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Morphometric features of topmouth gudgeon *Pseudorasbora parva* (Temminck & Schlegel, 1846) in the Hirfanlı Reservoir, Turkey

Semra Benzer [a, *]

[a] Department of Science Education, Gazi University, Turkey

Abstract

The aim of this study was to some morphometric characteristics of *Pseudorasbora parva* from Hirfanlı Reservoir, Turkey. A morphological analysis of 29 morphometric characters were performed. These characteristics head length; preorbital distance; eye diameter; postorbital distance; head depth; predorsal distance; prepelvic distance; preanal distance; pectoral fin–pelvic fin (P-V) distance; pelvic fin– anal fin (V-A) distance; body depth (18 perpendicular); dorsal fin (anterior end)-anal fin distance (Da-A); dorsal fin (posterior end)–anal fin distance (Dp-A); postdorsal distance; postanal distance; caudal (C) peduncle length (dorsal); caudal peduncle length (ventral); caudal peduncle depth; dorsal fin (D) base length; anal fin (A) base fin length; pectoral fin (P) length; pelvic (V) fin length; caudal upper lobe length; caudal fork length; caudal lower lobe length; dorsal fin length; anal fin length; gape. The samples were measured weight to the nearest 0.01g and total, fork and standard length to the nearest 0.01 mm. The total length (TL) ranged from 4.10 cm to 9.30 cm and body weight ranged from 0.600 to 7.137 g.

Keywords: *Pseudorasbora parva; topmouth gudgeon; morphometric properties; Hirfanlı Reservoir*

1. Introduction

Morphometric measurements are widely used to identify differences between fish populations (Cheng et al., 2005). Fish morphology means anatomical design among fish species. Body architecture can be discussed in terms of the characteristic depth, predation style and other swimming specializations required for the survival success of a given species (Hogan, 2007).

The topmouth gudgeon *Pseudorasbora parva* is a small cyprinid in the freshwaters of Japan, China, Korea and the River Amur. It was described originally from Nagasaki Japan, holotype (Eschemeyer, 2003). Topmouth gudgeon, *P. parva* (Temmick & Schlegel, 1842) is a highly invasive species in Europe (Gozlan et al., 2002). It has environmental tolerance to low oxygen, organic pollution, and even concentrations of pesticides that are lethal to other fish species (Allen et al., 2006). The life story flexibility of successful invaders may be also be associated with their potential for great morphological plasticity (Zahorska et al., 2009, Novomeska et al., 2013). *P. parva* have negative impact on the negative fish fauna via competition spawning area, food and other resources (Ekmekçi et al., 2013).

There are many studies on various features of *P. parva* at national and international (Erk'akan, 1984, Wildekamp et al., 1997, Cakic et al., 2004, Ekmekçi & Kırankaya, 2006; Britton et al., 2007; Boltachev, 2006; Karabanov et al., 2010; Wang et al., 2012; Patimar & Baensaf, 2012; Huo et al., 2012; Tarkan et al., 2014; Kırankaya et al., 2014; Kapusta et al., 2014; Tarkan et al., 2015; İlhan & Sarı 2015; Carosi et al., 2016; Benzer et al., 2016; Bakaç et al., 2017; Benzer 2018; Benzer & Benzer 2019) in the different locations. This paper describes the area where this fish was found and recorded morphometric data of the population in Hirfanlı Reservoir.

2. Materials and methods

2.1. Study area

The study was carried out in Hirfanlı Reservoir (Fig. 1), which was constructed in 1959, on river Kızılırmak, 70 km far from the south of Kırıkkale. It is located at 856 m altitude with a capacity of 7.63 x 109 m^3 and an area of 320 km^2. The depth, length and width of the lake are 58 m, 90 and 15 km, respectively. It is 24 km far from Ankara Kırşehir Highway and 30 km from Ankara-Adana highway (DSI, 1968).

2.2. Methodology

Fish specimens were captured by commercial fisherman from Hirfanlı Reservoir in 2016. The samples were preserved in 4% formaldehyde solution and transported to the laboratory; weight was measured to the nearest 0.001g and total and standard length to the nearest 0.1 mm.

