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LENGTH-WEIGHT RELATIONSHIPS IN THREE SPECIES OF FLATFISHES AT CALICUT

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ABSTRACT

Length-weight regression equations were derived for the males and females of *Cynoglossus semifasciatus*, *C. dubius* and *C. bilineatus* based on material from Calicut Coast. Regression coefficients were estimated by using the logarithms of the total lengths and the corresponding weights. The straight-line relationships of length-weight equations for the three species were as follows:

(1) *C. semifasciatus* - *Males:* Log Weight = 3.9518 + 2.7712 Log Length; *Females:* Log Weight = $\bar{3}$.8516 + 2.9024 Log Length; (2) *C. dubius* - *Males:* Log Weight = 3.2514 + 3.2926 Log Length; *Females:* Log Weight = $\bar{3}$.3667 + 3.2170 Log Length; (3) *C. bilineatus* - *Males:* Log Weight = $\bar{3}$.4665 + 3.1667 Log Length; *Females:* Log Weight = 3.3646 + 3.2489 Log Length. These and earlier findings on *Cynoglossus* spp. have indicated that the cube law approximately holds good in these flatfishes also as in the case of other fishes.

INTRODUCTION

THE DETERMINATION of the exact nature of the relationship that exists between the length and the weight of the fishes has been recognised as an important part of fishery biological studies in recent decades. The real beginning in this line of work in India with the application of an approved modern statistical technique may be said to have been made by Jhingran (1952) on three species of major carps namely, *Labeo rohita* (Ham.), *Cirrhina mrigala* (Ham.) and *Catla catla* (Ham.). He determined the length-weight relationships in these fishes using the approved modification (*i.e.* $W=cL^n$) of Herbert Spencer's cube law equation which is : $W=aL^3$. Using the same method, Prabhu (1955 a) studied the length-weight relationship in five species of perches near Mandapam and also in the ribbonfish (Prabhu, 1955 b) *Trichiurus haumela* (Forsskål). Subsequensly, studies on length-weight relationships have been included by most Indian workers in their biological studies on fishes (Bal and Joshi, 1956; Pradhan, 1956; Venkataraman, 1956; Sarojini, 1957, 1958; Radhakrishnan, 1957; Sujansinghani, 1957; Pillay, 1958; Varghese, 1961; Tandon, 1961; Talwar, 1962; Chakravarthy and Singh, 1963; Venkatasubba Rao, 1963; Bhatnagar, 1963; Luther, 1963; David, 1963; Antony Raja, 1967; Sekharan, 1968; Krishnamoorthi, 1971; Hanumantha Rao, 1974; James and Badrudeen, 1981; Srinivasan, 1981; Shamsul Hoda, 1983; Sriramachandra Murty, 1983; Udupa and Krishna Bhatt, 1983; Venkatasubba Rao, 1983). Information is thus now available for many of the species of Indian fishes, both marine and freshwater, on the length-weight relationship equations. While some workers have derived the equations without separating the two sexes, most others in recent years have determined the relationships for the males and females separately, and sometimes also for the juveniles and even different size-groups. It also seems to have been recognised that the same species at different stages of maturity, or from different regions of occurrence, or during different seasons of the year, may show slight variations in the nature of their length-weight relationships (Sekharan, 1968;

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Antony Raja, 1967; David, 1963). There also seem to be possibilities of the length-weight relationships turning out to be useful tools in the recognition different stocks of the same species (David, 1963).

the cube law as a rough general approximation. However, rare examples of rather wide departures from this are also on record; for example, Antony Raja (1967) found the value of *b* to be 2.0122 for mature male *Sardinella*

