

BIOLOGY OF *VALAMUGIL SEHELI* FORSKÅL FROM INSHORE WATERS OF THE UNITED ARAB EMIRATES : 1 — AGE AND GROWTH

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ABSTRACT

Age structure and growth pattern of the fish *Valamugil sehelii* Forskal, were studied. The fish scales which are of ctenoid type with an oval to round shape, reveal validity in age determination. The anterior scale radius grows in relation to the body length with a body scale formation starting at 30 mm body length. *Valamugil sehelii* in U.A.E. waters reach their highest increments in length and in weight in the third year of life in case of females and in the fourth year in case of males.

INTRODUCTION

THE UNITED ARAB EMIRATES is endeavouring to develop and modernise its fisheries in order to meet the people's requirements from fresh marine fishes as well as to ameliorate the fish exports. From the economic point of view the grey mullets (F. Mugilidae) are considered as one of the highly contributed fishes to the U.A.E. fisheries. Despite their great importance, the biological aspects as well as the fisheries studies in the Arabian and Oman Gulfs have received little attention, whereas taxonomical as well as morphological description were given by Biogvad (1944); Kuronoma and Abe (1972) and Relyea (1981).

The present study was undertaken to study the age structure, the growth pattern and the condition factors of one of the most common mullet species *Valamugil sehelii* Forskal, in the U.A.E. waters in order to throw some biological informations that may improve the U.A.E. fisheries and to be of certain use during the mariculture in U.A.E. waters.

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MATERIAL AND METHODS

A total number of 387 specimens of *Valamugil sehelii* were collected from AL Fojaira and Kalba fishing centres (Fig. 1) located in the southern most part of U.A.E.



FIG. 1. Sampling stations in UAE waters.

East coast from October 1985 to July 1986. Records of the physical, chemical as well as biological characters of these areas had been previously recorded by the department of fisheries in the U.A.E., Ministry of Agriculture. Data show that the surface water temperature

was $21.5 \pm 0.4^\circ\text{C}$ and the salinity 37.7‰ during December with an increase to $34 \pm 0.6^\circ\text{C}$ and the salinity 42.1‰ during June. Gill-nets, Set-nets and Beach-seines were the commonly used methods for fishing *V. seheli*. Morphological and microscopical examination of gonads were made to determine the fish sex. Scales were removed from the region below the pectoral fin and cleaned in 10% ammonium hydroxide. Total fish lengths were measured to the nearest 1.0 mm and fresh weights to 1.0 gm. Measurements of the total scale radius and the annular distance from the focus to the successive annulies were achieved by using a Slide projector. False scales detected by the nonclearance or the discontinuity of the sclerites around the centre were omitted. Scales with true annulies were valid as year marks for age and growth studies. Body length-scale radius relationship was determined according to Van Oosten (1929) equations:

$$L = a + bS \text{ and } L_n = \frac{S_n}{S} (L - a) + a$$

where L_n is the average length of the fish at the end of n year.

S_n is the average length of the fish scale at the end of n year.

S is the average total scale radius.

L is the average total fish length at capture.

a is the length of the fish at scale formation (correction factor).

Length-weight relationship was estimated according to the logarithmic regression equation proposed by Lee (1920):

$$\log W = \log C + n \log L$$

where W = weight in gm

L = total length in cm

c and n are constants

The condition factor (K) was defined according to Beckman (1948):

$$K = \frac{W \times 100}{L^3}$$

where K = Condition factor

W = fish weight in gm

L = total length in cm

RESULTS

Scale characters

Microscopical examination reveals that scales of *V. seheli* (Pl. I) are of ctenoid thin type with an oval to round shape, structurally 5-6 mucus canals as well as concentric sclerites or circuli are found anteriorly about the centre of the scale. The true annual rings usually appear as narrow bands edged with cutted sclerites and followed by closely spaced sclerites.

Body length scale relationship

Table 1 shows that there is a definite relationship between the growth length of the fish and that of its scale growth ($L = 30 + 2.83 S$). The anterior coefficient (a) which equals 30 mm clearly indicates the length of fish before scale formation.