* *Corresponding author: Department of Science Education, Faculty of Education, Gazi University Teknikokullar, Y. Mahalle, Ankara, Turkey*
Tel: +90.312.202 1608
e-mail: sbenzer@gazi.edu.tr; sbenzer@gmail.com
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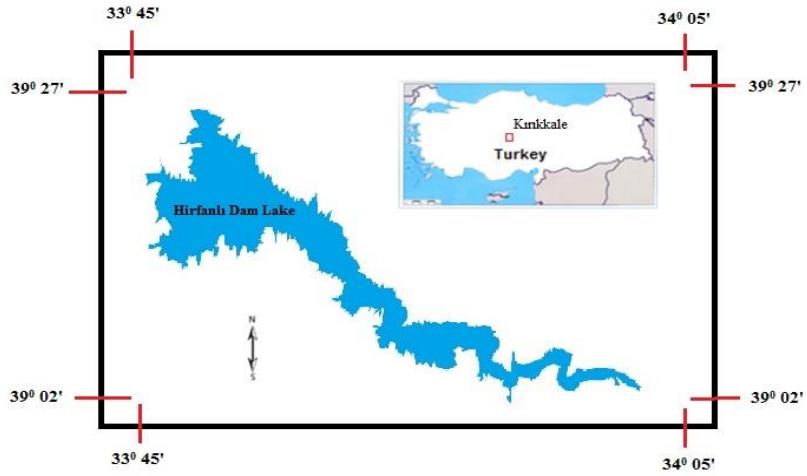

Figure 1. Hirfanlı Reservoir

In total, twenty-nine (29) morphometric characters of samples were measured (Fig. 2). These characteristics were standard length (SL), total length (TL) body weight (W), head length (11–8); preorbital distance (11– ´13); eye diameter (13–12); postorbital distance (12–8); head depth (15–2); predorsal distance (11–18); prepelvic distance (11–3); preanal distance (11–4); pectoral fin–pelvic fin (P-V) distance (6–3); pelvic fin–anal fin (V-A) distance (3–4); body depth (18 perpendicular); dorsal fin (anterior end)–anal fin distance (Da-A) (18–4); dorsal fin (posterior end)–anal fin distance (Dp-A) (17–4); postdorsal distance (17–10); postanal distance (7–10); caudal (C) peduncle length (dorsal) (17–14); caudal peduncle length (ventral) (7–5); caudal peduncle depth (14–5); dorsal fin (D) base length (18–17); anal fin (A) base fin length (4–7); pectoral fin (P) length (6–20); pelvic (V) fin length (3–21); caudal upper lobe length (10–16); caudal fork length (10–9); caudal lower lobe length (10–1); dorsal fin length (18–19); anal fin length (4–22); gape (11–23) (Fig.3) (Záhorská et al. 2013).

Figure 2. *Pseudorasbora parva*

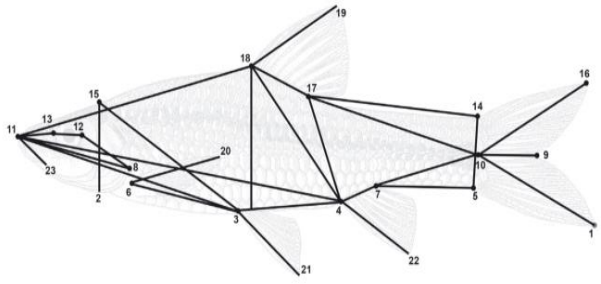

Figure 3. Morphometric characters for distance-based measurements (Záhorská et al., 2013)

Fishermen who hunted for commercial purposes to hunt *Atherina boyeri* have also been found to hunt *Aphanius marassantensis* and *P. parva* species in Hirfanlı Reservoir.

3. Result and discussion

In this research, some morphometric characters were examined and the minimum, maximum, mean, standard deviation values are given in Table 1. Measurements and counts of the 25 specimens are given Table 1. Total lengths and body weights of the examined specimens ranged 4.10 and 9.30 cm; 0.600 and 7.137 g respectively.

