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CONDITION FACTOR AND LENGTH WEIGHT RELATIONSHIP OF NEMIPTERUS JAPONICUS (BLOCH) OFF BOMBAY COAST

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ABSTRACT

Fluctuations in the K values of the fish *Nemipterus japonicus* (Bloch) off Bombay coast have been interpreted sexwise, monthwise and for females maturity stagewise also. These indicated differential growth rates in males and females. Males and females attain first maturity at 145mm and 115mm respectively, second maturity is attained by both the sexes at 195mm. First spawning occurs when both are of 155mm length and at second spawning males and females attain 215 and 205 mm of length respectively. The fish mature and breed at 'O' year, main spawning period is from August to November with peak spawning activities in October. Little spawning activities in February-March is also indicated. It grows about 155mm in first year @ 12.91mm per month and about 215mm in the second year @ 5.0 mm per month on an average. Length weight relationships for males and females have been studied separately and found to be $W=0.00000\,9922L^{3.0634}$ for females and $W=0.00003535L^{2.8609}$ for males. The rate of growth of females by weight was found to be slower below 150mm which became faster than that of males above 150mm specimens. Studies revealed little variation in results obtained from the studies of specimens from East Coast.

INTRODUCTION

Fluctuations in condition factor (K) has been used as a tool for determination of many biological factors like fatness, onset of maturity, spawning period, growth etc. by Hickling (1930)., Thomson (1943), Menon (1950), Le Cren (1951), Pantulu (1961), Devaraj (1973) and many other fishery scientists. In the present studies also an attempt has been made to correlate the fluctuations in K values of *N. japonicus* off Bombay coast (India) with above mentioned factors. The formula $K=W100/L^3$, (Hile, 1936), holds good for the fishes which obey the formula $W=aL(n)$ and the value of 'n is equal to 3, thus obeying the cube law in the present studies the value of n in case of length weight relationship was found to be 2.8069 and 3.0634 for males and females respectively. As such for determination of K values this formula was used.

"The length of a fish is often more rapidly and accurately measured than weight. It is very convenient to determine a weight where length only is known and

occasionally it may be useful to reverse this process Besides providing a means for calculating weight from length this may also give indications of taxonomic differences and events in the life history, such as metamorphosis and the onset of maturity" (Lacren, 1951). These informations are valuable for forecasting the recruitment, potential yield of different year classes and thus in the management of fishery. From West Coast of India, no work on this aspect of *Nemipterus japonicus* has been reported so far. In the present communication length weight relationship of *N. japonicus* off Bombay coast (India) has also been described.

MATERIALS AND METHODS

Condition factor in the present studies have been determined from the length and weight of 485 fishes of which 242 males ranging 96-250 mm and 243 females ranging 95-210 mm in length, collected over a period of 12 months from Sassoon Dock Bombay, during April 1977 to March 1978. K values separately for individual males and females were calculated by the formula $K=W \times 10^5/L^3$ instead of $K=W \times 10^2/L^3$ for shifting the decimal point to three digits towards left for better graphical representation. The values thus obtained for each individual fish, grouped in 10 mm length groups and monthwise separately for males and females and also for different stages of maturity in case of females only. The average value of each group thus obtained was plotted, which gave indications of the general condition of the fishes, age at first maturity, spawning, rate of growth, favourable period of the year etc. (Fig. 1 & 2).

