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LENGTH – WEIGHT RELATIONSHIP AND CONDITION FACTOR OF *LIZA RAMADA* FROM EASTERN COAST OF LIBYA

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ABSTRACT: *Monthly samples of Liza ramada were obtained during the period November 2014 to December 2015, from fishermen working at different location of the Eastern coast of Libya. Sex ratio,length-weight relationship and condition factor (K) were studied.Number of fish sample were 234. 96 were male, 47 were female and 91 were immature.Sex ratio male to female were 2:1. The correlation coefficient "r" with total Length and weight during all months, male, female, and both sex, was high, range between 0.761 to 0.995. The values of slope "b"ranged between 2.165 to 3.3and at most months, male, female and both sex, were bequal 3.The general equation of length-weight relationship for both sex were: $W = 0.004543L^{3.22}$, For males was: $W = 0.003L^{3.297}$, and For females was:$W= 0.005L^{3.17}$. Values of condition factor of species L. ramada are high in December (2014) 1.0714 and April (2015) and lower values are on January (2015) 0.8163.*

KEYWORDS: Liza Ramada, Condition Factor, Eastern Coast, Length, Weight

INTRODUCTION

The relation between the length and the weight of fish used since before year 1930 (Bond, 1986), first this relation was described by the cubic parabola. $W = aL^3$. But after that another equation was used instead of cubic parabola called general parabola, it gives better results. $W = aL^b$. b = 2 to 4.The values of a and b differ between species, through the year and through the spawning season (Ahemed, 1987). When the values of b equal 3, the growth is called isometric, if it is less or more than 3 it is called allometric growth. Also length-weight relationship studies of any fish species is a pre requisite for the study of its population (LeCren, 1951). Condition factor or the 'fatness' (k) was worked out to assess the well-being of the population with assumption that the growth of fish ideal conditions maintain an equilibrium in length and weight (Hile, 1936). The thin-lipped greymullet (*Liza ramada*) is one of the most appreciated fish in Mediterranean sea (Nelson, 1994). It constitutes animportant part of inland fish production, especially in the brackish water of the eastern part of Libya coast.Rafalah and El-Mor, 2014, they studied feeding habits and length weight relationship of *L. ramada* in Ain El Ghazala lagoon in Eastern Libya. Rasheed in 2012 described the length weight relationship for *L. ramada* in AlGabal Al-Akadar –Libya. In this study, the relationship between length and weight and condition factor were mentioned monthly and by sex, in order to describe the variation in b values during period study.

MATERIAL AND METHODS

Monthly samples of*L. ramada* were obtained during the period November 2014 to December 2015 (almost 30 fish/ month), from fishermenworking at different locations along the Eastern coast around of Benghazi coast (Figure 1). Thesefishermen usually use small boats with

engines and fishwith nets, hooks and lines.Because of the war and conflicts in Benghazi fishing port, the fishing activities were limited to shallow near shore coastal waters.Gears like trawling nets are no more used because of insecurity. The obtained monthly samples were taken to Marine Biology Laboratory of Omar El-Mukhtar University where each fish was measured to the nearest cm (Total length) and weighed to the nearest gram.

