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Condition and relative condition cycles in the tropical glassy perchlet *Chanda (=Ambassis) commersonii* (Cuv. and Val.) (Pisces: Centropomidae)

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Abstract. The seasonal condition (K) and relative condition (K_n) cycles and their changes with the growth of the fish *Chanda commersonii* (Cuv. and Val.) for 2 yrs are presented. Better K is shown by the smaller immature and first maturity stages and larger, almost senile groups but they show a K_n factor below '1'. The actively breeding adults show a uniform fall in K but they give comparatively high K_n values (above '1'). These changes in K and K_n with the growth of the fish are clearly reflected in their seasonal cycles also. K cycle would thus appear to follow a pattern of build up and loss of body resources, indirectly following the breeding cycle while the K_n cycle follow the breeding and feeding cycles directly, as shown by their seasonal changes and changes with growth of the fish for 2 yrs. Since only minor deviations from unity occur in K_n factor it furnishes a more sensitive index of somatic difference between age groups, of breeding season and feeding cycle.

Keywords. Condition factor; relative condition factor; breeding cycle; feeding cycle; maturity stages; *Chanda commersonii*.

1. Introduction

Chanda (=*Ambassis*) *commersonii* (Cuv. and Val.) is a medium sized shoaling predator (Nair and Nair 1981) inhabiting the estuarine, brackish and low saline tracts of Kerala along the South-west coast of India.

Variations from the expected weight for length of individual fish or groups of fish as indicative of fatness, general well-being or gonad development may be termed as 'condition' (Le Cren 1951). Kestevan (1947) has discussed the importance of variations in specific gravity of fish flesh in studies on condition. Usually the density of the fish is maintained as same as that of the surrounding medium and hence changes in weight for length are due to change in form or volume and not specific gravity. Such changes are analysed by the K factor or coefficient of condition or ponderal index (Hile 1936; Thompson 1943) and is given by the formula $K = 1000\ W/L^3$ where K = condition factor, W = weight of fish and L = length of fish, when the cube relationship with an ideal fish holds good in the length-weight relationship.

In case the fish does not obey the cube law in its length-weight relationship the relative condition factor (K_n) could be calculated using the formula $K_n = W/W$

where W = observed weight and $\overline{W}$ = calculated weight of the fish (by using the empirically calculated length-weight relationship formula).

Innumerable studies have been conducted on K cycle in fish since difference in values of condition can frequently yield insight into the circumstances of the fish's lives *i.e.*, with regard to timing and duration of breeding cycle, food supply etc. The values of these factors to fishery science is, therefore, considerable.

With the object of tracing the K cycle of the fish, *Chanda commersonii* a commercially important species, and to find out its relationship with the growth of the fish and the breeding and feeding cycles, the monthly condition of the fish for 2 yr (December 1976–November 1978) and the change in condition with the growth of the fish were worked out.

2. Materials and Methods

The monthly collections were made from the Veli lake and Panathura estuary (Trivandrum, Kerala). A total of 250 females and 110 males (360 fish) for the first year and 310 females and 177 males (487 fish) for the second year were used for the computation.

For individuals showing isometry in length-weight relationships (females during the first year and males during the second year) the K factor was calculated for each month's samples to illustrate the seasonal cycles in condition, and for different length classes to illustrate the change in K with growth. For individuals showing departures from isometry (males during the first year and females during the second year) the corresponding K_n was calculated for each month's samples and for different length classes.

3. Results and discussion

The females range in size from 6.1-11.7 cms SL (class intervals 0.56 cm) for the first year and from 4.8-12.0 cm (class intervals 0.8 cm) for the second year. The males range in size from 5.8-8.6 cm SL (class intervals 0.31 cm) for the first year and from 4.8-8.6 cm SL (class intervals 0.33 cm) for second year.

The length-weight relationship of males and females for the two year period together with the results of the 't' test are given in table 1.