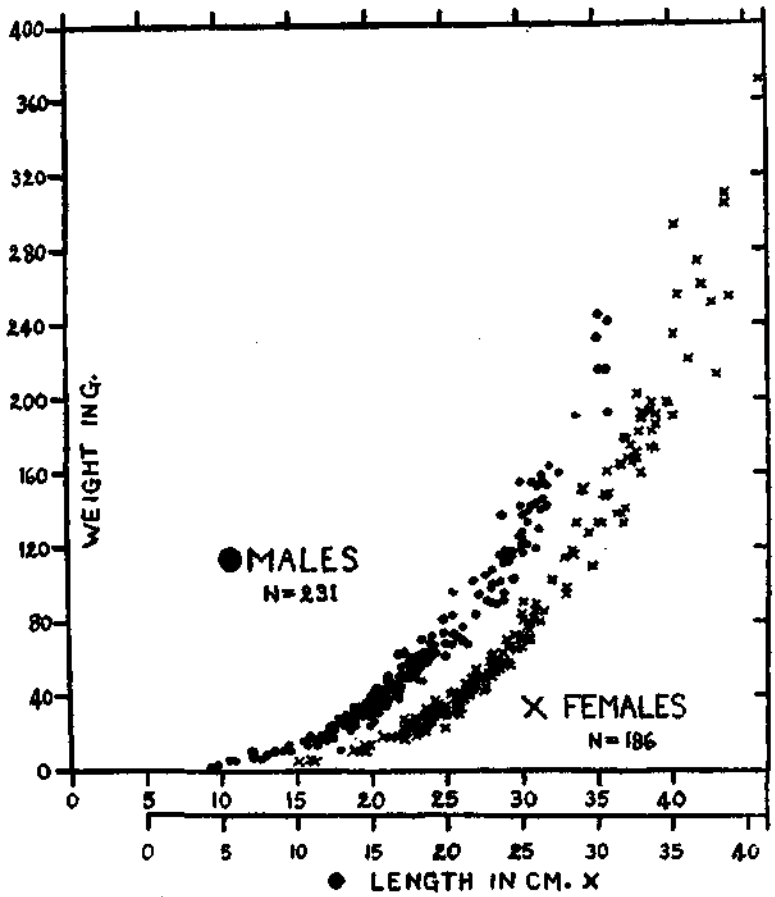

Fig. 1. Scatter diagram of length-weight relationship in males and females of *Cynoglossus dubius*.

In almost all the work so far the value of the regression co-efficient *b* (in the equation $W = aL^b$, where W stands for weight, L for length and 'a' for a constant to be empirically determined) has been found to be approximately 3 (and not beyond the generally recognised limits of 2.5 and 4), thus justifying

longiceps (Val.) of the 165-184 mm group in 1959 and 5.3530 for spent females of the same species in the 160-182 mm group of 1962-63.

Almost all the Indian work so far in this line has been on the round fishes. However, Edwards *et al.* (1971) determined and recorded the length-weight equations for four species of

Cynoglossus namely, *C. brevis*, *C. cynoglossus*, *C. puncticeps* and *C. lida* from the southwest coast. Seshappa and Chakrapani have more recently (1983) worked out the length-weight relationships in the males and females of *C. lida* from the Calicut Coast; they have compared and discussed the findings of Edwards *et al.* (1971) with their data on *C. lida* ands also reviewed the known regression co-efficient in the length-weight relationships of different species of *Cyngoosisus* from India. Earlier Victor (1978) studed *C. semlifasciatus* (=*C. macrostomus*) for length-weight relationships at Mangalore.

