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AGE AND GROWTH OF THE GROUPER *Epinephelus chlorostigma* (SERRANIDAE) FROM THE RED SEA.

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ABSTRACT

Age and growth of the grouper, **Epinephelus chlorostigma**, from the Red Sea were studied. Scales from 433 fish were used to estimate the age and growth rate of this species. The constants of the length - weight relationship were computed using the least square and geometric regression methods. The length - weight equations computed were:

$$W = 1.7620403 \times 10^{2} L^{2.8933592}$$

by the least square method and

$$W = 1.488702 \times 10^{2} L^{2.9399814}$$

by the geometric regression method. The Von Bertalanffy growth in length equation was as follows:

$$l_t = 113.7934 \left[1 - e^{-0.0728 (t + 1.0804)} \right].$$

INTRODUCTION

Serranid fishes are considered to be among the important elements of the coral reef environment. However, their biology is poorly studied. In this respect, the Red Sea is one of the least studied areas. Some authors studied the general biology of some serranids at different places in the world. From those are Robinson (1960), Cnoat (1968), Rafail et al. (1969), Borton (1971), Smith (1971), Huntsman and Dixon (1975), Goldspink and Goodwin (1978), Thompson and Munro (1978) and Ghorab et al. (1983).

MATERIAL AND METHODS

Random monthly samples of about ten to sixty specimens were collected from the commercial fish markets at Suez and Ghardaqa. This collection (667 fishes) exteneded from May 1979 to June 1981. The following measurements were taken from fresh specimens: date of capture, total length in mm, total weight in gm, sex and maturity stage. The scales were removed from a "key" area on the left side of the fish, under the distal part of the pectoral fin and kept in special envelopes. The scales were then soaked overnight in 5% ammonia solution, cleaned and pressed in between two glass slides for further investigation. The scales were examined by binocular dissecting microscope with an ocular micrometer. The scale radius (S) was measured from the focus to the margin along the axis. The annuli were counted and measured to their distal edges along this axis. They were classified into age groups according to the number of annuli.

The body length-scale radius relationship was determined by using the least square method. The lengths at earlier ages were back-calculated from the scale measurements using Lee's equation (1920).

A modified version (Bebars, 1981) of the WTLN computer program of Abramson (1971) was used to compute the length-weigth equation constants by the least square and the geomtric regression methods. Ricker (1973) recommends the use of the geometric regression method. 667 length-weight measurements of **Epinephelus chlorostigma** were used in the present study. This program was modified to give the coefficient of condition with three different methods: Fulton's (K), Relative (K_n), and mean (K_m), coefficients of condition.

The BGC computer program by Abramson (1971) was used to fit the Von Bertalanffy theoretical growth curves.

RESULTS AND DISCUSSION

a) Body Length - Scale radius Relationship

The scales of **Epinephelus chlorostigma** are ctenoid scales with smooth anterior margin and spiny posterior one. The relationship between the body length (cm) and scale radius (x 10.8) can be expressed by the following equation:

$$L = 1.0781321 + 0.8232782\ S$$

with a correlation coefficient of 0.6134202.

b) Back-calculated growth in length

The body length - scale radius relationship of **Epinephelus chlorostigma** was found to be linear and does not pass through the origin. So, the back calculation of body lengths was calculated using the following equation:

$$l_n = [\,(L - a)\, s_n / S\,] + a$$

TABLE (1)

Mean back-calculated total lengths in cm. at the end of the different years of life of *Epinephelus chlorostigma* from the Red Sea, during 1979 - 1981.

Age group in years	Frequency	Mean calculated total lengths (cm.) at the End of each year of life							
		1	2	3	4	5	6	7	8
I	21	18.00							
II	34	17.49	23.38						
III	51	17.79	22.50	28.61					
IV	91	18.33	23.87	29.12	34.49				
V	144	18.58	23.64	29.19	34.39	40.03			
VI	77	19.38	24.55	30.01	34.46	41.30	47.21		
VII	13	18.99	23.70	28.93	34.16	40.11	46.52	52.59	
VIII	2	17.23	22.86	27.28	33.71	39.77	45.00	51.44	56.30

TABLE (2)

The constants of the Length-Weight relationship of *Epinephelus chlorostigma* from the Red Sea.