Table 1. Length-weight relationship of males and females of *C. commersonii* for 2 yrs (December 1976 – November 1978)

Sex	Period	Regression equation	't' value
Female	Dec. 76 – Nov. 77	$\log Y = 2.9763 \log X - 1.5546$	0.5661 (df=248)
	Dec. 77 – Nov. 78	$\log Y = 3.1305 \log X - 1.6782$	3.2434 (df=308)
Male	Dec. 76 – Nov. 77	$\log Y = 2.8793 \log x - 1.5020$	3.8827 (df=108)
	Dec. 77 – Nov. 78	$\log Y = 2.9455 \log x - 1.5402$	1.6278 (df=175)

3.1 *Relation with growth of fish*

The changes in K (females during first year and males during second year) and K_n (females during second year and males during first year) with the growth of the fish are illustrated in figures 1 and 2.

The changes in K of females during the first year and males during the second year in different size classes show almost a similar gross picture. Better K is exhibited by the immature and first maturity stage females (6.1-8.34 cm SL) and immature males (4.8-6.32 cm SL). In actively spawning adult group (8.34 cm to 11.14 cm for females and 6.32-8.22 cm SL for males) almost uniformly low K is shown whereas it goes up in the largest group sampled (11.14-11.70 cm SL for females and 8.22-8.60 cm SL for males). The active breeding or spawning stress almost constantly encountered by the adult groups may be the cause for their uniform fall in K, while the immature smallest groups and almost senile largest groups show better condition due to their non-entry and cessation or slowing down in the breeding activity respectively.

The prespawners and first maturing males and females were found to have fat deposition on the immature and ripening gonads. They were found to be completely used up in ripe and actively breeding adult fishes. Qasim (1957) suggested that the waxing and waning of the K factor can probably be due to the building up or loss of reserves of the fish.

The near uniformity in the K factor shown by both adult females and males

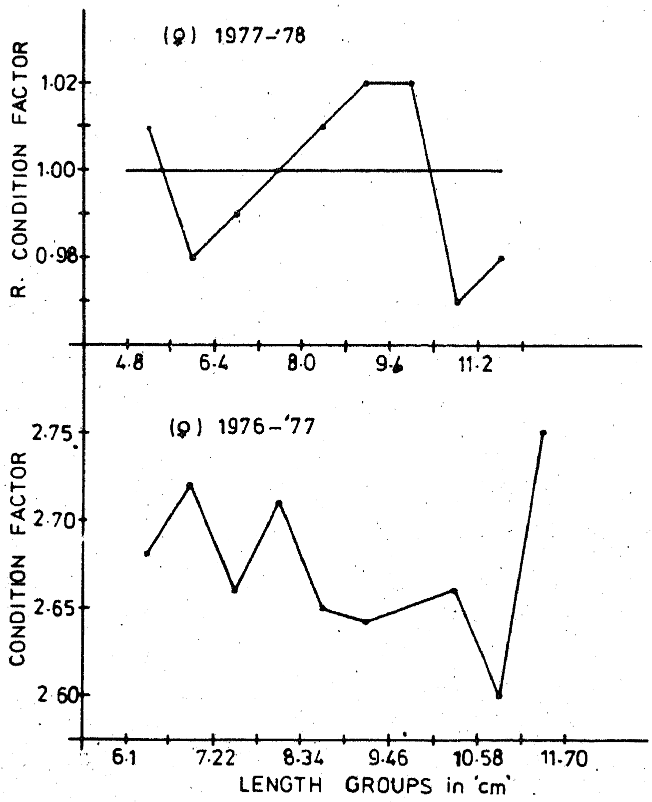

Figure 1. Variations in the mean condition (first year) and relative condition (second year) in different size groups of females of *C. commersonii*.