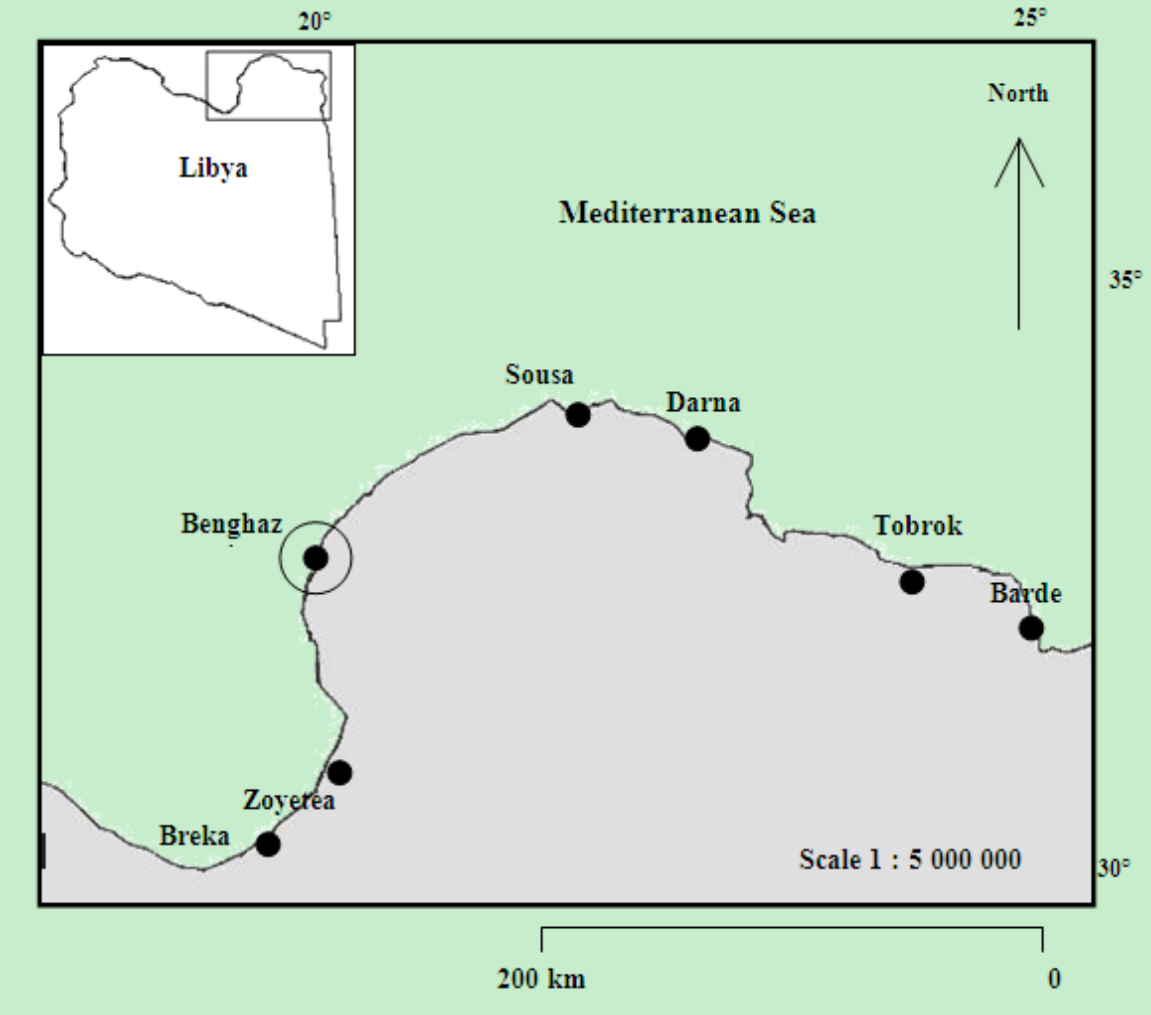

Figure 1. showed the study area (Eastern Coast of Libya).

The relationships between body weight and total length for the species *L. ramada*were established following Gulland (1985), for the whole total sample, monthly and by sexes (male and females).The constants "a" and "b" were obtained from the equation:

$W(i) = a*L(i)^{b}$

Where W (i) is the body weight, L(i) is the total length "a" and "b" are constants. The exponential equation was converted into a linear by logarithmic transformation.

$\ln W(i) = \ln a + b*\ln L(i)$ Or $Y(i) = a + b*X(i)$

Condition Factor

Condition factors were used to compare the health or fattening of the fishes. They were estimated following Ahemed (1987). The condition factors were established for twelve months.K = $(W/L^3)*100$ (this equation was used because the growth was isometric).W = the weight in grams.L = the length in centimeters.(If the growth is not isometric, we would use the following equation:K = $(W/L^b)*100$) ,b = constant.

Statically Analysis

The effect of sex and months

General linear model was performed to determine the effects of the sex of fish and the month of captured using SPSS computer software (2012), release 20. Duncan Multiple Range Test was used to estimate the differences between means.

RESULTS

From table 1and 2. The results indicated that high correlation coefficient "r" with total weight and total length from a linear equation of species study during all months, male, female, and for both sex, which range between 0.761 to 0.995, hence >0.5. also we see from table 1 and figure 1, 2, and 3 . The values of slope "b" range between 2.165 to 3.3 , but at most months, male, female and both sex b equal 3, meaning that since the weight of a fish species (in grammas) is approximately equal to its volume (in cubic cm), and since its volume is often proportional to the cube of its length, L^3.Fishes sample studied 234 fish specimens, malewere 96, female 47 and the remaining 91 fish specimen immature, hence, sex ratio male to female seem to be 2:1.

