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ON THE BIOLOGY OF LUTJANUS LINEOLATUS (BLOCH) IN THE GULF OF SUEZ: LENGTH- WEIGHT RELATIONSHIP, RELATIVE CONDITION FACTOR AND FECUNDITY.

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ABSTRACT

The regression coefficient "b" in the formula $W= al^b$ for **Lutjanus lineolatus** collected from Ataka, near Suez was found to be 2.8852. This value was statistically analysed and the fish showed isometric growth. The relative condition factor at different lengths distinctly decreased at the end of the first, second, thrid and fourth years of life for both sexes. Fecundity was fluctuated between 4873 - 27644 ripening eggs for the range of total length 107 - 177 mm. It was found that the absolute fecundity is the better expression than the relative one. The fecundity length relationship was found to be more correlated where it is best described by the equation:

$$\text{Log } F= -2.742 + 3.214 \text{ Log } L \quad (r= 0.984).$$

INTRODUCTION

The bigeye snapper **Lutjanus lineolatus** (Bloch.) is of considerable importance in the trawl catches of the Gulf of Suez. In the recent years the annual trawl catches from the Gulf of Suez were about 5300 tonne, of which **L. lineolatus** represented 10-20%. Information on the biology of different species of Lutjanidae has been given by several authors in different localities. Among them, Armira and Bashirullah (1975), Harry (1977), Manooch and Mason (1984), Edward (1985) and Mason and Manooch (1986) may be mentioned.

However, very little work has been done on the biology of **L. lineolatus** in the Gulf of Suez. El-Serafy et al. (1987) studied its age and growth. On the other hand, the maturity and spawning were reported by Al-Zahaby et al. (1987). This paper presents information on length-weight relationship, relative condition factor and fecundity which may be helpful in the management of **L. lineolaturs** fisheries in the Gulf of Suez.

MATERIAL AND METHODS

A total number of 455 specimens of **Lutjanus lineolatus** was collected from commercial landings at Ataka, near Suez during January to December 1985. The determination of length-weight relationship based on the combination of the data regardless of date of capture and stage of maturity.

Since the regression coefficient for the two sexes did not show significant differences (Table 1), the general relationship between weight and length for the combined sexes of **L. lineolatus** (Fig. 1) has been calculated as:

$$\text{Log } W = -4.6802 + 2.8852 \text{ log } L.$$

TABLE 1
Mean observed, calculated weighted and relative condition factor (Kn) per group of lengths for Male and female **Lutjanus lineolatus.**

		MALE				FEMALE		
Range of total length (mm)	Mean observed weight (gm.)	Calculated weight (gm)	Relative condition factor (kn)	No. of fish examined	Mean observed weight (gm.)	calculated weight (gm)	Relative condition factor (Kn.)	No. of fish examined
100-104	13.23	13.01	1.008	4	13.64	13.10	1.041	4
105-109	13.71	14.94	0.913	6	14.13	15.04	0.940	4
110-114	17.86	17.03	1.044	18	18.14	17.14	1.058	12
115-119	19.97	19.32	1.032	16	20.85	19.43	1.073	16
120-124	22.85	21.79	1.049	36	21.73	21.92	0.991	36
125-129	24.33	24.46	0.997	29	24.05	24.60	0.978	31
130-134	28.73	27.33	1.055	24	27.35	27.48	0.995	28
135-139	29.72	30.42	0.982	22	29.18	30.58	0.954	25
140-144	32.77	33.73	0.979	24	32.25	33.90	0.951	21
145-149	35.65	37.26	0.966	20	34.84	37.44	0.931	16
150-154	39.74	41.02	0.979	6	41.36	41.22	1.003	12
155-159	41.60	45.03	0.935	3	43.90	45.23	0.971	8
160-164	49.06	49.28	1.009	6	40.50	49.49	1.018	8
165-169	45.62	53.78	1.031	3	56.58	54.01	1.048	3
170-174	63.42	58.55	1.101	3	61.44	58.79	1.045	5
175-179	64.38	63.58	1.031	3	64.93	63.83	1.017	5

