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Biological and morphological aspects of *spiny eel* *Mastacembelus mastacembelus* (Banks and Solander, 1794) inhabiting Al-Tharthar canal / Samarra, Iraq

ABSTRACT

Biological aspects (size composition, length-weight relationship, condition factor, food habit and reproduction season), and morphological of *Mastacembelus mastacembelus* inhabiting Al-Tharthar canal studied during the period from April to September 2012. The growth pattern was negative allometric with (b) values for males 2.680, females 2.845 and for combined sexes 2.597. Condition factor values were lower than one, ranged from 0.183 to 0.432 with average 0.282 ± 0.053 for combined sexes. Food items from stomach collected and analyzed using both points and frequency methods. Two food items found only in the diet. *M. mastacembelus* is a predator, the males preferring fish while the females preferring fish and crustacean (prawns). The research cover, the ratios each of sixteen morphometric measurements to standard length, and each of four morphometric measurements to head length and their linear regression equations. All the length-length relationships between standard length and the others measurements were highly correlated except head depth, body depth and body width, and for head length, head depth only.

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INTRODUCTION

Mastacembelus mastacembelus belong to the family Mastacembelidae, known as spiny eel, occurs in Euphrates - Tigris rivers basin in Iraq. The common names for this fish are marmarij or salbough abu-el-sian and it is not a regular food item (Coad, 2010). Coad (2015) described its systematic morphology, distribution, biology, economic importance and conservation in Iran. In Iraq, Bashe and Abdullah (2010) studied parasitic fauna of *M. mastacembelus* that collected from Greater Zab River. It occupied 1.12% of total catch from Al-Hilla river (Al-Amari, 2011). A seasonal species occupied 2.1% of total catch from Um Alnaaj in Al-Hawaizah marsh (Youns *et al.*, 2011). Mohamed *et al.* (2012) categorized it as occasional fish species that appeared in four months in Chybayish marsh, Southern Iraq.

There is virtually little published work on the biology of *M. mastacembelus* in Iraq. Wahab (2006) studied some its biological aspects from Tuz Chai River based on twelve specimens. It is more common to use morphometric measurements to identify fishes (Bagenal and Tesch, 1978). These morphometric measurements usually presented as a proportion of standard, fork and total length (Howe, 2002). The biology this species is still scarce in Iraq. This fish is not a regular food item and does not appear to under threat.

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This paper aims to provide data on length weight relationship, condition factor, stomach contents, gonadosomatic index and morphology of *M. mastacembelus* for the first time from Al-Tharthar canal. This information will allow for future comparisons between populations of the same species.

MATERIALS AND METHODS

Al-Tharthar canal conduct Tigris River with Al-Tharthar Lake to supply the lake with water through Samarra dam (Fig. 1). The canal distinctive by availability of fishing activity. Most sources of fish captured in Samarra city comes from this canal. Sampling site covered around 17 km from the beginning of the canal. Sixty-two specimens of *M. mastacembelus* caught during the study, twice a month during the period from April to September 2012, using seine net of 80 meters length, 8 meters height with mesh size (40x40) mm and gill nets with mesh-size ranging from 22 to 36 mm. Estimation of length-weight relationship was determined using the formula $W=a L^b$ (Ricker, 1975), which is transformed into logarithmic form $\ln W = \ln a + b (\ln L)$, where w is the body weight in grams, L the standard length in cm and b regression coefficient of the relationship. Whose parameters fitted to a regression line by the least square study Students t-test determined the significance level ($P<0.05$) of the differences between isometric growth ($b=3$) and calculated b value in the equation. Condition factor (K) computed using the formula: $K = 100W/L^3$ (Pauly, 1983). Gonadosomatic index (GSI) calculated as gonad weight as percentage of total weight.

$GSI = [\text{gonad weight} / \text{total body weight}] \times 100$

Sex ratio= Number of males/number of females

Specimens preserved in the deep freezer immediately after measuring and weighing. The preserved fish later thawed and dissected laboratorially, the gut taken and food items from stomach collected and analyzed. The percentage fullness of each stomach assessed using "point" method and the percentage frequency of occurrence method used (Hynes, 1950).

