Turkish Journal of Zoology

Volume 47 | Number 2 Article 9

1-1-2023

Condition factor and length-weight relationships evaluation of 15 Oxynoemacheilus species (Cypriniformes: Nemacheilidae) from Iran

ATTA MOULUDI-SALEH

SOHEIL EAGDERI

ERDOĞAN ÇİÇEK

EDRIS GHADERI

Follow this and additional works at: https://journals.tubitak.gov.tr/zoology

 Part of the Zoology Commons

Recommended Citation

MOULUDI-SALEH, ATTA; EAGDERI, SOHEIL; ÇİÇEK, ERDOĞAN; and GHADERI, EDRIS (2023) "Condition factor and length-weight relationships evaluation of 15 Oxynoemacheilus species (Cypriniformes: Nemacheilidae) from Iran," *Turkish Journal of Zoology*: Vol. 47: No. 2, Article 9. https://doi.org/10.55730/1300-0179.3123

Available at: https://journals.tubitak.gov.tr/zoology/vol47/iss2/9

This Article is brought to you for free and open access by TÜBİTAK Academic Journals. It has been accepted for inclusion in Turkish Journal of Zoology by an authorized editor of TÜBİTAK Academic Journals. For more information, please contact academic.publications@tubitak.gov.tr.

TÜBİTAK

Turkish Journal of Zoology

http://journals.tubitak.gov.tr/zoology/

Short Communication

Turk J Zool
(2023) 47: 130-134
© TÜBİTAK
doi:10.55730/1300-0179.3123

Condition factor and length-weight relationships evaluation of 15 *Oxynoemacheilus* species (Cypriniformes: Nemacheilidae) from Iran

Atta MOULUDI-SALEH[1], Soheil EAGDERI[1,*], Erdoğan ÇİÇEK[2], Edris GHADERI[3]
[1]Department of Fisheries, Faculty of Natural Resources, University of Tehran, Karaj, Iran
[2]Department of Biology, Faculty of Art and Sciences, Nevşehir Hacı Bektaş Veli University, Nevşehir, Turkey
[3]Department of Fisheries, Faculty of Natural Resources, University of Kurdistan, Sanandaj, Iran

Received: 19.12.2022 • **Accepted/Published Online:** 08.02.2023 • **Final Version:** 01.03.2023

Abstract: This study was conducted to determine the relationship between the length and weight (LWR) of 15 *Oxynoemacheilus* species i.e. *Oxynoemacheilus bergianus*, *O. brandtii*, *O. chomanicus*, *O. euphraticus*, *O. elsae*, *O. frenatus*, *O. karunensis*, *O. kiabii*, *O. kurdistanicus*, *O. longipinnis*, *O. parvinae*, *O. persa*, *O. marunensis*, *O. zagrosensis*, and *O. zarzianus* from Iranian inland waters. LWRs with high coefficients of determination were calculated for all species. The values of the slope parameter (*b*) ranged from 2.225 in *O. brandtii* to 3.575 in *O. euphraticus*. Fulton's condition factor (K_F) ranged from 0.673 in *O. persa* to 1.407 in *O. kiabili*. Relative conditions had a narrow distribution range of 0.988–1.009 with a mean of 1.001 ± 0.028. This study presents the first LWRs data for *O. chomanicus*, *O. euphraticus*, *O. elsae, O. karunensis*, *O. kurdistanicus, O. longipinnis*, *O. parvinae*, *O. marunensis*, and *O. zarzianus* from Iranian inland waters that can be used for future studies and fisheries stock managements.

Key words: Stone loaches, morphology, length-weight relationship, condition factor

The determination of growth parameters is important in ecological studies to investigate demographic differences and biological and habitat characteristics. Therefore, it is important in their management and ecological studies in different habitats and populations (Kovach and Copp, 1996; Froese and Binohlan, 2000). One of the important issues in the growth studies is the length and weight relationship (LWR) that is used to assess fish stocks and compare the fishes' growth pattern (Gonzalez Acosta et al., 2004; King, 2007). It also provides information on biomass estimation, fish stocks, growth rate, and condition factors (Froese, 2006; Jafari-Patcan et al., 2018; Abbasi et al., 2019; Eagderi et al., 2020).

