Results

PART 1

MORPHOMETRIC CHARACTERISTICS OF THE MIRROR CARP CYPRINUS CARPIO V. SPECULARIS LAC

Morphometric measurements .

A. Morphometric indices :

Fresh fish samples were collected fro
Barrage Experimental Fish Farm, near Cairo.
fish samples were at the first year of thei
and ranged in length between 2 and 31 am.

For each fresh fish sample, four morp
measurements were recorded as already stat
the methods. These measurements are: Total
(T.L.), standard length (S.L.), head leng
and body depth (B.D.).

The morphometric index of each measur
was calculated for every fish as a numeric
between this measurements and the standard
these indices included T.L./S.L., S.L./H.L
/B.D. Then the mean value of the ratio fo
centimetre group and for all length groups
obtained. All these ratio values are shown
(1), the values from table (1) are summeri

table (2) Fig.1,2,3, shows the relation b
ween the morphometric indices for differe
morphometric measurements and the total l
gth for the mirror carp.

The results of the morphometric indi
of Cyprinus carpio V. specularis Lac , ar
summrarized as follows :

1. Total length/standard length index(TL./S

T.L./S.L. index ranged from 1.20 to
with a mean of 1.26, this index showd sli
fluctuation around mean value. Generally
was observed that the values of T.L./S.L.
tends to decrease with increase of total
This means that the rate of increase of s
rd length was greater than that of total
gth .

2. Standard length/Head length index (S.L./

S.L./H.L. index varied from 2.62 to
with a mean of 3.04, the value of S.L./H.
index showed a trend towards increase wit
increase of standard length. This may be
erpreted as indicating a slower growth ra
the head relative to that of the body.

3 . Standard length/body depth index (S.L./B

S.L./B.D. index ranged from 2.09 to
with a mean of 2.45. This index showed ma
variation around mean value, Generally, t
S.L./B.D. index showed higher values in s
ller fish samples relative to that of lar
ones, i.e. the deeper body of larger samp
gives lower value for this index than tha
smaller ones. This means that the body de
increased with a rate lower than that of
ndard length in smaller fish samples and
versa in the larger ones.

Table. (1) : Morphometric indices for differen
morphometric measurements of mirr
carp Cyprinus carpio V. specularis

Total length interval.	Average length	No. of fish	T.L/S.L.	S.L/H.L.	S.
2 - 3	2.2	219	1.27	2.75	2
3 - 4	3.3	78	1.27	2.89	2
4 - 5	4.4	84	1.29	2.62	2
5 - 6	4.5	30	1.24	2.63	2
6 - 7	6.3	15	1.29	2.72	2
7 - 8	7.4	12	1.32	2.67	2
8 - 9	8.5	15	1.31	2.83	2
9 -10	9.4	12	1.31	2.88	2
10-11	10.2	15	1.29	3.04	2
11-12	11.4	24	1.24	2.81	2
12-13	12.2	12	1.27	3.00	2
13-14	13.4	15	1.28	3.00	2
14-15	14.2	21	1.28	3.00	2
15-16	15.3	21	1.29	3.13	2
16-17	16.6	36	1.27	3.19	2
17-18	17.4	48	1.26	3.21	2
18-19	18.3	69	1.26	3.22	2
19-20	19.3	66	1.25	3.30	2
20-21	20.3	78	1.26	3.29	2
21-22	21.4	84	1.26	3.33	2

Table. (1) : Continued

Total length interval.	Average length	No. of fish	T.L/S.L.	S.L/H.L.	S.L
22 - 23	22.4	78	1.24	3.33	2.
23 - 24	23.5	54	1.23	3.35	2.
24 - 25	24.4	69	1.23	3.25	2.
25 - 26	25.3	21	1.23	3.17	2.
26 - 27	26.3	42	1.22	3.27	2.
27 - 28	27.2	12	1.22	3.97	2.
28 - 29	28.2	6	1.22	3.10	2.
29 - 30	29.2	6	1.20	3.16	2.
30 - 31	30.1	4	1.24	2.97	2.
Average index			1.26	3.04	2.

T.L. = Total length.

S.L. = Standar length.

H.L. = Head length.

B.D. = Body depth.

Table (2) : The ranges and means of morphometric
ices of Cyprimus carpio V. specularis

Morphometric index	Index range	Index m
T.L. / S.L.	1.20 - 1.32	1.26
S.L. / H.L.	2.62 - 3.35	3.04
S.L. / B.D.	2.09 - 2.80	2.45

