academicJournals

Vol. 6(7), pp. 238-243, July 2014
DOI: 10.5897/JENE2014.0449
Article Number: F90ADAE46856
ISSN 2006-9847

http://www.academicjournals.org/JENE

Journal of Ecology and the Natural Environment

Full Length Research Paper

Length-weight relationship and Fulton's condition factor of *Carasobarbus luteus* (Heckel, 1843) in Hoor Al-azim wetland

Afrooz Eydizadeh[1]*, Gholamreza Eskandary[2] and Seyed Ahmad Reza Hashemi[3]

[1]Department of Fishery, Science and Research Branch,Islamic Azad University, Khuzestan Iran.
[2]South of Iran Aquaculture Fishery Research Center, Ahvaz, Iran.
[3]Department of Fishery, Faculty of Fisheries and Environment, University of Agricultural Science and Natural Resources, Gorgan, Iran.

Received 18 April, 2014; Accepted 2 June, 2014

Length-weight relationship and Fulton's condition factor of Hemeri (*Carasobarbus luteus*) in Hoor Al-azim wetland (Khuzestan provinces, Iran) were investigated. During this study, from 2012 to 2013 more than 460 specimens' *of C. lutus* were measured. Mean±S.D length values for this species were 228±15 respectively and maximum and minimum total length were 118 and 362 mm respectively. Mean ±S.D weight values for this species were 190±91 g and maximum and minimum weight were 86 - 416 g respectively. The length-weight relation were calculated as $W=0.0096\ L^{3.11}$ ($n=138, R^2=0.97$) for males, $W=0.0079\ L^{3.18}$ ($n=271, R^2= 0.94$) for females, $Y=0.0018L^{3.18}$ ($n=466$, R2 =0.96) for total fishes; verifying calculated b with 3 using Students t-test, there was no significant difference between calculated b and 3 ($P>0.05$) and the growth pattern was isometric. The b value in the length-weight relationship did not differ significantly between males and females (t-test, $P>0.05$). Fulton's condition factor (K) for male and female and total fish was 1.38±0.12, 1.44±0.20, and 1.40±0.18 respectively and Students t-test showed no significant difference between Fulton's condition factor of males and females ($P>0.05$). This study reports and provides basic information for fishery biologists in Iran.

Key words: *Carasobarbus luteus*, length-weight relationship, Fulton's condition factor.

INTRODUCTION

The relationship between body weight and length is simple but essential in fishery management (Chien-Chung, 1999). Length-weight relationships of fish are useful in fisheries ecology and stock assessment for converting growth-in-length to growth-in-weight, for estimating condition factor, and for geographic comparisons of life histories (Pauly, 1983; Froese and Pauly, 2010). Length-Weight Relationship (LWR) has the important role in fishery resource

*Corresponding author. E-mail: afrooz_eydizadeh@yahoo.com.

management and also useful for comparing life history and morphological aspects of populations inhabiting different regions. In fish studies, the length of a fish is often more rapidly and easily measured than is its mass, therefore it is opportune to be able to determine mass where only the length is known (Harrison, 2001).

Hoor Al- AzimWetland in Khuzestan province is one of the 18 international wetlands registered on UNESCO's Natural Heritage List. Hoor Al-Azim is parts of a single hydrological system and forms one of the largest permanent freshwater wetlands in Lower Mesopotamia, being located between N 30° 58´- 31° 50´ and E 47° 55´- 47° 20´ (Ghadiri, 2005). This wetland is situated in the North Azadegan Plain, 80 km south-west of Ahvaz city, near the border between Iran and Iraq. The marshes have experienced significant changes during the last two decades and are expected to face further modifications in the next years; formerly they extended 85 km from north to south and 40 km from east to west, covering about 254000 ha. The system was fed by two tributaries of the Tigris and by the River Karkheh, which rises on the Zagross Mountains in western Iran. The northern and central parts of the marshes were permanent, while in the south they were largely seasonal (UNEP, 2001).

