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RESEARCH ARTICLE

STUDIES ON CONDITION FACTORS, GONADOSOMATIC AND HEPATOSOMATIC INDICES OF THE FRESH WATER MALE FISH, *OREOCHROMIS MOSSAMBICUS (PETERS)* FROM DAROJI WATER TANK, BALLARI

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ABSTRACT

The mouth brooding Cichilid fish *Oreochromis mossambicus (p)* is found to be omnivorous and prolific breeder. The present study is on the assessment of condition of the male fish *Oreochromis mossambicus* from Daroji water tank, considering gonadosomatic (GSI) and hepatosomatic (HSI) indices, Fulton's condition factor (K), somatic condition factor (KS), in relation to length and body weight. Ten specimens of male *Oreochromis mossambicus* were randomly selected every month from June to December 2016 for the assessment. The females and males can be identified on the morphological basis. Such studies are needed for the fish to understand the health condition of the female and male fish separately in an aquatic body for their survival, growth and breeding activities. The K values of the male fish during breeding period from June to December 2016 indicates that as the length and body weight increases the K values also increase. The KS values exhibit fluctuations in different length and body weight. However, as the length and body weight increases, the KS values also increase. The GSI increases as the length and body weight increases. The HSI exhibits a different trend of values as the gonad weight increases the liver weight decreases and as the liver weight increases the gonad weight reduces and similarly the HSI values are found. The study indicates that the condition of male fish improves as the length and body weight increases with a inverse relationship of GSI and HSI and thus indicating that the fish is thriving well in the aquatic body.

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INTRODUCTION

The development and improvement of fisheries in an area depend upon knowledge of biology of local fishes. The study on the biology of a particular fish to local environmental conditions is not only prerequisite for commercial exploitation but also for their application in fish culture practices. The study on the mathematical relationship between length and weight of fishes has considerable interest and importance in fishery research especially for the study of fish population dynamics and pattern of growth in fish stocks. This aspect is useful in rationally managing the population of fishes, and is an index of relative robustness of the fish (Zofair and Mustafa, 1992). The variations from expected weight or length of an individual fish or group of fish indicate the general well being and state of gonadal development. The condition can be influenced by the onset of maturity. The study on this aspect is based on variation in length, body, liver and gonad weight. The data obtained were used to determine condition factor (K) and somatic condition factor (KS) to find out influence of the local environmental factors on the general well being of the fish.

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The gonadosomatic index is an important tool in establishing the breeding period in animals and has been successfully employed in fishes (Saxena.1986). Liver forms an important organ of the body, which has a role in the gonadal development. Hence, hepatosomatic index has been correlated with gonadosomatic index. The reproductive biology of *Tilapia Sp.* is widely investigated in different parts of the world, Sena S. Desilva and J Chandrasoma (1980), Gomez-marquez J.L (2003), Sandeep (2012). In the present study condition factors along with gonadosomatic and hepatosomtic indices were considered for determine the suitability of aquatic body for survival and breeding activities of the male fish, *Oreochromis mossambicus* collected from Daroji water tank near Ballari.

MATERIALS AND METHODS

The freshwater male fish, *Oreochromis mossambicus* was selected for the study as this fish is available in good numbers in the fresh water ponds, tanks and rivers around Ballari. The fish were collected from Daroji water tank which is located in 15°14'11"N latitude 76°40'13"E longitude 30kms away from Ballari city. The fish were brought to the laboratory every month from July to December 2016 and kept in plastic pool

tanks having size 90 cm in diameter and 70 cm in height. Ten male fish of different sizes were selected and measured for total length as well as total weight of the body every month and were sacrificed by decapitation and used as material for further processing. At sacrifice the gonads and liver were removed and weighed with the help of electronic balance and fixed for histological studies.

Morphometric studies

The average values of total length of the fish, total weight of the fish, total weight of the gonad and liver of ten fishes every month 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.

- Fulton's condition factor (K) = $\frac{W \times 100}{L^3}$
- where(W = Weight of fish, L = Total length of fish)
  Somatic condition factor (Ks) = $\frac{\text{Body weight - Gonad weight}}{L^3}$
- Gonadosomatic index (GSI) = $\frac{\text{Weight of the ovary}}{\text{Weight of the fish}} \times 100$,
  Hepatosomatic index (HSI) = $\frac{\text{Weight of the liver}}{\text{Weight of the fish}} \times 100$

Observation

The fresh water male fish, *Oreochromis mossambicus* is available in large numbers in Daroji water tank near Ballari throughout the year. The fish were collected by cast net by the local fisherman. The maximum contribution to the fisheries from the aquatic body was the presence of this fish. The fish feeds on diatoms and algae and found to be omnivorous feeder. The sexes are separate and can be easily distinguished by their colouration as the Female exhibit brighter colouration than females. Courtship behaviour has been observed even in the fish kept in aquarium tanks in the laboratory. Since this fish is a mouth breeder, the young ones are developed in the mouth.

