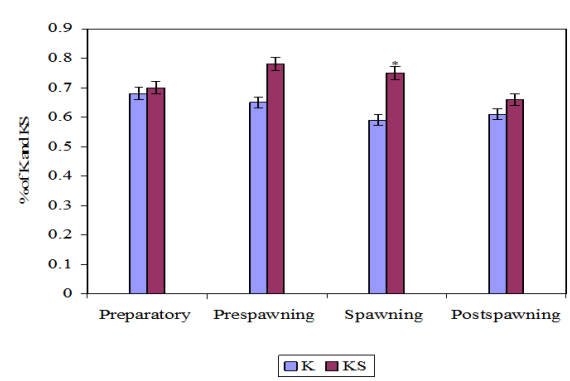


Fig. 3.2(b) Showing condition factor (K) somatic condition factor (KS) in the freshwater fish *N. notopterus* during different reproductive phases



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