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RESEARCH PAPER

Length-Weight Relationship and Condition Factors of Freshwater Bream *Abramis brama* (Linnaeus, 1758) from the Kremenchug Reservoir, Middle Dnieper

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Abstract

This study was conducted to determine length–weight relationships, condition factor (K) and relative condition factor (K_n) of freshwater bream *Abramis brama* (Linnaeus, 1758), inhabiting Kremenchug Reservoir (Middle Dnieper, Ukraine). Fishes aged from 0+ to 19+ were analysed. Length-weight relationships were found to be W=0.0094×$SL^{3.2545}$ (R^2=0.9882), W=0.0133×$SL^{3.1318}$ (R^2=0.9832), and W=0.0106×$SL^{3.2098}$ (R^2=0.9848) for females, males and combined sexes, respectively. A positive allometric growth (b>3) was observed for all samples. Calculation of average K resulted as 2.29 for females, 2.12 for males and 2.21 for all specimen. Average K_n of these groups were found to be 1.05, 0.98 and 1.01, respectively. This study is the first reference on LWR equation parameters and K_n of *A. brama* in the Dnieper River.

Keywords: *Abramis brama*, Fulton's condition factor, relative condition factor, Dnieper River, commercial catches.

Introduction

Fisheries science and management use quantitative description of the relationship between length and weight of individuals in a fish population as a basic tool for assessing the natural populations (Ricker, 1975; Froese, 2006; Tsoumani *et al*., 2006; Britton and Davies, 2007). Equation $W = a×SL^b$ (Le Cren, 1951) allows describing of a specific population and gives an idea of its condition and fitness by using equation parameters a and b. Furthermore, these parameters give an opportunity to compare populations of a certain species over time or between regions. When these parameters are available from a given population, they allow fisheries managers and scientists to derive weight data simply from length distribution data that makes fieldwork much easier. In addition, condition oriented indices such as Fulton's condition factor (K), Le Cren's relative condition factor (K_n) on, have been derived from this LWR, and have been powerful instruments in fisheries science (Froese, 2006; Verreycken *et al*., 2011; Froese *et al*., 2014).

We focused our investigations on a freshwater bream *Abramis brama* (Linnaeus, 1758) because it is one of the most numerous native benthivorous fish in freshwater bodies of Europe and abundant commercial fish species in the Dnieper River basin. This species is protected in Ukraine. Annual stocks assessing and minimum landing size (32 cm standard body length) prevent its overfishing. This is one of the main species in commercial catches, which constituted from 35.62 to 42.54 % (40.01±0.74) of total catches in the Kremenchug reservoir during 2007–2013. However, catch structure showed that Kremenchug Reservoir's fish fauna contains numerous benthivorous fish species (Table 1).

Therefore, the goals of this paper were: to report the a and b values of LWR equation and condition factors of *A. brama* in Kremenchug Reservoir recorded during the fisheries monitoring programme; to compare our values with those published in FishBase and to provide the data from our fish surveys as reference values for FishBase (www.fishbase.org). In addition, presenting of such condition oriented indices as K and K_n will provide broader understanding of fish conditions and give an opportunity to compare studied population with other parts of its areal.

Materials and Methods

Study Area

The Kremenchug Reservoir (Figure 1) is the largest reservoir in the cascade of six reservoirs