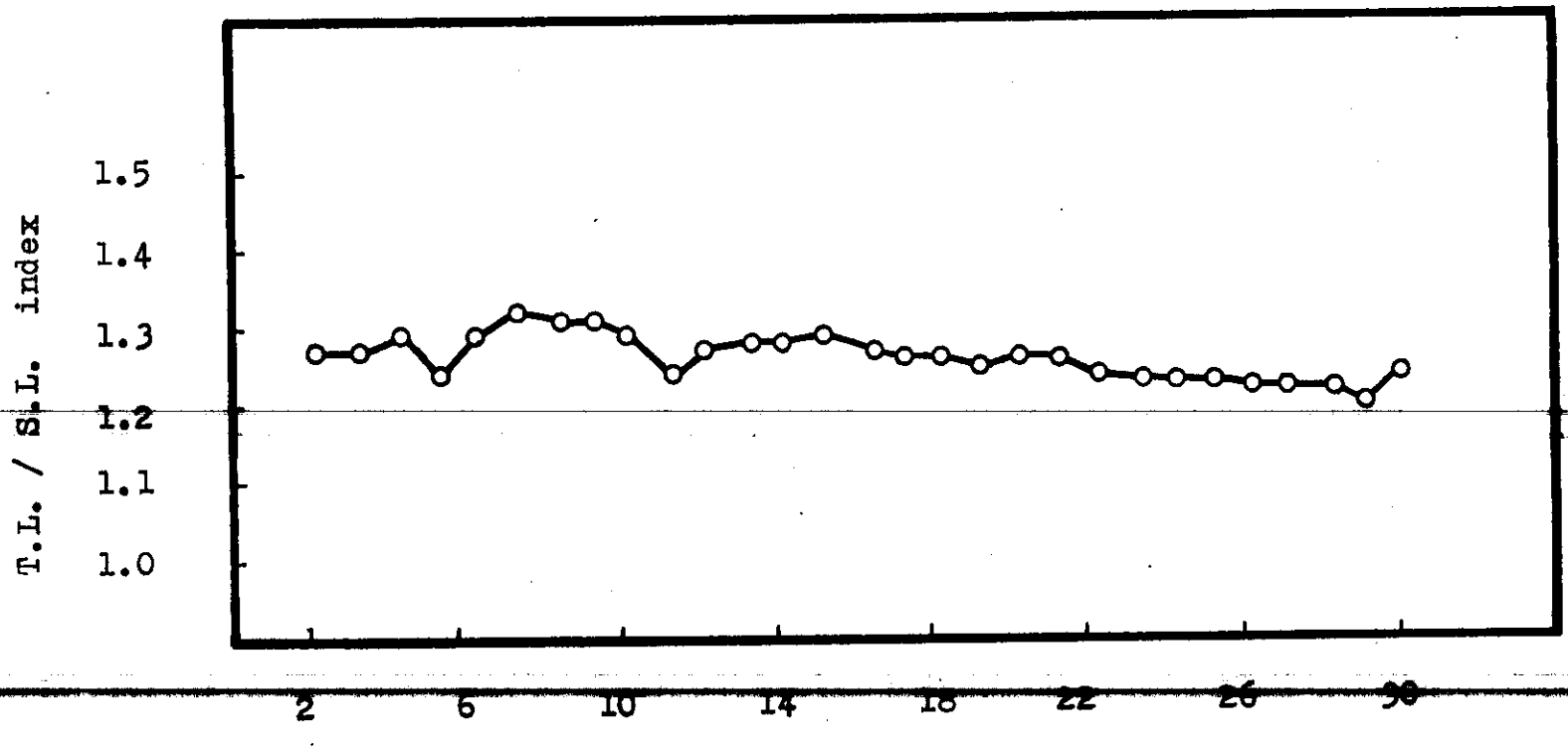


Fig (1) : The relation between the total length/standard length index and total length for the mirror carp Cyprimus carpio V. specularis Lac.

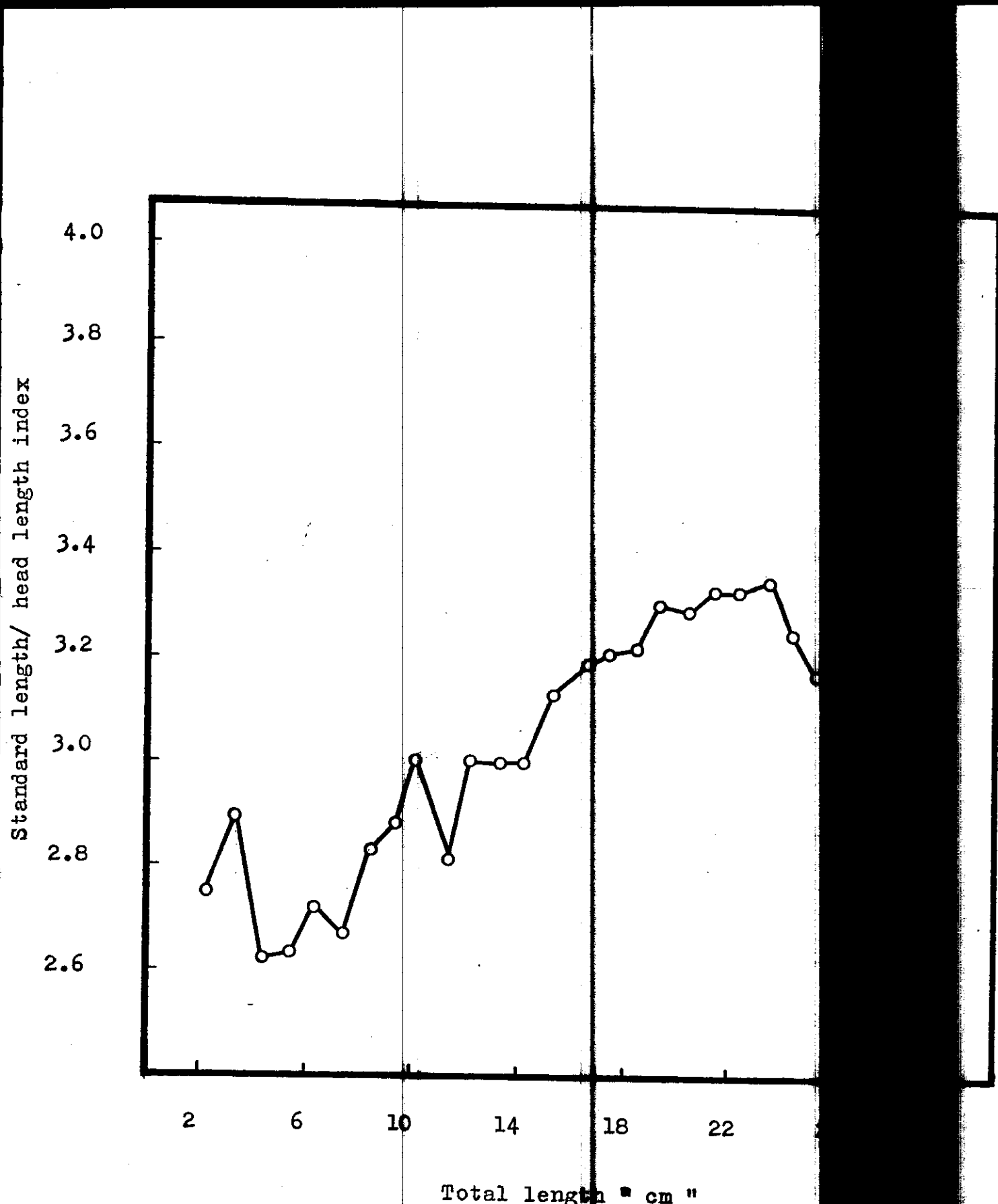
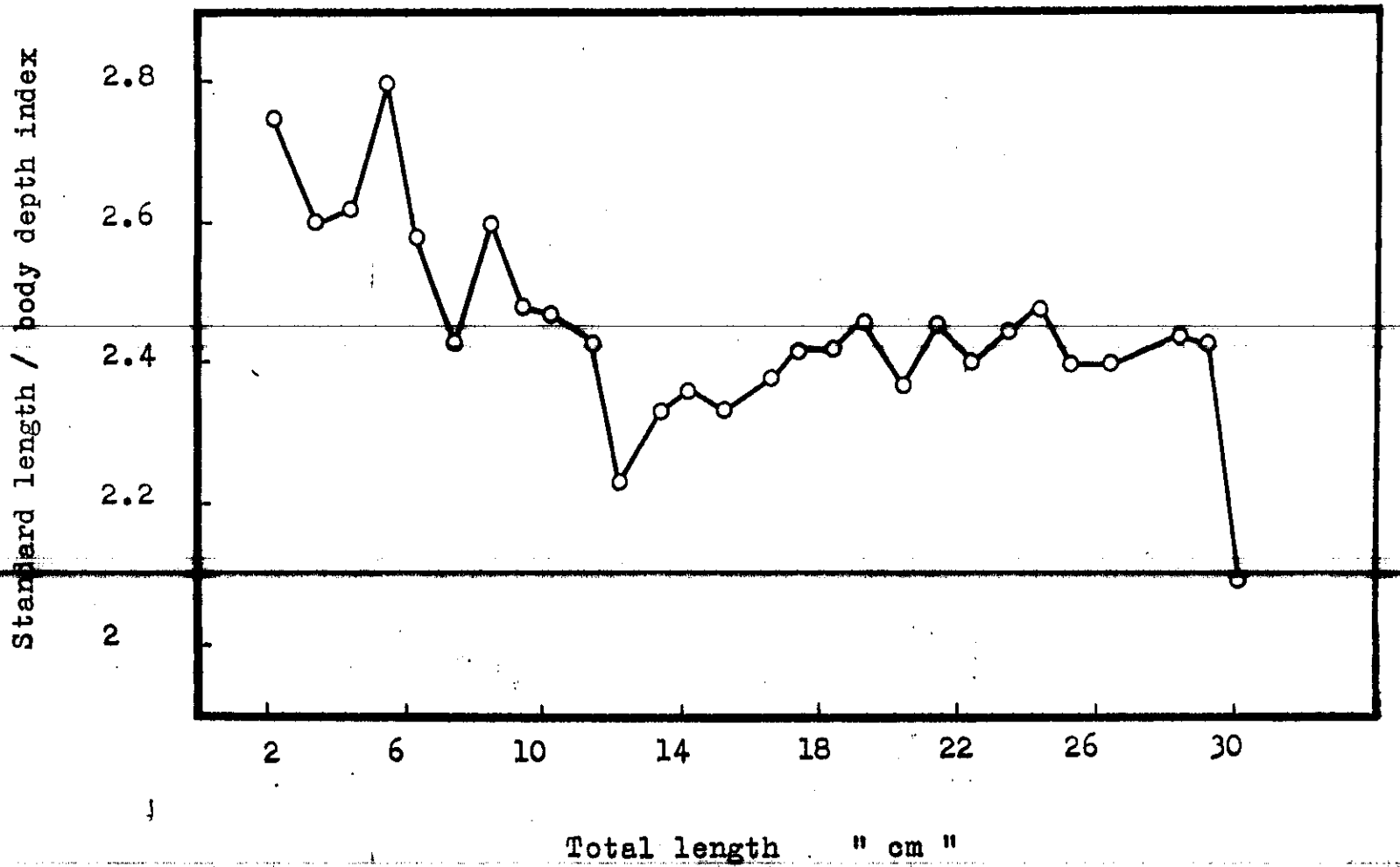