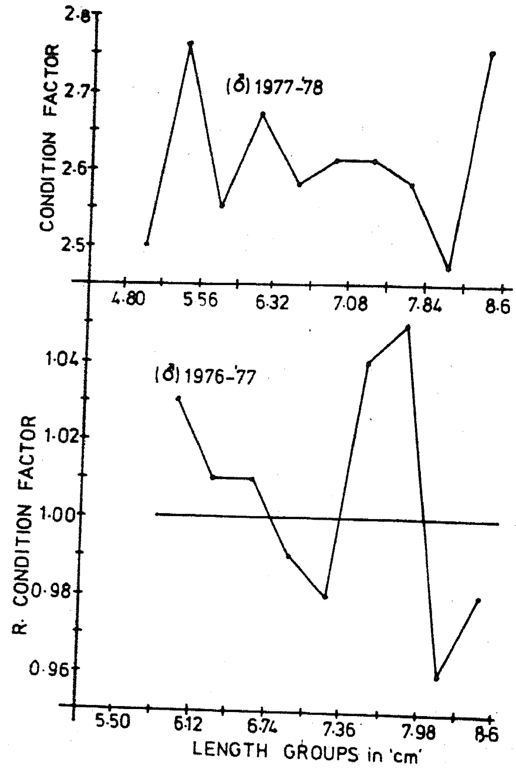

Figure 2. Variations in the mean relative condition (first year) and condition (second year) in different size groups of males of *C. commersonii*.

(different size groups) may be due to the almost year round breeding activity exhibited by the population giving only small intervals for recrudescence and subsequent spawning in the individuals.

The K_n factor for females during the second year and males during the first year show a similar gross picture, one quite different from that given by the K factor. The immature males (5.81-6.74 cm SL) show a K_n value '1' while the immature and first maturity stages of females and first maturity stages of males show a K_n value below '1'. The actively breeding groups of males (7.36-7.98 cm SL) and females (8.0-10.4 cm SL) show comparatively very high K_n values while the highest groups (7.98-8.6 cm SL for males and 10.4-12.0 cm SL for females) show comparatively very low K_n values.

Thus while the immature first maturity stages and almost senile groups show values below '1' the actively breeding adult-fish show high K_n values. Raman *et al.* (1975) made similar observations in *Ambassis gymnocephalus*, where the males and females in advanced stages of maturity showed very high K_n.

3.2 *Relation between K and breeding cycle*

The K cycle and gonadosomatic indices (GSI) for females (first year) and males (second year) are illustrated in figures 3 and 4. The change in K with the growth of the sexes *i.e.*, the immature and prespawners showing better K than the actively breeding adult fish is clearly reflected in the cyclic seasonal changes in K with breeding cycle also. The peaks in K factor of the population clearly alternate with the peaks in GSI for both males and females.