Table 1. Mean commercial catch during 2007–2013in Kremenchug reservoir, tonnes

	Mean	SE	Min	Max	SD	Conf. SD –95.0%	Conf. SD +95.0%
Freshwater bream (*Abramis brama*)	1599.27	60.23	1395.2	1790	159.34	102.68	350.88
Roach (*Rutilus rutilus*)	1422.37	69.49	1108.6	1623	183.85	118.47	404.85
Silver bream (*Blicca bjoerkna*)	364.34	16.39	302	427	43.36	27.94	95.48
Bigheaded carps (*Hypophthalmichthys sp.: H. nobilis andH. molitrix*)	236.59	74.81	41.1	536	197.94	127.55	435.88
Prussian carp (*Carassius gibelio*)	97.01	9.73	61	134.8	25.73	16.58	56.67
Pike-perch (*Sander lucioperca*)	76.99	2.71	70	89.5	7.17	4.62	15.78
Bleak (*Alburnus alburnus*) and Kilka (*Clupeonella cultriventris*)	72.4	15.08	14	116.5	39.9	25.71	87.87
Zope (*Ballerus ballerus*)	45.23	5.4	24.4	62	14.28	9.2	31.45
Sichel (*Pelecus cultratus*)	32.37	3.33	20.1	42	8.81	5.68	19.39
Wels catfish (*Silurus glanis*)	19.13	3.28	5.5	31.3	8.69	5.6	19.14
European perch (*Perca fluviatilis*)	15.71	1.82	10	25.1	4.81	3.1	10.6
Common carp (*Cyprinus carpio*)	14.19	2.92	7	27.7	7.74	4.99	17.04
Northern pike (*Esox lucius*)	9.19	1.24	5	15.7	3.29	2.12	7.25
Asp (*Aspius aspius*)	4.54	0.78	2	6.6	2.06	1.33	4.53
Other small chastik*	1.66	0.44	0.7	3.9	1.15	0.74	2.54
Ide (*Leuciscus idus*)	0.96	0.05	0.8	1.1	0.11	0.07	0.33
Other large chastik*	0.5	0.15	0.3	0.8	0.26	0.14	1.66

Note: * – "chastik" is a commercial name of a group of fish, taken mostly in the fishing areas of former Soviet Union countries bordering the Caspian, Aral, Azov and Black seas. The name appeared in connection with fishing for certain species of fish by so-called "chastik" – gill nets. Fish is commonly divided into "large chastik" (minimum landing size (MLS) is 30 cm and more) and small chastik (MLS is 29 cm and less)

Figure. 1. Kremenchug Reservoir on the map of Ukraine.

located on the Dnieper River. Its total surface area is 2252 km^2 the territories of the Poltava, Cherkasy, and Kirovohrad Oblasts in central Ukraine. It has a length of 149 km, maximum width of 28 km, average depth of 6.0 m, and maximum depth of 28 m.

Data Collection and Analysis

Sampling in the Kremenchug Reservoir were conducted during the fishing seasons of 2009, 2010, 2014 and 2015 within the framework of annual monitoring fish surveys of Institute of Fisheries of National Academy of Agrarian Sciences (IF NAAS) in the Dnieper Reservoirs. The same sites were sampled during each year. Geographical coordinates of each sampling site were registered using a GPS receiver (Garmin Dakota 10). Ethic permission for investigations was proved by scientific fishing licenses of Cherkasy, Sula and Poltava state fishery inspections because fish specimens, protected by commercial fishery rules, were removed from the wild. The fish were caught using 24 commercial gill nets: 70.0 m length, 3.0 m high. Their mesh size was 30, 36, 40, 45, 50, 55, 60, 65, 70, 75, 80, 90 mm in twos each mesh size (Ozinkovska *et al.*, 1998). We use all these gill nets simultaneously in order to omit errors mentioned by Froese (2006). These gillnets were used 15 days in September-October for each year. Therefore, 360 gill net catches for each year or 1440 gill net catches within four years of the study period were examined. Fishes were usually processed at the fisheries posts of IF NAAS (species identification (Kottelat and Freyhof, 2007), wet weight (precision balance VTD-6EL (Ukraine)), length measurements (standard measuring bar of IF NAAS with one mm accuracy)). Fish of smaller size were caught with a push-net (10 m ×1 m ×1 mm mesh size). The area of seine hauls depended on the water depth and bank steepness and ranged from approximately 10 to 100 m^2, which was measured visually using the seine length as a reference, according to standard methodology (Ozinkovska *et al*., 1998). The age of the fish was determined from scales collected in September and October. The growth rate of bream was estimated by growth zones on scales and found from back-calculated lengths (Bagenal and Tesch, 1978) in combination with Petersen's method (De Bout, 1967).

