

LENGTH-WEIGHT RELATIONSHIP AND CONDITION FACTOR OF EPINEPHELUS AENEUS AND EPINEPHELUS ALEXANDRINUS IN THE EGYPTIAN MEDITERRANEAN WATERS.

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ABSTRACT

The present study showed a clear difference in the value of the constant (n), this may be attributed to the different ecological conditions in the studied regions. Also, variations in the rate of the growth were observed. For the same length group it can be concluded that the observed and calculated weights for fishes were higher in Alexandria region than in Salloum Bay. Also, the condition factor for both species was higher in Alexandria than in Salloum Bay. This is due to the higher productivity of Alexandria region.

INTRODUCTION

Length-weight relationship is an essential biological parameter, needed to appreciate the suitability of the environment for any fish that is why most fishery biological studies usually give an importance to it.

The value of the condition factor gives the degree of the well being of the fish. Comparison of the mean condition factors of individuals from a population in any specific locality with those of others, shows the suitability of any of the two localities to the population with regards to feeding condition.

In the present study, length-weight relationship of the two species under study will be given. Comparison between the two areas namely Alexandria waters and Salloum Bay is also studied. Besides, the condition factor is also given for the two species.

MATERIAL and METHODS

Monthly samples of the two species were collected from professional fishermen at the Alexandria fish market, besides, samples were fished from Salloum Bay region (region West of Alexandria, (Fig. 1) by experimental fishing gears. Sampling from Alexandria fish market lasted from January 1976 to March 1977. In Salloum Bay, sampling started in

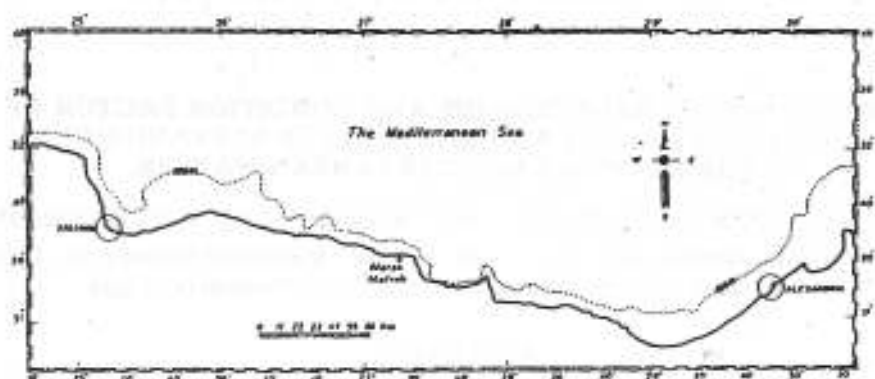


Fig. 1. Area of investigation.

November 1975 and ended in July 1976.

For length-weight relation and condition factor, gutted weight was used instead of total weight, in order to avoid bias caused by variations in the weight of gonads and gut. The determination of the length-weight relationship for the two species, was based on the combined data for all fishes, regardless of the time of capture, sex and stage of maturity.

In this study, the length-weight relationship was calculated as the logarithmic formula (Lagler, 1956),

$$\text{Log } W = \log a + n \log L$$

where,

W = gutted weight of the fish in grams,

L = total length of the fish in centimeters and

log a and n are constants, which can be calculated by the following formula

$$\text{Log } a = \frac{\log W (\log L)^2 - \log L \cdot (\log L \cdot \log W)}{N \log L - (\log L)}$$

$$n = \frac{\log W - N \log a}{\log L}$$

where,

W = gutted weight of the fish in grams,

L = total length of the fish in centimeters, and

Log a and n are constants, which can be calculated by the following formula

$$\text{Log } a = \frac{\log W (\log L)^2 - \log L (\log L \log W)}{N \log L^2 - (\log L)^2}$$

$$n = \frac{\log W - N \log a}{\log L}$$

where, N = number of groups in grouped data.

