BIOLOGICAL GROWTH QUALITY OF *CARASOBARBUS LUTEUS* FROM EUPHRATES IN AL- MUTHANNA PROVINCE

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ABSTRACT

Results of current study represents the first investigation on age groups and growth of *Carasobarbus luteus* from two stations of the Euphrates in Al- Muthanna province, during the period from September 2017 to March 2018.A total of 155 samples were caught belonging this fish species . age group comprised five (II^+-VI^+) for males and six (II^+-VII^+) for females with dominant III^+ age group in both sexes. The annual increment in length was decreased with the increase in age group, while the annual increment in weight was the highest in the first year and increase with age, except for VI+ year for males. The regression coefficient (b) indicated that the growth modality of *Carasobarbus luteus* was Allometric in males and isometric in females. mean values of condition factor from 1.06699 (IV^+) to 1.51979 (II^+) in males and between 1.156865(VII^+) to 1.558341(IV^+) for females, statistical analysis showed significant differences($P\leq0.05$) between males and females in values of condition factor .Growth models of Von Bertalanffy were($L\infty$=30 cm, K=0.15, t_0= -0.213) for both sexes. The current study found that this fish does not reach large, ages and the female growth is better than male.

Keywords: Cyprinids, growth, Regression coefficient, Log a, scales, *Carasobarbus*.

جودة النمو الاحيائي لسمكة *Carasobarbus luteus* المصيدة من نهر الفرات في محافظة المثنى

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المستخلص

تعد نتائج الدراسة الحالية أول استقصاء حول المجاميع العمرية ونمو سمكة الحمري *Carasobarbus luteus* المصطادة من موقعين لنهر الفرات في محافظة المثنى ، خلال الأشهر من ايلول 2017 إلى اذار 2018. تم جمع 155 عينة من هذه الأسماك .تكونت المجاميع العمرية من خمس (II^+ – VI^+) للذكور وست (II^+ – VII^+) للإناث مع سيادة واضحة لمجموعة العمر (III^+) في كلا الجنسين. انخفضت الزيادة السنوية في الطول مع الزيادة في المجموعة العمرية ، وان الزيادة السنوية في الوزن أعلى في السنة الأولى وتزداد مع المجموعة العمرية ولكلا الجنسين ، باستثناء انخفاض الزيادة في المجموعة العمرية (VI^+) للذكور حيث كانت 10.85 غم . اشارت قيمة معامل الانحدار (b) إلى أن نمط نمو *Carasobarbus luteus* كان غير قياسي Allometric في الذكور وقياسي في الإناث .تراوحت معدل قيم معامل الحالة وحسب المجاميع العمرية من 1.06699 (IV^+) إلى 1.51979(II^+) في الذكور وبين 1.156865(VII^+)إلى 1.558341 (IV^+) للإناث .أظهر التحليل الإحصائي فروق معنوية ($P\leq0.05$) بين الذكور والإناث في قيم معامل الحالة ، تم تطبيق نموذج Von Bertalanffy للنمو وكانت قيم الثوابت :الطول النهائي ($L\infty$= 30 سم) ، معدل النمو (k=0.15) والعمر عند الطول صفر (t_0 =0.213−) لكلا الجنسين .وجدت الدراسة الحالية أن هذه الأسماك لا تصل إلى أعمار كبيرة وأن نمو الإناث أفضل من نمو الذكور.

الكلمات المفتاحية: شبوطيات ، النمو ، معامل الانحدار ، لوغارتم أ ، الحراشف ، الحمري.