Order Cypriniformes with six families, 321 genera and some 3268 species (Nelson, 2006) is one of the most widespread and large (specious) orders of fishes all over the world. The barbels, genus *Barbus*, are found in Europe, Southwest Asia and Africa and comprise about 800 species (Coad, 2006). According to Coad (1995) and Abdoli (2000) more than 17 species of Barbus have been reported from different basins of Iran. Hemeri *(Carasobarbus (=Barbus)luteus*) belong to the order Cypriniformes, the family Cyprinidae, and the genus Barbus. This species widely distributed in the rivers Tigris and Euphrates and adjacent drainage basins (Berg, 1949; Marammazi, 1995; Abdoli, 2000).

Different aspects of biological work of *C. luteus* have been done by different authors (Szypula et al., 2001; AL Hazzaa, 2005; Gokcek and Akyurt, 2008; Hashemi et al., 2010; Eydizadeh et al., 2013; Hashemi et al., 2014), but no work has been done on relationship between body weight and length and Fulton's condition factor of this species in Hoor Al-azimwetland. The present study describes the Length-Weight Relationships and Fulton's condition factor of *C .luteus* from Hoor Al-azim wetland in Khuzestan Province (Iran).

MATERIALS AND METHODS

Study area

Length-frequency data of *C. luteus* were collected monthly from the catches from landing At three stations: Rofaie(47˚,53´ E, 31˚,35´ N), Tabor(47˚,51´ E, 31˚,29´ N) and Shatali (47˚,42´ E, 31˚,23´ N) from April 2012to March 2013 (Figure 1). Fish sampling was carried out by using 12.5m long gill nets, with meshes of 45 mm (stretched) and then transported to lab with dry ice. Nets were anchored at each of the sampling stations at sunset and they were removed at sunrise on the following day, remaining 12 h in water. Total length with ± 1 mm and total weight with ±0.01 g were measured for this species.

Methods

A total of 466 fresh specimens of *C.luteus* were collected from Hoor Al-azim wetland in Khuzestan Province (Iran). Fishes were collected by fishermen using cast net or gill nets with 45 mm mesh and then transported to laboratory with dry ice. In the laboratory, for each specimen, total length (TL), whole body wet weight (g) and sex was recorded. The length-weight relationship was estimated by using following equation:

$$W = a\,L^{b}$$

Where W is the whole body weight (g), L is the total length (mm), a is the intercept of the regression and b is the regression coefficient (slope) (Ricker , 1975).

A t-test was used for comparison b value in the power regression of male and female fishes (Zar, 1999). The growth pattern (t) was determined using the following Equation (Pauly and Munro, 1984):

$$t = \frac{sd\ln L}{sd\ln W} * \frac{|b-3|}{\sqrt{1-r^2}} * \sqrt{n-2}$$

Where Sdlnx is Standard deviation of the Length natural logarithm (cm), Sdlnw is Standard deviation of the natural logarithm weight (g), b is Curve slope of the relationship between length and weight, r2 is Regression coefficient between length and weight and n is number of samples. When the b value in length-weight relationship was statistically equal to or did not show significant deviation from 3, the growth was considered isometric, whereas the positive or negative allometric growth occurred when the b value was significantly different from 3. In order to verify if calculated b was significantly different from 3, the Students t-test was employed (Zar, 1996).

Fulton's condition factor (K) was calculated by the formula (Htun-Han, 1978): $K=W/L^3\times100$, Where, W is the whole body wet weight in grams and L is the total length in cm (Froese, 2006). Data were transferred to Microsoft Excel spreadsheet for analysis. SPSS 21.0 statistical software was used Student's t-test analysis; differences were considered significant at values of $p<0.05$.

RESULTS AND DISCUSSION

The total lengths of 466 fish in the size range 118 to 362 mm for *C. luteus* using a meter scale (1±mm) were measured. Length frequency percentage groups of *C. luteus* are presented in Figure 2. Mean±S.D length values for this species were 228±15 respectively and maximum and minimum total length were 118 and 362 mm respectively. Size sexual dimorphism was observed in Hemeri species since females dominated in the longer length classes and the males in the shorter.