The present report is on the assessment of condition of the male fish from a water body considering Fulton's condition factor (K), somatic condition factor (KS), gonadosomatic (GSI) and hepatosomatic (HSI) indices in relation to length and body weight randomly selected in ten specimens of male *Oreochromis mossambicus* every month from June to December 2016 (Table-1). Such studies are essential for the fish to evaluate health condition of the fish for their survival and breeding activities in a specific aquatic body. The K values of the male fish during study breeding period indicates that as the length and body weight increases the K values also increase. The KS values exhibit fluctuations in different length and body weight. However, as the length and body weight increases, the KS values also increase. The GSI increases as the length and body weight increases whereas the GSI decreases as length and body weight decreases indicating release of developed and matured spermatozoa. The HSI exhibits a different trend of values as the testis weight increases the liver weight decreases and as the liver weight increases the testis weight reduces and similarly the HSI values are found. The above study indicates that the condition of female fish improves as the length and body weight increases with a inverse relationship of GSI and HSI. Thus, the results indicate that the fish is thriving well in the aquatic body with proper feeding, growth and breeding activities.

DISCUSSION

The water body from which the male fish, *Oreochromis mossambicus* was collected provides suitable ecology for its survival, growth and breeding activity as the fish is available in large numbers throughout the study period. Jhingran, (1982) has classified the water bodies based on the fish yield. In most of the water bodies around Ballari city this fish is available in plenty and available though out year. The water body from which *O.mossambicus* was collected is suitable for its survival and reproduction. Parameshwaran and Sinha, (1970) suggested that the growth of fish from the ponds of Cuttack was due to presence of insects, their larvae, minnows, etc., which compete either directly or indirectly with the fish for space and food. Similarly Lakshmanan (1967) has inferred that the growth of fish may be hampered due to composite culture and certain environmental conditions. However, based on the availability of fish *O. mossambica* throughout the study period indicates that the fish has favourable environment.

Gonadosomatic index (GSI)

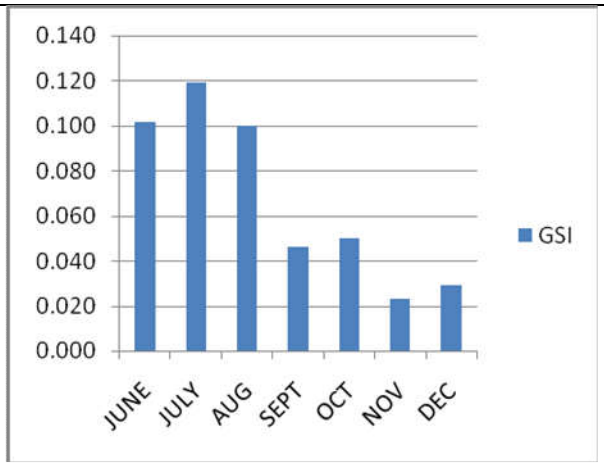
The gonadosomatic index studied in the male fish *O. mossambicus* during seven different months of reproductive phase. The GSI found to be increased on approaching to breeding period during prespawning and decline during spawning and post spawning indicates that the gonads undergo seasonal growth of gonads and depletion.

Month 2016	Length cm	Body Wt. g	Liver Wt. g	Testis Wt. g	HS I	GSI	K	KS
June	17.38	128.95	0.581	0.124	0.708	0.101	2.038	128.95
July	21.4	146.63	0.635	0.172	0.425	0.119	1.517	146.628
August	21.38	149.98	0.69	0.15	0.440	0.100	1.530	149.97
September	24.85	273.35	1.36	0.13	0.505	0.046	1.777	273.35
October	20.68	159.4	0.95	0.08	0.630	0.050	1.760	159.40
November	21.93	205.09	1.228	0.048	0.655	0.023	1.823	205.09
December	21.18	195.43	1.361	0.048	0.714	0.029	1.820	195.43
Average	21.25	179.83	0.97	0.11	0.58	0.07	1.75	179.83
Standard Deviation	2.19	49.37	0.35	0.05	0.12	0.04	0.18	49.37
Standard Error	0.83	18.66	0.13	0.02	0.05	0.01	0.07	18.66