***Received:10/5/2018, Accepted:17/8/2018**

INTRODUCTION

The genus of *Barbus* constitutes a dominant formed of Cyprinids family, including more than 800 species spread over Europe, Africa and Asia (26). They are a major formed of Eurasian temperate fresh water fauna (13).This species(***Carasobarbus luteus***) lives in different area of Iraq such as southern marshes , natural and artificial lakes , in irrigation and drainage canals, in streams of Shatt- Al-Arab, in main and their branches inTigris and Euphrates Rivers(20).Among the many species of fish in Euphrates River, the Cyprinidae were the most common and endemic , with 34 species out of 52 in total(12). The study of age and growth in fish is a prerequisite to generate the information on recruitment, longevity, mortality and fluctuations in fishery caused by various year classes (3)."The determination of the age of fish to develop a relationship between the size and age of fish, Fish age can be estimated by direct or indirect methods, direct methods provide accurate data but are impractical in natural waters, The most widely used methods of age estimation are length-frequency distribution and reading annuli on hard structures(scales, otoliths, opercular bones, fin rays and spines etc.) ,age data is also mandatory to develop fish growth models, apart from back- calculation method, there are a number of models to study fish growth one of the most widely used method is von Bertalanffy growth model, such studies with proper statistical refinements are helpful in describing the present status and past history of a fish population all of which can contribute towards planning for a rational exploitation of these fish stocks (22). When the value of the condition factor is higher, it means that the fish has achieved a better state. From the available literature it is apparent several works have been done on some biological aspects of the species under investigation form different area of Iraq and another countries(1,2,6,7,10,11,14,16,20,23).The present study considers the first investigation about the growth of this species in Al-Muthanna province.

MATERIALS AND METHODS

155 specimens were collected monthly from the fishermen fishing in Euphrates River during the period from September 2017 to March 2018 from two stations, the distance between each two station was approximaly 2-4 km, located between latitude $30^{0}19^{'}$N and longitude $45^{o}17^{'}$E(figure1).The fishermen used different gills nets (seine nets,Length 80 meters, width 3meters, 1.5 X1.5 cm mesh size and cast nets , diameter 3meters , 1.5 X1.5 cm mesh size) in both stations. Each gill net was used twice for 1 hour each time . The sampling time was about 3 hours for each station .Fish specimens were weighted in the laboratory to the nearest gram using electric balance.Total length for each fish was recorded. From measuring the length and weight of the fish, the condition factor (K) value resulting from the formula:

$[K=(W*100) / L^3]$ was calculated proposed by Htun-Han (19) where:

K= condition factor

W= fish weight

L= fish length

The total Length-weight relationship was calculated by applying the following logarithmic equation:

$$\text{Log } W = b \text{ Log } L - \text{Log } a \quad (3)$$

Where

Log W = Logarithm of total weight

Log L= Logarithm of total length

b = Regression coefficient

Log a=The intersection point of the straight line equation with the y-coordinate

Clean and dry scales were used to determine the age by using a projectina apparatus and growth was estimated using the von Bertalanffy growth curve model (25):

$$Lt = L\infty \{1 - \exp[-K (t - t0)]\}$$

where Lt = total length (cm), $L\infty$ = asymptotic length (cm), k = curve growth coefficient, t = age (years), and t_0 = age at zero length. The von Bertalanffy growth parameters were estimated for males and females separately as well as for both sexes combined.

Statistical analysis

The statistical program SPSS (20) and the application of T-test were used to determined that the differences in growth between males and females is significant or not significant at the level of probability ≤ 0.05, and Microsoft Windows 10 for the rest of the calculations was used.

Figure 1. Map of Euphrates River in Al Muthanna province indicate the sites where *Carasobarbus luteus* has been collected.

RESULTS AND DISCUSION

Age group: A total of 155 samples *Carasobarbus luteus* were divided into 41 males and 114 females, the numbers measured and aged are listed in Table1,2. Results of the current study indicated that there were five age group (II^+-VI^+) for males and six age group (II^+-VII^+) for females with clear dominant III^+ age group in both sexes, the number and percentage were represented 16(39.02 %) for males and 38(33.33 %) for females. the number and percentage of II^+ and more than III^+ age groups were rather low, but the lowest percentage in age groups VI^+ was 2(4.88 %) for male and VI^+ was 2(1.75 %) for females. The age groups 0^+ and I^+ were not represented in all samples during the period of study which may be related to the size of the nets that lead to missed the small fishes as they were able to pass through the nets(5 , 14)