Fig (2) The relation between the standard leng
length index and the total length for
carp Cyprinus carpio V. specularis Lac


Standard length / body depth index
2.8
2.6
2.4
2.2
2
2
6
10
14
18
22
26
30
Total length " cm "

B - Morphometric regressions :

The observed values of the standard Langt length and body depth were plotted as a scatter ams in Fig (4).

The points in all cases aggregated distinc straight lines, consequently, the linear regres formula, $Y = a + b\,x$ was used to obtain the reg formula for each morphometric character. In thi equation :

Y = the morphometric measurements i r.

X = the total length in centimeter.

"a" and "b" are constants which can be determined t statistical method of least square in which:

$$b = \frac{N \Sigma xy - (\Sigma x)(\Sigma y)}{N \Sigma x^2 - (\Sigma x)^2}$$

$$a = \frac{\Sigma Y - b \Sigma x}{N}$$

Where : N = the number of items in the sample.

Table(3) shows the means of the observed valu
morphometric measurements. The regression equatio
calculated from the preceeding equations, and are
ted in table (4), these regression equations were u
obtain the calculated measurements of the forementi
characters.

The average observed values and the calculate
for these measurements are matched in table (5).

In figure (5) the straight lines represent ca
values, and the dotted, the average observed ones.
close fitness of the mean observed values on the s
lines show that the regression equations expressin
ght lines are correct and they best the morphometr
acters in equation.

The regression lines equations of the different pa
the body in relation to the total length indicate
ometric growth occures.

Table (3): The mean observed values of the morphe measurements of the mirror carp Cypri carpio V. specularis Lac.

Total length group "cm"	S.L.	H.L.	B.D.
2 - 3	2.2	0.8	0.8
3 - 4	2.6	0.9	1
4 - 5	3.4	1.3	1.3
5 - 6	4.2	1.6	1.5
6 - 7	4.9	1.8	1.9
7 - 8	5.6	2.1	2.3
8 - 9	6.5	2.3	2.5
9 - 10	7.2	2.5	2.9
10 - 11	7.9	2.6	3.2
11 - 12	9	3.2	3.7
12 - 13	9.6	3.4	4.3
13 - 14	10.5	3.5	4.5
14 - 15	11.1	3.7	4.7
15 - 16	11.9	3.8	5.1
16 - 17	13.1	4.1	5.5
17 - 18	13.8	4.3	5.7

Table. (3) : Continued

Total length group "cm"	S.L.	H.L	B.D.
18 - 19	14.5	4.5	6
19 - 20	15.5	4.7	6.3
20 - 21	16.1	4.9	6.8
21 - 22	17	5.1	6.9
22 - 23	18	5.4	7.5
23 - 24	19.1	5.7	7.8
24 - 25	19.8	6.1	8
25 - 26	20.6	6.5	8.6
26 - 27	21.6	6.6	9
27 - 28	22.3	7.5	9.3
28 - 29	23.1	7.6	9,7
29 - 30	23.9	7.7	9.8
30 - 31	25	7.9	10.3

S.L. = Standard length,

H.L. = Head length,

B.D. = Body depth .