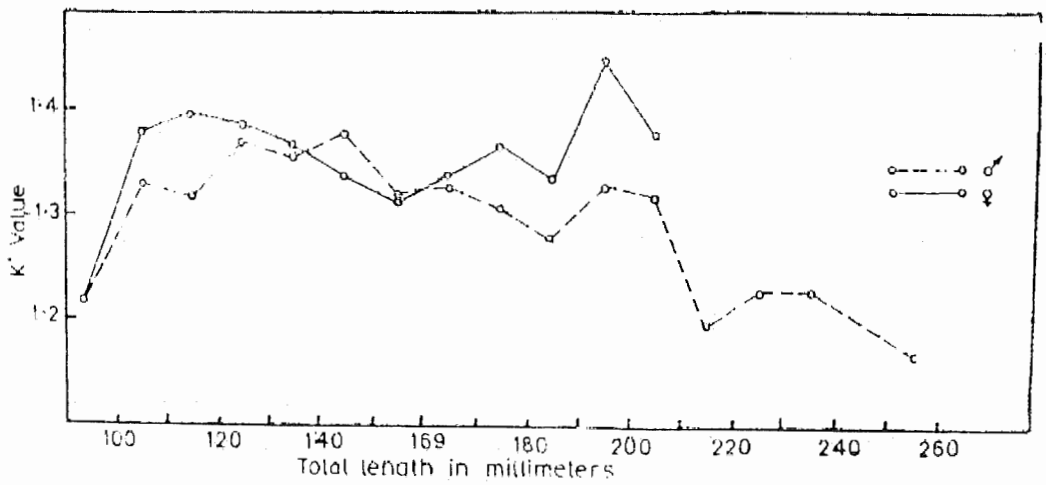

Fig. 1 Changes in average K. Value in each 10 MM length group

Length weight relationship in the present studies has been determined from the total length measured in millimetres from snout to the tip of lower caudal lobe and weight taken in grams of 473 specimens of which 240 males, ranging 10.8 — 184.0 g in weight and 96-250mm in length and 233 females ranging 9.5-134.8 g in weight and 95-210 mm in length, collected over a period of 12 months from April, 1977 to March 1978, from Sassoon Dock — the main landing centre of Bom-

bay. The formula W = a L(n) as used by Hile (1936), Allen (1938), Martin (1949) and many others for determination of length weight relationship was followed in the present study also.

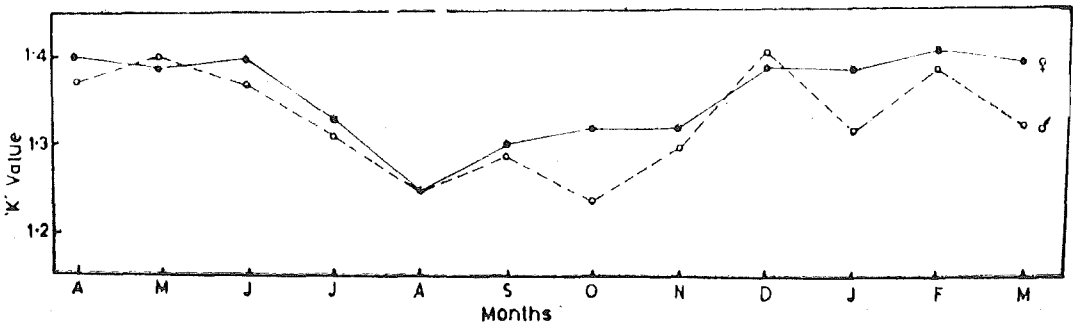

Fig. 2a Changes in average K. Value in different months.

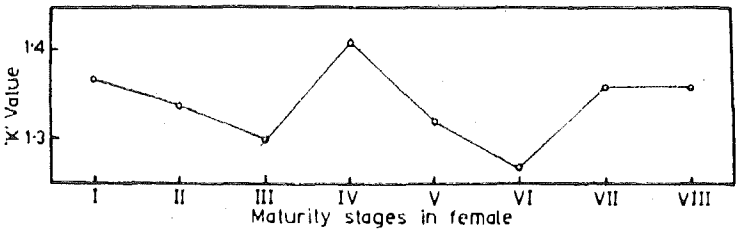

Fig. 2b Changes in average K. Value in different maturity, stages.

RESULTS AND DISCUSSION

a) *Ponderal Index* :

Lengthwise fluctuation in K values (Fig. 1) shows that the general conditions of the males and females are more or less similar except at the length of 155 mm where the value of both males and females coincide. Both the curves of males and females depict two deep valleys, a common at 155mm and next valley at 205mm for females and 215mm for males. The point 155mm where the K values of both males and females coincide in a steep fall, indicates the length at which the first spawning occurs. The next fall in case of females at 205 mm and males at 215 mm probably indicates the length at which 2nd spawning of females and males occurs. It also indicates that in the 2nd year also the rate of growth in length in males and females differs. Males grow faster in length than that of females. The length at 1st & 2nd spawning observed in the present studies is more or less in conformity with Krishnamoorthi (1971), who reported first spawning and 2nd spawning of *N. japonicus* at Andhra-Orissa coast (East coast) at 165mm and 220 mm respectively. However, as the females above 205 mm was not available in the samples, the exact second spawning length of the females could not be determined.

The two high peaks at 145mm and 195mm for males and at 115mm and 195mm for females appear to represent the sizes at which the males and females attain their 1st and 2nd maturity. Females attain their first maturity at a smaller size

(115 mm) than that of males (145 mm) may be due to the fact that males grow faster than that of females or the females actually mature earlier to males or this may be due to the effect of both the causes. Length frequency studies (Acharya, 1980), indicated the growth of this fish in the first year as 165 mm. As such, *N. japonicus* off Bombay coast mature and spawn at their 'O' year class itself.

The marked decline in K values at 115 mm for males and at 185 mm for both males and females appear to be due to change of season. Length frequency studies indicated that the fishes of 'O' year class and 1st year class attained a length of 115 mm and 185 mm respectively during winter months of December-January 1977-78 or this depression may also be caused due to stray spawning activities during sporadic winter rain at Bombay region during 1978. The values started increasing showing a regain of the general conditions of the fishes to form peaks at 125 mm in males and at 195 mm for both males and females. According to the length frequency studies, the fishes of 'O'year and 1 year class attained these length, in February-March, 1978 thus indicating February-March as favourable period for this fish. The females at 115 mm, that is, during winter do not register any decline in K values which may be due to their developed ovary.