The current study result was broadly consistent with the result recorded by Salman (24) in lake Tharthar, Al-Ridini et al. (8) at lake Hamrin dam and Amari et al. in Hilla river (4)in obtaining six age groups of *Carasobarbus luteus* and that the dominance was for the fourth age group in the study of Al-Ridini *et al.* and Amari *et al*.While it differed from the results of Al-Ridini and Nasseri (9) in one of the artificial lakes west of Baghdad, which showed that the reconstruction of *Carasobarbus luteus* ranged from 1-9 years and that the lengths ranged from 3 to 35 cm. Especially in the age groups, where record VII^+ age groups in a flooded gravel pit near Al-Nibaey and with results by Mohamed *et al.*(23) in Eastern Side of Hammar Marsh, south of Iraq and agreed with Gokcek *et al.*(16) at Orontes River, Turkey as they found that dominant age group was III^+ and disagree with this result in age group IX^+ that recorded by Gokcek *et al*(17). In addition,memtion Baboli and Sayahi(10) at Karkheh River, Southwestern Iran "the difference between sexes was not statistically significant($p \leq 0.05$) and the age ranged from 0+ to 6+ years , males 0 to 5 years. And 2+ years classes were dominant, accounting for over 50% of the total". In general, through the results of previous studies and the result of the current study, it can be concluded that the age groups of these fish can reach range from VII^+ to IX^+.

Growth in length: The regression calculations were used to determine the length of fish at each of the previous years of life from scales. Table 1,2 showed age group ,sex distribution and mean of length (mm) at each growth period in male and female *C.luteus* with the mean of annual increment , has illustrated the relationship between the growth for each year of life "Mean of Observed total length, Mean of calculated total length and the annual increment were calculated separately for both sexes The mean of the total length increases with the age groups and has the highest mean length in the VI^+ age group for males (204mm) and in VII^+ age group for females (234mm), while the annual increment in length was decreased with the increase in age group and the highest annual increment of length in the first age group and both sexes(106.8 and 120.5mm) for males and females respectively and lowest in VI^+ age group for males(7 mm) and VII^+ age group for females(7.5).This indicates that the annual increase in length applies to Lee's phenomenon. Results showed no statistically significant differences ($p \leq 0.05$) in growth between males and females. Khalf *et al.*(20) Pointed on that the first year of life has the highest increment of 67mm increase. In the following years, the annual increase is much lower on average only 22.2 mm and shows a modest tendency to decrease. Mohamed *et al.*(23) mentioned that the highest annual increase in the first year (10.5 cm) by 39.1% and decreased in subsequent years to the lowest rate in the sixth year of age (2.2 cm) by

7.3%. The results of the present study are somewhat similar to those of previous studies, possibly due to the nature of fish's life and their ability to adapt to different environments. (4, 23).

Growth in weight: The actual weight of each age group obtained from the back calculations for length was calculated. The increment of mean weight was calculated by subtracting the mean weight for each age group from the mean weight of age group which previous it. The mean calculated weight for various years of the life of different years classes along with the mean annual increment are shown in Table 1,2 showed that these increases are the highest in the first year and increase with age, except for VI^+ year for males was10.85gm. When comparing the results of the current study with the results of other studies on fish *C. luteus* from different environments, it is clear that the growth of the fish in the current study is lower than indicated by studies in other bodies of water (4,6,20) and higher than that recorded by Abdul Latif and AlMahna (1) during a study this fish caught from Al-Hindia river in Karbala province, which confirms the fact that the growth of these fish was affected by the physical, chemical and biological factors prevailing in the areas of the presence of these fish, which vary between the region and the other depending on geographical location and environmental components (10).

Total Length – Weight relationship

The relationship between total length and total body weight of males, females and both sexes were calculated and demonstrated in the straight-line logarithmic equation:

Log W=b Log L-Log a as follows:

Log W= 2.85046 Log L- 1.13205($r = 0.90$, $p \leq 0.05$) for both sexes

Log W= 2.57141 Log L - 0.86522 ($r = 0.89$, $p \leq 0.05$) for males

Log W= 3.25956 Log L - 1.19371($r = 0.91$, $p \leq 0.05$) for females

They were summarized in figure 2.

Table 1. Age group and mean of length (mm) at each growth period in male *Carasobarbus luteus*

Age group	Fish	Mean Observed total length	Length at age					
	n(n%)		I^+	II^+	III^+	IV^+	V^+	VI^+
II^+	10(24.39)	166	97	155				
III^+	16(39.02)	164	100	133	154			
IV^+	7(17.07)	201	112	145	178	191		
V^+	6(14.63)	222	102	134	177	190	206	
VI^+	2(4.88)	215	123	136	152	183	188	204
Mean length m			106.8	140.6	165.3	188	197	204
Increment of mean length mm				33.8	24.7	20.7	9	7
Mean weight (gm) for Observed fish m				65.5	69.52	87.20	114	124.85
Increment of mean weight(gm)					4.02	17.688	26.806	10.85