Mean ±S.D weight values for this species were 174±87 g and maximum and minimum weight were 154-202 g respectively. The mean value of length for the male and female were calculated as 216±37 and 233±38 mm and mean value of weight for the male and female was as

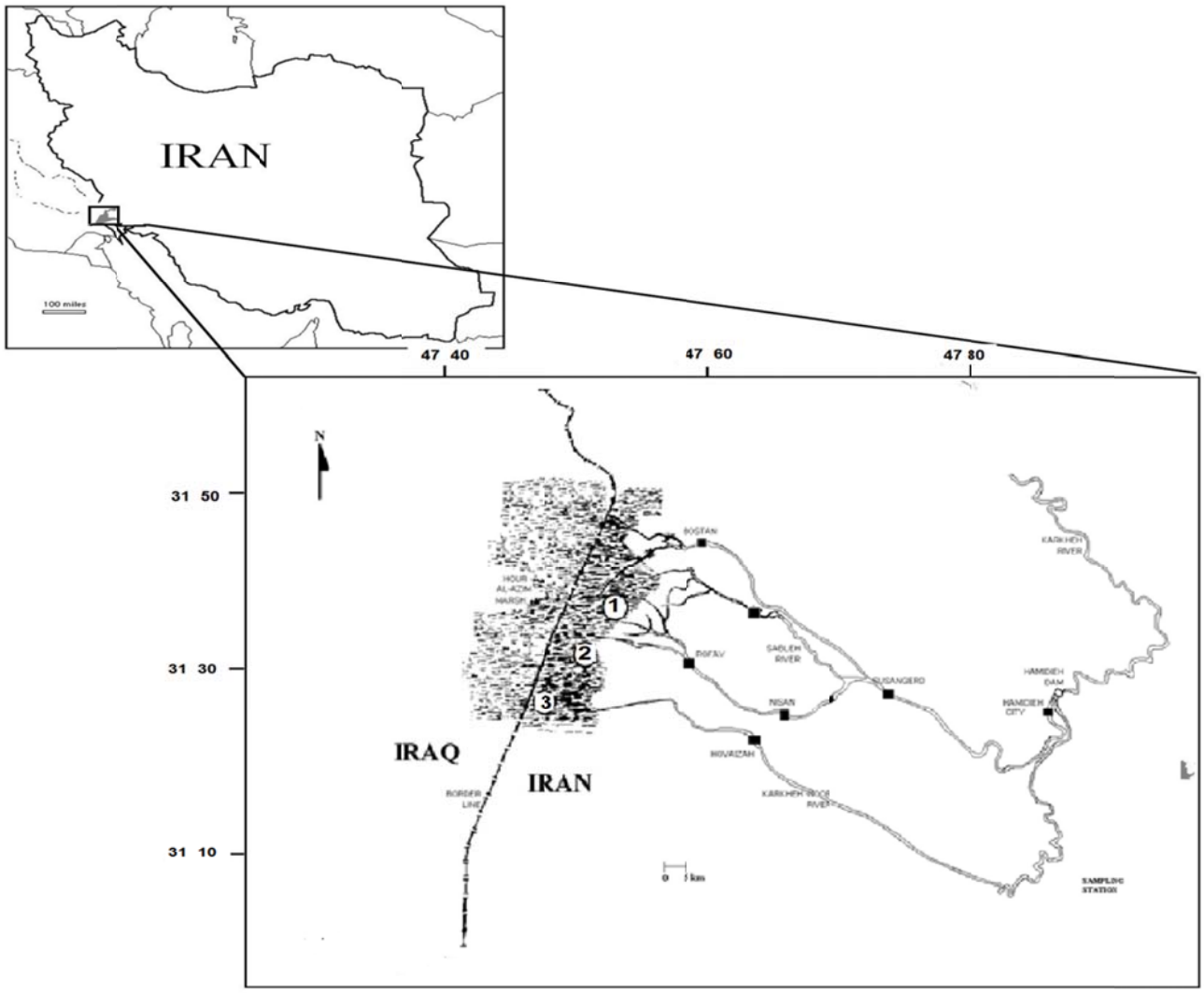

Figure 1. The map of Situation on Hoor al-azimwetland (1: Rofaye , 2: Tabar, 3: Shatali) in Khuzestan province (South West of Iran).