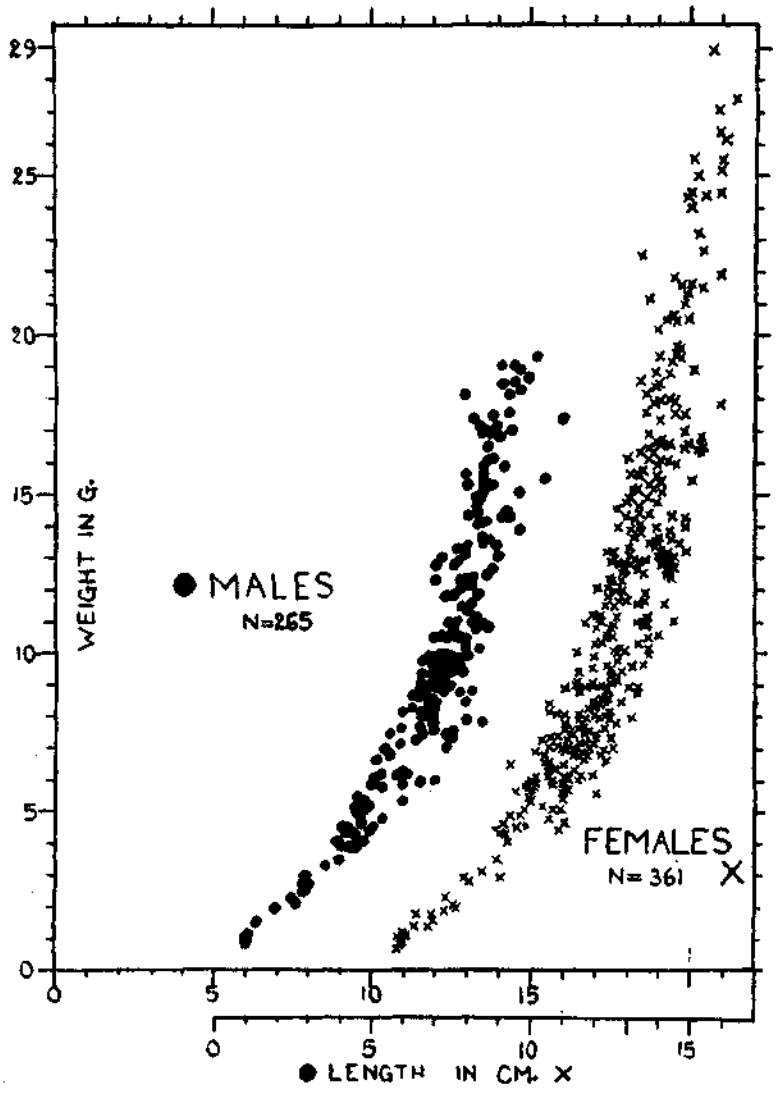

Fig. 2. Scatter diagram of length-weight relationship in males and females of *Cynoglossus semifasciatus*.

respectively. The logarithmic straight line equation is found to be : Log Weight $=\bar{3}.8516+2.9024$ respectively. The exponential equation was found to be: $W=0.0070L^{2.9024}$.

$W=0.0018L^{3.2926}$. (2) *Females* : The total number of one-centimetre groups was 26. *b* and *a* were found to be 3.2170 and –2.6333 respectively. The logarithmic straight line equation for the length-weight relationship.

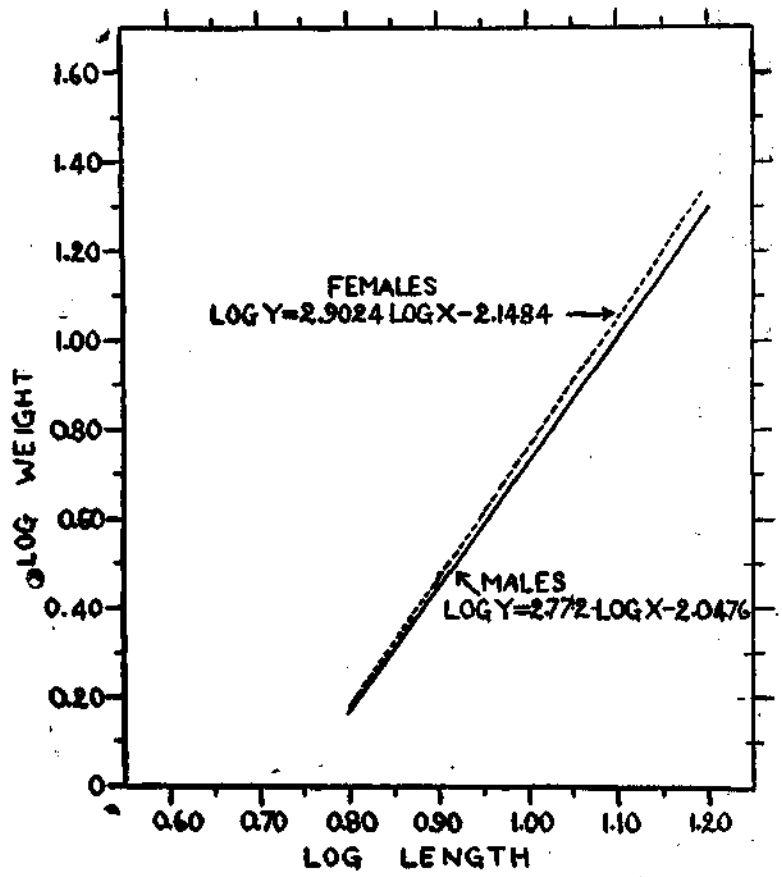

Fig. 4. Logarithmic length-weight relationship in males and females of *Cynoglossus semifasciatus*.

B. *Cynoglossus dubius* (1) *Males* : There were 25 one-centimetre groups. *b* and *a* were estimated to be 3.2926 and –2.7486 respectively. The logarithmic equation for the length-weight relationship is: Log Weight $=\bar{3}.2514+3.2926$ Log Length. The exponential form of the Length-Weight relationship is : $W=0.0018L^{3.2926}$. (2) *Females* : The total number of one-centimetre groups was 26. *b* and *a* were found to be 3.2170 and –2.6333 respectively. The logarithmic straight line equation for the length-weight relationship is: Log Weight $=3.3667+\bar{3}.2170$ Log Length. The converted exponential equation will be $W=0.0023L^{3.2170}$.