Oxynoemacheilus genus of the Nemacheilidae family has 62 valid species (van der Laan, 2021). Of these, 17 *Oxynoemacheilus* species have been reported from the inland waters of Iran (Eagderi et al., 2022). Since in the previous studies, some available LWR data of *Oxynoemacheilus* were based on the formalin-fixed specimens and also lacked LWR data of some species, we conducted this work to calculate the LWRs of 15 *Oxynoemacheilus* species viz. *O. bergianus*, *O. brandtii*, *O. chomanicus*, *O. euphraticus*, *O. elsae*, *O. frenatus*, *O. karunensis*, *O. kiabii*, *O. kurdistanicus*, *O. longipinnis*, *O. parvinae*, *O. persa*, *O. marunensis*, *O. zagrosensis*, and *O. zarzianus* from Iranian inland waters that have been collected since 2017 based on the fresh specimens.

During 2017–2021, a total of 359 *Oxynoemacheilus* specimens were collected using an electrofishing device (SAMUS 750P). After anesthesia, the specimens were dried with a paper tissue, and their total length (TL) and whole-body wet weight (TW) were measured by a digital caliper to the nearest 0.01 mm and a digital scale to the nearest 0.01 g, respectively. The length-weight relationship (LWR) equation was used as , where W = total weight (g), TL = total length (cm) and "*a*" = intercept and "*b*" is the slope (Le Cren, 1951). The 95% confidence interval (CI) was determined for *a* and *b* (Froese, 2006). Before regression analyses, log-log plots of LW pairs were done to detect outliers (Froese et al., 2011) then all outlier's data were removed from the regression.

Fulton's condition factor (K_F) was assessed using $K_F = (W/L^3) \times 100$ (Fulton, 1904). The relative condition factor (K_R) which shows changes in form or condition as length increases, was calculated based on the equation of $K_R = W/(a \times L^b)$ (Froese, 2006). Hence, the form factor (a3:0) is used to find whether the body shape of a population or species differs from the others. The

* Correspondence: soheil.eagderi@ut.ac.ir

This work is licensed under a Creative Commons Attribution 4.0 International License.

formula of a3:0 = 10 loga – S(b- 3) (Froese, 2006) was used for its calculation, where S = slope of the log a vs. b regression. This value was used as a –1.358 proxy to estimate the form factor (Froese, 2006; Çiçek et al., 2022).

The dependence degree between the variables was calculated using R^2 (determination coefficient). The ANOVA test was used to estimate the level of R^2. The Student's *t*-test was applied to find whether the *b-value* is different from the theoretical value of 3 (i.e. $b = 3$, $p < 0.05$). Microsoft Excel 2016 and PAST 4.09 software were used for statistical analyses (Hammer et al., 2001).

The present work provides the LWR and condition factors in 15 *Oxynoemacheilus* species. The descriptive statistics, number of individuals, and maximum and minimum of the total length and weight are given in Table 1. The parameters of the LWR, regression parameters *a* and *b*, the 95% confidence limits of *b*, the 95% confidence limits of *a*, the coefficient of determination (R^2) and type of growth, and condition factors are given in Table 2. The *b*-value of the studied species varied from 2.225 in *O. brandtii* to 3.575 in *O. euphraticus* (Figure 1). The R^2 between length and weight was between 0.89 and 0.99. K_F of the studied species ranged from 0.673 in *O. persa* to 1.407 in *O. kiabili* (Figure 1). K_R had a narrow range of 0.988–1.009 with a mean of 1.001 ± 0.028.

In the length-weight relationship, *b* values are between 2.5 and 3.5 (Froese, 2006) or 2–4 (Tesch, 1971), and the studied species were within the expected ranges. Some factors can affect *b* values, including fish health, nutrition, sex, sampling season, and physiological factors (Pauly, 1984; Froese, 2006; Jisr et al., 2018). There is also the argument that the *b* value can vary under the influence of a full or empty gut, and the general state of gonadal stages (De Giosa et al., 2014; Zaher et al., 2015; Jisr et al., 2018). This study reports the first LWRs data for nine species, including *O. chomanicus*, *O. euphraticus*, *O. elsae, O. karunensis*, *O. kurdistanicus, O. longipinnis*, *O. parvinae*, *O. marunensis*, and *O. zarzianus* from Iranian inland waters. Our provided LWRs data of the *Oxynoemacheilus* species can be used in fishery biology

Table 1. Sampling localities and descriptive statistics of length and weight for 15 *Oxynoemacheilus* species in Iran (N: number of individuals; *: maximum length bigger than given in FishBase; **: maximum total length not given in FishBase).

