



Length-weight relationship and condition factor of ten fish species (Cyprinidae, Sisoridae, Mugilidae, Cichlidae, Gobiidae and Channidae) from Iranian inland waters

Atta Mouludi-Saleh, Soheil Eagderi*

Department of Fisheries, Faculty of Natural Resources, University of Tehran, Karaj, Iran

email: soheil.eagderi@ut.ac.ir

Received: 14 May 2019 / Revised: 4 June 2019 / Accepted: 9 June 2019 / Published online: 13 June 2019. Ministry of Sciences, Research and Technology, Arak University, Iran.

Abstract

During 2010-2017, a total 296 specimens including *Romanogobio persus*, *Hemiculter leucisculus*, *Schizothorax pelzami*, *Rhodeus amarus* and *Cabdio morar* (Cyprinidae), *Glyptothorax silviae* (Sisoridae), *Planiliza abu* (Mugilidae), *Iranocichla persa* (Cichlidae), *Glossogobius giuris* (Gobiidae) and *Channa gachua* (Channidae) were collected using electrofishing device with ranging from 3.3 to 14.95 cm (in total length) and 0.85 to 36.57 g (in total weight). Based on the results, the growth coefficient values “*b*” ranged 2.75 (*R. amarus*) to 3.62 (*C. morar*). R^2 in length-weight relationships estimated were greater than 0.851. Also condition factor of the studied fishes was ranged from 0.6 (*R. persus*) to 1.47 (*R. amarus*). This study represents the first reports of LWRs data for *G. giuris*, *I. persa* and *R. persus* from Iranian inland waters and this reported for *R. persus* and *I. persa* are first in fish base. The results of this study provides useful information for further fisheries management, fish population dynamic studies and for comparisons in future studies.

Keywords: Length-weight relationship, *Iranocichla persa*, *Romanogobio persus*.

Introduction

The growth parameters such as length-weight relationship (LWRs) and condition factor (K)

are used to express the demographic differences, biological features, and habitat condition of fish species (Kovach and Coop 1996). Furthermore, the length-weight relationship (LWRs) is used to estimate the weight of a specimen from its length and vice versa, estimating biomass, fish stocks evaluation, studies of growth rate, understanding the life cycle in fisheries (Froese 2006, Jafari-Patcan *et al.* 2018), understanding allometric growth changes in fishes (Eagderi and Radkhah 2015, Mouludi-Saleh and Kievany 2018). Condition factor can be indicated suitability of a specific water body for growth of fish and environmental differences in ecological conditions such as seasonal changes, nutritional quality and type of aquatic system e.g. rivers or lakes (Nikolski 1996).

Despite ecological importance of freshwater fishes, length-weight relationship and condition factor information are often limited. Therefore, this study was to carry out to describe the LWRs and K of ten fish species, viz. *Romanogobio persus*, *Hemiculter leucisculus*, *Schizothorax pelzami*, *Rhodeus amarus*, *Cabdio morar*, *Glyptothorax silviae*, *Planiliza abu*, *Iranocichla persa*, *Glossogobius giuris* and *Channa gachua* belonging to six families, including Cyprinidae, Sisoridae, Mugilidae, Cichlidae, Gobiidae and Channidae from Iranian inland waters that can help for their proper management and initiate conservation measures.

Material and methods

Study area

Sampling was carried out between July 2010 and August 2017. A total of 296 specimens belonging to ten rare fish species were collected using electrofishing device (SAMUS MP750) from Iranian Inland waters (Table 1).

After anesthesia, the specimens were fixed into 10% buffered formalin and transported to the laboratory for further study. In the lab, the total length (TL) and total weight (TW) of the specimens were measured using digital calipers and digital balance to the nearest 0.01 mm and 0.01 gr, respectively.

Table 1. Description of the sampling sites in the present study during 2010–2017 (N= number of individuals).