Morphometric measurements (standard length, total length, pectoral fin length, pectoral fin base length, dorsal fin base length, anal fin base length, distance before dorsal fin, distance between anus and end of dorsal fin base, body depth, destine between anus and the beginning of dorsal fin spines, destine between anus and the beginning of dorsal fin rays, head length, head depth, snout length, mouth length, mouth width, body depth and body width were taken. All measured to nearest millimeter. The data were analyzed using simple linear regression of the morphometric measurements against fish standard length. The equations expressing the length-to-length relationship derived by the method of least squares and of the general form:

$Y = a + b X$ (Where Y = variable, a = Y intercept, b = regression coefficient and X = Standard length).

Students t-test determined the significance level ($P<0.05$) of the differences between these variables.



Fig (1) Sampling area

RESULTS

SIZE COMPOSITION OF THE SAMPLES

Length distribution and length frequency of 62 individuals of *M. mastacembelus* of standard length ranging from 27.40-63.30 cm. and weight from 48.30-549.41 gm. from Al-Tharthar canal carried out. As shown in Table 1, the greatest proportion of the sampled fish was 25.81%, for the length group 41-45 cm. SL, followed 22.58% for the length group 36-40 cm. SL, while the fish below 30 cm. SL was least represent in the sample. The fish sizes from 36-50 cm occupied 66.13% of the total catch.

Table 1. Standard length frequency of *M. mastacembelus* population

Standard length group(cm)	Length frequency		Standard length(cm) Mean Extreme	Total weight (gm.) Mean Extreme
	Number	Proportion		
26-30	2	3.23	28.90±2.121 27.40-30.40	55.13±9.659 48.30-61.96
31-35	6	9.68	33.47±1.331 31.90-35.60	105.64±19.975 72.28-125.95
36-40	14	22.58	38.50±1.498 36.00-40.00	178.72±22.023 152.22-217.40
41-45	16	25.81	42.85±1.202 41.30-45.10	239.34±53.802 157.05-323.60
46-50	11	17.74	47.67±0.923 46.50-49.90	297.31±67.382 196.16-338.68
51-55	6	9.68	52.63±1.578 51.20-54.20	380.34±59.096 287.00-449.92
56-60	4	6.45	57.98±1.819 56.70-60.60	435.16±87.206 353.76-558.50
61-65	3	4.84	62.83±0.503 62.30-63.30	495.73±49.854 451.44-549.41
total	62	100	44.26±81.972 27.40-63.30	255.70±118.617 48.30-558.50

LENGTH-WEIGHT RELATIONSHIP:

Sampled *M. mastacembelus* showed that they have negative isometric growth patterns. Regression coefficients inferred from the weight-length relationships for males or females were not significantly different, regression coefficients for females (2.854), males (2.680) and combined sex (2.597), were

not significantly different from the hypothesized value 3 at 5 percent level of significance. Coefficient of determination (r) was very high for males as well (Table, 2).

Table 2. Measurements and parameters of weight-length relationships for *M. mastacembelus* females, males and combined sex.

Dependent variable	N	Mean L	L range (cm)	Log a	b	r
Female	37	42.01±5.568	31.90-54.20	-5.263	2.854	0.902
Male	25	47.57±10.251	27.40-63.30	-4.791	2.680	0.967
combined sex	62	44.26±81.972	27.40-63.30	-4.375	2.597	0.927

N, number of specimens; L, standard length (cm); a, intercept of the relationship; b, regression coefficient; r, coefficient of determination

CONDITION FACTOR

The mean condition factor for *M. mastacembelus* was 0.282±0.057; the condition factor for males was lower than females, for males ranged from 0.183 to 0.314 with average 0.247±0.044 and for females ranged from 0.192 to 0.432 with a mean 0.305±0.054 (Table 3). No significant differences between the condition factors of males and females.