Growth in length

a. *Length at capture*: Data given in Table 2 shows a gradual increase in length with the successive age groups. For 170 females (age group I to V) and 75 males (age groups I to IV) the means of total length are 24.8, 30.0, 35.7, 40.6 and 45.4 cm and 23.9, 29.0, 34.1 and 29.2 cm respectively.

b. *Calculated length*: Results in Table 2 show that the back calculated lengths are 23.8, 28.5, 35.2, 39.4 and 42.8 cm with a respective length increments of 24.2, 4.7, 6.2, 4.2 and 3.5 cm for females (age groups I to V), whereas for males (age groups I to IV) they are 22.9, 27.5, 33.6 and 38.9 cm with a respective length increments of 23.2, 4.6, 5.6 and 5.5 cm. From these results it appears that the maximum increments in length for both sexes of *V. seheli* ($\text{♀} + 6.2$ and $\text{♂} = 5.6$) are reached in the third year of their age.

TABLE 1. *Body length-scale relationship of Valamugil seheli*

TL (cm)	Av. Scale radius	L'/S'' (b)	Calc. Sc. r.	TL (cm)	Av. Scale radius	L'/S'' (b)	Calc. Sc. r.
18	6.1	2.95	5.30	33	11.8	2.80	10.60
19	6.4	2.96	5.65	34	12.0	2.83	10.95
20	6.7	2.98	6.00	35	12.4	2.82	11.31
21	7.1	2.96	6.36	36	13.0	2.77	11.66
22	7.6	2.89	6.71	37	13.4	2.76	12.01
23	8.0	2.88	7.07	38	13.6	2.79	12.37
24	8.4	2.86	7.42	39	14.0	2.79	12.72
25	8.8	2.84	7.77	40	14.4	2.78	13.07
26	9.0	2.89	8.13	41	15.0	2.73	13.43
27	9.2	2.93	8.48	42	15.4	2.73	13.78
28	9.7	2.89	8.83	43	15.6	2.76	14.13
29	10.0	2.90	9.19	44	16.0	2.75	14.49
30	10.6	2.83	9.54	45	16.4	2.74	14.84
31	10.8	2.87	9.89	46	17.0	2.71	15.19
32	11.3	2.83	10.25				

b=2.83

L'=Total length

S''=magnified scale radius

TABLE 2. *Calculated lengths (cm) for different age groups in Valamugil seheli*

Age group	No. of specimens	Size at capture	Years of life					
			I	II	III	IV	V	
<i>Female</i>								
I	45	24.8	23.8					
II	50	30.0	23.9	28.5				
III	31	35.7	24.6	29.4	35.2			
IV	26	40.6	24.4	29.1	34.9	39.4		
V	18	45.4	24.6	29.3	35.1	39.1	42.8	
Mean	..		24.2	28.9	35.1	39.3	42.8	
Increment	..		24.2	4.7	6.2	4.2	3.5	
<i>Male</i>								
I	17	23.9	22.9					
II	26	29.0	23.1	27.5				
III	21	34.1	23.6	28.1	33.6			
IV	11	39.2	23.2	27.7	33.1	38.9		
Mean	..		23.2	27.8	33.4	38.9		
Increment	..		23.2	4.6	5.6	5.5		