The mean observed total length for male was 19.2 cm at total weight 63.66 g, for female the mean observed length was 23.77 cm at weight 132.12g and for the box sex, mean observed length 22.3cm at weight 104.9 g.

The analysis of variance (table 2) indicated a high significant effects of months on both total length and total weight, while the sex had no significant effects on the a bellow mentioned traits.

The general equation of weight length relationship for both sex was:$\mathbf{W = 0.004543L^{3.22}}$, **For** males was:$\mathbf{W = 0.003L^{3.297}}$, and **For** females was:

$\mathbf{W= 0.005L^{3.17}.}$

Values of condition factor of species *L. ramada* vary from month to another, according to the mean values of length and weight, which are high in December (2014) 1.0714 and April (2015) 1.0383 at mean length 21.8 cm, mean weight 111.0 gm and 24.2cm and 147.7 gm, respectively. The lower values are on January (2015) 0.8163, at mean length 21.0 cm and weight 75.6gm.

Table 1. Monthly, male, female and both sex, the weight length relationship equation, the values of a, b, r for *L. ramada* from Eastern coast of Libya 2014-2015.

Month	Equation	A	b	r	Number	Significant
December	y = 3.3038x - 2.4525	2.4525	3.3038	0.995	29	p<0.001
January	y = 3.153x - 2.3045	2.3045	3.153	0.928	27	p<0.001
February	y = 2.973X-2.002	2.002	2.973	0.858	14	p<0.001
March	y = 3.0264x - 2.0979	2.0979	3.0264	0.761	27	p<0.001
April	y = 3.0264x - 1.6593	1.6593	3.0264	0.925	20	p<0.001
May	y =2.165x-0.965	0.965	2.165	0.889	23	p<0.001
June	y =3.13x-2.197	2.197	3.13	0.928	21	p<0.001
July	y = 3.3405x - 2.4482	2.4482	3.3405	0.843	15	p<0.001
August	y = 2.7278x - 1.6749	1.6749	2.7278	0.922	15	p<0.001
September	y = 2.4575x - 1.2545	1.2545	2.4575	0. 898	13	p<0.001
October	y = 3.2781x - 2.4515	2.4515	3.2781	0.978	15	p<0.001
November	y = 3.3201x - 2.4752	2.4752	3.3201	0.959	15	p<0.001
Male	Y=3.2915x-2.4284	2.4284	3.2915	0.9596	96	p<0.001
Female	Y=3.2219x-2.3587	2.3587	3.2219	0.9789	47	p<0.001
Whole	Y=3.2241x-3.3427	3.3427	3.2241x	0.9533	234	p<0.001

Table 2. The monthly, observed and calculated mean length and weight of male, female and whole, for *L. ramda* from Eastern coast of Libya 2014-2015.

Month	Observed Mean length±SD	Observed Mean weight±SD	Calculated mean length	Calculated mean weight	Number
Effect of month					
December	21.8 ± 4.6^{bcd}	111.0 ± 27.8^{bcd}	23.05	93.61987	29
January	21.0 ± 1.8^{abc}	75.6 ± 24.8^{ab}	20.5	82.24987	27
February	21.6± 1.03bc	94.03 ± 14.9^{abc}	21.8	90.77698	14
March	19.21 ± 1.5^{a}	63.66 ± 19.7^{a}	19.3	61.79018	27
April	$24.23\pm1.8cd^{ef}$	147.7 ± 32.7^{de}	25.19	130.3049	20
May	19.5 ± 1.2^{ab}	65.8 ± 11.7^{ab}	22.02	64.79493	23
June	26.4 ± 2.02^{f}	180.5 ± 5.5^{e}	26.8	172.3415	21
July	20.9 ± 1.9^{bcde}	95.3 ± 29.9^{abcd}	21.9	81.27414	15
August	20.7 ± 2.5^{bcdef}	86.1 ± 32.7^{abcd}	21.5	78.88508	15
September	24.1 ± 1.03^{cdef}	139.8 ± 16.2^{cde}	24.76	128.8559	13
October	24.82 ± 2.5^{def}	136.6 ± 37.5^{cde}	24.59	140.8006	15
November	25.43 ± 1.3^{ef}	156.9 ± 27.8^{de}	25.67	152.2503	15
Effect of sex					
Male	23.77 ± 3.29^{a}	132.12 ± 58.8^{a}	24.33	122.5058	96
Female	24.05 ± 3.39^{a}	126.67 ± 56.04^{a}	23.98	127.2135	47
Whole	22.3±3.27	109.3±54.12	22.94	99.74345	234