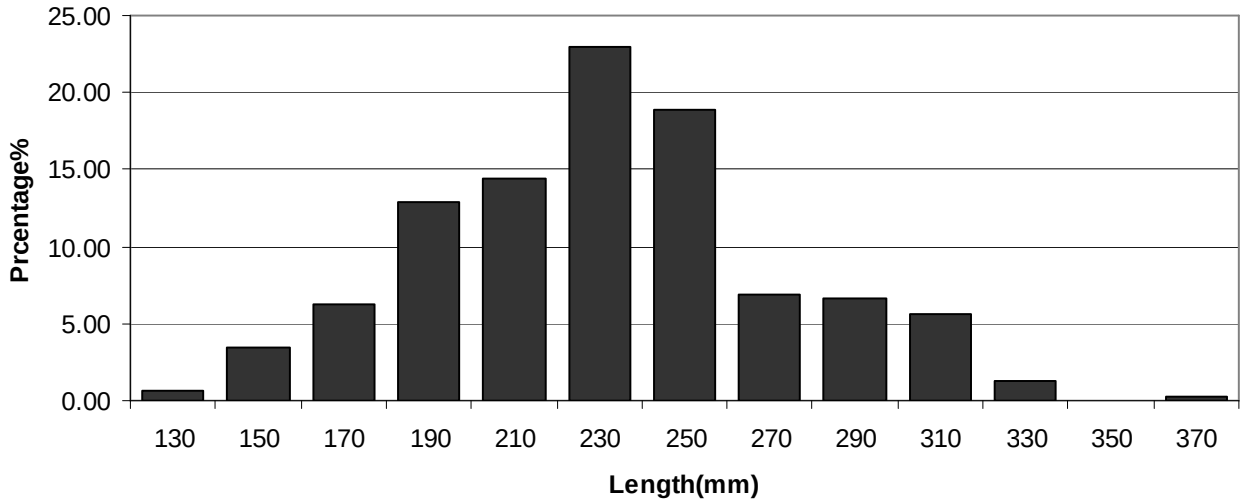

Figure 2. Percentage frequency of length *C. luteus* on HoorAl-azim wetland in Khuzestan province during 2012-2013.