C. *Cynoglossus bilineatus* (1) *Males:* There were 16 one-centimetre groups. The values of *b* and *a* were found to be 3.1667 and –2.5335

respectively. The logarithmic length-weight relationship was found to be: Log Weight $=\bar{3}.4665+3.1667$ Log Length. The converted values give the exponential form : $W=0.0029L^{3.1667}$. (2) *Females* : Total number of one-centimetre groups $=21$. $b=3.2489$ and $a=-2.6354$; the straight line equation for the length-weight equation is: Log Weight $=3.3646+3.2489$ Log Length. The exponential form of equation after conversion of values into antilogarithms is: $W=0.0023L^{3.2489}$.

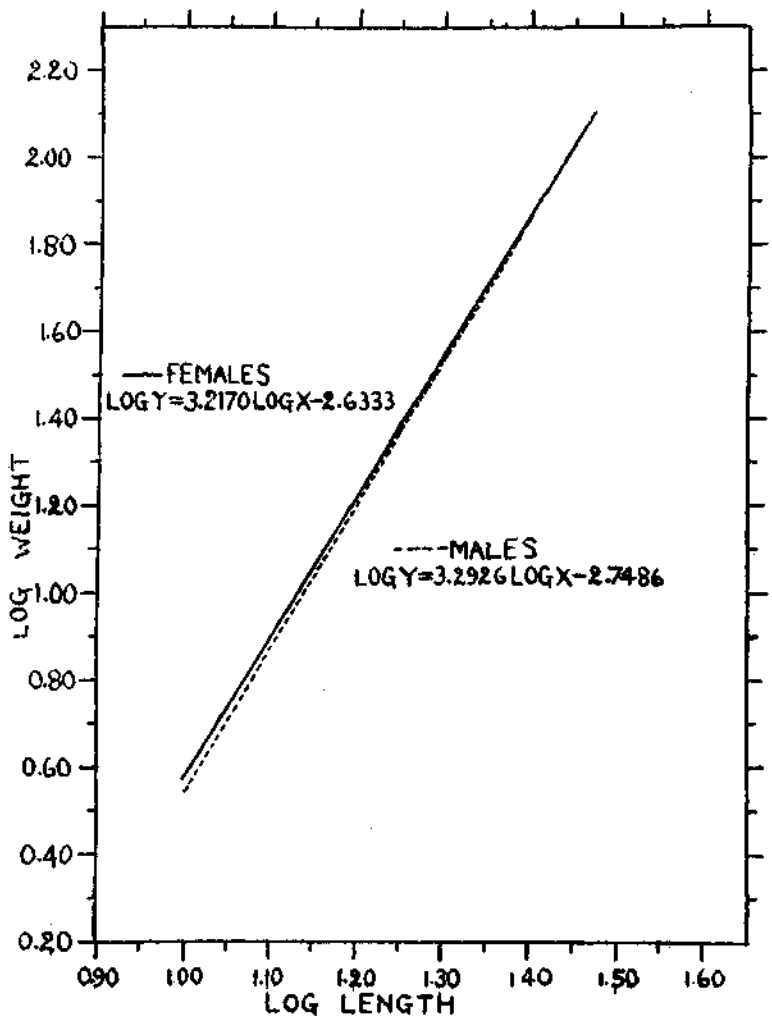

Fig. 5. Logarithmic length-weight relationship in males and females of *Cynoglossus dubius*.

Discussion and Conclusions

The present attempt is only to estimate general length-weight relationships in the three species studied, with the data of various periods

pooled together, but separated as to sex though not for other parameters. While it is hoped that future studies may go into more details, information on the length-weight relationships in any Indian flatfishes so far seems to be the work of Edwards *et. al.* (1971); these