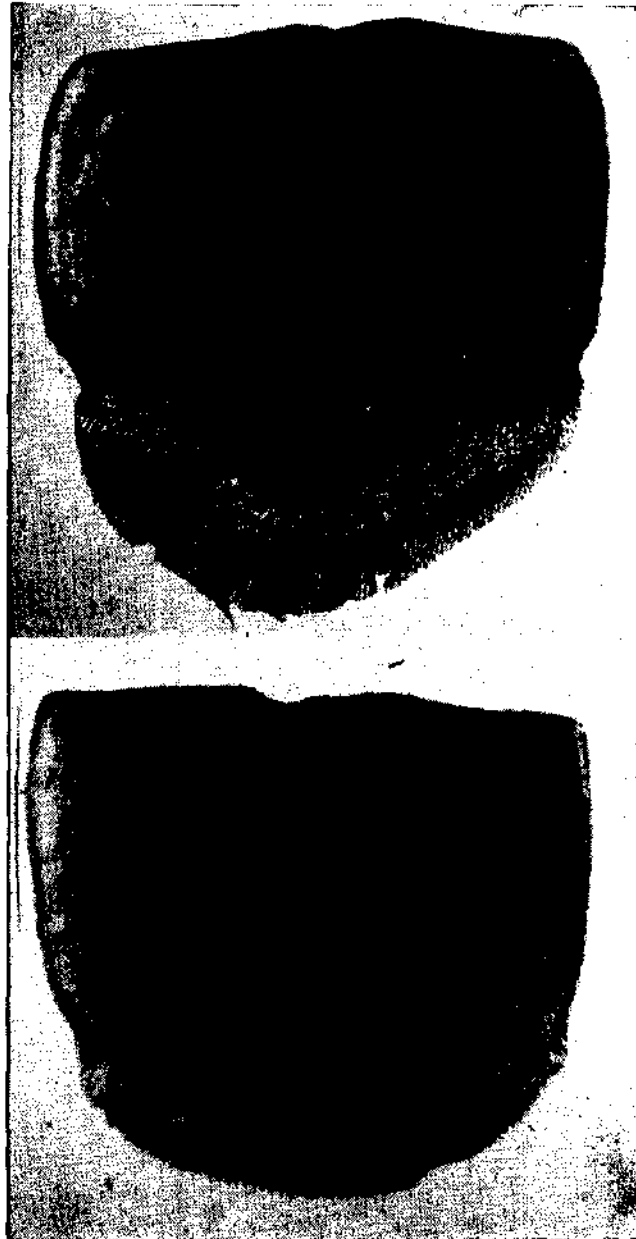


PLATE I. Ctenoid scales of *Valamugil seheli* in UAE waters.

Growth in weight

a. **Weight at capture** : Results given in Table 3 show that the actual weights of the studied fishes ranged between 150 gm and 1060 gm with a mean actual weights for females (age groups I to V) 150, 320, 510, 765 and 1060 gm respectively whereas for males (age groups I to IV) 118, 239, 405 and 610 gm respectively.

b. **Calculated weights** : Data in Table 3 show that the mean calculated weights are :

for both sexes, also the highest annual increment is 196.8 gm for females in the third year whereas it is 162.3 gm for males in the fourth year of their life.

Length-weight relationship

Estimates of the relation between the two variables length and weight of *V. seheli* was calculated by using 282 females and 105 males arranged into size groups ranging from 18 to

TABLE 3. *Calculated weights (gm) for different age groups in Valamugil seheli*

Age group	No. of specimens	Weight at capture	Year of life				
			I	II	III	IV	V
<i>Female</i>							
I	45	150	143.0				
II	50	320	247.6	301.6			
III	31	510	337.3	411.3	501.8		
IV	26	765	435.6	531.3	648.1	727.8	
V	18	1060	539.9	658.4	803.2	902.0	969.1
Mean	..		296.0	428.1	624.9	799.1	969.1
Increment	..		296.0	132.1	196.8	174.2	170.0
<i>Male</i>							
I	17	118	112.5				
II	26	239	184.9	225.5			
III	21	405	267.8	326.6	398.5		
IV	11	610	347.4	423.6	516.8	601.5	
Mean	..		215.5	299.7	439.2	601.5	
Increment	..		215.5	84.2	139.5	162.3	

143.0, 301.9, 501.8, 727.8 and 969.1 gm with an annual increments of 296.0, 132.1, 196.8, 174.2 and 170 gm respectively for females of age groups I to V whereas for males of age groups I to IV the mean calculated weights are : 112.5, 225.5, 398.5, and 601.5 gm with an annual increments of 214.5, 84.2, 139.5 and 162.3 gm respectively. From these results it appears that the calculated weights are generally less than the actual weights in all age groups

46 cm total length with an intervals of 10 mm. Results obtained were :

$$\log W = 6.128 + 3.462 \log L \text{ for females}$$

$$\log W = 6.227 + 3.508 \log L \text{ for males}$$

The derived parabolic equations are :

$$W = 0.074 \times 10^{-5} L^{3.462} \text{ for females}$$

$$\text{and } W = 0.059 \times 10^{-5} L^{3.508} \text{ for males.}$$

From these results it appears that the value of the exponent "n" is nearly similar in both

sexes, and almost higher than the cube. Results given in Tables 4 and 5 and Fig. 2 show a clear limited difference between the empirical and the calculated weights within the length groups. No significant difference is found between the slope and the cubic value.