Table (4) : Regression equations of the differe morphometric chere ters relative to total length in mirror carp Cyprinu carpio V. specnlaris Lac.

Morphometric character	Regression equation
S.L.	S.L. = 0.4345 + 0.8288
B.D.	B.D. = 0.2112 + 0.3450
H.L.	H.L. = 0.7675 + 0.2190

S.L. = Standard length,
B.D. = Body depth,
H.L. = Head length.

Table (5) : Observed and calculated morphometr
urements for mirror carp Cyprinus
V. specularis Las after respectiv
ression equations

Total length group "cm"	S.L.		H . L.		B
	obs.	cal.	obs.	cal.	obs
2 - 3	2.2	1.8861	0.8	1.3796	0.8
3 - 4	2.6	2.3005	0.9	1.4892	1
4 - 5	3.4	3.2122	1.3	1.7302	1.3
5 - 6	4.2	3.8752	1.6	1.9055	1.5
6 - 7	4.9	4.7869	1.8	2.1465	1.9
7 - 8	5.6	5.5328	2.1	2.3437	2.3
8 - 9	6.5	6.6103	2.3	2.6285	2.5
9 - 10	7.2	7.3562	2.5	2.8257	2.9
10 - 11	7.9	8.0192	2.6	3.0010	3.2
11 - 12	9	9.0138	3.2	3.2639	3.7
12 - 13	9.6	9.6768	3.4	3.4392	4.3
13 - 14	10.5	10.6714	3.5	3.7021	4.5
14 - 15	11.1	11.3344	3.7	3.8774	4.7
15 - 16	11.9	12.2461	3.8	4.1184	5.1
16 - 17	13.1	13.3235	4.1	4.4031	5.5
17 - 18	13.8	13.9866	4.3	4.8785	5.7

Table. (5) : Continued

Total length group " cm "	S . L.		H . L.		B
	obs.	cal.	obs.	cal.	obs.
18 - 19	14.5	14.7325	4.5	4.7757	6
19 - 20	15.5	15.5613	4.7	4.9948	6.3
20 - 21	16.1	16.3901	4.9	5.2139	6.8
21 - 22	17	17.3018	5.1	5.4549	6.9
22 - 23	18	18.1306	5.4	5.6740	7.5
23 - 24	19.1	19.0423	5.7	5.9150	7.8
24 - 25	19.8	19.7882	6.1	6.1122	8
25 - 26	20.6	20.5341	6.5	6.3094	8.6
26 - 27	21.6	21.3629	6.6	6.5285	9
27 - 28	22.3	22.1088	7.5	6.7257	9.3
28 - 29	23.1	22.9376	7.6	6.9448	9.7
29 - 30	23.9	23.7664	7.7	7.1639	9.8
30 - 31	25	24.5123	7.9	7.3611	10.3

S . L . = Standard length,

H . L . = Head length,

B . D . = Body depth.