Within columns, means had different superscripts differed significantly (p<0.05)

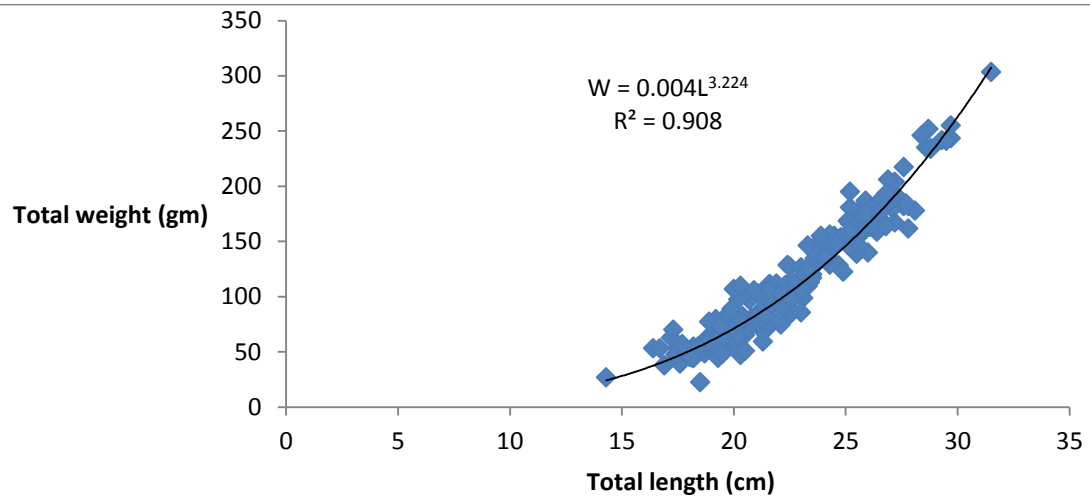

Figure2. The weight length relationship for both sex *L. ramada* from Eastern coast of Libya 2014-2015.

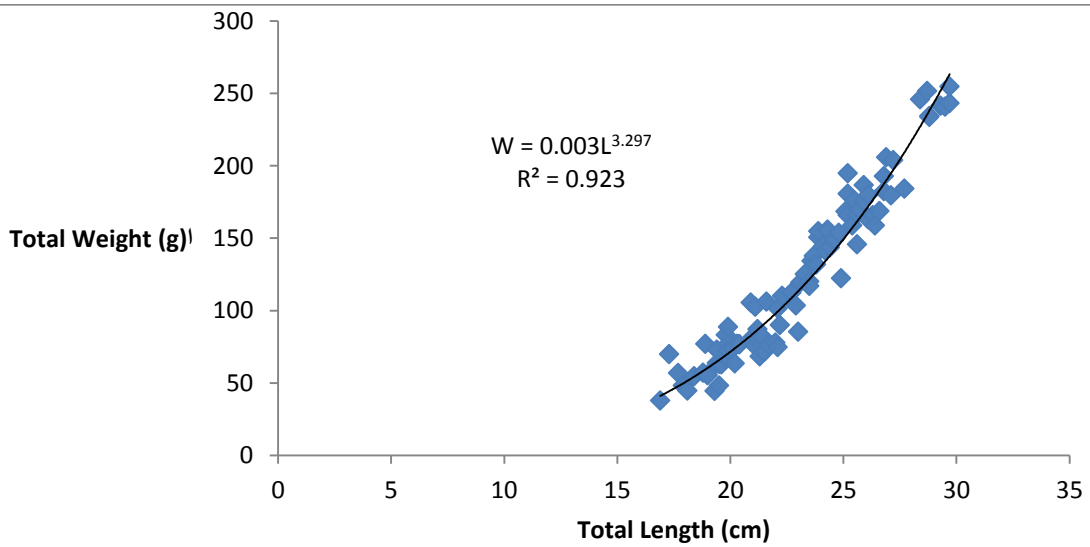

Figure 3. The weight length relationship for male of *L.ramada* from Eastern coast of Libya 2014-2015.