Condition factor

The condition factor of *V. seheli* males and females was calculated for 10 mm length groups intervals separately. Results obtained in Tables 4 and 5 show that the condition factor "K"

seheli scales show that they are of ctenoid type. However, Day (1978) reported that freshwater mullets developed ctenoid scales whereas marine species have cycloid scales. This view was reported by Pillay (1951) who stated that there is no apparent correlation between the nature of the scale and the habitat. Thomson (1966) stated that the mullet scale is of typical percormorph type and is seldom more than weakly ctenoid. Studies show a definite relationship between the growth length of the fish and its scale growth. Age determination in relation

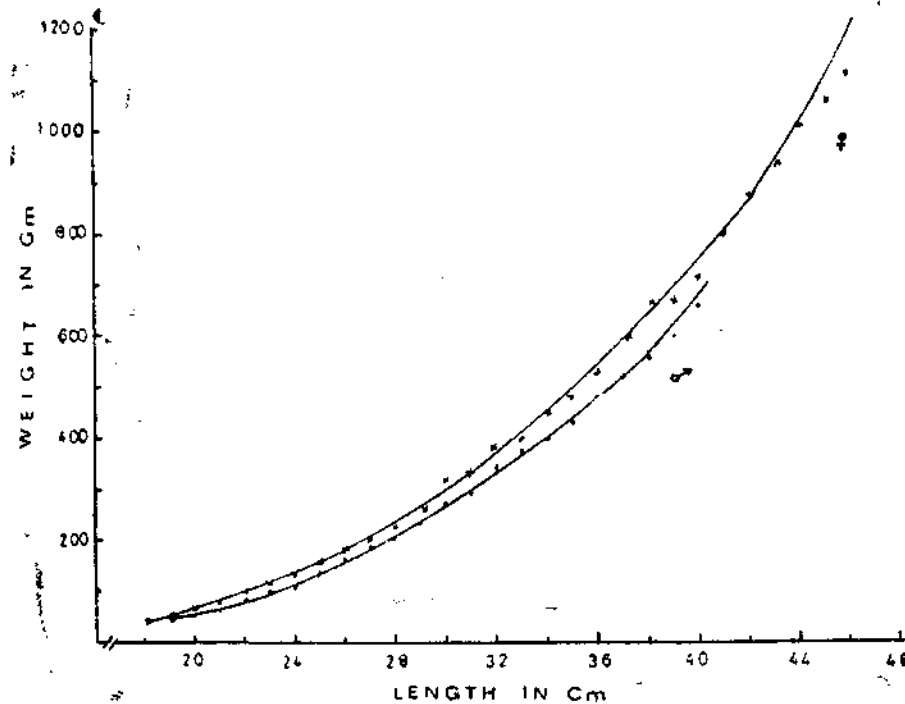


FIG. 2. Length-weight relationship in *Valamugil seheli* in UAE waters.

values increase progressively with growth in length in both sexes. The K values range between 0.72 to 1.22 with a means of 1.062 ± 0.138 in case of females and between 0.71 to 1.04 with a mean of 0.94 ± 0.109 in case of males.