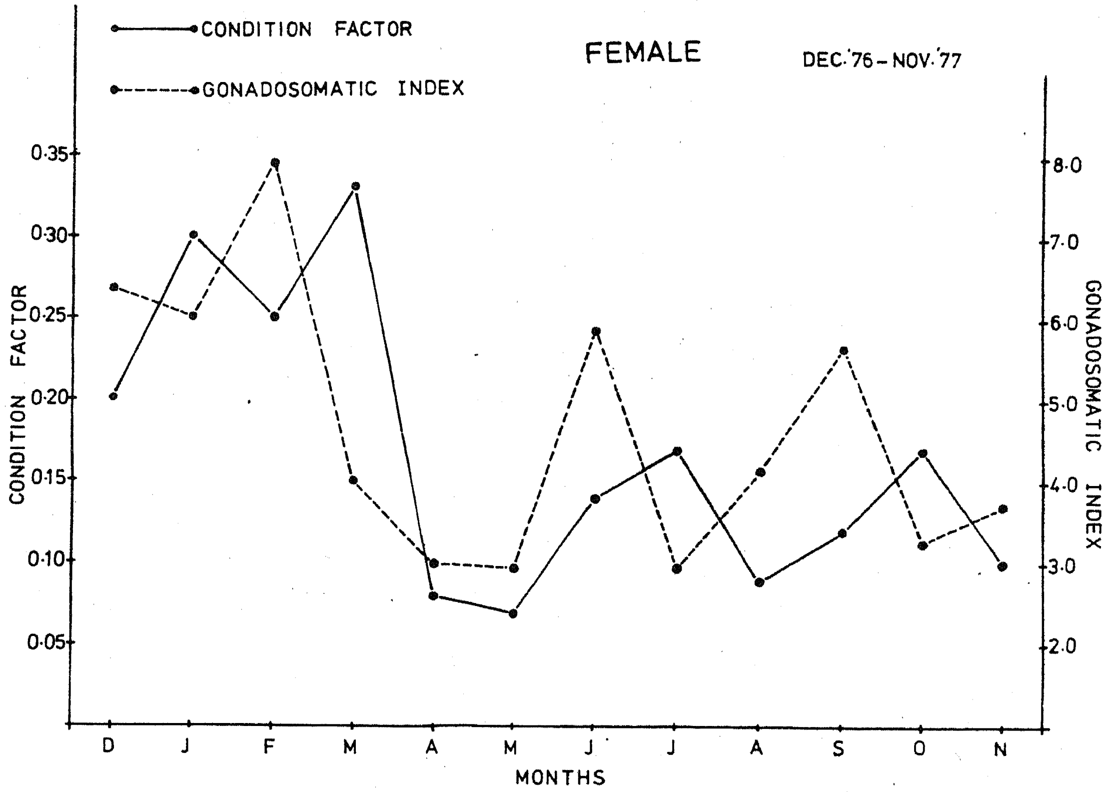

Figure 3. Relationship between seasonal cycle in condition and gonadosomatic index in females of *C. commersonii* (Dec.'76 - Nov.'77).

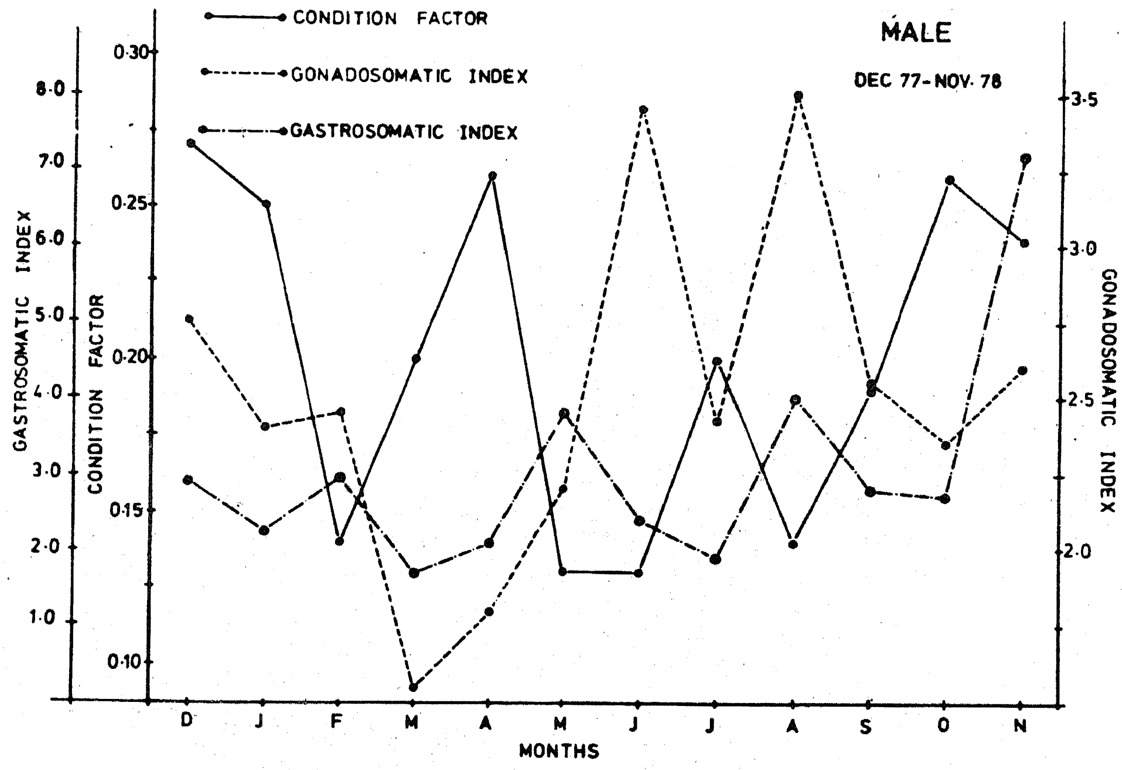

Figure 4. Relationship between seasonal cycle in condition, gonadosomatic index and gastrosomatic index in males of *C. commersonii* (Dec. '77 – Nov. '78).