It appear that both the adult phenotype and the pattern of development in introduced *P. parva* can, in general, be highly influenced by local conditions because the morphology and the ecology presented by an organism have been shown to be directly or indirectly under the influence of the environmental conditions that the organism experiences and its heritable composition (Norton et al., 1995).

In this study were found difference even between population from the other water systems (Table 2). The topmouth gudgeon is considered to be a species with great morphological variability (Kotusz & Witkowski, 1998, Zhorska et al., 2013). Some of the research work related to *P.parva* in Turkey and in the world include (TL 27.8 to 58.1 mm, 0.4 to 3.2 g in Kuchki Pond (Boltachev et al., 2006); TL 4.58-7.50 cm Iran (Esmaeili & Ebrahimi, 2006); SL 23.42-59.71 mm Slovakia (Zahorska & Kovac, 2009); SL 18.16 - 67.57 mm, Sur Pond (Zahorska et al., 2010); TL 5.4-8.3 cm Lake Doirani, Lake Mikri Prespa and Lake Volvi (Bobori et al., 2010); TL 3.0-7.2 cm Sirwan River (Hasankhani et al., 2014); TL 18.02-96.24 mm Hirfanlı Reservoir (Kırankaya et al., 2014); TL 5.20-11.0 Marmara Lake (İlhan & Sarı, 2015); TL 4.6-7.5 Tajan River (Aazami et al., 2015); TL 4.2-9.2 cm Mogan Lake (Benzer et al., 2016); TL 56.75-76.10 mm Gökçeada Dam Lake (Bakaç et al., 2017); TL 4.10-6.80 cm Süreyyabey Dam Lake (Benzer, 2018); TL 2.7-9.2 Hirfanlı Dam Lake (Benzer & Benzer, 2019).

The difference may be caused by differences in morphological features of the species and habitats. In general, topmouth gudgeon popultions show considerable variation in external morphology, which is not only evident in European populations but also in its native range (Gozlan et al., 2010). It would be expected that populations from different latitudes and/or habitats show significant morphological variability, but differences were also found between populations from the same region (Zahorska et al., 2009). This variability can be expressed not only in the formation of different adult phenotypes but also in the manner with which the phenotypes are achieved. In general, the temperature regime has a considerable influence on life histories and extreme temperatures are known to affect various traits, from morphology (Sumer et al., 2005).

P. parva indivuduals prefers wide, varied environments with abundant food sources, in shallow regions and regions with dense vegetation (Kapusta et al., 2008). It was reported that *P. parva* transmits fatal diseas to native fish fauna, limits the reproduction of the endangered native fish species, and influences the decline of native fish species (Ekmekçi & Kırankaya, 2006).

