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# **Original Research** Paper

Zoology

# STUDIES ON CONDITION FACTORS, GONADOSOMATIC AND HEPATOSOMATIC INDICES OF THE FRESH WATER FEMALE FISH, *TILAPIA MOSSAMBICA* (PETERS) FROM AN AQUATIC BODY

D.Satheesh	Department of Studies in Zoology, Gulbarga University, Kalaburagi, Karnataka.
R.S.Kulkarni	Department of Studies in Zoology, Gulbarga University, Kalaburagi, Karnataka.
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The fresh water fish, *Thapla mossambica* (Peters) found to be ofmitvorous feeder. The present study is on the assessment of condition of the fish in a water body considering gonadosomatic (GSI) and *hepatosomatic* (HSI) indices, somatic condition factor (KS), Fulton condition factor (KS), in relation to length and body weight in randomly selected 21 specimens of female *Tilapia mossambica P*. The sexes are separate as female and male and could be identifiable. 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 female fish during four months of during 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 increases whereas the GSI decreases when length and body weight reduces. The HSI exhibits a different trend of values as the ovary weight increases the liver weight decreases and as the liver weight increases the ovary weight reduces and similarly the HSI values are found. The study indicates that the condition of female 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.

	KEYWORDS	<i>Tilapia mossambica</i> , gonadosomatic index (GSI) hepatosomatic idex (HSI), somatic condition factor (K), Fulton condition factor (KS).
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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 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.

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. In the present study condition factors along with gonadosomatic and hepatosomic indices were considered for determing the suitability of aquatic body for survival and breeding activities of the fish, *Tilapia mossambica* p. collected from an aquatic body called Daroji tank near Ballari. The reproductive biology of Tilapia Sp. is widely investigated in different parts of the world, Sena S. Desilva and J Chandrasoma(1980), Gomezmarquez J.L (2003), Sandeep (2012).

## Material and Methods:

The fresh water female fish, *Tilapia mossambica* was selected for the study as this fish is available in good numbers in the fresh water ponds, tanks and rivers around Bellary. The fish were collected from Daroji tank which is 30 kms away from Ballari city. The fish were brought to the laboratory every month from July to October and kept in plastic pool tanks having size 90 cm in diameter and 70 cm in height. The fish of different size were measured for total length as well as total weight of the body and twenty one fish 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 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 factor (KS), gonadosomatic index (GSI) and hepatosomatic index (HSI) of each fish by using the following formula.

1)Fulton's condition factor (K) = 
$$\frac{W \times 100}{L^3}$$
  
(W = Weight of fish, L = Total length of fish)

2) Somatic condition factor (Ks)	$=\frac{\text{Body weigh t} - \text{Gonad weight}}{L^3}$
3) Gonadosomatic index (GSI) =	$\frac{\text{Weight of the ovary}}{\text{Weight of the fish}} \times 100 ,$
4) Hepatosomatic index (HSI) =	$\frac{\text{Weight of the liver}}{\text{Weight of the fish}} \times 100$

## Observation:

The fresh water female fish, *Tilapia mossambica* is available in large numbers in the aquatic body Daroji Water near Bellary 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 vegetable feeder. The sexes are saperate and can be easily distinguished by their colouration as the males' 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 female fish from a water body considering (KS), gonado somatic (GSI) and hepatosomatic (HSI) indices, somatic condition factor (K), Fulton condition factor in relation to length and body weight randomly selected in 21 specimans of female *Tilapia mossambica* (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 female fish during four months during 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 oocytes. The HSI exhibits a different trend of values as the ovary weight increases the liver weight decreases and as the liver weight increases the ovary 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 indicates that the fish is thriving well in the aquatic body with proper feeding, growth and breeding activities.

### Discussion:

The water body from which the fish, Tilapia mossambica 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 Bellary city this fish is available in plenty and though the water body from which T.mossambica was collected is a small water body may be a 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 T. mossambica throughout the study period indicates that the fish has favourable environment. The feeding of T. mossambica comprises of sufficient vegetable contents and weeds which has been identified on their presence in the stomach after opening viscera. This fish can be considered as herbivorous preferring aquatic algae.

## Condition factor (K):

The data presented on the condition factor of the fish *T. mossambica* show that fish the 'K' value increased from prespawning phase indicating that the overall condition of 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 post spawning 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 pre spawning 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 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*. The reduction in the KS values following spawning the *T. mossambica* in the present study may be due to less feeding activity because of the spawning exhaustion.

## Gonadosomatic index (GSI):

The gonadosomatic index studied in the fish T. mossambica during four 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. 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) 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 (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, T. mossambica studied during four different months of reproductive phase indicates marked difference. The HSI value was high during beginning of pre spawning phase and gradually declined to lower levels in the pawning phase. The highest values of HSI indicate heavier liver. The correlation of HSI and GSI in T. mossambica 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.

**Conclusions:** 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.

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### Table-1: Showing morphometric studies of the fish, Tilapia mossambicus including gonadosomatic (GSI) and hepatosomatic (HSI) indices, Fulton's Condition Factor -K Somatic condition factor KS, collected from an aquatic body.

S.	Body	Body Weight	Ovary	Liver	G	цсі	ĸ	ĸs	
No.	h (cm)	(q)	ht (q)	(q)	001	1131		K3	
1	18	87.6	1.88	0.92	2.146	1.05	1.502	87.6	
2	18	120	0.45	1.2	0.375	1	2.058	120	
3	18	102	0.22	0.68	0.216	0.667	1.749	102	
4	18	111	0.4	1.3	0.36	1.171	1.903	111	
5	18.5	120.8	0.94	1.3	0.778	1.076	1.908	120.8	
6	19	118	0.94	2.2	0.797	1.864	1.72	118	
7	19	118.6	0.9	0.95	0.759	0.801	1.729	118.6	
8	19	145	0.55	1.2	0.379	0.828	2.114	145	
9	19.5	123	0.92	1.02	0.748	0.829	1.659	123	
10	20	126.35	4.16	1.42	3.292	1.124	1.579	126.35	
11	20	160	1.72	0.6	1.075	0.375	2	160	
12	20	158.5	1.82	0.9	1.148	0.568	1.981	158.5	
13	20.5	190	2.2	0.94	1.158	0.495	2.205	190	
14	21	141	1.02	1.65	0.723	1.17	1.523	141	
15	21	161	1.72	1	1.068	0.621	1.738	161	
16	21	170	1.1	1.4	0.647	0.824	1.836	170	
17	21	175	0.39	1.03	0.223	0.589	1.89	175	
18	21	171	2.56	1.21	1.497	0.708	1.846	171	
19	22	162.5	1.45	1.9	0.892	1.169	1.526	162.5	
20	22	173	1.46	1.65	0.844	0.954	1.625	173	
21	22	180	0.48	0.7	0.267	0.389	1.69	180	
Av	19.92	143.540	1.299	1.198	0.923	0.870	1.7991	143.54	
SD	1.390	29.106	0.922	0.405	0.712	0.342	0.200	29.106	
SE	0.303	6.351	0.201	0.088	0.155	0.074	0.0438	6.351	
AV : Average , SD: Standard Deviation. SE: Standard Error									

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