Table 3. Condition factor for *M. mastacembelus* females, males, and combined sex

Dependent variable	Mean W	W range	Mean K	±SD	K range
Female	235.32	72.28-449.92	0.305	0.054	0.192-0.432
Male	285.87	48.30-558.5	0.247	0.044	0.183-0.314
combined sex	255.70	48.30-558.70	0.282	0.057	0.183-0.432

W, body weight (g); K, condition factor; SD, standard deviation

FOOD HABIT

Food habit for *M. mastacembelus* was carnivorous. The fish was euryphagous, consuming mainly fish and prawn. Fish occupied 58.33% of the diet by point method and 53.33% by frequency of occurrence method, while for the prawn 41.77 and 46.67% respectively. The percentage of food items differ between sexes, the most important food item for females was prawn that occupied 71.43% of the diet, while the males fed on fish entirely.

Table 4. Food items identified in the stomachs of *M. mastacembelus*

Food items	Female		Male		Combined sexes	
	P%	F%	P%	F%	P%	F%
Fish	28.57	30.00	100.00	100.00	58.33	53.33
Crustacean (Prawn)	71.43	70.00	----	----	41.77	46.67

P point method, F frequency of occurrence method

SEX RATIO

There were 25(40.32%) males and 37(59.67%) females. This give a Male/Female ratio was 1:1.48 in favor of the females (Table 5). The male's individual dominated especially at bigger sizes.

Table 5. Sex compositions of *M. mastacembelus*

Length group (cm)	Male		Female		Sex ratio Male/Female
	Number	%	Number	%	
26-30	2	3.23			
31-35	1	1.61	5	8.06	1:5.0
36-40	3	4.84	11	17.74	1:3.7
41-45	4	6.45	12	19.35	1:3.0

46-50	5	8.06	6	9.68	1:1.2
51-55	3	4.84	3	4.84	1:1.0
56-60	4	6.45	---	---	---
61-65	3	4.84	---	---	---
Total	25	40.32	37	59.67	1:4.8

GONADOSOMATIC INDEX

The mean gonadosomatic index for *M. mastacembelus* female's individuals during the period from April to August ranged from 0.31 to 21.67, while for males individuals from 0.04 to 2.10. Maximum GSI for females 15.17 ± 9.11 and for males 0.92 ± 0.57 in June. After June the GSI decrease, while no fish captured in September. The spawning period for may be during the period from June to July.

Table 6. Gonadosomatic index of *M. mastacembelus* during captured months

Months	Gonadosomatic index							
	Females				Males			
	N	GSI	\pm SD	GSI range	N	GSI	\pm SD	GSI range
April	13	4.66	5.24	0.31-12.30	15	0.42	0.33	0.06-1.04
May	6	8.78	4.0	3.95-11.40	---	---	---	---
June	16	15.17	9.11	1.19-21.67	7	0.92	0.57	0.50-2.10
July	2	6.45	7.26	1.20-9.77	2	0.06	0.01	0.04-0.05
August	---	---	---	---	1	0.17	---	---

N, number of fish; GSI, gonadosomatic index; SD, standard deviation

The morphometric of *M. mastacembelus* as a ratio of standard length (mean and the range) show in Tabl.7. The highest ratio was 1.052 (1.033-1.072) for total length and the lowest 0.022 (0.019-0.25) for pectoral fin base length. The relation were close for pectoral fin length 0.042, head length 0.041, snout length 0.046 and mouth length 0.045. The other body measurement mouth width, body width, body depth, head depth, distance between the beginning of dorsal fin rays and anus, distance before dorsal fin base, distance between the beginning of dorsal fin spins and anus, distance between the end of dorsal fin base and anus, anal fin base length and anal fin base length dorsal fin base length make up 0.036, 0.052, 0.082, 0.136, 0.148, 0.191, 0.346, 0.466, 0.474 and 0.827 of the standard length respectively.