	Least square method	Geometric regression method
a	1.7620403×10^{-2}	1.488702×10^{-2}
n	2.8933592	2.9399814
t	-5.2732	-2.9678
Average weight in gm.	797.05	
Average lenght in dm.	38.49	
N	667	

a and n : Constants.

t : Value of the Student test.

Sign : Significance of the deviation of n from 3 at 5% confidence limit.

N : Number of fishes.

Regarding the mean (K_m) coefficient of condition of Laurent and Moreau (1973), in spite of its solid mathematical derivation, the present authors do not approve this model as a measure for the condition of the fish. Actually, it does not fulfill the objective of the coefficient of condition which is the comparison between the observed weight of a fish and the calculated one. It is clear from the equation of calculating "K_m" that it involves the use of the lengths only without taking the observed weights into consideration. This defect is clear in the results given in table 3 where the variability in the coefficient of condition between the length intervals reflected by K and K_n is not detected by K_m, although no noticeable trend of variation is observed with the change of length.

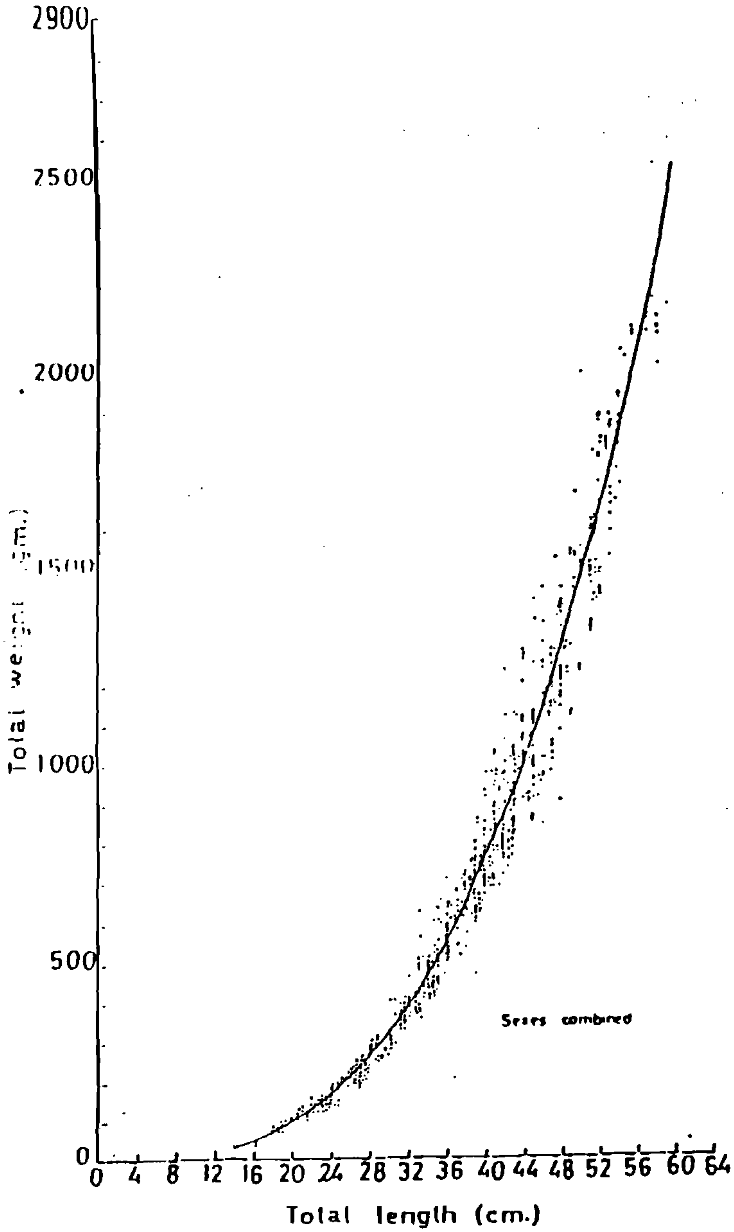

Fig. (1)
Length - Weight relationship of **Epinephelus chlorostigma** on normal co-ordinates. (The smooth curve represents the calculated weights by the geometric regrssion method and the dots repersent the observed ones)

TABLE (3)

Average composite "K", relative "K_n" and mean "K_m" coefficients of condition of Epinephelus chlorostigma from the Red Sea for the different length groups between 14 and 60 cm.