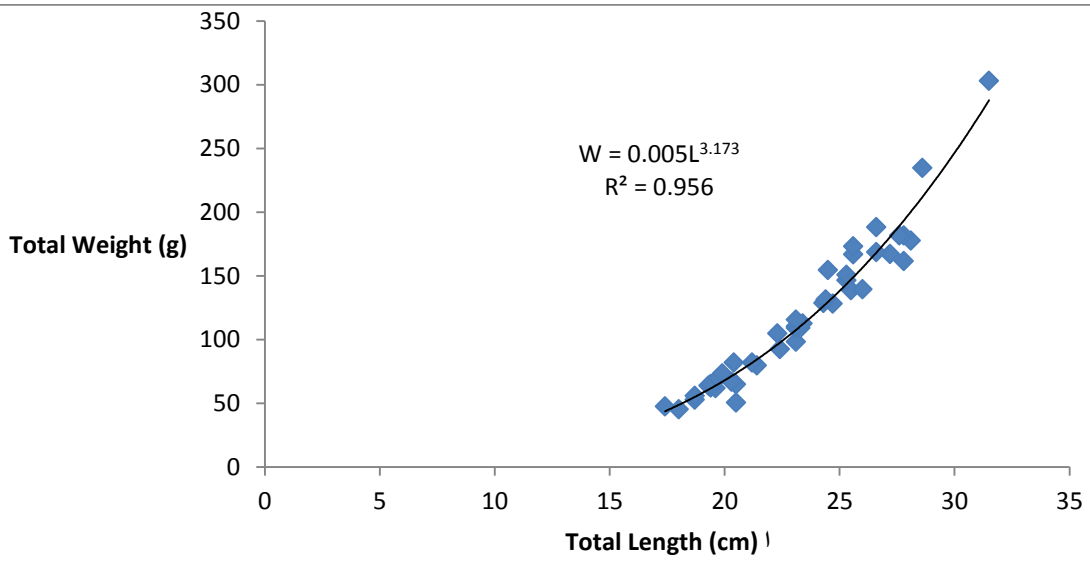

Figure 4. The weight length relationship for female of *L.ramada* from Eastern coast of Libya 2014-2015.

Table 3. Showed the mean length, mean weight, fish number and condition factor (K) value of *Liza ramada* from Eastern coast of Libya 2016.

Month	Mean length(cm)	Mean weight (gm)	Number of fish	K value
December	21.8	111.0	29	1.0714
January	21.0	75.6	27	0.8163
February	21.6	94.03	14	0.9331
March	19.2	63.7	27	0.8980
April	24.2	147.7	20	1.0383
May	19.5	65.8	23	0.8874
June	26.4	180.5	21	0.9809
July	20.9	95.3	15	1.0438
August	20.7	86.1	15	0.9707
September	24.1	139.8	13	0.9987
October	24.82	136.6	15	0.8933
November	25.43	156.9	15	0.95408