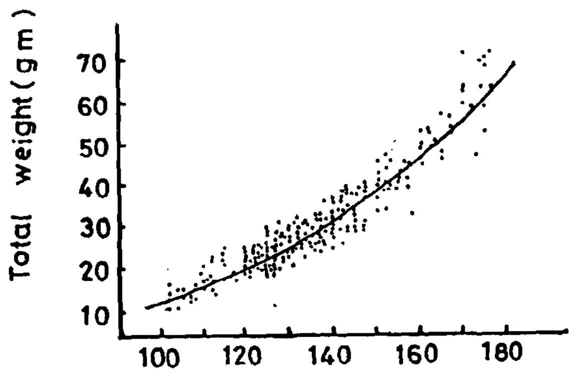


FIG. 1
Length-weight relationship of **Lutjanus lineolatus** (sexes combined).

The samples were grouped into sixteen length groups (0.5 mm. interval) and the mean corresponding weight for each length group was computed. The length-weight relationship was calculated by the standard formula $W = a L^b$ (Beckman, 1948 and Le Cren, 1951) where W = weight in grams, L = total length in mm. and a & b are constants. Using the least squares method, the coefficients a & b are calcuated after linearization by taking logarithms of both sides of the equation.

The relative condition factor (K_n) can produce information on many interesting events in the life history of the fish. Le Cren (1951) recommended a study of K_n in preference to the pondral index K. The value of K_n is a physiological factor dependance as it is affected by maturity and spawning as well as the environmental factors like food availability (Brown, 1957 and Sinha, 1975). K_n was calculated from the formula: $K_n = W°/W$ where W° is the observed weight and W is the weight calculated using the length-weight equation for the observed length of **L. lineolatus.**

For fecunditiy studies, 195 gravid females were collected just prior to the spawning season (April-May). The ripe ovaries (ripening eggs 0.71-0.80 mm. in its diameter) from each fish were carefully removed, weighed to the nearest gm and preserved in Gilson's fluid as recommended by Bagenal and Braum (1978). After two months of fixation, the preserved ovaries were washed by runing tap water. Then, filter paper was used to adsorb the excess water. The total weight of ova was recorded in grams. Four subsamples of one gram each were taken, and the ova present in each subsample was counted separately. The formula used for fecundity calculation is :

$$A\,F = W/[W_1 + W_2 + W_3 + W_4] \times (n_1 + n_2 + n_3 + n_4).$$

$$R\,F = A\,F/\,G\,W$$

A F is the absolute fecundity, W is the weight of ovary, W_1, W_2, W_3 W_4 are weights of subsamples, n_1, n_2, n_3, n_4 are the numbers of ova present in the subsamples, RF is the relative fecundity and G W is the gutted of the fish in gram.

RESULTS AND DISCUSSION

It is known that the weight of fish increases as a function of its length. For many species, it has been found that weight increases as the cube of length, but for others, the weight increases at a great or less rate (Hile, 1948 and Le Cren, 1951). The analysis of length-weight relationship of **Lutjanus lineolatus**, which is based on the available data collected through 1985, showed a log-log linear fit with regression coefficient "b" differing from the cube for both sexes:-

$$\text{Log } W = -4.6513 + 2.8708 \log L \quad \text{for male fishes}$$
$$\text{and} \quad \text{Log } W = -4.6912 + 2.8925 \log L \quad \text{for female fishes}$$

The agreement between the observed and calculated weights was fairly good (Table 2). The value of the exponent "b" show that the weight of L. **lineolatus** increases to a power not significantly lesser than the cube of length (Table 3). Thus the body shape is unchanged as the fish grow in length, i.e. the fish grow isometrically. The regression coefficients of different species of the family Lutjanidae, at different localities, as determined by various authors, are shown in Table 4. It is clear from th

TABLE 2
Test of significance of equality of regression coefficients

	dF	SS(Sum of squares)	mean squares (mean SS)	F ratio
Polled regression	29	0.011926	0.00041124	
Individual regression	28	0.11776	0.00042057	
Deviation	1	0.00016	$F_{1;28}$	0.356659
				not significant.