Total length group (cm.)		No. of fishes	Coefficients of condition using observed total weight		
Range	Mean		K	K_n	K_m
14 - 15.9	14.00	1	1.28	1.00	0.00
16 - 17.9	16.80	2	1.04	0.83	1.26
18 - 19.9	18.86	16	1.27	1.02	1.25
20 - 21.9	20.78	19	1.31	1.05	1.24
22 - 23.9	22.82	20	1.28	1.04	1.23
24 - 25.9	24.81	23	1.70	1.39	1.23
26 - 27.9	26.90	34	1.20	0.98	1.22
28 - 29.9	28.52	18	1.23	1.01	1.22
30 - 31.9	31.01	25	1.20	0.99	1.21
32 - 33.9	32.79	35	1.25	1.03	1.21
34 - 35.9	34.70	46	1.19	0.99	1.20
36 - 37.9	36.49	44	1.26	1.05	1.20
38 - 39.9	38.83	53	1.19	1.00	1.20
40 - 41.9	40.59	66	1.21	1.01	1.19
42 - 43.9	42.56	63	1.18	0.99	1.19
44 - 45.9	44.62	48	1.18	1.00	1.18
46 - 47.9	46.70	30	1.16	0.98	1.18
48 - 49.9	48.38	36	1.15	0.98	1.18
50 - 51.9	50.90	33	1.13	0.96	1.18
52 - 53.9	52.52	33	1.17	1.00	1.17
54 - 55.9	54.38	12	1.22	1.04	1.17
56 - 57.9	57.17	3	1.14	0.98	1.17
58 - 59.9	58.17	6	1.10	0.94	1.17
60 - 61.9	60.00	1	1.33	1.14	0.00
Mean			1.22	1.02	1.20
St. Dev.			0.12	0.09	0.03

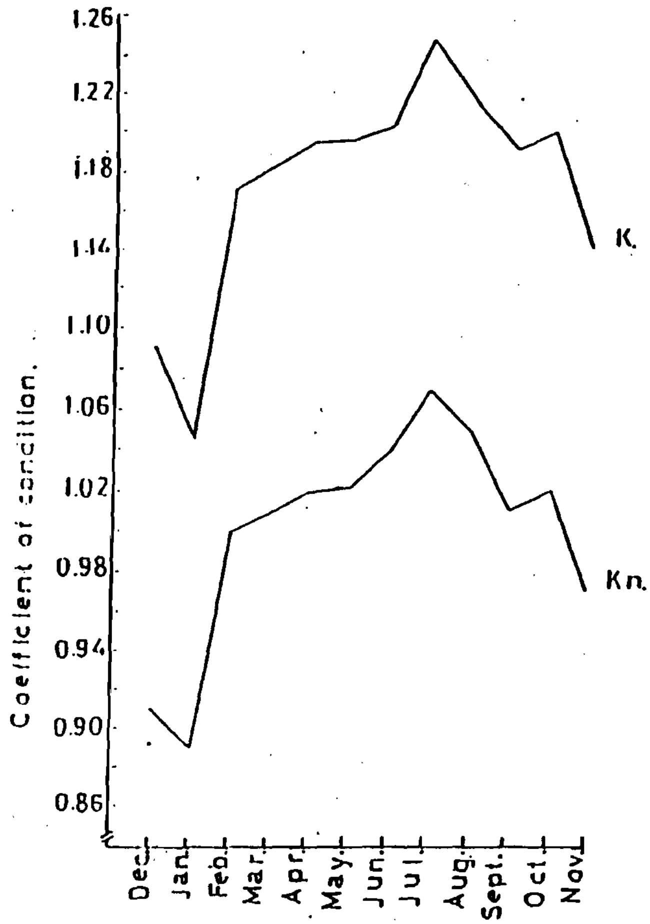

Fig. (2)

Monthly variation of the composite (K) and relative (K_n)coefficients of condition of **Epinephelus chlorostigma** from the Red Sea during 1979 - 1981.

e) Theoretical growth

The Von Bertalanffy theoretical growth in length parameters of **Epinephelus chlorostigma** computed from all observed age - length data by Tomlinson and Abramson (1961) method are: L = 113.7934, K = 0.0728 and t_0 = -1.0804. The Von Bertalanffy growth in length equation is in the from:

$$l_t = L \ [1 - e^{-k(t - t_0)}]$$

Where l_t is the length at age t, L is the assymptotic length, k is the growth coefficient and t_0 is the age at which the length is theoretically nil.