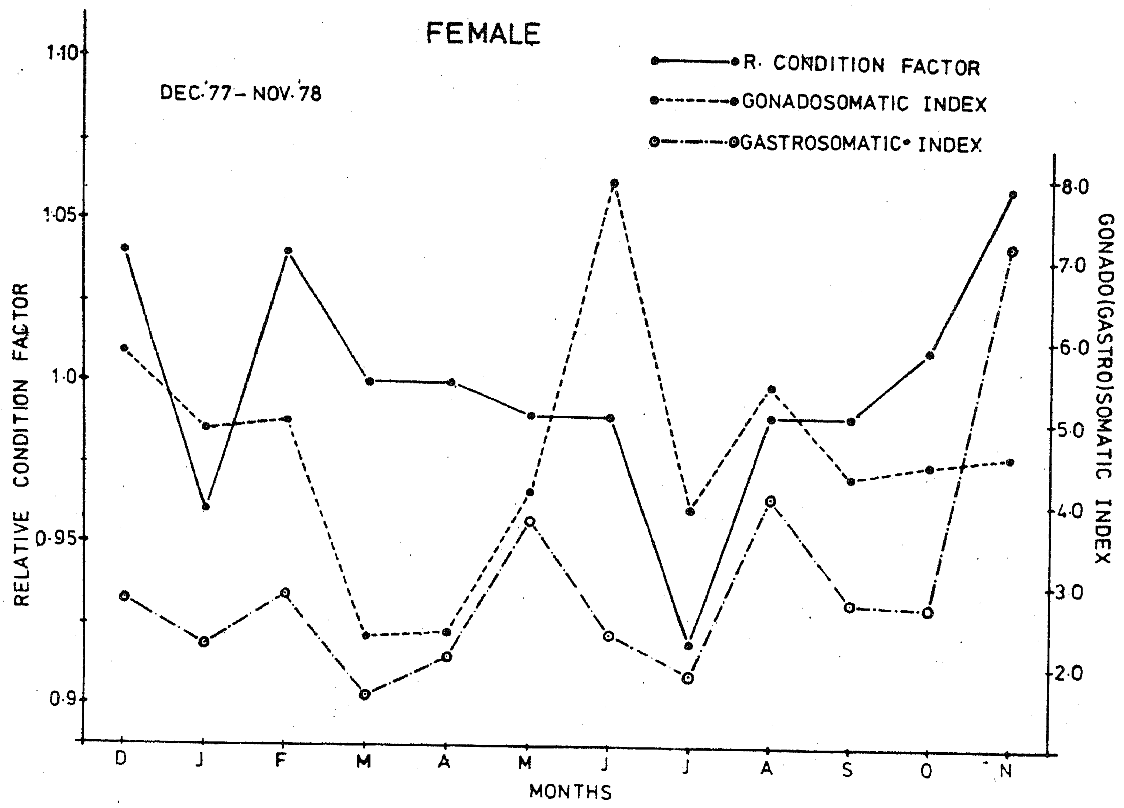

Figure 5. Relationship between seasonal cycle in relative condition, gonadosomatic index and gastrosomatic index in females of *C. commersonii* (Dec. '77 – Nov. '78).