For the determination of the condition factor in the present study, the following equation is used

$$K = \frac{W}{L^3} \times 100 \quad (\text{Hile, 1936})$$

Where, W = gutted weight in grams and

L = total length of the fish in centimeters.

OBSERVATIONS

A-1 Length-weight relationship of *Epinephelus aeneus*

In Alexandria region, 169 fishes were analysed with the total length ranging between 17.5 and 97.5 cm, while in Salloum Bay, 80 fishes were analysed ranging in total length from 12.5 to 47.5 cm. Fig. (2) represents the length-weight relationship of *Epinephelus aeneus* in Alexandria and Salloum Bay regions. As shown from the curve, the relation is a curvilinear. The formula representing the above mentioned relationship of *Epinephelus aeneus* in the two regions are the following

For Alexandria region :

$$\text{Log } W = -1.8895 + 2.9645 \log L$$

or

$$W = 0.0129 L^{2.9645}$$

For Salloum Bay region:

$$\text{Log } W = -1.6078 + 2.7636 \log L$$

or

$$W = 0.0247 L^{2.7636}$$

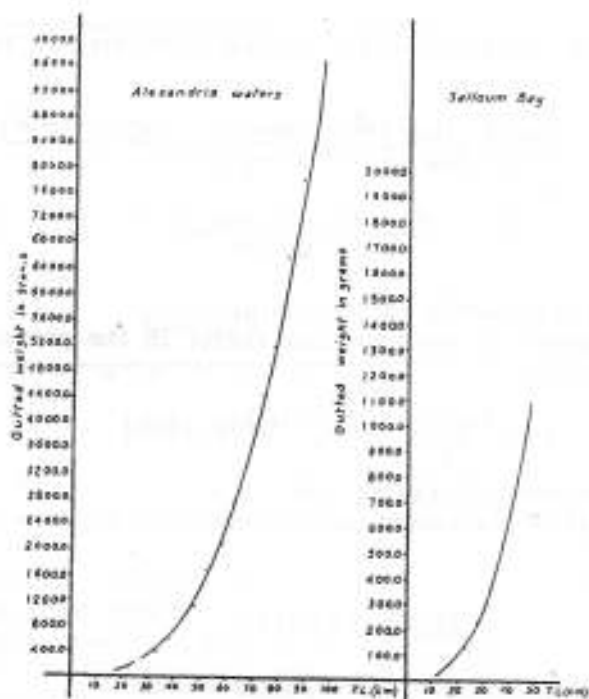


Fig. Length-weight relationship of *Epinephelus aeneus* in Alexandria waters (1976-1977) and Salloum Bay region (1975-1976).

Table (1) gives the mean observed and calculated weights in grams of *Epinephelus aeneus* using these equations for different length groups for the two regions.

This shows that, for a certain length, the weight of this species in Alexandria region is higher than that in Salloum Bay.

A-2. Length-weight relationship of *Epinephelus alexandrinus*

From Alexandria region, 360 fish were examined with total length from 14.0 to 60.0 cm. In Salloum Bay, 127 fish were analysed ranging in total length between 12.0 and 26.0 cm.

Fig. (3) represents the length-weight relationship of *Epinephelus alexandrinus* in the two regions. The formulae representing this relationship are the following

For alexandria region :

Table (1)
 Mean observed and calculated gutted weight for *Epinephelus aeneus*
 in Alexandria (1976-1977) and Salloum Bay (1975-1976) regions.

Total length (cm)	No. of Fish	Alexandria region		Salloum Bay region	
		observed wt. (gm)	calculated wt. (gm)	observed wt. (gm)	calculated wt. (gm)
12.5	-	-	-	28.25	26.52
17.5	4	72.75	62.44	67.38	67.21
22.5	26	123.38	131.54	131.38	134.61
27.5	17	226.06	238.45	227.84	234.39
32.5	11	385.45	391.27	333.75	371.91
37.5	13	569.92	598.02	515.00	552.32
42.5	25	845.60	866.68	797.50	780.58
47.5	16	1102.69	1205.20	1240.00	1061.48
52.5	14	1686.21	1621.48	-	-
57.5	14	2060.14	2123.42	1780.00	1799.77
62.5	9	2772.20	2719.86	-	-
67.5	10	3385.00	3415.63	-	-
72.5	2	4451.50	4221.59	-	-
77.5	3	5205.67	5144.40	-	-
82.5	2	6502.50	6191.95	-	-
87.5	1	7625.00	7371.96	-	-
92.5	1	8645.00	8692.15	-	-
97.5	1	9920.00	10160.24	-	-