Species	Geographic coordinate	Basin	Year	N	Total length (cm)		Total weight (g)		Lmax in FishBase
					Min	Max	Min	Max	
O. bergianus	38°47'28"N–47°29'30"E	Caspian Sea	2017	16	4.37	7.65	0.63	3.56	8.4
	34°52'48"N–50°02'16"E	Namak Lake		20					
O. brandtii	38°00'46"N–47°58'24"E	Caspian Sea	2017	12	5.32	6.68	1.39	2.45	7.8
				4					
O. chomanicus	36°00′45″N–45°54′34″E	Tigris	2017	21	4.25	6.42	0.87	2.54	6.7
	35°55′56″N–45°56′18″E			23					
*O. elsae**	36°46′04″N–49°43′01″E	Urmia Lake	2018	8	5.47	6.89	1.55	2.95	5.3
	37°00′07″N–49°56′18″E			6					
O. euphraticus	33°36′26.6″N–48°17′53.1″E	Tigris	2020	18	3.4	7.79	0.23	4.13	9.3
	35°35′18″N–46°18′51″E			13					
O. frenatus	36°26′22″N–45°20′59″E	Tigris	2017	9	4.48	7.07	0.95	3.45	8.0
*O. karunensis***	34°28'51"N–47°25'19"E	Tigris	2017	31	4.25	5.61	0.58	1.57	-
*O. kiabii**	34°28'51"N–47°25'19"E	Tigris	2017	19	5.32	7.35	1.95	5.16	7.2
*O. kurdistanicus**	36°33′56″N–45°14′13.69″E	Tigris	2018	9	5.54	8.83	1.48	6.16	6.9
*O. longipinnis**	33°35'26"N–46°15'54"E	Tigris	2018	24	4.78	6.97	0.81	3.75	4.1
*O. marunensis***	30°40'8.6"N–50°16'8.59"E	Jarrahi	2021	23	3.04	5.07	0.19	1.01	-
*O. parvinae**	34°53'45"N–47°23'42"E	Tigris	2019	28	4.04	7.74	0.49	3.76	6.4
	34°55'26"N–47°11'60"E			16					
O. persa	30°27'56"N–52°6'2.4"E	Kor	2017	26	4.58	6.45	0.68	2.02	14.0
*O. zagrosensis**	35°57′52″N–45°42′28″E	Tigris	2017	25	2.87	6.45	0.27	2.99	6.1
O. zarzianus	35°23′43″N–46°15′16″E	Tigris	2021	12	5.41	7.19	1.63	4.27	7.5

Table 2. Estimated parameters of the length-weight relationships, condition factors, and form factor for 15 *Oxynoemacheilus* species in Iran (*a*: intercept; *b*: slope; R^2: coefficient of determination; CI: confidence limits; SD: standard deviation; I: isometric growth; A–: negative allometric growth; A+: positive allometric growth; GT: growth type; FF: form Factor; *: first listing species for LWRs in Iranian inland waters).

Species	LWR parameters in this study						Fulton's condition				Relative condition				FF
	a	*b*	R^2	CI of *a*	CI of *b*	GT	Min	Max	Mean	SD	Min	Max	Mean	SD	
O. bergianus	0.006	3.152	0.957	0.0040–0.0086	2.976–3.399	I	0.697	0.975	0.838	0.075	0.845	1.155	1.002	0.086	0.0102
O. brandti	0.037	2.225	0.951	0.0235–0.0674	1.879–2.477	A-	0.821	1.028	0.939	0.067	0.912	1.060	0.994	0.040	0.0033
*O. chomanicus**	0.016	2.7221	0.943	0.0120–0.0235	2.502–2.893	A-	0.890	1.147	1.009	0.069	0.893	1.134	1.003	0.061	0.0067
*O. elsae**	0.017	2.679	0.897	0.0036–0.0372	2.251–3.528	I	0.884	1.036	0.953	0.046	0.938	1.095	1.002	0.045	0.0063
*O. euphraticus**	0.003	3.575	0.986	0.0022–0.0036	3.423–3.707	A+	0.542	0.944	0.691	0.120	0.828	1.295	1.006	0.107	0.0168
O. frenatus	0.013	2.842	0.999	0.0038–0.0931	1.565–3.493	I	0.977	1.056	1.028	0.035	0.989	1.039	1.004	0.024	0.0082
*O. karunensis**	0.004	3.4442	0.917	0.0020–0.0071	3.071–3.849	A+	0.669	0.928	0.788	0.058	0.858	1.202	1.000	0.070	0.0155
O. kiabi	0.009	3.2472	0.911	0.0047–0.0482	2.282–3.629	I	1.216	1.673	1.407	0.119	0.869	1.162	0.997	0.080	0.0198
*O. kurdistanicus**	0.010	2.9697	0.963	0.0044–0.0233	2.484–3.413	I	0.799	1.063	0.906	0.080	0.873	1.165	0.988	0.088	0.0088
*O. longepenis**	0.004	3.3914	0.953	0.0023–0.0082	3.035–3.766	A+	0.733	1.160	0.875	0.104	0.854	1.283	1.009	0.106	0.0150
*O. marunensis**	0.004	3.422	0.931	0.0028–0.0077	2.968–3.684	I	0.603	1.016	0.749	0.108	0.823	1.322	1.004	0.132	0.0154
*O. parvinae**	0.005	3.2736	0.976	0.0040–0.0653	3.137–3.408	A+	0.674	1.010	0.832	0.086	0.855	1.242	1.002	0.094	0.0121
O. persa	0.010	2.787	0.903	0.0039–0.0185	2.389–3.324	I	0.587	0.754	0.673	0.047	0.886	1.168	1.003	0.069	0.0049
O. zagrusensis	0.012	2.95	0.982	0.0036–0.0136	2.880–3.642	I	0.964	1.237	1.115	0.066	0.866	1.111	0.999	0.058	0.0104
*O. zarzianus**	0.014	2.864	0.895	0.0024–0.0319	2.408–3.841	I	0.935	1.227	1.079	0.086	0.878	1.129	1.004	0.079	0.0040