From 95 to 155 mm, both males and females depict a good general condition, the reason of which can very well be attributed to the dominance of young and maturing fishes of 'O' year class with developing gonads within that range. After first spawning at 155 mm the females not only recover, but also gain better condition than their first prespawning period. However, the general condition of males decline thereafter to even lower than their younger stage, particularly at the time of their 2nd spawning at 215 mm.

As the fishes which have attained their first maturity and spawned at the 1st breeding season of their life at 155 mm belong to 'O' year class, those must be the off springs of the last breeding season and thus attained one year of age approximately. On an average their rate of growth in the first year can therefore be calculated as $155/12 = 12.91$ mm. Length frequency studies indicated growth during 1st year of life as 165mm and rate of growth per month as 13.75 mm. Minor difference may be due to combining of two months data together in case of length frequency studies. By extending the same argument, the length attained at the end of 2nd year may be taken as 215 mm which is the 2nd spawning length of the fish. Krishnamoorthi (1971), obtained this length to be 210 mm in 1964 at Andhra-Orissa coast. The rate of growth at the end of 2nd year as obtained in the present studies and by Krishnamoorthi (1971), works out to be same as $(215-155)/12 = 5.0$ mm and $(210-150)/12=5.0$ mm respectively. Minor difference in total length obtained in the present studies with that of Krishnamoorthi (1971), may be due to difference in time and place of observation.

Fig. 2a depicts monthwise changes in K values for the observed period. It shows that a decline in the general condition commences in case of males from May and in case of females from June and both coincides in a valley during August indi-

cating that the advancement towards onset of spawning in males commences one month earlier than that of females, and spawning commences from August when both coincides. The crest in the K values continues through rise and fall upto November and the fishes nearly regain their prespawning general condition in the month of December only, thus completing a seasonal cycle of general condition indicating December to June as the building up period of *N. japonicus* off Bombay coast, which decline during June to December. According to K values, the period from August to November, may therefore be considered as the main spawning period. Another minor decline for females but very prominent decline for males in the month of January-March may be due to winter season and stray breeding in sporadic January rain at Bombay region during 1978 or for both.

From August onwards though the spawning continues, the general condition of the females tend to improve may be due to increase in their feeding intensity. (Study of food and feeding habit indicated a gradual increase in the feeding intensity in post monsoon months). The maximum fall in the K values of the males in the month of October, indicates October as the month of maximum breeding activities for males and obviously for females also.

Fig. 1 also depicts that throughout the year the females maintain a better general condition than that of males, except in the month of May and December. This further indicates that spawning of *N. japonicus* off Bombay coast continues for a long period from August to November and a stray spawning occurs upto March. Krishnamoorthi (1971), obtaining a sharp fall in the K values in the month of November in 1964 remarked November as the onset of spawning season of *N. japonicus* in East coast (India). This difference may be due to differences in the time and place of observation.

Fig. 2b shows a low general condition of the females at their IIIrd and VIth stage of maturity. In the IVth stage there is a sharp build up in general conditions which may be due to sharp developmental changes, that is, accumulation of yolk, in the ova, in the gonads of the females. The fall in VIth stage is due to physiological strain on the females caused by spawning activities and release of ova.

Thus it is revealed from above discussions that the general condition of both sexes of *N. japonicus* off Bombay coast shows more or less similar fluctuations. The females and males attain their first maturity at 115 mm and 145 mm respectively but the 2nd maturity is attained by both males and females at 195 mm. The first maturity in females may be either actually earlier, or it may be due to the fact that the males grow faster than females or for both the reasons. First spawning in both males and females occur at their 155 mm length and the 2nd spawning of males at 215 mm, in females probably at 205 mm. The fish matures at their '0' year age and spawn before they complete their one year of age.