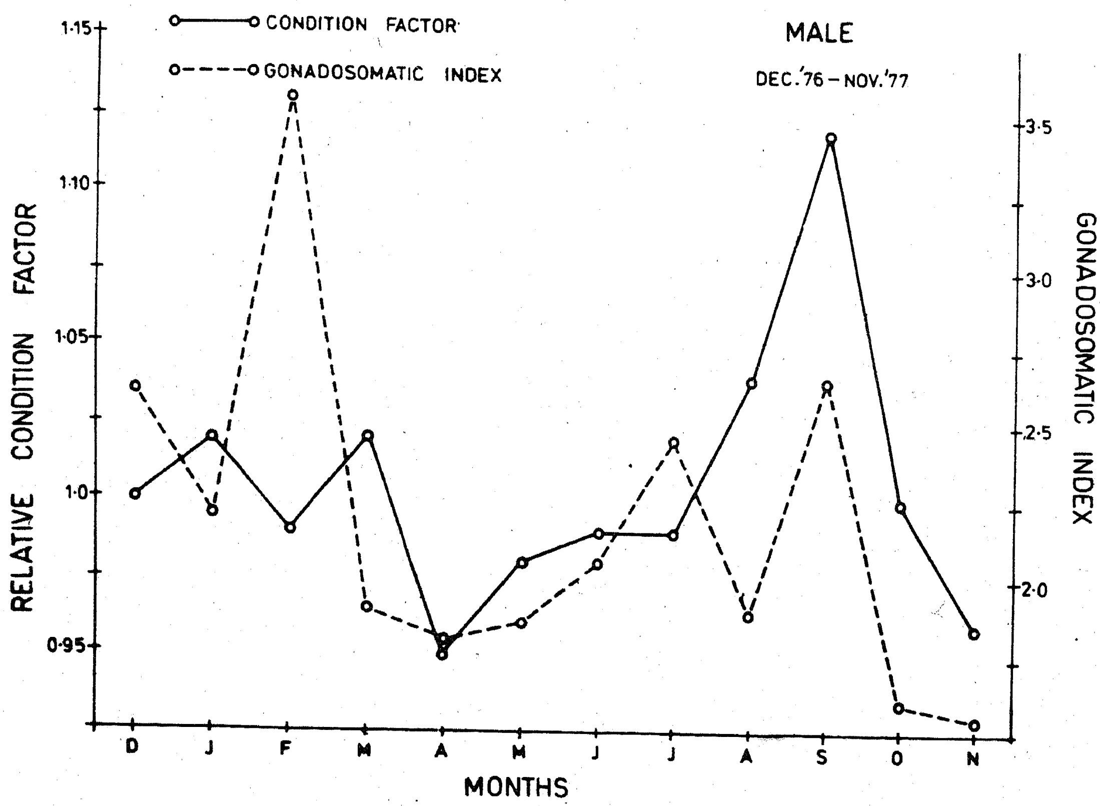

Figure 6. Relationship between seasonal cycle in relative condition and gonadosomatic index in males of *C. commersonii* (Dec. '76-Nov. '77).

Thompson (1943) pointed out that the high and low K, in the plaice *Pleuronectus platessa* are found before and after spawning. Hickling (1945) in the cornish pilchard, *Sardinia pilchardus* found the condition low before spawning and high after, which was explained by him as due to sexual cycle and the availability of food respectively.

The K_n cycle and GSI for females (second year) and males (first year) are illustrated in figures 5 and 6. Similarly the changes in K_n with the growth of sexes *i.e.*, the immature and first maturity stages showing poor K_n while the adult active breeders showing better K_n is clearly reflected in the seasonal changes in K_n with breeding cycle also. Here the rise and fall in GSI is closely followed by the K_n factor, peaking and subsiding with the GSI as can be seen in the figures. Le Cren (1957) investigated K_n throughout the year in the windermere perch population in which the main difference between the patterns of change in mature males and females and immature fish were attributable to the sexual cycle — *i.e.*, change in gonad size or GSI.

3.3 *Relation between condition and feeding cycle*

The seasonal changes in K_n of females and the K of males for the second year are compared with the GSI in figures 4 and 5. The K_n cycle of the females closely follows the seasonal pattern taken by the GSI, the periods of heavy feeding activity showing comparatively high Kn and vice-versa. But the K cycle of males does not give any clear correlation with the feeding cycle.

4. Conclusion

Weatherley (1972) outlined a debate concerning the relative merits of calculating K as compared to that of calculating K_n. From the results of the present study the K cycle would thus appear to follow a pattern of build up and loss of body resources. indirectly following the breeding cycle, while the K_n cycle follow the breeding and feeding cycles directly, as shown by their seasonal changes and changes with the growth of sexes for the two years. Since only minor deviations from unity occur in K_n factor in this species, it furnishes a more sensitive index of somatic differences between age groups, of breeding season and feeding cycle in *C. commersonii.*

Weatherley (1972) also states that $K = W/L^3$ cannot yield a K factor very near unity for all species or even for all ages of a particular species, while a K_n factor near unity can be derived for any group of fishes, populations, age groups etc., by use of $K_n = W/aL^n$ in which case $n \neq 3$ but is derived empirically for such group. Similarly Craig (1977) is of opinion that K factor may be adequate for a simple comparison but, if used at all, for a scientific collation between population in time and or space, the K factor must be based on the length-weight relationship (K_n factor), so that any size of fish may be compared.

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