In the present study, the Von Bertalanffy growth in weight equation was derived from the growth in length equation by using the length - weight relationship. The Von Bertalanffy growth in weight equation should be:

$$w_t = W \ [1 - e^{-k(t - t_0)}]^n$$

Where w is the weight at age t, W is the theoretical maximum weight calculated by the conversion of the theoretical maximum length by the length - weight relationship, k and t_0 are the constants of the Von Bertalanffy growth in length equation and n is the exponent of the length - weight relationship.

The Von Bertalanffy theoretical growth in weight equation of **Epinephelus chlorostigma** is:

$$w_t = 16510.25 \ [1 - e^{-0.0728(t + 1.0804)}]^{2.939914}$$

The graphical representation of the mean observed and the calculated lengths and the mean observed and calculated weights by using the Von Bertalanffy equation are given in figures 3 and 4, which show clear agreement between the mean observed and the calculated ones.

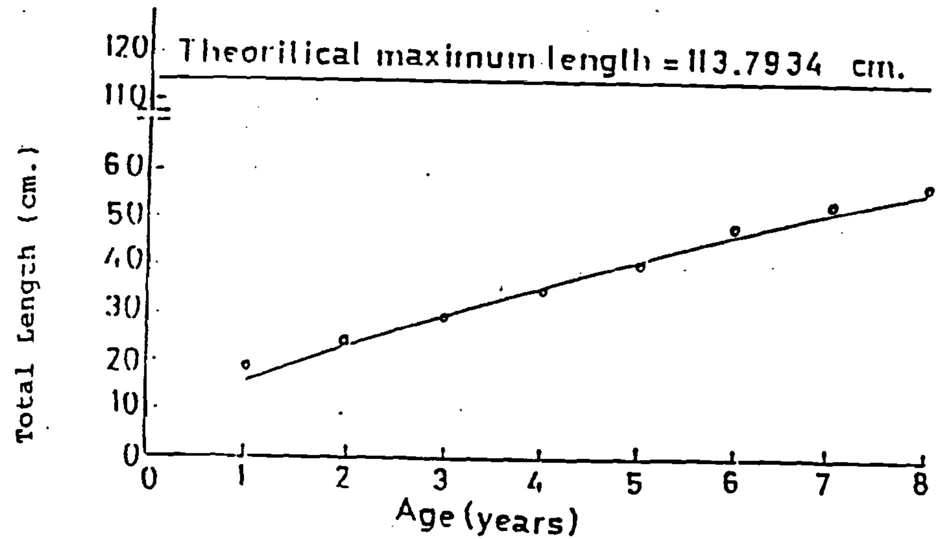

Fig. (3)
Theoritical growth in length of **Epinephelus chlorostigma** from the Red Sea.
Von Bertalanffy Model using Tomlinson and Abramson fitting method.
"The smooth curve represents the calculated values and the circles represent the observed ones".

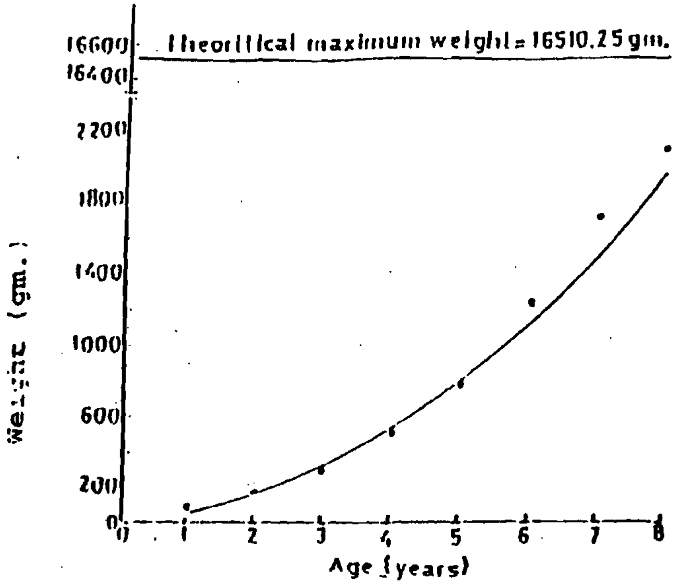

Fig. (4)
Theoritical growth in weight of Epinephelus chlorostigma from the Red Sea. Von Bertalanffy Model using Tomlinson and Abramson fitting method. "The smooth curve represents the calculated values and the circles represent the observed ones".

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