TABLE 3
Test of deviation of "b" value from "3"

Sex	Sample size	Regression coefficient "b"	Standard error of "b" sb	T = value b-3/sb.
Male	16	2.878029	0.072187	-1.68965+
Female	16	2.8726	0.068	-1.873629+
combined sexes	16	2.88539	0.065704	-1.744330+

+ Non significant

TABLE 4

The regression coefficient "b" of length-weight relationship of the family Lutjanidae at different localities

Species	Locality	Author	Regression coefficient
Lutjanus griseus	Cubagua island Venzuela	Armira and Boshirullah (1975)	2.86 ♂ 2.73 ♀
Lutjanus synagris	Southern Florida (U.S.A.)	Manooch and Mason (1984)	2.6524
Lutjanus malabaricus	Australian water	Edwards (1985)	2.842
Pristipomoid typus	Australian water	Edwards (1985)	2.822
Pristipomoid multidens	Australian water	Edwards (1985)	2.897
Lutjanus bohar	Tigak Island New Guinea	Wright et al.,(1986)	3.01
Lutjanus analis	East coast of Florida (U.S.A)	Mason and Manooch (1986)	3.044
Lutjanus lineolatus	Egyptian water	Present Study	2.878 ♂ 2.872 ♀

table that the regression coefficient "b" of *L. lineolatus* in the Gulf of Suez lies within the range 2.6524 - 3.044. The lower limit of that range was reported for *L. synagris* in Southern Florida (Manooch and Mason, 1984). However, the upper one was recorded for *L. analis* in east coast of Florida (Mason and Manooch, 1986).

The relative condition factor at different lengths showed a distinct decrease at the length ranges : 105-109 mm, 125-129 mm, 145-149 mm and 155-159 mm. for both sexes (Fig. 2). These were found to correspond to the end of first, second, third, and fourth years of life . In *L. lineolatus* at the Gulf of Suez, the checks were formed once a year during the spawning season (El-Serafy et al., 1987). Further, *L. lineolatus* spawns once a year in April-May (Al-Zahaby et al., 1987). Thus, it can be concluded that the fall and rise in K_n values are more or less cyclic in nature which might have resulted from repeated spawning and recovery respectively during the life history of the fish.

The monthly variation of K_n values as shown in Fig. 3 ranged between 0.947 in January and 1.127 in April. The highest value as recorded in April coincided with the maximum value of the gonadosomatic index in the same month (Fig. 4). K_n decreased in May after the commencement of

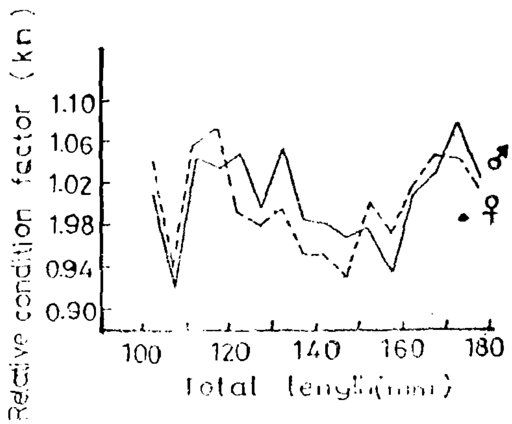
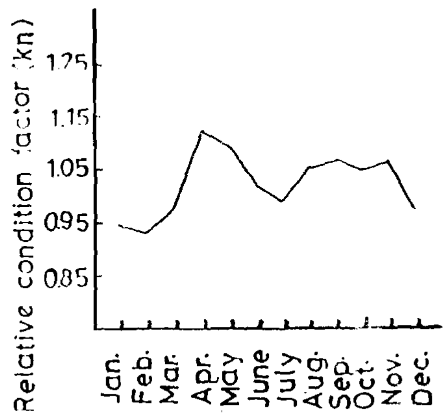


FIG. 2
Relative condition factor of
Male and Female **Lutjanus lineolatus**
(lengthwise).