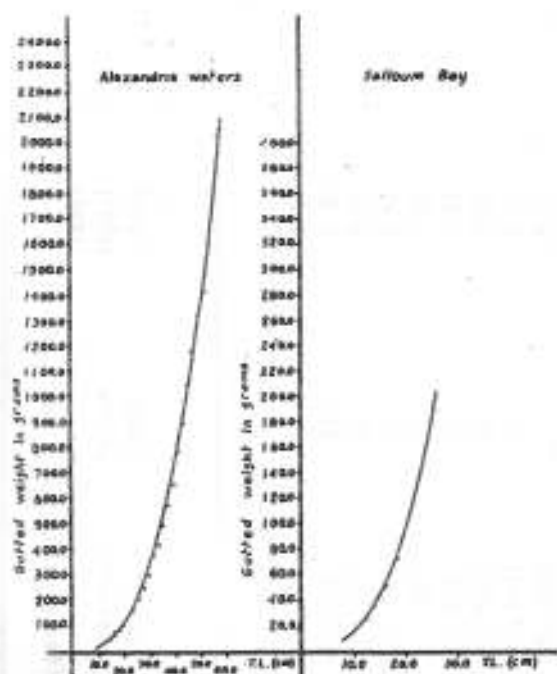


Fig. 3. Length-weight relationship of *Epinephelus alexandrinus* in Alexandria waters (1976-1977) and Salloum Bay region (1975-1976).

$$\text{Log } W = -1.6195 + 2.7784 \log L$$

OR

$$W = 0.024 L^{2.7764}$$

For Salloum Bay region:

$$\text{Log } W = -1.7035 + 2.8184 \log L$$

OR

$$W = 0.0198 \cdot L^{2.8184}$$

Table (2) gives the mean observed and calculated weights in grams using these equations for the different length groups in each region. Also, we notice that the mean fish weight per length group is higher in Alexandria region than in Salloum Bay region.

Table (2)
 Mean observed and calculated gutted weights for *Epinephelus alexandrinus*
 in Alexandria (1976-1977) and Salloum Bay (1975-1976) Regions.

Total length (cm.)	Alexandria Region			Salloum Bay Region		
	No. of fish	Observed wt. (gm)	Calculated wt. (gm)	No. of fish	Observed wt. (gm)	Calculated wt. (gm)
12.0	-	-	-	1	20.00	21.78
14.0	2	39.50	36.72	1	32.00	33.63
16.0	1	66.00	53.33	5	52.20	49.00
18.0	2	70.00	73.82	43	70.44	68.29
20.0	6	96.00	98.93	35	92.11	91.90
22.0	15	126.27	128.92	27	114.19	120.22
24.0	30	155.73	164.18	10	148.50	153.63
26.0	25	194.16	205.07	5	193.60	192.51
28.0	27	239.78	251.95			
30.0	37	287.38	305.19			
32.0	45	245.80	365.12			
34.0	33	409.91	432.11			
36.0	18	487.83	506.48			
38.0	19	563.89	589.57			
40.0	14	647.81	678.72			
42.0	20	774.65	777.26			
44.0	16	879.06	884.50			
46.0	17	1035.71	1000.77			
48.0	11	1175.00	1126.39			
50.0	6	1285.17	1261.68			
52.0	8	1435.88	1406.93			
54.0	2	1557.50	1562.47			
56.0	-	-	-			
58.0	3	2018.33	1905.63			
60.0	3	2360.00	2093.85			

B-1 Condition factor of *Epinephelus aeneus*

The condition factor for each length group of *Epinephelus aeneus* both in Alexandria and Salloum Bay regions was calculated and the obtained data were given in table (3). As it is clear from the table, the small sized fishes have higher K than bigger ones. Also from table (3), it is evident that the condition factor is less in Salloum Bay region than in Alexandria region.