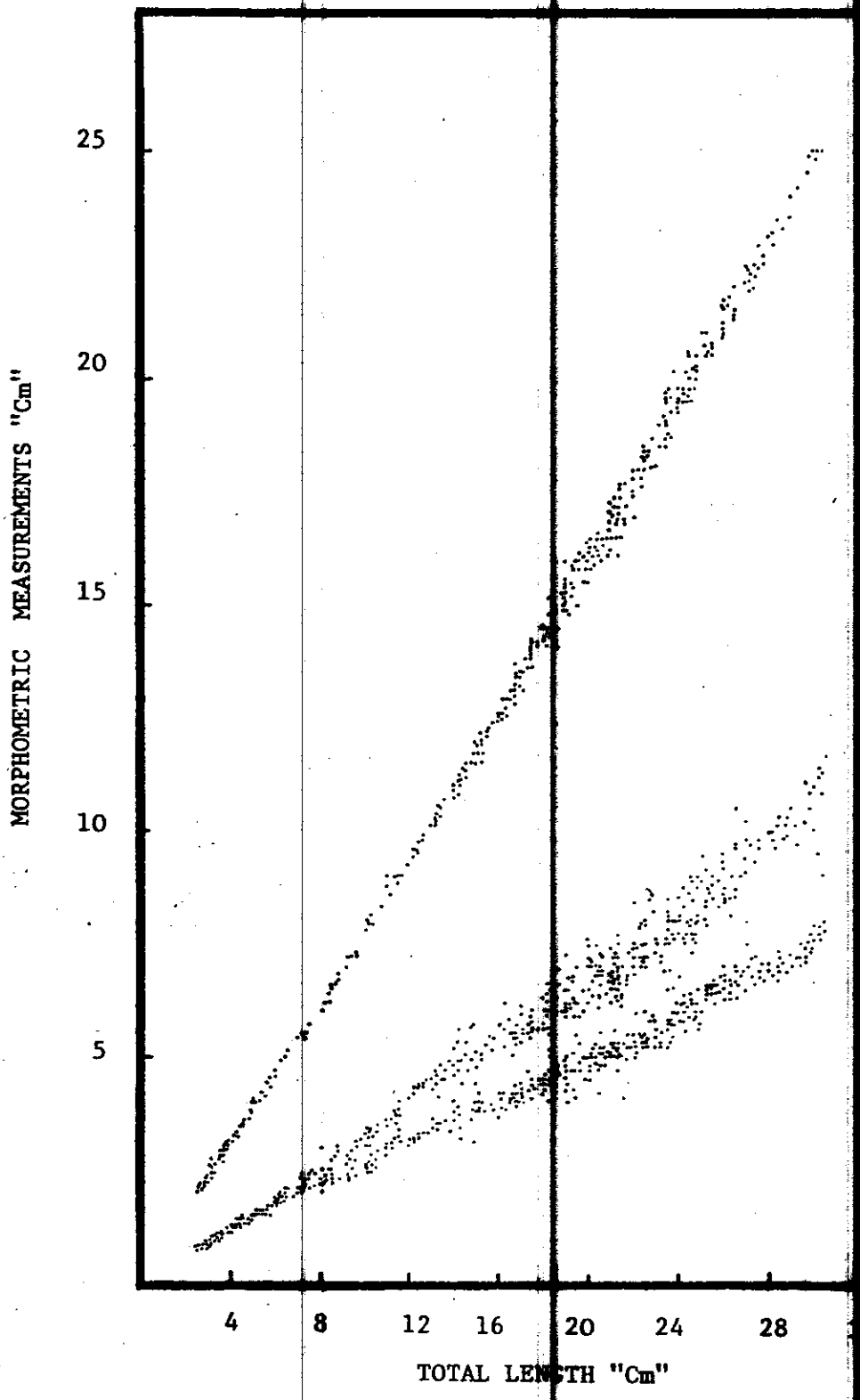


Fig (4) : A scatter diagram to show the
between the total length and
erent morphometric measuremen
mirror carp Cyprinus carpio V

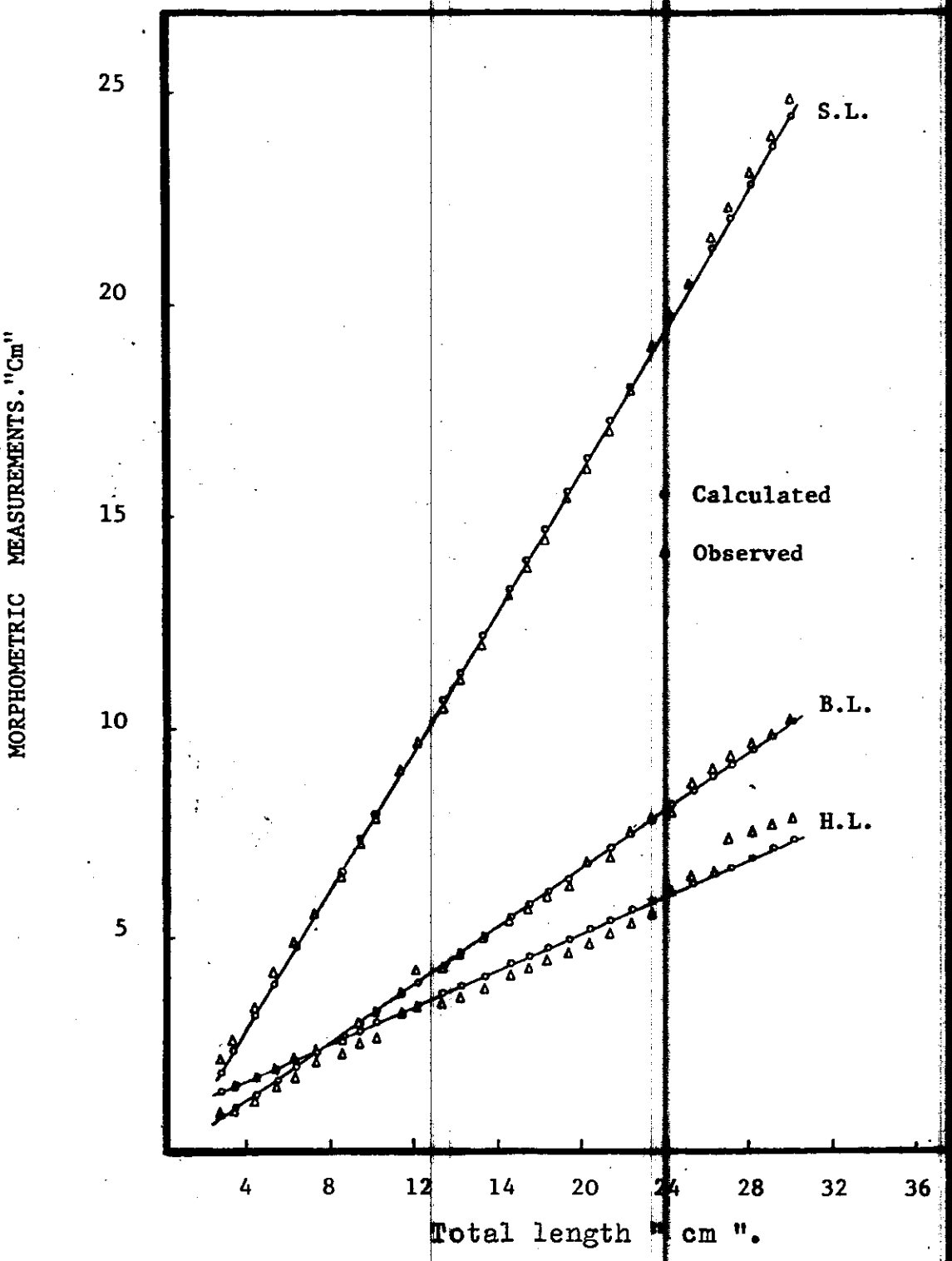


Fig (5) : The relation between the total length and the different morphometric measurements for the mirror carp Cyprinis carpio V. specularis Lac.

C. Length-weight relationship of the mirror carp Cyprinus carpio V. specularis Lac.

The length - weight relationship of fish has usually been directed towards establishing a mathematical relationship between length and weight, so that one may be obtained from the other.

Since the length of a fish is often more rapidly and accurately measured than, its weight (especially in the field), it is thus very convenient to find a relationship by which weight can be determined if length is only known.

It has been found that the lenght-weight relationship of most fish can be better described by the general parabola :

$$W = c\ L^n$$

where

W = weight in grams

L = length in millimeters.

" c " and " n " are constants which can be determined emperically.