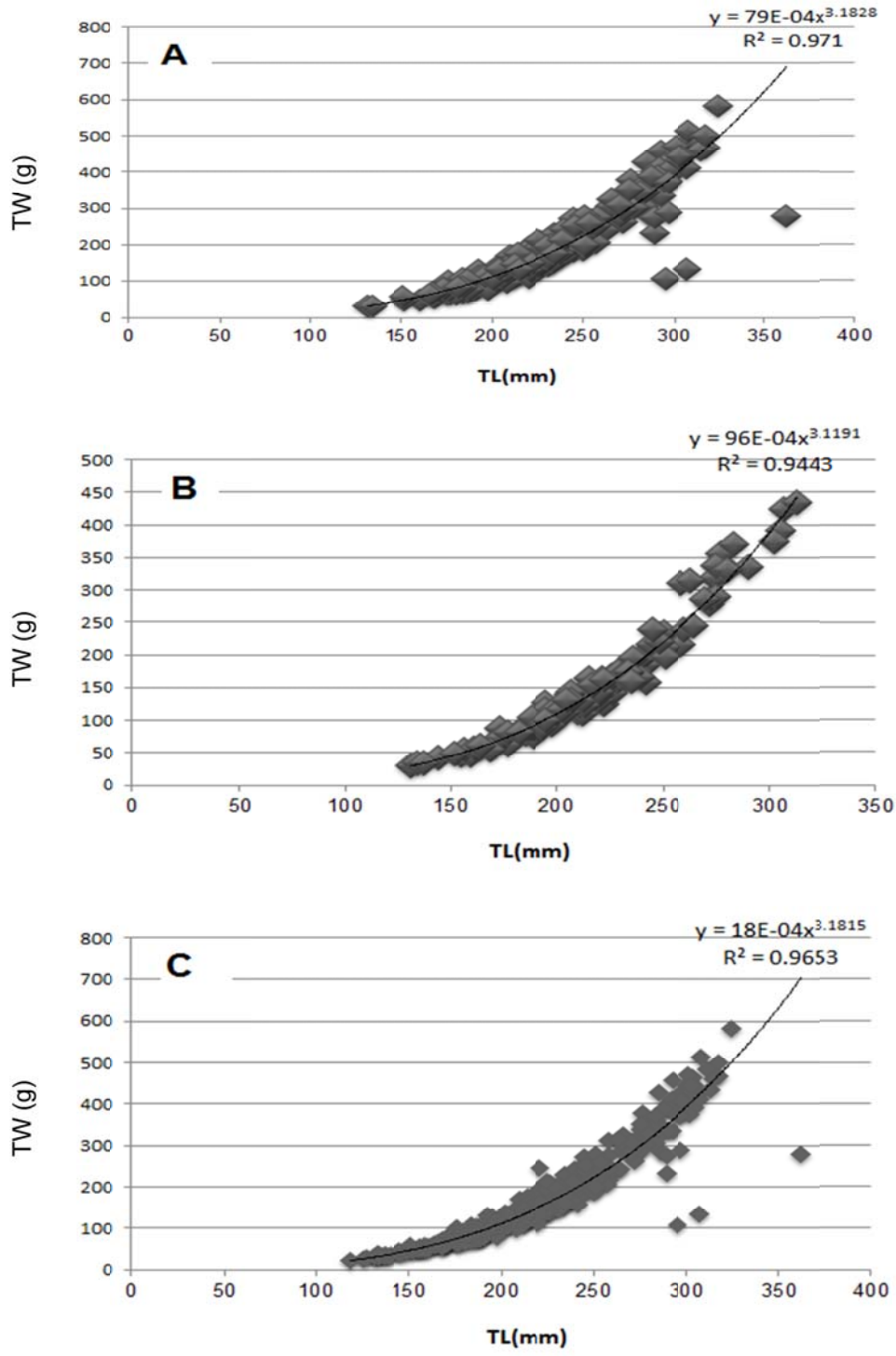

Figure 3. Length-weight relationship of *C. luteus* (A=Female, B=Male, C=Total) on Hoor Al-azim wetland in Khuzestan province during 2012-2013.

170±91 and 211±88 g respectively which means that length-weight of the female was heavier than males in the same length group. The length-weight relation were calculated as $W=0.0096\ L^{3.11}$ (n=138, R^2=0.97) for males, $W=0.0079\ L^{3.18}$ (n=271,R^2= 0.94) for females and $Y=0.0018L^{3.18}$ (n=466, R2 =0.96) for total fishes (Figure 3); verifying calculated b with 3, using Students t-test there was no significant difference between calculated b

Table 1. Length-weight relationships of some species from the HoorAl-azim wetland (2012-2013).

Family	Species	N	a	Min (mm)	Max (mm)	b	S.E (b)	R2	P=0.05	Growth type
Cyprinidae	*C. luteus* (male)	138	0.0096	131	313	3.11	0.15	0.97	P> 0.05	I
	C. luteus (female)	271	0.0019	131	362	3.18	0.4	0.94	P> 0.05	I
	C. luteus (All fish)	466	0.0018	131	362	3.18	0.23	0.96	P> 0.05	I

N, the sample size; min; max; mean total length; a, the intercept of relationship b, the slope of relationship; r, coefficient of correlation; P value (difference of b from 3) and Growth type (isometric=I and allometric negative= A- and allometric positive= A+).

Table 2. Fulton's condition factor (K) of C. luteus species from the HoorAl-azim wetland (2012-2013).

Family	Species	N	Mean ±S.D	Minimum	Maximun	CL (%95)
Cyprinidae	*C. luteus* (male)	138	1.38±0.12	1.1	1.81	0.02
	C. luteus (female)	271	1.44±0.20	0.96	1.87	0.024
	C. luteus (All fish)	466	1.40±0.18	0.96	1.87	0.016

and 3 (P>0.05), growth pattern was isometric (Table 1).The b value in the length-weight relationship did not differ significantly between males and females (t-test, P>0.05). The b parameter values in the weight-length model, $W= a L^b$ are close to 3 for *C. luteus*, indicating isometric growth.