Table 7. Morphometric of *M. mastacembelus* as ratio to standard length

Morphometric measurement (MO)	Mean (mm)	Rang (mm)	Ratio (MO) /standard length	\pm SD	Ratio rang
Total length	481	291-669	1.052	0.012	1.035-1.072
Pectoral fin length	19	12-27	0.042	0.007	0.024-0.051
Pectoral fin base length	10	6-15	0.022	0.001	0.019-0.025
Dorsal fin base length	379	214-574	0.827	0.035	0.707-0.867
Anal fin base length	217	124-350	0.474	0.038	0.409-0.690
Distance before dorsal fin base	87	60-110	0.191	0.016	0.174-0.236

Distance between the end of dorsal fin base and anus	215	124-330	0.466	0.024	0.414-0.521
Distance between the beginning of dorsal fin spines and anus	158	83-206	0.346	0.015	0.303-0.372
Distance between the beginning of dorsal fin rays and anus	68	39-91	0.148	0.010	0.131-0.164
Head length	62	44-85	0.136	0.006	0.126-0.161
Head depth	19	8-34	0.041	0.014	0.023-0.091
Snout length	21	12-30	0.046	0.002	0.042-0.054
Mouth length	21	11-30	0.045	0.003	0.036-0.050
Mouth width	17	8-25	0.036	0.003	0.026-0.041
Body depth	37	18-47	0.082	0.013	0.062-0.122
Body width	24	10-27	0.052	0.011	0.036-0.074

All the length-length relationships between standard length and the others measurements were highly correlated except head depth (0.622), body depth (0.684) and body width (0.483) (Table, 8), and for head length, head depth only (0.622) (Table, 9).

Table 8. Morphometric relationship between standard length(X) and the variables studied (Y) for *M. mastacembelus*.

Morphometric measurement	A	B regression	R
Total length	7.849	1.035	0.998
Pectoral fin length	1.377	0.039	0.806
Pectoral fin base length	-0.732	0.024	0.971
Dorsal fin base length	-13.808	0.858	0.978
Anal fin base length	-25.918	0.532	0.937
Distance before dorsal fin base	14.601	0.158	0.911
Distance between the end of dorsal fin base and anus	-24.898	0.564	0.989
Distance between the beginning of dorsal fin spines and anus	5.432	0.334	0.973
Distance between the beginning of dorsal fin rays and anus	-6.090	0.162	0.962
Head length	7.173	0.120	0.988
Head depth	-6.281	0.055	0.622
Snout length	-4.265	0.169	0.990
Mouth length	1.115	0.043	0.954
Mouth width	-3.449	0.044	0.967
Body depth	11.744	0.059	0.684
Body width	9.766	0.030	0.483

Table 9. Morphometric relationship between head length(X) and the variables (snout length, mouth length, head depth and mouth width) (Y) for *M. mastacembelus*.

Morphometric measurement	Ratio (MO) /head length	±SD	Ratio rang	Length-length relationship variables		
				A	B regression	R
Snout length	0.336	0.018	0.273-0.364	-3.224	0.389	0.982
Mouth length	0.333	0.026	0.239-0.374	-0.891	0.348	0.941
Head depth	0.304	0.105	0.184-0.454	-9.257	0.458	0.622
Mouth width	0.265	0.027	0.174-0.299	-5.821	0.362	0.967

DISCUSSION

Pazira *et al.* (2005) found the maximum total lengths for *M. mastacembelus* were 425mm in males and 432mm in females in southern Iran. Oyamak *et al.* (2009) found it reaches 85cm total length and 1.1 kg., in Iraq it reached 58.4 cm total length, probably higher to almost 1 m., and a maximum weight of 1 kg is cited lakes (Coad, 2010).

In general, female's number were more than male's number. Oyamak *et al.* (2009) found that the males dominated especially at an older age and the sex ratio was 1:0.63 in Ataturk Dam Lake in Turkey. Pala *et al.* (2010) and Eroglu and Sen (2007) found that the numbers of males were more than females in all age group from Karakaya Dam Lake in Turkey, the females individual consist 47.06% while for males individual 52.94%.

The result of the present study showed that the growth of *M. mastacembelus* from Al-Tharthar canal was allometric and the growth regression coefficient for males lower than females. This means that the fish do not grow symmetrically (Tesch, 1968), or the fish becomes thinner with increase in length. Tuz Chai River, the length-weight regression coefficient was 2.856 for fish individual's size ranged from 8.3 to 32.2 cm. Pazira *et al.* (2005) found the growth of *M. mastacembelus* was allometric, the growth regression coefficient for males was 2.54 lower than females 2.73. The regression coefficient was 2.43 for males and 2.95 for females showing negative allometry from Ataturk Dam Lake in Turkey (Oyamak *et al.*, 2009). Gumus *et al.* (2010) referred that the regression coefficient was 2.84 for *M. mastacembelus* from southern Anatolia, Turkey. Gerami *et al.* (2014) found the growth regression coefficient for 32 fish (19.8-46.5) cm total length was 2.675 from Cholvar River in the Karun river basin in Iran, which is closer to find out.