Graphicl representation of the relationships between fish length and weight invariably gives a curvilinear shape, the general parabola, $W = cL^n$ can be expressed in logarithmic form, the curve thus turning to a straight line, the relation is thus expressed as :

$$\text{Log } W = \text{Log } c + n \text{ Log } L.$$

Where " n " equals the slope and " Log c " equals the intercept which are easily determined by fitting a line to the logarithms of " L " and " W

The values of " Log c " and " n " are computed from the following formula which is simply a resultant of solutions of the normal equation :

$$\text{Log } c = \frac{\Sigma \text{ Log } W \; \Sigma \; (\text{Log } L)^2 - \Sigma \text{ Log } L. \; \Sigma \; (\quad W)}{N \; \Sigma \; (\text{Log } L.)^2 - (\; \Sigma \text{ Lo}}$$

and

$$n = \frac{\Sigma \text{ Log } W \quad - \quad N \text{ Log } c}{\Sigma \text{ Log } L.}$$

In the present study of length - weight relationship of the mirror carp Cyprinus carpio V. specular Lac, 1246 fish samples were used, with total length ranging between 2 - 31 cm.

The relationship between the length and weig was worked out , the data were taken from freshly samples and are represented in table (6) , by gro ping the fish by one centimetre total length and weight of the fish.

The average observed weights for both sexes c ined were calculated, as it was found that there appearent differences between males and females . The averages were then converted into logarithms the linear regression was used whose values were c uted by the logarithms of total lengths and actua weights, table (7) and Fig (7) .

To express the lenght-weight relationship in of parabola , $W = cL^n$.

Where W = weight in grams and L = lengthin m meters , the values of " c " and " n " were calcul for the formula referred to before .

The calculated length-weight formula was fou

$$\text{Log } W = -1.8942 + 3.05762 \text{ Log } L .$$

or

$$W = 0.01276\ L^{3.05762} .$$

It is noted that the weight increases at a r
equal to the cube of length, the close agreement
between emprical and calculated weights can be cl
seen in table (6) and Fig (6) .

In Fig (6) the continuous curve represents t
emprical weights and the dotted represents the ca
lated ones.

The emprical weights are slightly higher tha
the calculated weights for lengths 2-4 cm. For th
ths between 5 and 30 cm, the emprical weights ar
lower than the calculated weights. Generally, th
differences between the calculated and emperical
showed a trend towards increase at the same rate
increase of length.

Table (8) and Fig. (8) shows the variation i
weight of fish samples of the same length. It has
found that for lengths ranging from 2 and 13 cm.
variations in the weight were observed. Moderate
ations in weight were shown for the lengths from
to 21 cm. For lengths from 21 to 30 cm. great var
ons in weights were observed.

Table (6) : Length - weight relationship for the mirror c

Cyprinus carpio V. specularis Loc.

Calculated weights are obtained by using the formul

(Log w = - 1.8942 + 3.0576 log L .)

Total length interval cm.	Mid point cm.	No. of fish examined	Average Empirical weight	Calculated weight
2 - 3	2 .8	219	0.3078	0.3064
3 - 4	3 .3	78	0.5090	0.5097
4 - 5	4 .4	84	1.2	1.2
5 - 6	5 .4	30	1.8	2.3
6 - 7	6 .3	15	3.7	3.8
7 - 8	7 .4	12	6.1	6.2
8 - 9	8 .5	15	9	9.6
9 -10	9 .4	12	10.5	13.1
10-11	10.2	15	13.8	16.9
11-12	11.4	24	22	23.8
12-13	12.2	12	28	29.3
13-14	13.4	15	36.6	39.3
14-15	14.2	21	40.6	46.9
15-16	15.3	21	53.7	59.2
16-17	16.6	36	65.4	76.3
17-18	17.4	48	75.8	88.2
18-19	18.3	69	89	103 .2

Table (6) : Continued.

Total length interval cm.	Mid point cm.	No.of fish examined	Average Emprical weight	Calcul weig
19-20	19.3	66	109	121.7
20-21	20.3	78	125	142.3
21-22	21.4	84	134.9	167.6
22-23	22.4	78	173.2	193
23-24	23.5	54	201.8	224.1
24-25	24.4	69	223.3	251.7
25-26	25.3	21	263.7	281.6
26-27	26.3	42	295.3	317.5
27-28	27.2	12	329	355.4
28-29	28.2	6	365	400.4
29-30	29.2	6	401	439.3
30-31	30.1	4	440.5	482.7