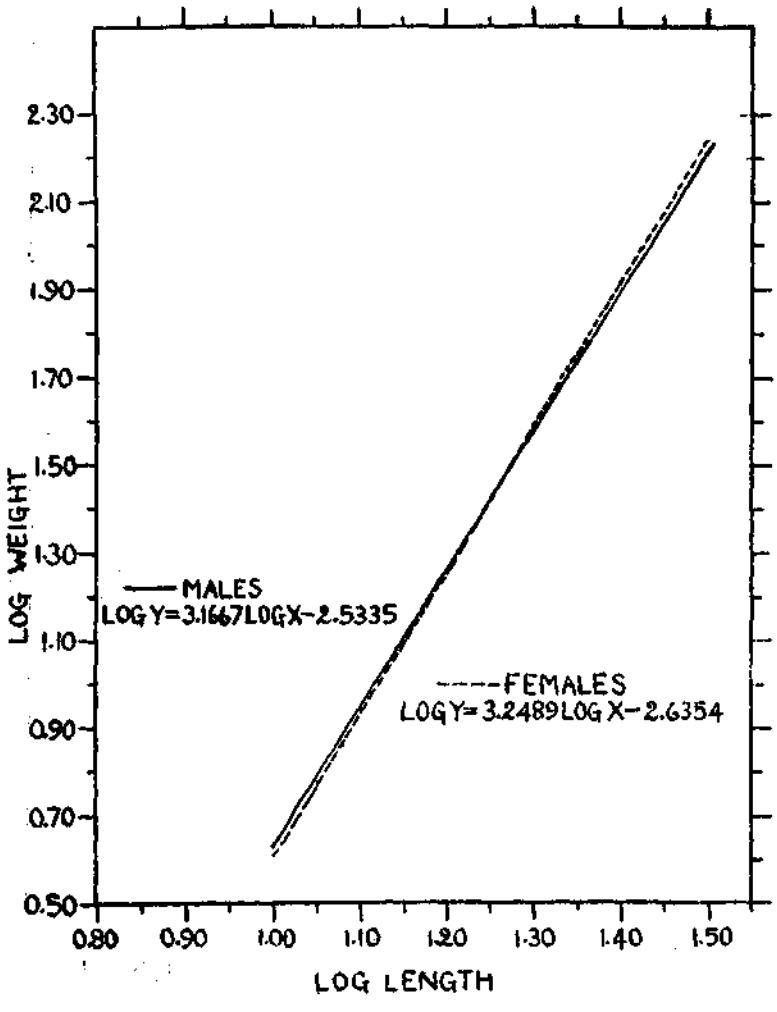

Fig. 6. Logarithmic length-weight relationship in males and females of *Cynoglossus bilineatus*.

the equations now derived have their own value in view of the fact that almost no other work in this line has been available on these species. The only earlier source of some authors have given the equations for four species of *Cynoglossus*, but not including the present three species; the four species and their length-weight relationships are as follows:

Species	*L-W equation I (for wet weight)*	*L-W equation II (for dry weight)*
C. brevis	$W=0.005\ L^{3.156}\ (\pm 0.091)$	$W=0.001\ L^{3.175}(\pm 0.093)$
C. cynoglossus	$W=0.004\ L^{3.155}(\pm 0.074)$	$W=0.001\ L^{3.3245}(\pm 0.071)$
C. lida	$W=0.004\ L^{3.096}(\pm 0.057)$	$W=0.001\ L^{3.070}(\pm 0.079)$
C. puncticeps	$W=0.004\ L^{3.161}\ (\pm 0.028)$	$W=0.001\ L^{3.264}(+0.049)$

While comparing the regression trends in the length-weight relationships of different species, the most important aspect to be considered is the regression co-efficient *b* which indicates the slope of the regression line. It will be noticed in the above Table that the b-value in all the cases is a little above 3, the range being from 3.070 to 3.3245 (including both wet and dry determinations). In the present work the specimens were weighed after removal of moisture by means of a dry cloth. It is to be noted that in both in *C. dubius* and *C. bilineatus* (both males and females) the regression co-efficient *b* has a value slightly above 3 (ranging between 3.1667 and 3.2926) and may be said to be in general agreement with the above values of Edwards *et al.* (1971). For *C. semifasciatus* the b-values are slightly below 3 in both the sexes, that of males being (2.7712) slightly less than the males (2.9024).

This paper was prepared for the symposium on coastal aquaculture nearly six years ago and Victor (1978) has in the meanwhile published a paper on the weight-length relationships in *C. macrostomus* (Norman) (=*C. semifasciatus* Day), and Seshappa and Chakrapani have also worked out in some detail the length-weight relationships in *C. semifasciatus* for several centres of the west coast; details regarding *C. semifasciatus* are being discussed in the latter paper which is now under consideration for publication in the Indian Journal of Fisheries.

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