From table (4) and fig. (4), we see that the condition factor reaches its maximum value in September and minimum in April. The high value of the condition factor in summer is probably attributed to active feeding in this season.

B-2. Condition factor of *Epinephelus alexandrinus*

The condition factor for each length group was calculated and the observed data are given in table (5). As shown from the table, there is an inverse relation between the condition factor and total length. It is clear from table (6) and fig. (5), that the condition factor reaches its maximum in June and minimum in April.



Fig. 4. Monthly variation in the condition factor of *Epinephelus aeneus* in Alexandria waters (January 1976-March 1977).

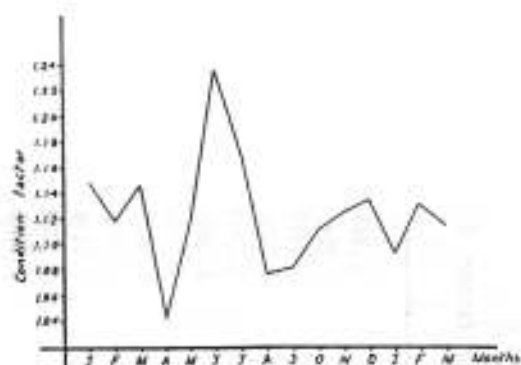


Fig. 5. Monthly variation in the condition factor of *Epinephelus alexandrinus* in Alexandria waters (Janu.1976-March 1977).

Table (3)
Mean condition factor (K) per length group of *Epinephelus aeneus* in Alexandria (1976-1977) and Salloum Bay (1975-1975) regions.

Total length (cm)	Alexandria Region			Salloum Bay Region		
	No. of fish*	Gutted wt.(gm)	Condition factor (K)	No. of fish	Gutted wt. (gm)	Condition factor (K)
12.5	-	-	-	2	28.25	1.4464
17.5	4	72.75	1.3574	8	67.38	1.2572
22.5	26	123.38	1.0832	24	131.37	1.1533
27.5	17	226.06	1.0870	31	227.84	1.0955
32.5	11	385.45	1.1228	8	333.75	0.9722
37.5	13	569.92	1.0807	1	515.00	0.9766
42.5	25	845.60	1.1015	2	797.50	1.0389
47.5	16	1102.69	1.0289	3	1240.00	1.1570
52.5	14	1686.21	1.1653	-	-	-
57.5	14	2060.14	1.0837	1	1780.00	0.9363
62.5	9	2772.20	1.1355			
67.5	10	3385.00	1.1006			
72.5	2	4451.50	1.1681			
77.5	3	5205.67	1.1183			
82.5	2	6502.50	1.1589			
87.5	1	7625.00	1.1382			
92.5	1	8645.00	1.0923			
97.5	1	9920.00	1.0703			
			Average K	Average K		
			1.1230	1.1148		

TABLE 4

Monthly variation of the condition factor 'K' of
Epinephelus aeneus in Alexandria region (1976-1977).

Month	No. of fish	Condition factor 'K'
Jan		
January 1976	13	1.1469
February	5	1.0667
March	6	1.0873
April	8	1.0439
May	13	1.1393
Jun	10	1.1665
July	12	1.1753
August	10	1.0848
September	9	1.2391
October	15	1.1158
November	8	1.1009
December	7	1.1185
January 1977	14	1.0774
February	10	1.0663
March	10	1.0817

TABLE 5
 Mean condition factor 'K' per length group of
Epinephelus alexandrinus in Alexandria (1976-1977)
 and Salloum Bay regions (1975-1976).