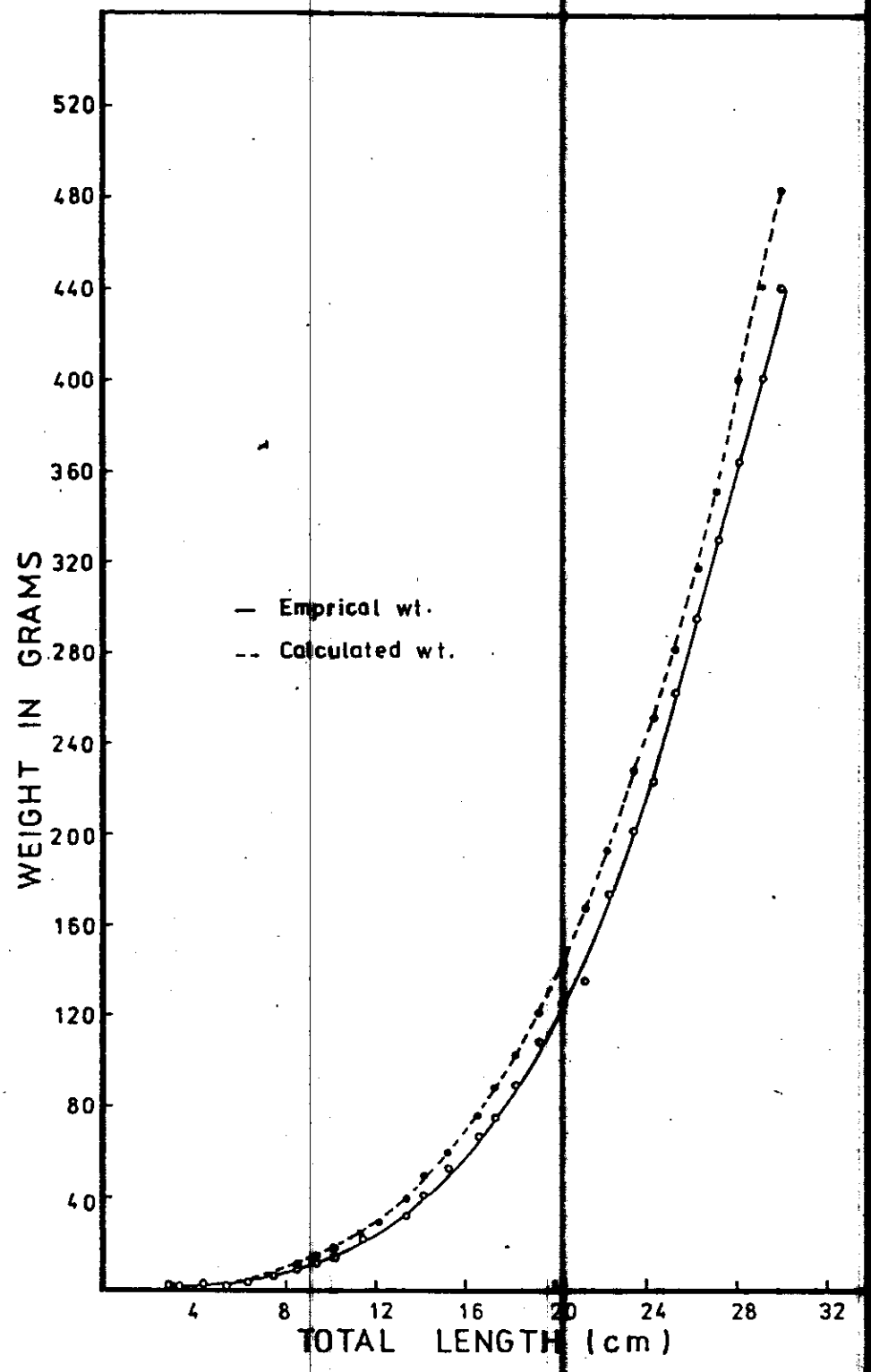


Fig (6) : Length-weight relation of the mi
carp Cyprimus carpio V. specular
Lac.

Table (7) : Length - weight , absolute and log values for the mirror carp Cyprinus carpio V. specularis Lac.

Length intervals	Length "cm"	Log length	weight "gm"	log weight
4 - 5	4 . 4	0.6435	1 .2	0.0792
5 - 6	5 . 4	0.7324	1 .8	0.2553
6 - 7	6 . 3	0.7993	3 .7	0.5682
7 - 8	7 . 4	0.8692	6 .1	0.7853
8 - 9	8 . 5	0.9294	9	0.9542
9 -10	9 . 4	0.9731	10.5	1.0212
10-11	10. 2	1.0086	13.8	1.1399
11-12	11. 4	1.0569	22	1.3424
12-13	12. 2	1.0863	28	1.4472
13-14	13. 4	1.1271	36.6	1.5634
14-15	14. 2	1.1522	40.6	1.6085
15-16	15. 3	1.1846	53.7	1.7299
16-17	16. 6	1.2201	65.4	1.8156
17-18	17. 4	1.2405	75.8	1.8797
18-19	18. 3	1.2625	89	1.9494
19-20	19. 3	1.2856	109	2.0374
20-21	20. 3	1.3075	125	2.0969
21-22	21. 4	1.3304	134.9	2.1300

Table (7) Continued

Length intervals	Length "cm".	Log length	weight "gm".	log weight
22-23	22.4	1.3502	173.2	2.2385
23-24	23.5	1.3711	201.8	2.3049
24-25	24.2	1.3874	223.3	2.3489
25-26	25.3	1.4031	263.7	2.4211
26-27	26.3	1.4199	295.3	2.4703
27-28	27.2	1.4357	329	2.5172
28-29	28.2	1.4524	365	2.5622
29-30	29.2	1.4654	401	2.6031
30-31	30.1	1.4786	440.5	2.6439