FIG. 3
Monthly variation of gonadosomatic index
of **Lutjanus lineolatus.**



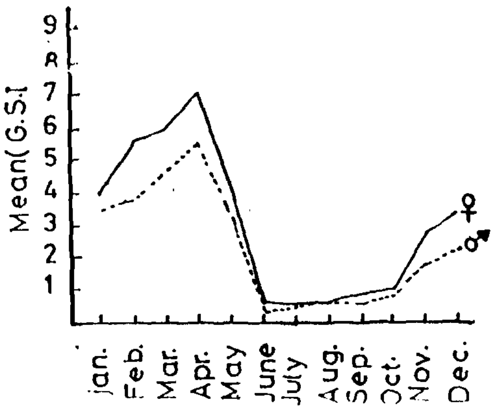


FIG. 4
Relative condition factor of
Lutjanus lineolatus (Monthwise)

the spawning and in the spent condition (June). Le Cren (1951) investigated the K_n of Windermere Perch population and found that a massive and rapid loss in K_n at spring spawning in mature females when a large quantities of ova were released. Also a loss of condition of perch *Perca fluviatilis* followed release of ova and sperms in summer rather than spring and after spawning condition declined to its winter low (Weatherley, 1959). Thus, it can be concluded that K_n of *L. lineolatus* is affected by maturity and spawning activities.

The results of the fecundity showed a variation according to the size of the fish, being 4873 and 27644 ripening eggs of the total lengths of 107 mm and 177 mm respectively (Table 5). For the same range of total lengths, the relative fecundity was found to be 395 and 376 ripening eggs respectively. Fecundity was found to be directly related to length, weight and age of the fish (Figs. 5, 6 and 7). The equations describing the relationships between fecundity either absolute or relative and the aforementioned variables were as followed:

Fecundity related to fish length:-

$$\text{Log A F} = -2.742 + 3.214 \log L \qquad r = 0.984$$
$$\text{Log R F} = 1.392 + 0.612 \log L \qquad r = 0.922$$

TABLE 5

Relationship between fecundity and length, and weight of *Lutjanus lineolatus*

Length range	Average of total length	Average of total weight	Mean absolute fecundity	Mean relative fecundity	Number of samples
105-109	107	17.06	4873	395	10
110-114	112	17.12	6531	444	12
115-119	117	19.94	8222	473	15
120-124	122	21.90	10921	478	20
125-129	127	25.95	11029	482	24
130-134	132	28.60	12600	492	21
135-139	137	30.96	14256	507	12
140-144	142	34.06	16560	524	13
145-149	147	36.98	16854	528	15
150-154	152	42.21	18080	536	14
155-159	157	50.02	20690	537	12
160-164	162	56.50	22731	549	10
165-169	167	62.30	25416	562	8
170-174	172	70.80	26213	565	4
175-179	177	76.16	27644	576	5