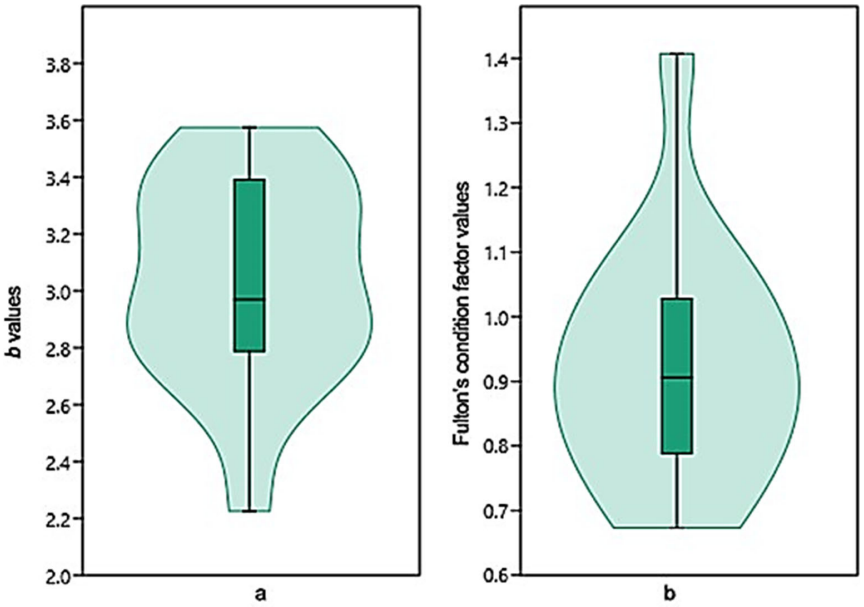

Figure 1. Box plot of (a) allometric coefficient *b* values, (b) Fulton's condition factor (K_F) for 15 *Oxynoemacheilus* species from Iran.

and management and future population dynamic studies.

Clark (1928) showed a relationship between K_F and the parameters of LWR and demonstrated that if the *b* value is not significantly different from 3, K_F can be compared directly. K_R assesses an individual's divergence from the sample's average weight for length (Le Cren, 1951). The K_R varied from 0.988 in *O. kurdistanicus* to 1.009 in *O. longepenis* (Table 2).

K_F shows the effect of biotic and abiotic parameters on the physiological condition of the fish species (Çiçek et al., 2022) and evaluates the aquatic ecosystem status where fish live (Anene, 2005). Based on our findings, the K_F shows proper health and environmental conditions for the studied noemacheilids. Based on our results, a3: ranges between 0.0033 in *O. brandti* to 0.0198 in *O. kiabi*, revealing the elongated body shape of the studied fishes.

Acknowledgment
This work was financially supported by the University of Tehran.

References

Abbasi-Ranjbar K, Mouludi-Saleh A, Eagderi S, Sarpanah A (2019). Morphometric and meristic characters and biological parameters comparison of Urmia bleak *Alburnus atropatenae* (Berg, 1925) from rivers of Lake Urmia basin. Journal of Applied Ichthyological Research 8 (1): 89-96.