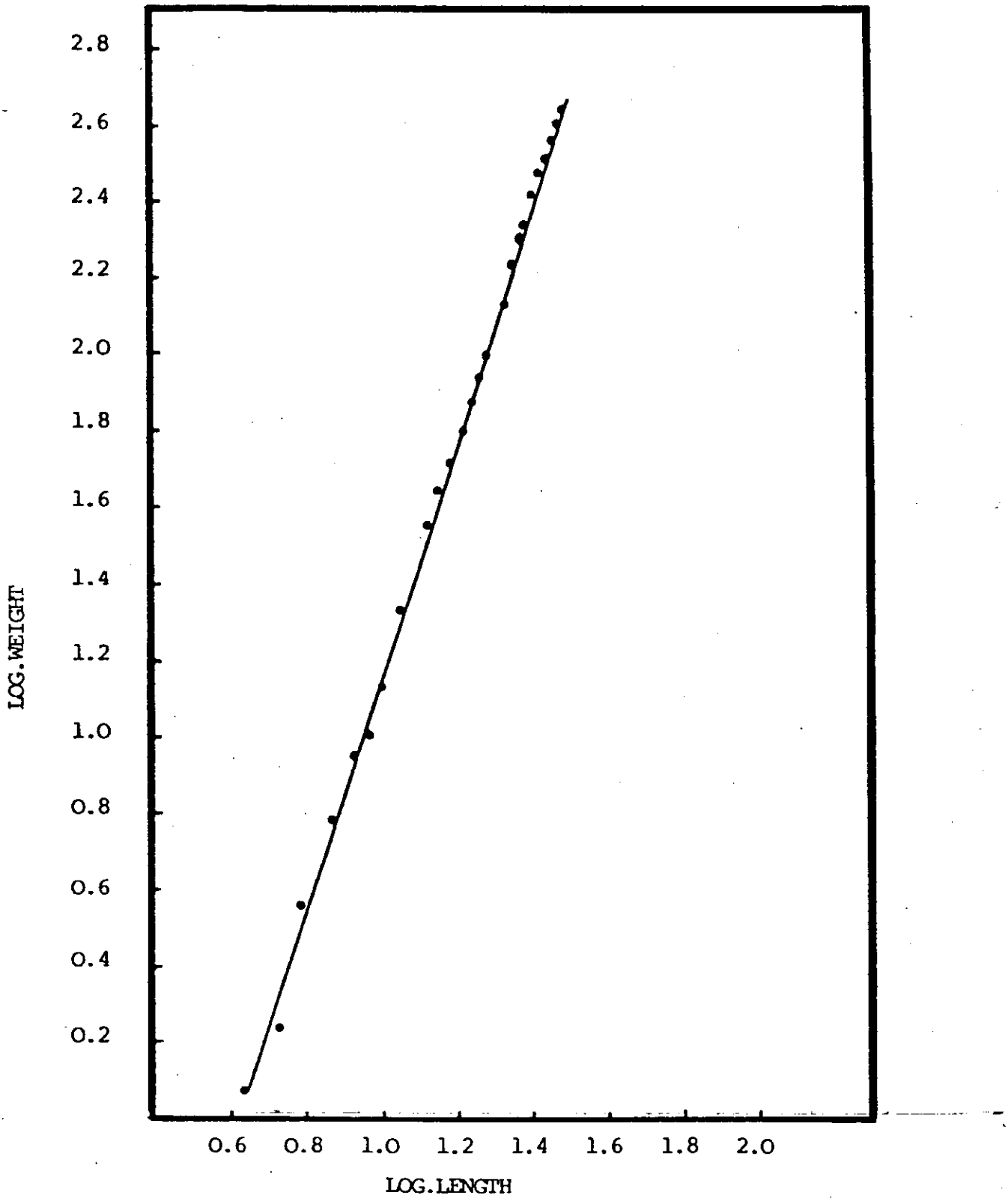


Fig. (7) : Log length-Log weight relationship of the Mirror Carp Cyprinus carpio V. specularis Lac.

Table (8) : Variation in weight of the mirror carp *Cyprinus carpio* V. *specularis* Lac. according to their length.

Total length " cm "	Range of weight " gm "	Total length " cm "	Range of weight " gm "
2 .8	0.2 - 0.4	17.4	64 - 87
3 .3	0.2 - 0.8	18.3	76 -108
4 .4	0.8 - 1.8	19.3	88 -139
5 .4	1.8 - 2.6	20.3	98 -148
6 .3	2.9 - 4.3	21.4	112-175
7 .4	5.2 - 6.8	22.4	138-241
8 .5	7 - 10	23.5	153-230
9 .4	9.2 - 12.6	24.4	186-288
10.2	12 - 16.1	25.3	232-299
11.4	20 - 23.5	26.3	260-359
12.2	27 - 29	27.2	296-386
13.4	34 - 40	28.2	344-410
14.2	37 - 48	29.2	378-424
15.3	50 - 63	30.1	416-462
16.6	55 - 74	-	-

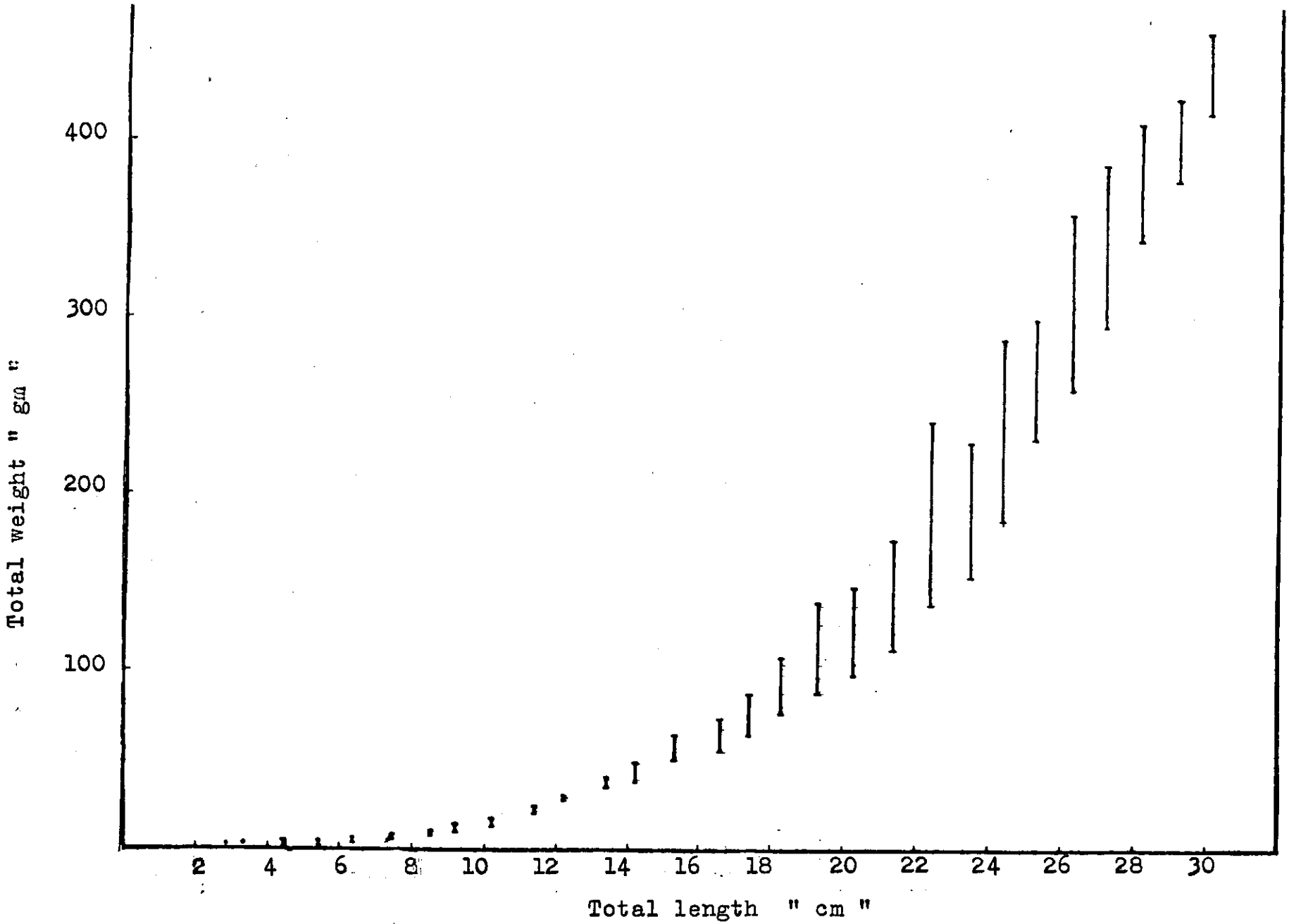


Fig.8. Variation in weight of the mirror carp Cyprinus carpio V. specularis Lac. according to their length.