Table 1.
Morphometric characteristics of *Pseudorasbora parva* specimens

	Parameters	min	Max	Average	SD	CI	Margin of error	Upper bound	Lower bound
1	Standard length	3.400	7.200	6.502	0.929	0.364	0.068	6.866	6.138
2	Fork length	3.900	8.200	7.370	1.098	0.449	0.103	7.818	6.921
3	Total length	4.100	9.300	8.176	1.227	0.481	0.118	8.657	7.695
4	Body weight	0.600	7.137	5.414	1.741	0.682	0.238	6.096	4.731
5	Head length	0.900	2.100	1.500	0.242	0.095	0.005	1.595	1.405
6	Preorbital distance	0.200	1.000	0.528	0.143	0.056	0.002	0.584	0.472
7	Eye diameter	0.200	0.500	0.384	0.080	0.031	0.001	0.415	0.353
8	Postorbital distance	0.400	1.400	0.752	0.190	0.074	0.003	0.826	0.678
9	Head depth	0.600	1.200	1.008	0.155	0.061	0.002	1.069	0.947
10	Predorsal distance	1.900	3.800	3.320	0.492	0.193	0.019	3.513	3.127
11	Prepelvic distance	1.800	3.800	3.300	0.465	0.182	0.017	3.482	3.118
12	Preanal distance	2.500	5.100	4.672	0.644	0.252	0.033	4.924	4.420
13	Pectoral fin - pelvic fin distance	0.900	2.000	1.632	0.261	0.102	0.005	1.734	1.530
14	Pelvic fin - anal fin distance	0.700	1.900	1.528	0.270	0.106	0.006	1.633	1.422
15	Body depth	0.700	2.000	1.668	0.318	0.125	0.008	1.793	1.543
16	Dorsal fin (anterior end) – anal fin distance	1.200	2.500	2.192	0.389	0.153	0.012	2.345	2.039
17	Dorsal fin (posterior end) – anal fin distance	0.800	2.800	1.692	0.438	0.172	0.015	1.864	1.520
18	Postdorsal distance	1.500	3.200	2.752	0.416	0.163	0.014	2.915	2.589
19	Postanal distance	0.700	2.500	1.584	0.358	0.140	0.010	1.724	1.444
20	Caudal peduncle length (dorsal)	1.700	3.100	2.532	0.409	0.160	0.013	2.692	2.372
21	Caudal peduncle length (ventral)	0.700	1.700	1.408	0.255	0.100	0.005	1.508	1.308
22	Caudal peduncle depth.	0.300	1.300	0.860	0.189	0.074	0.003	0.934	0.786
23	Dorsal fin base length	0.300	1.200	0.920	0.196	0.077	0.003	0.997	0.843
24	Anal fin base fin length	0.400	0.900	0.628	0.172	0.067	0.002	0.695	0.561
25	Pectoral fin length	0.500	1.200	0.992	0.191	0.075	0.003	1.067	0.917
26	Pelvic fin length	0.500	1.500	1.092	0.214	0.084	0.004	1.176	1.008
27	Caudal upper lobe length	1.000	1.900	1.663	0.214	0.086	0.004	1.748	1.577
28	Caudal fork length	0.500	1.400	0.926	0.220	0.090	0.004	1.016	0.836
29	Caudal lower lobe length	0.800	2.000	1.636	0.335	0.131	0.009	1.767	1.505
30	Dorsal fin length	0.700	1.900	1.528	0.242	0.095	0.005	1.623	1.433
31	Anal fin length	0.500	1.500	1.016	0.203	0.080	0.003	1.096	0.936
32	Gape	0.200	0.700	0.400	0.147	0.058	0.002	0.458	0.342