Wahab (2006) pointed that the condition factor of *M. mastacembelus* 0.23, also lower than one. Pazira *et al.* (2005) found this factor for females 0.296 (0.162-0.458) higher than males 0.289 (0.162-0.386) in the Helleh and Dalaki rivers basins of southern Iran.

Hussain *et al.* (2006) showed the food of *M. mastacembelus* in the Hawr al Hawizah include 55% shrimps and 45% fish and in Chybayish Marsh entirely fish, while Mohamed *et al.* (2012) noted it fed on fish entirely in Chybayish Marsh, southern Iraq.

Pala *et al.* (2010) observed pieces occupied 0.09% of digestive system content and the fish was omnivorous feeding character from Karakaya Dam Lake in Turkey. This founding differ from the resent study, which may be related to the gill-net that used in sampling collection, which lets fish don't die fast and its digestion still continued for some time after fish was caught. The animal feeding organisms can digested in shorter terms than plant feeding organisms. Its food include invertebrates but two fish contained fish scale and fish skeletal remains (Coad, 2015). The spawning of *M. mastacembelus* from Al-Tharthar canal in June.

The spawning of this species take place mostly in June to July in Turkish population and Iraq (Eroglu & Sen, 2007; Al-Rudainy, 2008). The bred from May to July in Ataturk dam lake in Turkey (Oymak *et al.*, 2009).

The morphometric of *M. mastacembelus* as percent of standard length were for anal fin base length 47.4, distance between the end of dorsal fin base and anus 46.6, distance between the beginning of dorsal fin spines and anus 34.6, distance between the beginning of dorsal fin rays and anus 14.8, head length 13.6, head depth 4.1, snout length 4.6 and body depth 8.2. The results of the present study were close to that from Tigris river in Diyarbakir in Turkey for head depth (3.94), body depth (7.58), snout length (4.57) and head length (13.87), and higher than for length were for anal fin base length 41.47, distance between the end of dorsal fin base and anus 42.65 and distance between the beginning of dorsal fin rays and anus 8.6 (Cakmak & Alp, 2010).

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الهيئات البيولوجية والمظهرية لسكة المرميج القاطنة قناة الثرثار -نهر دجلة/سامراء العراق

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المستخلص

درست الهيئات البيولوجية (توزيع مجاميع الطول وعلاقة الطول بالوزن ومعامل الحالة وعادات التغذية وموسم التكاثر) والمظهرية لسكة المرميج *Mastacembelus mastacembelus* المستوطنة في قناة الثرثار، نهر دجلة للفترة من نيسان-أيلول.

كان نمط النمو غير قياسي سلبي مع قيم (b) للذكور 2.680 وللإناث 2.845 وللجنسين معا" 2.597. كانت قيمة معامل الحالة اقل من واحد، تراوح بين 0.183-0.432 مع معدل 0.282 للجنسين معا".

حللت مكونات غذاء المعدة باستخدام طريقتي النقاط وتكرار الظهور. وجد مكونين من الغذاء في غذاءه فقط. سمكة المرمريج سمكة مفترسة، تفضل الذكور التغذية على الأسماك في حين تفضل الإناث التغذية على الأسماك والقشريات (روبيان). غطى البحث نسب 16 صفة مظهرية الى الطول القياسي وأربعة قياسات مظهرية الى طول الرأس ومعادلات الانحدار الخطية لها. كانت كل العلاقات الطول-الطول بين الطول القياسي والقياسات المظهرية الأخرى ذات ارتباط عالي ماعدا قياس عمق الرأس وعمق الجسم وعرض الجسم، وللقياسات لطول الرأس فقط عمق الرأس.

الكلمات المفتاحية: بيولوجي، مذهري، سمكة المرمريج، قناة الثرثار، نهر دجلة، العراق