The value of b from other studies for *C. luteus* were b=2.98 and b=3.00 (male and female) in Orontes river of Turkey (Gokcek and Akyurt, 2008), b=3.05 and b=2.98 (male and female) in Euphrates River, Syria (Szypula et al., 2001) and b= 3.06 in Shadegan wetland of Iran (Hashemi et al., 2010) were estimated. The value of b from other studies for this species were b=3.09 in Habbaniya lake, b= 2.97 in Tharthar lake estimated in the Iraq country (Szypula et al., 2001). Length–weight relationship is a practical index of the condition of fish, and may vary over the year according to several exogenous and endogenous factors such as food availability, feeding rate, health, sex, gonad development, spawning period and preservation techniques (Froese, 2006).The length-weight relationship in fish is of great importance in fishery assessments (Haimovic and Velasco, 2000). The variation of b in the different regions could be by seasonal fluctuations in environmental parameters, physiological conditions of the fish at the time of collection, sex, gonad development and nutritive conditions in the environment of fish (Biswas, 1993; Eydizadeh et al., 2013). According to Martin (1994), the range of "b" could be from 2.5 to 4 and Tesch (1968) believed "b=3 in fish with isometric growth". These results are suitable for the estimation of length-weight relationship since; the values of bare within the range of values of this parameter usually estimated in fishes, which according to Froese (2006) lies between 2.5 and 3.5.

In the present study, (a) were 0.0096 and 0.0019 (male and female). In length- weight a value is related to fish condition. The value of (a) for *C. luteus* were a = 0.0001 in Shadegan wetland of Iran (Hashemi et al., 2014) and a=0.013 and a=0.019 (male and female) in Euphrates river (Syria) (Szypula et al., 2001). The value of (a) from other studies for this species: a =0.0071 in Habbaniya lake, a = 0.0097 in Tharthar lake were estimated in the Iraq country (Szypula et al., 2001). Also (a) depends on weight and it can be used as status value (King, 2007) and may vary over the year according fish condition.

Fulton's condition factor (K) for male and female and total fish was 1.38±0.12, 1.44±0.20, and 1.40±0.18 respectively and Students t-test showed no significant difference between this parameter for males and females (Table 2). The K values for males and females of these species of fishes are presented in Table 2.The mean values of condition factor (K) in the female was heavier than for male's specimens. The K value did not differ significantly between males and females (t-test, P>0.05). Unfortunately, no references from other studies for K value are available regarding these species in this local. The relative robustness or degree of well-being of a fish expressed as the coefficient of condition (condition factor) is an important tool for the study of fish biology, mainly when the species lies at the base of the higher food web (Diaz et al., 2000; Lizama and Ambrósio, 2002). Fulton's condition factor is widely used in fisheries and fish biology studies (Froese, 2006). Condition factor is a well-being value and it increasing coincides with fish weight increasing (King, 2007). Seasonal growth amount can be measured by status factor and growth changes may be related to fish food or reproduction stage (King, 2007).This study reported the length-weight relationship and K value of this species and the results of the study are useful inputs for fisheries scientists stock assessment models and useful spatial- temporal comparison in the future.

Conflict of Interests

The author(s) have not declared any conflict of interests.

ACKNOWLEDGEMENTS

We thank Dr. Maramazi, the manager of the South of Iran Aquaculture Fishery Research Center, Ahwaz. We are also very grateful to the experts of the South of Iran Aquaculture Fishery Research Center, Ahwaz for helping the project work.

REFERENCES

Abdoli A, (2000). The Inland Water Fishes of Iran. Iranian Museum of Nature and Wildlife, Tehran. 378 pp. In Farsi.

AL Hazzaa R (2005). Some Biological Aspects of the HimriBarbel, *Barbusluteus*, in the Intermediate Reaches of the Euphrates River. Turk J. Zool. 29:311-315.

Berg LS (1949). Presnovodnyerybylrana i sopredel'nykhstran (Freshwater fishes of Iran and adjacent countries). Trudy Zoologicheskogo Instituta Akademii Nauk SSSR. 8:783-858.

Biswas SP (1993). Manuel of methods in fish biology, fish biology and Ecology laboratory, Dibruyarh university, Dibrugarh. p157.

Chien-Chung H (1999). The length-weight relationship of Albacore.Thunnusalalunga, from the Indian Ocean. Fish. Res. 14:87-9.

Coad BW (2006). Endemicity in the freshwater fishes of Iran. Iranian J. Animal Biosyst. 1(1)(2005):1-13.

Coad BW (1995).Fresh Water Fishes of Iran.Acta Sci. Nat. Acad. Sci. Bohemicae. 29:1-164.