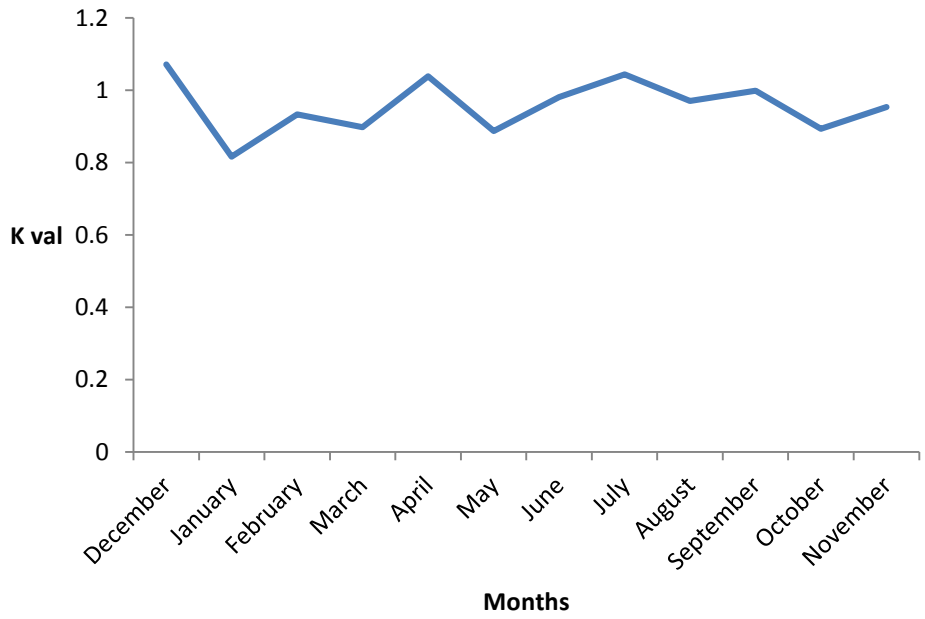

Figure 5. The values of condition factors by month of *L. ramada* during period 2015-2016

DISCUSSION

From the results of the relationship between weight and length of this study, the values of slope "b" range between 2.1 to 3.3, and showed high variation during months, which quite equal 3 at most categories, especially for male, females and both sex, meaning that the relation between weight and length were isometric. That meaning since the weight of a fish species (in grams) is approximately equal to its volume (in cubic cm), and since its volume is often proportional to the cube of its length, L^3(Le Cren , 1951).

While in fewer months show allometeric growth, which b not equal 3, especially during February, June, August and September. These variation in results return to full or empty of the stomach of the fishes specimens, this finding supported by (Verdiel, *et al* 2006, Ahmed, 1987 and PerSare, 1992). They mention that the exponent b vary during the day, month, season and year reflecting to fullness of stomach and gonads stages, alsothe differences between b values are due to one or more factors: the season and effects of areas of origin, sex, and the food availability. Differences in the sampling design may also affect the relationships, as the numbers of specimens and length ranges of the species were distinct among localities (Tesch, 1971; Sparre*et al*. 1989; Moutopoulos and Stergiou, 2002, Elawad, 2009).the present results, the mean observed total length for male was 19.2 cm at total weight 63.66 g, for female and for box sex, mean observed total length 22.3cm at weight 104.9 g, these compare with the Mehanna, 2006. from lake Bardrwil, Egypt he mention a total of 837 *L. ramada*of total length varied from 16.9 to 42 cm, with weights ranging between 40 and 725 g exponent b was 3.13 . such, the results showed different also, the length ranges covered for *L. ramada* should be considered when using parameters of weight-length relationships, as to some extent the

smallest specimens may change the parameters (Moura and Gorda, 2000, Nelson, 1994 and Oliveira and Ferreira, 1997).

In this study sex ratio male to female were 2:1, in favor to male. This results showed different, when compared with Glemuzina*et al* 2007, in the *L. ramada* from Neretva River in Eastern Adriatic, Croalina coast, he mentioned sex ratio male to female 1:1.Period and habitat where fish were sampled clearly affected sex ratio (Al-Daham and Wahab, 1991). Moreover, males and females seems to occupy different areas and to arrive asynchronously in spawning areas. The ratio increases after the spawning season peak as more females leave the coastal areas and appear in the open sea reproduction grounds. Males then seem to move close to the coast faster than females, leading sex ratio to decrease and remain biased toward males until the next spawning season. The faster migration of males to coastal areas may be due to the high energetic cost of reproduction for females, which in turn affects their migration speed towards their usual feeding grounds close to the coast (Almeida, *et al*, 1993).

Condition factor (k), usually use to describe the status fitness of fish species (Bagenal and Tesch, 1978). The condition factor obtained in the present study ranged between 0.81633 in January to high value 1.07141 in December (2015). The variation in condition factor values, usually return to effect of food intake and, degree of ovary development and effect of other environmental factors (Elawad, 2010, Ekwella, 2008). The maximum peak or value appear in December and July, and minimum values appear in January and May. This finding nearly agree with Ekwella, 2008, he mention that in Eastern coast of Libya the condition factor of species *L. ramada* usually high in summer season and low on other season (usually summer season start from May, June, July, and August).Gozukara, 1999, in Akgol-Paradeniz lagoon in Turkey Mediterranean sea, recognized the condition factor values of *L.ramada* maximum was 1.57 and minimum was 0.89.

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