(b) *Length weight relationships* :

Li (1954), Selvakumar (1971), reported relationships between length and

weight of *N. virgatus* and *N. japonicus* as $W = 0.22L^3$ and $W = (-2.085)\ L\ (3.092)$ respectively, for both sexes combined. But Eggleston (1972) and Krishnamoorthi (1974), observed highly significant differences at 5% level in those species

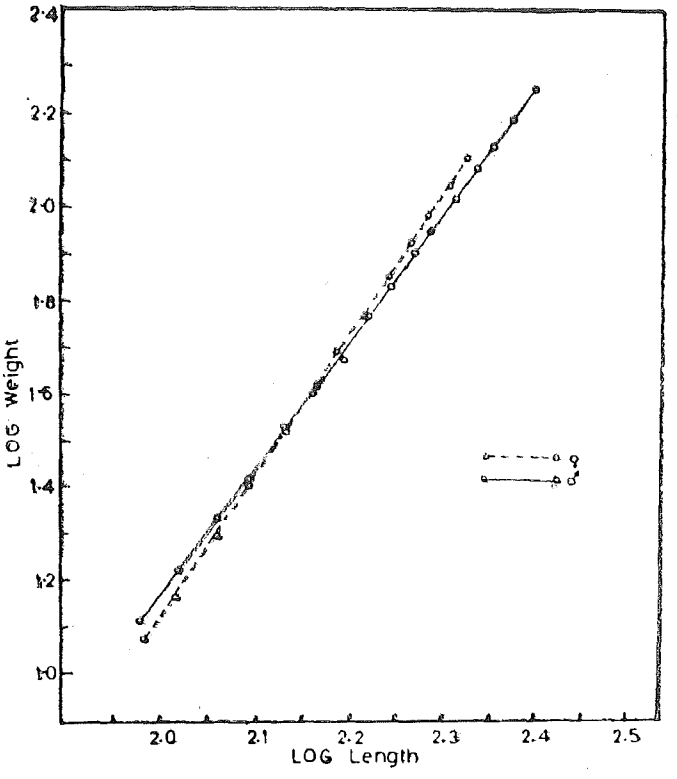

Fig. 3 Logerithmic length weight relationship.

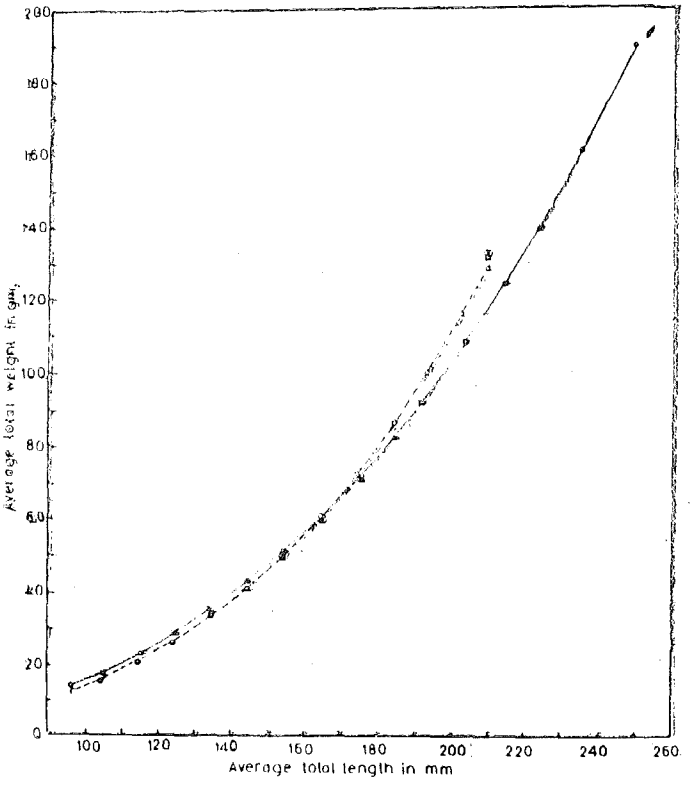

Fig. 4 Relationship between average total length and total weight.

respectively when data for males and females were treated separately. Eggleston (1972), observed variations in growth rates in males and females of *N. japonicus* in otolith reading also. Therefore in the present studies data for length weight relationship for males and females have been treated separately. Relationships obtained by Krishnamoorthi (1971), from East coast of India and in the present studies from off Bombay coast are depicted in Table-I.

Table I

Length weight relationship for males and females of *N. Japonicus* collected from East and West Coasts.

Sex	East Coast Krishnamoorthi (1971)	West Coast Present studies
Males	$W = -2.7565 + 2.0769 \text{ Log } L$ or $0.001752\ L^{2.0769}$	$W = -4.4516 + 2.8069 \text{ Log } L$ or $0.00003535\ L^{2.8069}$
Females	$W = -4.745 + 2.9423 \text{ Log } L$ or $0.0000183\ L^{2.9423}$	$W = -5.0034 + 3.0634 \text{ Log } L$ or $0.000009922 L^{3.0634}$

Apparently the length weight relationship obtained for females from East and West Coast (India) do not show any appreciable difference but in the males it differs. The difference is perhaps due to the difference in geographical conditions of these two places.

Present studies indicate (Fig. 3) that initially upto 150 mm the rate of growth of females by weight is slower which after 150 mm becomes faster than that of males. Fig. 4 depicts the characteristic curvilinear relationship of average length and weight of males and females. As the fish grows older it adds more weight than length.

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