A total of 1420 fishes (732 females and 688 males) with a length of 15.0-55.0 cm were weighed. The length and weight were measured with the accuracy of 1.0 cm and 1.0 g, respectively. Sexes were identified by macroscopic examination of the gonads (Bagenal and Tesch, 1978). Age estimation was based mainly on the annual ring structure of scales. Several scales were taken from every bream, from the left side of the body, from the first row above the lateral line and below the insertion of the dorsal fin. The scales were examined under dissecting microscope. In addition, to confirm the determinations made on scales, random sample of 160 *A.brama* of 9.0 to 56.0 cm SL (in 40s each year), results of independent readings of the age of scales were compared with readings of hard rays from dorsal fins that were clearly legible. In 158 cases, the results of readings were identical, so it was assumed that the age determination based on scales was reliable (Pravdin, 1966).

The LWRs were determined for males, females and combined sexes according to the equation $W = a \times SL^b$ given by Le Cren (1951) where W is the total wet weight (g), SL is the standard length (cm), and a and b are parameters of the LWR equation. These parameters were estimated by the least squares regressions method and, then, subjected to logarithmic transformation $\log(W) = \log(a) + b \times \log(SL)$. Standard error was calculated for the slope (b). The hypothesis of isometric growth was tested through Student's t-test, with values of P<0.05 considered significant.

A t-test was used for comparison b value obtained in the linear regression with isometric value (Sokal and Rohlf, 1987): $t_s = \frac{(b-3)}{S_b}$, where t_s is the t-test value, b the slope and S_b the standard error of the slope (b). The comparison obtained values of t-test with the respective tabled critical values allowed for the determination of the b values statistically significant, and their inclusion in the isometric range (b=3) or allometric range (negative allometric; b<3 or positive allometric; b>3). The degree of correlation between the variables was computed to determine coefficient, r^2.

Fulton's condition factor (K) was calculated using the equation $K = 100\frac{W}{SL^3}$ (Bagenal and Tesch, 1978). The equation used for relative condition factor was: $K_n = \frac{W}{a \times SL^b}$, where a and b are the exponential form of the intercept and slope, respectively, of the logarithmic length-weight equation (Le Cren, 1951). In our calculations were used gender separated and mixed samples.

Results

Age and Length of Different Age Groups

The results of reading scale rings are given in Table 2. In autumn 2009-2010 and 2014-2015 the bream population of Kremenchug Reservoir consisted of fishes aged 0+ to 19+. Age classes ranged from 0+ to 19+ years, with a predominance of ages 2+–6+ in catches. Fish aged 4+ (27.0–31.0 cm SL) dominated in the sample. During the first year, bream in Kremenchug Reservoir reached a standard body length of 10 cm (Table 2), that is less than in 2000-2005 (Khrystenko and Didenko, 2007), however the MLS 32 cm was attained by the age 5+. Within 20 seasons, bream had an average body length of 55-56 cm.

Length-Weight Relationships and Condition Factors

A total of 1420 individuals of *A. brama* (732 females and 688 males) were used for the investigation. Average standard length and wet weight values of all investigated fish were 33.19±5.1 cm and 1075.07±477.27 g for mixed samples, 34.76±5.47 cm and 1338.55 ± 598.49 g for females and 32.94±4.86 cm and 972.39±382.13 g for males, respectively. Detailed calculations of these parameters were presented in the Table 3.

Although weight depends largely on the stomach content, the length-weight relationship can be used as an indicator of fish condition as well (Froese, 2006). According to our calculations, the length-weight relationships of *A. brama* calculated on pulled data can be expressed by the regression equations: $W=0.0094 \times SL^{3.2545}$ (R^2=0.9882) for females, $W=0.0133 \times SL^{3.1318}$ (R^2=0.9832) for males and $W=0.0106 \times SL^{3.2098}$ (R^2=0.9848) for combined sexes. Calculations for separate years presented in Table 3.

The investigation of condition factors of *A. brama* revealed that mean Fulton's condition factors (K) values of *A. brama* ranged between 1.17 and 3.45 with an average of 2.21±0.15. for pooled samples, 1.19–3.45 with average 2.29±0.16 for females and 1.17–3.17 with average 2.12±0.13 for males. Similarly, mean relative condition factors (K_n) were found to be 0.54–1.67 (1.01±0.07), 0.55–1.67 (1.05±0.07) and 0.54–1.56 (0.98±0.06), respectively (Table 3).