River	Species	N	Basin	Geographical coordinates	
				N	E
Zarrineh	<i>Romanogobio persus</i> (Günther,	1	Urmia Lake	34°27'48.52"	46°54'4.8"
Kaboudval	<i>Hemiculter leucisculus</i>	8	Caspian Sea	36°52'19"	54°53'19"
Zarrineh	<i>Hemiculter leucisculus</i>	6	Urmia Lake	34°27'48.52"	46°54'4.8"
Aal	<i>Schizothorax pelzami</i> Kessler,	5	Hari River	36°14'56"	60°09'07"
Siah-Darvishan	<i>Rhodeus amarus</i> (Bloch 1782)	2	Caspian Sea	37°16'16"	49°22'07"
Sirik	<i>Cabdio morar</i> (Hamilton 1822)	2	Makran	26°32'31.86"	57°34'19.26"
Beshar	<i>Glyptothorax silviae</i> Coad, 1981	1	Persian Gulf	30°34'32.8"	51°40'57.6"
Tireh	<i>Planiliza abu</i> (Heckel 1843)	3	Persian Gulf	33°33'03"	49°00'56"
Khorgoor	<i>Iranocichla persa</i> Esmaeili, Sayyadzadeh & Seehausen 2016	4	Persian Gulf	27°22'30.2"	56°27'27.56"
Sarbaz	<i>Glossogobius giuris</i> (Hamilton,	1			
Sarbaz	<i>Channa gachua</i> (Hamilton 1822)	3	Makran	26°37'47"	61°15'31"
Sarbaz	<i>Channa gachua</i> (Hamilton 1822)	2	Makran	26°37'47"	61°15'31"
Halil	<i>Channa gachua</i> (Hamilton 1822)	1	Hamun-e	28°40'29.43"	57°42'22.96"
		7	Jaz Murian,		

The length-weight relationship were calculated by the method of least squares using the equation of $W = aL^b$ with 95% confidence limits of the constants ("a" and "b") and logarithmically transformed into $\text{Log}W = \text{Log}a + b\text{Log}L$ (Froese *et al.* 2011, Tabatabaei *et al.* 2015), where W is the total body weight (g), L the total length (cm), b the regression coefficient and a the intercept of the regression. Condition factor was determinate according to Fulton (1904) and Froese (2006) using $k = \frac{W}{L^3} \times 100$, where, W is the weight of fish (g) and L is the total length (cm). All statistical analyses were performed in PAST v 2.1 and Excel 2016.

Results and Discussion

Descriptive statistics, including, ranges of the total length and weight parameters, estimated

LWRs parameters i.e. a, b, coefficient of correlation (r^2), and condition factor (K) (Mean±SD) of the studied populations are presented in Table 2. Based on the results, b parameter ranges 2.75-3.62, regression coefficients (r^2) 0.85-0.99 and condition factor 0.6-1.47. These results revealed positive allometric growth pattern for *R. persus* ($b = 3.46$), *C. morar* ($b = 3.04$) and *G. giuris* ($b = 3.13$), and negative one for *C. gachua* ($b = 2.78$), *P. abu* ($b = 2.82$), *R. amarus* ($b = 2.75$), *S. pelzami* ($b = 2.87$) and *I. persa* ($b = 2.81$) allometric growth patterns. In fish, seasons, habitat, diet, sex, gonad maturity, stomach fullness and health can be affected on the LWR parameters (Tesch 1971, Bagenal and Tesch 1978, Kamal *et al.* 2009, Jalili *et al.* 2015).

We analyzed 296 specimens representing ten fish species which the LWRs are reported for

the first time for *G. giuris*, *I. persa* and *R. persus* and other studied species belong to new localities or basins than before reported. In LWRs parameter, the *b* value ranges between 2.5 and 3.5 (Froese 2006) or 2-4 (Tesch 1971). In this study, *b*-values of the studied fish species were within the expected ranges. Condition factors (*K*) higher than 1 (*R. amarus*, *G. silviae*, *I. persa* and *C. gachua*)

can show a better environmental condition (Eagderi and Radkhah 2015) for these species inhabiting Siah-Darvishan, Beshar, Khorgoor, and Sarbaz and Hali rivers, respectively. The results of this study provides useful information for further fisheries management, fish population dynamic studies and for comparisons in future studies.

Table 2. Descriptive statistics and length-weight relationship parameters and condition factor for ten species from different Iranian inland waters during 2010–2017.