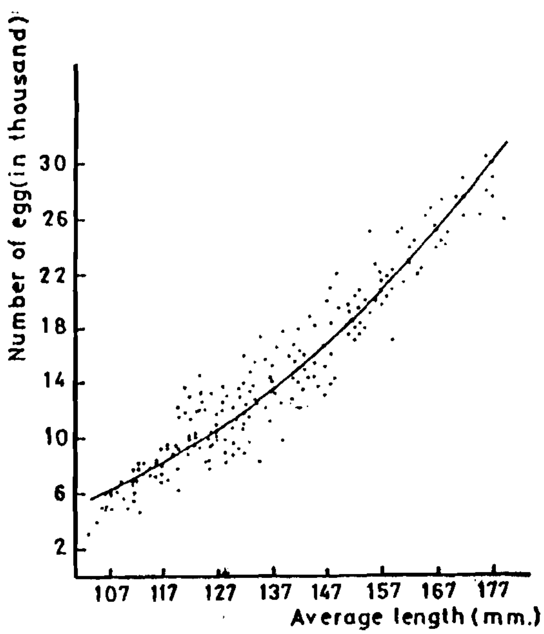


FIG. 5
Fecundity total length relationship
of Lutjanus lineolatus.

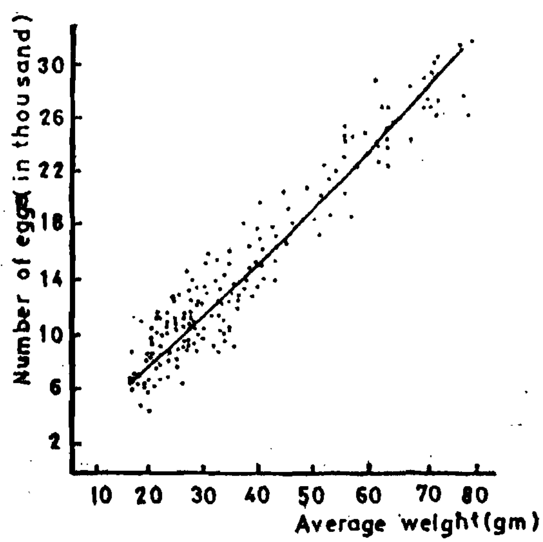


FIG. 6
Fecundity total weight relationship
of Lutjanus lineolatus.

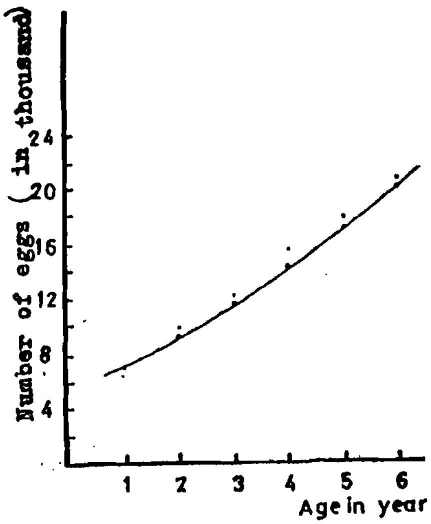


FIG. 7
Fecundity age relationship
of *Lutjanus lineolatus*.

Fecundity related to fish weight :

$$\text{Log A F} = 2.616 + 0.998 \log W \qquad r = 0.950$$
$$\text{Log R F} = 2.4145 + 0.188 \log W \qquad r = 0.930$$

Fecundity related to fish age:

$$\text{Log A F} = 3.826 + 0.6209 \log A \qquad r = 0.940$$
$$\text{Log R F} = 2.596 + 0.210 \log A \qquad r = 0.928$$

The absolute and relative fecundity as related to total length, total weight and age of the examined fish were found to increase as these variables increase. Howeve., in comparison of the correlation coefficients for the relationships of fecundity to length, weight and age of *L. lineolatus* it was found that the absolute fecundity-total length relationship is more close (r = 0.984). Therefore, it is reasonable to say that the term of absolute fecundity is a better expression than that of relative one, especially when related to total body length. Armira and Bashirullah (1975) reported for *L. griseus* from the Cubagua Island, Venezueala that the number of eggs varies individually, but fecundity seems related to the body weight and total length. In the present study the value of the exponent "b" in the relation between fecundity and total length of the examined fish is found to be 3.214. Rait (1933), Katz (1947) and Simpson (1951) pointed out that the relationbetween fecundity and total length is best expressed by an equation of the type:

$$F = C\,L^{n}$$

where the value of exponent "n" is greater than 3.

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