Diaz LS, Roa A, Garcia CB, Acero A, Navas G (2000). Length-weight relationship of demersal fishes from the upper continental slope off Columbia. NAGA, 23(3):23-25.

Eydizadeh A, Eskandary Gh, Mohammadi Gh, Hashemi SAR (2013). Population Dynamics and Assessment of *Carasobarbusluteus* (Heckel, 1843) in hooral-Azim Wetland (Khuzestan provinces, Iran). World J. Fish Marine Sci. 5(4):430-436.

Froese R, Pauly D (2012). FishBase World Wide Web electronic publication http://www.fishbase.org.

Froese R (2006). Length-weight relationships for 18 less-studied Fish species. 14:117-118.

Ghadiri H, Ghadiri M (2005). Marsh lands of Mesopotamia and the rivers that feed them. 8th International River Symposium 2005, 5-9 September, Brisbane, Australia.

Gökçek CK, Akyurt I (2008). Age and growth characteristics of himribarbel (*Barbusluteus*Heckel, 1843) in Orontes River, Turkey. Turk. J. Zool. 32(4):461-467.

Haimovici M, Velasco G (2000). LengthWeight relationship of marine from southern Brazil. NAGA 23(1):14-16.

Harrison TD (2001). Length-weight relationships of fishes from South African estuaries. 17:46-48.

Hashemi SAR, Ghorbani R, Kaymaram F, Hossini SA,Eskandari G, hedayati A (2014). Length-Weight Relationships for some fish Species from Shadegan wetland. Global Adv. Res. J. Food Sci. Technol. 3(2):076-083.

Hashemi SAR (2010). Survey growth parameters of fish species in the Shadegan wetland. National Wildlife Conference, Azad University, Ahvaz, March 2010. 14 pp. In Farsi.

Htun-Han M (1978). The reproductive bio.of the dab Limandalimanada)L.) in the north Sea: gonadosomatic index, hepatosomatic index and condition factor. J. Fish Biol. 13(1):351-377.

King M (2007). Fisheries biology and assessment and management .Fishing news press,p 340.

Krupp F (1985). Systematik und Zoogeographie der Süßwasserfische des levantinischen Grabenbruchsystems und der Ostküste des Mittelmeeres. Dissertation zur Erlangung des Grades "Doktor der Naturwissenschaften" am Fachbereich Biologie der Johannes Gutenberg Universität in Mainz. 215 pp., Anhang: Abbildungen, Karten, Tabellen, 169 pp.

Lizama M, de Los AP, Ambrósio (2002). Condition factor in nine species of fish of the Characidae family in the Upper Parana River floodplain, Brazil. Braz. J. Biol. 62(1):113-124.

Maramazi Gh, (1995). Ichthology report of marshShadegan, South of Iran aquaculture fishery research center,Ahwaz.Iran.63 p.In Farsi.

Martine WR (1949). The Mechanics of environmental control of body form in fishes. Univ. Toronto stud. BioI. 58:1-91.

Nelson JS, (2006). Fishes of the World.3rd Edition. John Wiley and Sons, New York. xix + 601pp.

Pauly D, Munro JI (1984). Once more on the comparison of growth in fish and invertebrates, ICLARM. Fish byte, 2 (1):106p.

Ricker WE (1975). Computation and interpretation of biological statistics of fish populations. Bull. Fish Res. Board Can., 191:382.

Sokal RR, Rohlf FJ (1995). Biometry. The Principles and Practice of Statistics in Biological Research, third ed., W.H. Freeman and Co., New York, 887pp.

Szypula J, Epler P, Bartel R, Szczerbowksi J (2001). Age and growth of fish in lakes Tharthar, Razzazah and Habbaniya. Arch. Pol. Fish. 9 (Suppl. 1):185-197.

Tesch FW (1968). Age and growth in methods for assessment of fish production in fresh water. Ed. WE Ricker. IBP Handbook No.3.

UNEP (2001). The Mesopotamian Marsh-lands: Demise of an Ecosystem, Early Warning and Assessment Technical Report. United Nations EnvironmentProgramme. UNEP/DEWA/TR.01-3.

Zar JH (1996). Biostatistical analysis.3rd edition. Prentice-Hall Inc. New Jersey,USA. 662p.