Total length (cm)	Alexandria region			Salloum Bay region		
	No. of fish	cutted weight (gm)	Condition factor (K)	No. of fish	cutted weight (gm)	Condition factor (K)
12.0	-	-	-	1	20.0	1.1574
14.0	2	39.50	1.4395	1	32.00	1.1662
16.0	1	36.00	1.6113	5	52.20	1.2744
18.0	2	70.00	1.2003	43	70.44	1.2078
20.0	6	96.00	1.2000	35	92.11	1.1514
22.0	15	12.27	1.1859	27	114.19	1.0724
24.0	30	155.73	1.1265	10	148.50	1.0742
26.0	25	194.16	1.1047	5	193.60	1.1015
28.0	27	239.78	1.0923			
30.0	37	287.38	1.0644			
32.0	45	365.80	1.0553			
34.0	33	409.91	1.0429			
36.0	18	487.83	1.0456			
38.0	19	563.89	1.0276			
40.0	14	647.71	1.0120			
42.0	20	774.65	1.0456			
44.0	16	879.06	1.0320			
46.0	17	1035.71	1.0641			
48.0	11	1175.00	1.0625			
50.0	6	1285.17	1.0281			
52.0	8	1435.88	1.0212			
54.0	2	1537.50	0.9640			
56.0	-	-	-			
58.0	3	2018.33	1.0344			
60.0	3	2360.00	1.0929			
		Average "K"	1.1115		Average "K"	1.1507

TABLE 6
 Monthly variations of condition factor 'K' of
Epinephelus alexandrinus in Alexandria region (1976-1977).

Month	Number of Fish	Condition Factor 'K'
January 1977	15	1.1485
February	20	1.1184
March	11	1.1475
April	13	1.0422
May	27	1.1193
June	23	1.2351
July	34	1.1697
August	23	1.0786
September	32	1.0833
October	33	1.1121
November	12	1.1248
December	26	1.1357
January	19	1.0926
February	29	1.1319
March	15	1.1150

DISCUSSION

Length-weight relationship is usually expressed by the power equation:

$$W = a \cdot L^n$$

(Le Cern, 1951; Rounsefell & Everhart, 1953; Lagler, 1956 and Rafail, 1972). Study of length-weight relationship is essentially an important parameter to get in the course of study of the biology of any fish species. In spite of this fact there were various fish species for which this relation have not been determined. Fishes of genus *Epinephelus* are badly studied from this point of view. In fact, data concerning growth for these species are very scanty in the available literature.

In Egyptian marine waters, it was only Rafail (1969 and 1972) who made such study on these species. According to the data given by Rafail for *Epinephelus* sp. in 1969 and 1972, the length-weight relationship of *Epinephelus alexandrinus* is expressed by the formula:

$$\text{Log } W = -1.731422 + 2.8914 \text{ Log } L.$$

If we compare this equation with the equation obtained in the present study for Alexandria region:

$$\text{Log } W = - 1.61952 + 2.7784 \text{ Log } L.$$

we can see a clear difference in the value of the constant 'n'. This might be due to variations in the ecological conditions since that time.

Variations in the rate of growth according to variations in ecological conditions is a fact that has been mentioned by various fishery biologists (Rounsefell and Everhart, 1953 and Nikolsky, 1963).

Concerning the equations obtained for *Epinephelus alexandrinus* caught from Salloum Bay and from Alexandria regions, a clear difference is evident in the values of the constant 'n'.

For the same length group we can see that fishes in Alexandria are heavier than those in Salloum Bay.

The equation obtained for *Epinephelus aeneus* in the two regions shows also clear difference in the value of 'n'. The calculated weights of fishes of the same length group are higher in Alexandria region than in Salloum Bay region.

By comparing the condition factor for both species in the two regions studied, we can see that the condition factor is clearly higher in fishes of Alexandria region than that in Salloum Bay region. This could be explained by the higher productivity of Alexandria region than the Salloum Bay region (Samaan, 1979). This explains the well being of these fishes in Alexandria region compared with those in Salloum Bay.

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