Table 2. Age group and mean of length (mm) at each growth period in female *Carasobarbus luteus*

Age group	Fish	Mean of Observed total length	Length at age						
	n(n%)		I^+	II^+	III^+	IV^+	V^+	VI^+	VII^+
II^+	30(26.32)	179	113	167					
III^+	38(33.33)	182	125	169	175				
IV^+	19(16.67)	200	134	153	192	197			
V^+	15(13.16)	205	114	143	193	196	204		
VI^+	10(8.77)	224	127	147	194	219	222	223	
VII^+	2(1.75)	245	110	158	181	226	229	230	234
Mean length m			120.5	156.2	187	209.5	218.33	226.5	234
Increment of mean length mm				35.7	30.8	22.5	8.83	8.17	7.5
Mean weight (gm) for Observed fish m				86.69	90.52	105	123.46	142.11	170.13
Increment of mean weight(gm)					3.83	14.48	18.46	18.65	28.02

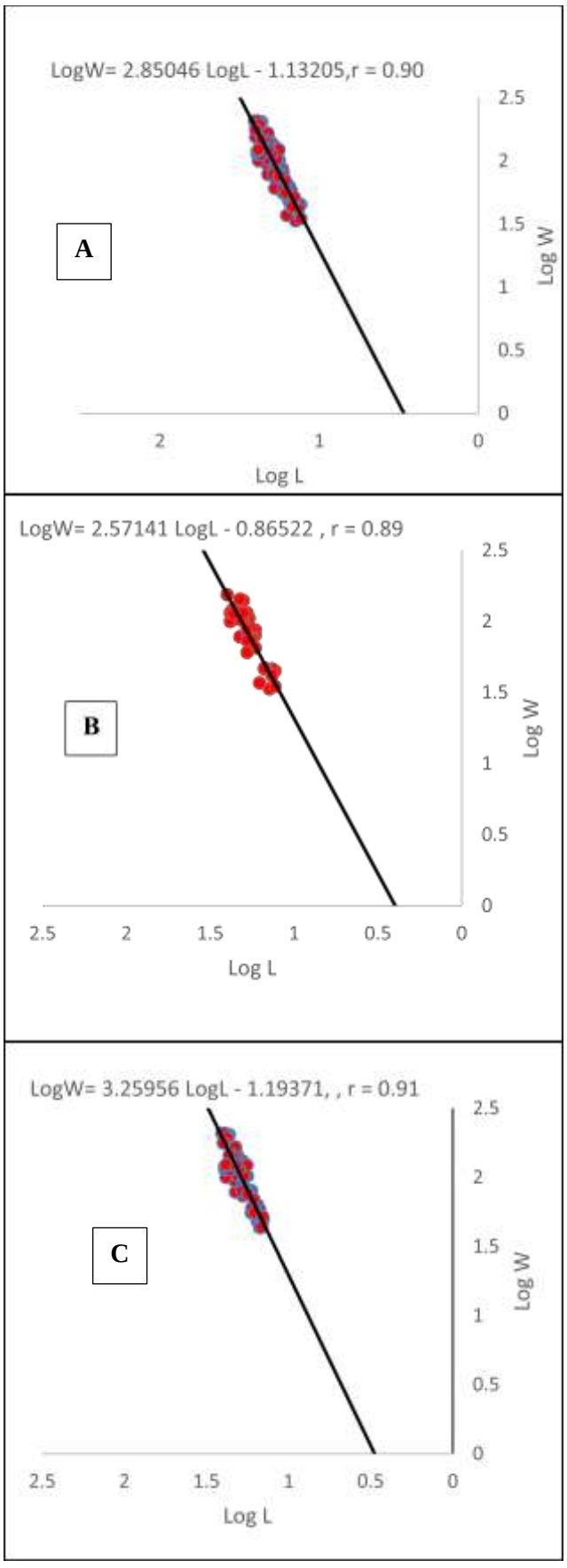

Figure2. Total Length – Weight relationship 0f *Carasobarbus luteus.*
A-Both sexes , B-Males , C-Females

Table 3. that illustrated the length-weight relationship (a , b value) of *C. luteus* in different water bodies, from this table the regression coefficient (b) indicated that the growth modality of both sexes and males of *C. luteus* was Allometric and isometric in females , also , b values indicated that fish growth in this study area in both sexes and males was equal or less , While females was higher than that recorded by other researchers in different countries , in addition the table 3. That point out the growth in females better than males of this study and all fishes in other studies.