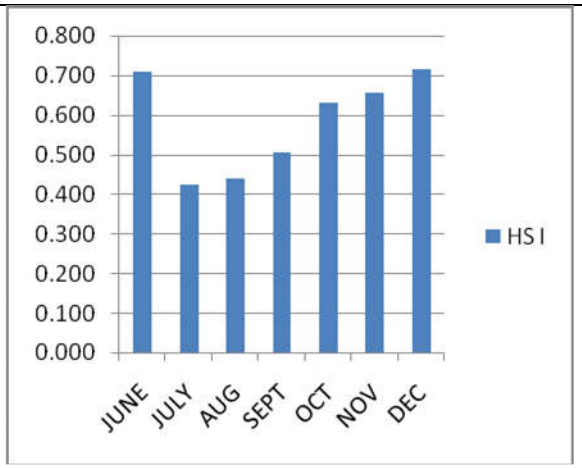
It is also considered as a sensitive 'parameter to monitor gonad maturation (Hong-Yang and Jong-Man, 1992). Gonads undergo regular seasonal cyclical changes in weight especially in males (Neelakantan *et al.,* 1989) and such changes are indicative of the spawning season. The gonadosomatic index which 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 *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 indicates the discharge of gametes (Graph-1)

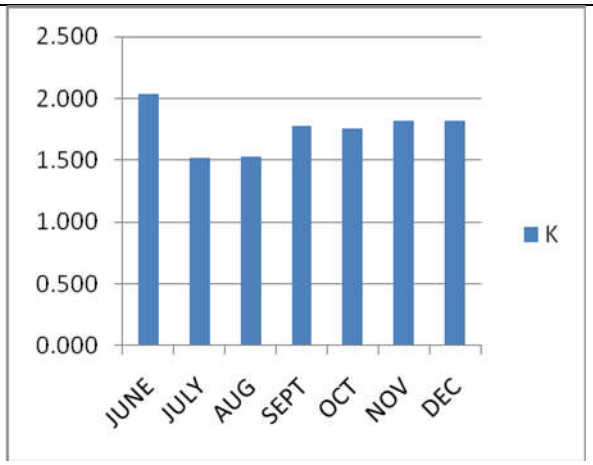
fish seems to get improved towards the approach of maturing and mature stage of gonads during prespawning phase (Graph-3).



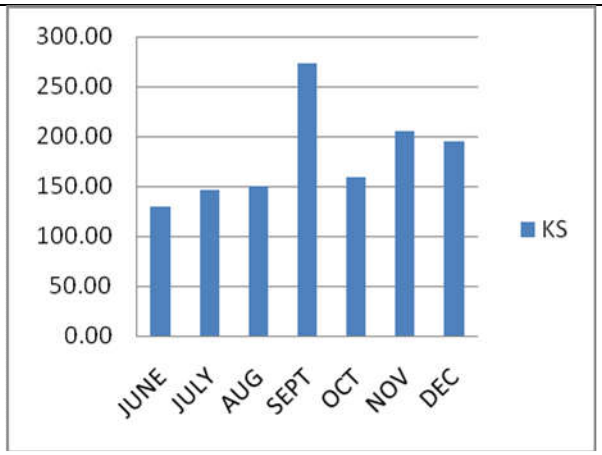
Graph 1. Showing GSI variations during study period



Graph 2. Showing HSI variations during study period



Graph 3. Showing Condition factor(K) variations during study period



Graph 4. Showing Somatic Condition factor (KS) variations during study period

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, *O. mossambicus* studied during seven different months of reproductive phase indicates marked difference. The HSI value was high during beginning of prespawning phase and gradually declined to lower levels in the spwaning phase (Graph-2) . The highest values of HSI indicate heavier liver. The correlation of HSI and GSI in *O. mossambicus* 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 prespawning 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.

Condition factor (K)

The data presented on the condition factor of the male fish *O. mossambica* show that fish the 'K' value increased from prespawning phase indicating that the overall condition of the

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 (Jobling, 1994). The increase in the 'K' value during prespawning phase 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 (Rimmer, 1985). Dasgupta (1988) has observed influence of seasonal factor on the condition factor in the fish *A. hexagonolepis*, in this fish the 'K' value showed increasing tendency towards the approach of breading period and this tendency also related to the increase in the length of the fish and in most of the higher length groups

'K' values were associated with the gonadal maturity. Increase in weight of the body due to weight of the maturing gonad followed by decrease in 'K' because of spawning.

Somatic condition factor (KS)

The KS values also found to be increased during pre spawning 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 pre spawning 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 pre spawning phase. Such conclusion was also made for the fish *Barbus anoplus* .The reduction in the KS values following spawning the *O. mossambicus* in the present study may be due to less feeding activity because of the spawning exhaustion.

Conclusion

The above study indicates that the condition of male fish improves as the length and body weight increases with a inverse relationship of GSI and HSI. Thus, the results indicate that the male fish is thriving well in the aquatic body with proper feeding, growth and breeding activities.

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