Anene A (2005). Condition Factor of Four Cichlid Species of a Man-made Lake in Imo State, Southeastern Nigeria. Turkish Journal of Fisheries and Aquatic Sciences 5 (1): 43-47.

Çiçek E, Seçer B, Eagderi S, Sungur S (2022). Length–weight relations and condition factors of 34 *Oxynoemacheilus* species (Actinopterygii: Cypriniformes: Nemacheilidae) from Turkish inland waters. Acta Ichthyologica et Piscatoria 52 (1): 29-34.

Clark FN (1928). The weight–length relationship of the California sardine (*Sardina caerulea*) at San Pedro. Fish Bulletin 12: 59.

De Giosa M, Czerniejewski P, Rybczyk A (2014). Seasonal changes in condition factor and weight-length relationship of invasive *Carassius gibelio* (Bloch, 1782) from Leszczynskie Lakeland, Poland. Advances in Zoology, 2014, Article ID 678763, pp. 1-7. http://dx.doi.org/10.1155/2014/678763

Eagderi S, Mouludi-Saleh A, Esmaeili HR, Sayyadzadeh G, Nasri M (2022). Freshwater lamprey and fishes of Iran; a revised and updated annotated checklist-2022. Turkish Journal of Zoology 46 (6): 500-522. https://doi.org/10.55730/1300-0179.3104

Eagderi S, Mouludi-Saleh A, Cicek E (2020). Length-weight relationship of ten species of Leuciscinae sub-family (Cyprinidae) from Iranian inland waters. International Aquatic Research 12: 133-136. https://doi.org/10.22034/IAR(20).2020.1891648.1004

Froese R (2006). Cube law, condition factor and weight length relationships: history, metaanalysis and recommendations. Journal of Applied Ichthyology 22 (4): 241-253. https://doi.org/10.1111/j.1439-0426.2006.00805.x

Fulton TW (1904). The rate of growth of fishes. Twenty-second Annual Report, Part III, Fisheries Board of Scotland, Edinburgh.

Froese R, Binohlan C (2000). Empirical relationship to estimate asymptotic length, length at first and length at maximum yield per recruit in fishes, with a simple method evaluate length frequency data. Journal of Fish Biology 56 (4): 758-773. https://doi.org/10.1111/j.1095-8649.2000.tb00870.x

Froese R, Tsikliras AC, Stergiou KI (2011). Editorial note on weight–length relations of fishes. Acta Ichthyologica Et Piscatoria 41 (4): 261-263.

Gonzalez Acosta AF, De La Cruz Aguero G, La Croz Aguero A (2004). Length-weight relationships of fish species caught in a mangrove swamp in the Gulf of California (Mexico). Journal of Applied Ichthyology 20 (2): 154-155. https://doi.org/10.1046/j.1439-0426.2003.00518.x

Hammer O, Harper DAT, Ryan PD (2001). Past: Paleontological Statistics Software Package for Education and Data Analysis. Palaeontologia Electronica 4: 1-9.

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. https://doi.org/10.22034/ijab.v6i5.562

Jisr N, Younes G, Sukhn C, El-Dakdouki MH (2018). Length-weight relationships and relative condition factor of fish inhabiting the marine area of the Eastern Mediterranean city, Tripoli-Lebanon. The Egyptian Journal of Aquatic Research 44: 299-305. https://doi.org/10.1016/j.ejar.2018.11.004

King M (2007). Fisheries biology, Assessment and Management. 2nd edition. Blackwell Scientific Publications, Oxford. 382 p.

Le Cren ED (1951). The length-weight relationships and seasonal cycle in gonad weight and condition in the perch (*Perca fluviatilis*). Journal of Animal Ecology 20: 201-219. https://doi.org/10.2307/1540

Pauly D (1984). Fish population dynamics in tropical waters: A manual for use with programmable calculators. ICLARM, Manila.

Tesch FW (1971). Age and growth. In: Ricker WE (Ed.), Methods for assessment of fish production in fresh waters. Blackwell Scientific Publications, Oxford, pp. 99-130.

van der Laan R (2021). Freshwater Fish List (Online). 37th edition. Richard van der Laan, Almere, the Netherlands. 1130 p.

Zaher FM, Rahman BMS, Rahman A, Alam MA, Pramanik MH (2015). Length-weight relationship and GSI of hilsa, *Tenualosa ilisha* (Hamilton, 1822) fishes in Meghna River, Bangladesh. International Journal of Natural and Social Sciences 2 (3): 82-88.