DISCUSSION

Microscopical examination of *Valamugil*

to the number of annual true rings of the fish scales has been used by most fishery biologists namely (Thompson, 1923, Van Oosten, 1929; Lagler, 1956; Thomson, 1966). Results given in Table 1 show that the anterior scale radius grows in relation to the body length and the body scale formation begin at 30 mm body length. However Salem and Mohammed (1982)

TABLE 4. Length-weight relationship and condition factor of *Valamugil seheli* (Females)

No. of fish	TL (cm)	Wt. (gm)	Calc. wt. (gm)	K	No. of fish	TL (cm)	Wt. (gm)	Calc. wt. (gm)	K
12	18	42	47.8	0.72	6	33	395	390.3	1.09
16	19	50	57.7	0.73	7	34	450	432.9	1.14
14	20	68	68.9	0.85	13	35	480	478.6	1.12
11	21	82	81.6	0.89	9	36	532	527.5	1.14
14	22	99	95.8	0.93	11	37	586	580.0	1.12
11	23	122	111.8	1.00	14	38	642	636.2	1.17
9	24	139	129.6	1.01	8	39	670	696.1	1.13
12	25	154	149.2	0.99	9	40	713	759.9	1.11
10	26	187	170.9	1.06	10	41	803	827.6	1.16
13	27	200	194.9	1.02	5	42	880	899.1	1.19
12	28	230	221.1	1.05	7	43	970	976.1	1.22
10	29	259	249.5	1.06	4	44	1,010	1,057.1	1.18
8	30	320	280.6	1.18	4	45	1,065	1,142.0	1.17
9	32	382	351.0	1.16					

Mean K=1.062±0.138

TABLE 5. Length-weight relationship and condition factor of *Valamugil seheli* (Males)

No. of fish	TL (cm)	Wt. (gm)	Calc. wt. (gm)	K	No. of fish	TL (cm)	Wt. (gm)	Calc. wt. (gm)	K
8	19	49	52.1	0.71	4	30	272	258.6	1.01
7	20	60	62.3	0.75	5	31	299	290.2	1.00
5	21	69	74.0	0.75	4	32	347	324.4	1.02
8	22	82	87.1	0.77	3	33	380	361.2	1.06
6	23	106	101.8	0.87	4	34	400	401.2	1.02
4	24	119	118.2	0.86	6	35	435	444.2	1.01
6	25	145	136.4	0.93	3	36	482	490.2	1.03
6	26	171	156.4	0.97	3	37	522	539.7	1.03
6	27	190	178.8	0.97	2	38	570	592.7	1.04
7	28	216	203.1	0.98	2	39	600	649.3	1.01
4	29	239	229.6	0.98	2	40	662	709.7	1.03

Mean K=0.945±0.109

found that the body scale relation of *Mugil seheli* in Lake Timsah begin at 1.445 mm. Results obtained during this study indicate that the marketable sizes of *Valamugil seheli* reveal five and four successive age classes in case of females and males respectively. These results indicate that the longevity of females is longer than that of males under the same fishing grounds in AL-Fojaira and Kalba areas. Similar results have been reported for *M. seheli* in Lake Timsah of the Red Sea by Salem and Mohammed (1982).

Results given in Table 2 and 3 show that *V. seheli* females reach their highest increment in length and in weight (6.2 cm, 196.8 gm respectively) in the third year of their life while the males reach their highest increment in length (5.6 cm) in the third year of their life while their highest increment in weight (162.3 gm) is reached in their fourth year. It seems that females *Valamugil seheli* are able to grow in length and weight faster than that of the males in the same fishing grounds. These findings are not in agreement with those reported by Salem and Mohammed (1982) in case of *Mugil seheli* in Lake Timsah of the

Red Sea. These differences in lengths and weights may be due to ecological factors affecting the biological activity of the fish in the two different localities.

Results regarding the relation between the two variables length and weight in both sexes of *Valamugil seheli* show that the exponent "n" equals 3.508 and 3.462 for males and females respectively. Meanwhile Salem and Mohammed (1982) obtained a value of 2.8017 for the exponent "n" for *Mugil seheli* in Lake Timsah. According to Tesch (1971) these differences in length weight relationship may results from certain factors as sex, maturity, season and time of day. During the present study no significant differences were observed among the sexes.

The condition factor "K" of *Valamugil seheli* increase with the progressive increase in length with a mean values of "K" 1.062 ± 0.138 and 0.945 ± 0.109 for females and males respectively. These values clearly indicate a better condition of females than males. While Salem and Mohammed (1982) found a higher values of "K" ranging from 1.64 and 1.89 in case of *Mugil seheli* in Lake Timsah of the Red Sea.

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