Table 2.
Morphometric measurements of *Pseudorasbora parva* in literature

Paramaters	This Study (Hirfanlı Reservoir)		Benzer (2018) (Süreyyabey Dam Lake)		Barkaç et al. (2017) Gökçeada Dam Lake (Dam Entrance)		Zahosska et al. (2013) (Lake Licheńskie)	
	Mean±SD	Range	Mean±SD	Range	Mean±SD	Range	Mean±SD	Range
Standard Length (cm)	6.502±0.929	3.4-7.2	4.388±0.47	3.50-5.50	-	46.25-62.0	32.77±15.27	9.26-81.89
Fork Length (cm)	7.370±1.098	3.9-8.2	4.794±0.53	3.80-6.10	-	-	36.38±16.82	10.35-86.46
Total Length (cm)	8.176±1.227	4.2-9.2	5.332±0.57	4.10-6.80	-	56.75-76.1	39.41±17.63	14.06-89.93
Body Weight (g)	5.414±1.741	0.6-7.137	1.612±0.56	1.0-3.46				
In % of SL								
Head length	23.07±3.72	13.84-32.30	25.23±3.19	20.51-34.18	21.28±0.24	21.08-21.55	26.49±2.12	19.63-35.13
Preorbital distance	8.12±2.20	3.08-15.38	24.98±11.52	4.56-79.76			7.59±0.90	4.78-11.16
Eye diameter	5.91±1.23	3.08-7.69	6.93±0.98	4.56-9.12			7.15±1.01	4.18-10.86
Postorbital distance	11.57±2.92	6.15-21.53	10.96±2.16	6.84-15.95			11.96±1.08	8.93-18.13
Head depth	15.50±2.38	9.23-18.46	19.64±3.35	13.67-29.63			20.11±1.16	15.81-24.69
Predorsal distance	51.06±577	29.22-58.44	53.65±5.95	45.58-68.37	48.11±1.46	45.36-50.27	53.20±2.27	45.11-68.82
Prepelvic distance	50.75±7.15	27.68-58.44	53.05±8.52	29.63-84.32	48.68±2.93	46.17-51.89	51.53±2.28	27.65-68.54
Preanal distance	71.85±9.90	38.45-78.44	72.31±8.71	50.14-97.99	70.14±3.49	67.7-74.05	70.63±2.90	26.92-85.94
Pectoral fin - pelvic fin distance	25.10±4.01	13.84-30.76	25.34±4.24	15.95-34.18			25.04±2.55	10.57-32.87
Pelvic fin - anal fin distance	23.50±4.15	10.77-29.22	21.60±3.71	13.67-29.63			21.48±2.08	13.89-30.90
Body depth	25.65±4.89	10.77-30.76	26.09±4.54	20.51-43.30			24.86±1.82	16.50-31.42
Dorsal fin (anterior end) – anal fin distance	33.71±5.98	18.46-38.45	31.65±5.90	18.23-47.86			29.98±2.11	19.47-40.37
Dorsal fin (posterior end) – anal fin distance	26.02±6.74	12.30-43.06	23.38±5.24	15.95-38.74			20.54±1.75	13.48-28.30
Postdorsal distance	42.33±6.40	23.07-49.22	38.61±6.91	20.51-52.42			39.27±2.01	26.65-4614
Postanal distance	24.36±5.51	10.77-38.45	23.31±3.46	15.95-29.63			23.73±1.92	10.07-41.42
Caudal peduncle length (dorsal)	38.94±6.29	26.15-47.68	35.48±7.25	15.95-50.14			37.78±1.94	27.52-45.66
Caudal peduncle length (ventral)	21.65±3.92	10.77-26.15	20.74±4.31	2.73-34.18			42.87±2.87	24.26-53.50
Caudal peduncle depth,	13.23±2.91	4.61-19.99	10.55±2.42	3.65-15.95			13.16±1.02	8.03-17.02
Dorsal fin base length	14.15±3.01	4.6118.46	12.42±3.42	4.56-27.35	11.66±1.46	10.05-12.91	13.05±1.28	7.51-19.94
Anal fin base fin length	9.66±2.65	6.15-13.84	8.04±2.26	2.28-13.67	7.64±0.82	6.7-8.23	9.50±1.21	3.89-16.11
Pectoral fin length	15.26±2.94	7.69-18.46	15.29±3.62	6.84-22.79			14.73±2.12	5.42-23.13
Pelvic fin length	16.79±3.29	7.69-23.07	14.43±3.19	9.12-22.79			14.88±1.88	4.06-25.63
Caudal upper lobe length	25.58±3.29	15.38-29.22	23.29±4.34	13.67-31.91			23.91±2.61	10.63-32.15
Caudal fork length	14.24±3.28	7.69-21.53	13.35±3.10	9.12-25.07			-	-
Caudal lower lobe length	25.16±5.15	12.30-30.76	23.43±4.08	15.95-31.91			23.98±2.80	7.15-32.51
Dorsal fin length	23.50±3.72	10.77-29.22	21.35±3.01	11.39-25.07			21.94±1.90	12.15-27.53
Anal fin length	15.63±3.12	7.69-23.07	14.40±4.08	4.56-25.07			13.28±1.59	8.35-20.12
Gape	6.15±2.26	3.08-10.77	6.24±2.53	2.28-13.67			8.87±1.74	2.30-14.49

4. Conclusion

This paper describes the area where this fish was found and recorded morphometric data of the population. Findings obtained in this study are very important because the previous studies about the morphometric properties of *P. parva* have not been found. It is considered that the data obtained in this study will also contribute to future studies.

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