Table 3. Length-weight relationship (a, b value) of *C. luteus* in different water bodies (Upper value a, lower value b for each source).

Authers and year	Location	(a , b) value		
		Male	Female	Both sexes
Al Hazzaa, 2005	Euphrates River, Deir ezzor, Syria	0.0130 3.05	0.0190 2.98	---
Gokeck, Akyurt, 2008	Orontes River, Turkey	0.0125 3.003	0.0129 2.986	0.0129 2.988
Al- Amari et al.	Hilla River, Iraq	--	---	- 4.961 3.056
Eydizaden et al.,2014(15)	Hoor AL-azim wetland, Iran	0.0096 3.11	0.0019 318	0.0018, 3.18
Hashemi et al. ,2014(18)	Shadegan wetland	0.00003 2.83	0.0002 2.50	0.0001 2.60
Baboli ,Sayahi, 2014	Karkheh River, Southwestern Iran	0.0152 2.9293	0.0185 2.857	0.0161 2.9064
Mohamed et al.,2015	Eastern Side of Hammar Marsh	---	---	1.1711 2.7864
Alasadiy, 2018	present study	-0.86522 2.57141	-1.19371 3.25956	- 1.13205 2.85046

The parameters condition factor and Von Bertalanffy ($L\infty$, K, t_o) for both sexes in each group of *C. luteus*, they were summarized in table 4 that indicated the mean values of condition factor were ranged from 1.06699(IV+) to 15.1979 in males and between 1.156865(VII+) to 1.558341(IV+) for females. Statistical analysis using T-test showed significant differences($P \leq 0.05$) between males and females, which negatively affected on the values of condition factor (kn) and $L\infty$, K and t_o value for both sexes and this can lead to an effect on fish growth. The value of condition factor and $L\infty$, K and t_o from several workers for *C. luteus* were ranged between 1.30 (VII^+) to 1.65(II^+) for both

sexes respectively in Al- Nibaey gravel –pit , Iraq (20), L∞ =54.71 , 56.93 , k = 0.110, 0.127 and $t_{o=}$ 0.377, 1.81 in both sexes respectively in Euphrates River, Deir ezzor, Syria(6) , L∞= 3877, 40.32, 39.32 , k= 0.300, 0.247, 0.282 and t_o= -1.69, -1.58, -1.54 in males , females and in both sexes respectively in Orontes River, Turkey(17), L∞= 31.78, 28.34, 27.52 , k= 0.16, 0.23, 0.28 and t_o= -1.35, -0.44 , -o.56 in males , females and in both sexes respectively at Karkheh River, Southwestern Iran (10), L∞ =37 , k = 00.26 and t_o=-0.255 in both sexes in Eastern Side of Hammar Marsh (23).by comparing the value of kn and L∞, K and to that obtained from the application of the von Bertalanffy relationship with the results of previous studies, the values of males are lower than in other water bodies The studies indicated that those values are influenced by a number of factors, such as the type and size of the nets used in fishing, the length and weight of the fish, the age groups, the natural food in the region and its frequency, and the sex ratio, that varies from one population to another and from year to year, the stage of gonads maturation. The degree of intestinal fullness, as well as parasitic infections. The difference may be caused by one or more of the previously mentioned causes, as well as the study showed that the fish infected by one of the non-diagnosed species of nematodes and the infection in males more than females.

Table 4. Condition factor and Von Bertalanffy (L∞, K) for both sexes in each group of *C.luteus*.

Age group	Mean Condition Factor			Both sexes (L_∞, K , t_o) Cm
	Male	Female	Both sexes	
II+	1.519797	1.51058	1.51714	
III+	1.483246	1.5067138	1.510506	
IV+	1.06699	1.558341	1.424616	30.0 0.15 - 0. 213
V+	1.144435	1.4759	1.369854	
VI+	1.147069	1.272007	1.253883	
VII+	---	1.156865	--	

(Upper value for L∞ (mm), mid value for K, a lower value for t_o)

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