Family	Species	Total length (cm)		Weight (g)		Regression parameters			K(Mean±SD)
		Min	Max	Min	Max	<i>a</i> 95% CL of <i>a</i>	<i>B</i> 95% CL of <i>b</i>	<i>r</i> ²	
	<i>R. persus</i>	5.65	9.67	0.97	6.14	0.002 0.001-0.003	3.46 3.28-3.64	0.989	0.60±0.07
	<i>H. leucisculus</i>	11.04	14.41	8.19	18.62	0.005 0.001-0.083	3.04 2.61-3.67	0.95	0.62±0.05
Cyprinidae	<i>S. pelzami</i>	9.08	14.48	7.05	27.34	0.012 0.007-0.026	2.87 2.59-3.12	0.908	0.96±0.09
	<i>R. amarus</i>	3.9	6.53	0.85	4.77	0.021 0.014-0.04	2.75 2.32-3.01	0.96	1.47±0.13
	<i>C. morar</i>	5.4	9.07	0.9	5.81	0.002 0.0008-0.018	3.62 2.58-3.9	0.934	0.72±0.09
Sisoridae	<i>G. silviae</i>	8.76	13.44	8.12	30.42	0.011 0.003-0.035	3.04 2.57-3.53	0.956	1.22±0.09
Mugilidae	<i>P. abu</i>	8.29	12.52	6.32	29.73	0.018 0.007-0.047	2.82 2.41-3.25	0.891	1.21±0.12
Cichlidae	<i>I. persa</i>	3.3	7.28	0.5	6.79	0.019 0.007-0.038	2.81 2.41-3.21	0.851	1.45±0.3
Gobiidae	<i>G. giuris</i>	5.29	10.68	1.16	9.16	0.005 0.0045-0.0076	3.13 2.97-3.25	0.984	0.7±0.05
Channidae	<i>C. gachua</i>	6.6	14.95	3.4	36.57	0.016	2.78	0.951	1.01±0.12
						0.011-0.027	2.59-2.95		

Min= minimum; Max= maximum; *a*= intercept; *b*= slope; CL= confidence limits; *r*², correlation coefficient; K= condition factor.

Acknowledgments

We are pleased to thank University of Tehran for financial support.

References

- Bagenal T.B., Tesch F.W. 1978. Age and growth. In: Methods for assessment of fish production in fresh waters, 3rd edn. Blackwell Scientific Publication: Oxford.
- Eagderi S., Radkhah A. 2015. Length-weight relationship and condition factor of Mosquitofish (*Gambusia holbrooki*) in three inland basins of Iran. *Poeciliid Research* 5(1): 39-43.
- Froese R. 2006. Cube law, condition factor and weight length relationships: history, metaanalysis and recommendations. *Journal of Applied Ichthyology* 22: 241-253.
- Froese R., Tsikliras A.C., Stergiou K.I. 2011. Editorial note on weight-length relations of fishes. *Acta Ichthyologica Et Piscatoria* 41(4): 261-263.
- Fulton T.W. 1904. The rate of growth of fishes. Twenty-second Annual Report, Part III. Fisheries Board of Scotland: Edinburgh.
- Jafari-Patcan A., Eagderi S., Mouludi-Saleh A. 2018. Length-weight relationship for four fish species from the Oman Sea, Iran. *International Journal of Aquatic Biology* 6(5): 294-295.
- Jalili P., Soheil Eagderi S., Keivany Y. 2015. Body shape comparison of Kura bleak (*Alburnus filippii*) in Aras and Ahar-Chai rivers using geometric morphometric approach. *Research in Zoology* 5(1): 20-24.
- Kamal S., Bakhtiyari M., Abdoli A., Eagderi S., Karami M. 2009. Life-history variations of killifish (*Aphanius sophiae*) populations in two environmentally different habitats in central Iran. *Journal of Applied Ichthyology* 25(4): 474-478.
- Kovach V., Copp G.H. 1996. Ontogenic patterns of relative growth in young roach *Rutilus rutilus*: within-river basin comparisons. *Ecography* 19(2): 153-161.
- Mouludi-Saleh A., Keivany Y. 2018. Length-weight and length-length relationships for three species of *Squalius* (Cyprinidae; Leuciscinae) from the Caspian Sea, Namak and Tigris basins of Iran. *Journal of Applied Ichthyology* 34(5): 1207-1209.
- Nikolski G.V. 1969. Theory of fish population dynamics as the biological background for rational exploitation and management of fishery resources. Oliver and Boyd: Edinburgh.
- Tabatabaei S.N., Hashemzadeh Segherloo I., Eagderi S., Zamani M. 2015. Length-weight relationships of fish species in Kordan River (Namak Lake basin), Iran. *Journal of Applied Ichthyology* 31(4): 800-801.
- Tesch F.W. 1971. Age and growth. In: W. E. Ricker (Ed.), Methods for assessment of fish production in fresh waters. Blackwell Scientific Publications, Oxford, pp. 99-130.