Discussion

Age and Length of Different Age Groups

The age of the bream ranged from 0+ to 19+ in our investigations. Older fishes aged 20+ have been found earlier in Kremenchug reservoir (Khrystenko, 2007; Khrystenko and Didenko, 2007). Furthermore, available scientific papers demonstrate that earlier up to 22-year-old breams have been encountered in some big eutrophic lakes, such as Peipsi (Kangur, 1996). However, in other water bodies the life span of bream was the same or even less (Morozova, 1956; Kompowski, 1982; Hanel 1991; Staras and Cernisencu, 1992a; Specziár *et al*., 1997).

The results of scale reading showed that there were some overlapping of individuals with same lengths, especially for the ages from 1+ to 6+. Consequently, age-length keys for females (Table 4) and males (Table 5) does not allow exact age determination of freshwater bream with 9–31 cm SL. Despite this fact, obviously that they give an idea about approximate age of certain length *A. brama* with one-year inaccuracy that can make easier age determination.

A. brama usually attained MLS of 32 cm SL at the age 5+ in Kremenchug Reservoir, that is slightly higher than in other water bodies (Morozova, 1956; Kompowski, 1982; Hanel 1991; Staras and Cernisencu, 1992a; Kangur, 1996; Specziár *et al*., 1997) likely due to suitable feeding (Khystenko and Didenko, 2007) and temperature (www.fishbase.org) conditions for this fish species.

Length-Weight Relationships and Condition Factors

Although there were many scientific papers about freshwater bream from the Middle Dnieper (Pavlov, 1947; Simonova, 1969; Vjatchanina and Konstantinova, 1981; Suhojvan and Kryzhanovskij, 1986; Khrystenko, 2007; Khrystenko and Didenko, 2007), where SL and wet weight of separate age groups were given, but LWRs have been never calculated. Consequently, LWRs and relative condition factor for this fish species in this area have never been reported elsewhere before (www.fishbase.org). From our point of view, this situation is caused by the influence of Soviet ichthyologic school, when scientists only reported mean values of length and weight for certain age groups. Therefore, this study reveals the first LWR and K_n data on this species in the Middle Dnieper.

Nevertheless, LWRs of *A. brama* have been widely reported on FishBase for different populations, especially for Danube Delta (Table 6). According to traditional methodology, cyprinid fish should be measured by SL because of inaccuracies of TL caused by caudal fins breaking (Pravdin, 1966), therefore we used it in our investigations. Standard length (SL) was also reported for Lake Balaton (Dauba and Biró, 1992), Berounka river (Hanel, 1991), Azov Sea (von Bertalanffy, 1951), Ladoga Lake (Morozova, 1956), Lake Dabie (Kompowski, 1982) and Volga river estuary (Tyurin, 1927).

However, it should be mentioned that in available scientific papers authors reported not only SL but also total length (TL). TL was reported for

Table 2. Standard length (SL) of different age groups of *A.brama* in Kremenchug Reservoir

Age	Female			Male		
	n	Mean SL± SE (cm)	Min–Max (cm)	n	Mean SL± SE (cm)	Min–Max (cm)
0+	30	10.13±1.13	9.00–12.00	27	9.56±0.51	9.00–12.00
1+	48	17.63±1.48	13.00–19.00	38	16.45±1.55	13.00–19.00
2+	64	20.86±1.48	18.00–23.00	56	18.84±1.59	17.00–23.00
3+	54	24.15±1.55	22.00–26.00	68	23.71±0.99	22.00–26.00
4+	61	28.57±1.07	27.00–31.00	64	28.55±0.66	27.00–31.00
5+	53	32.49±0.70	31.00–34.00	37	31.89±0.66	31.00–34.00
6+	50	35.41±0.69	34.00–36.00	49	35.37±0.64	34.00–36.00
7+	35	37.80±0.41	37.00–38.00	39	37.62±0.49	37.00–38.00
8+	35	39.91±0.87	39.00–41.00	37	39.89±0.75	39.00–41.00
9+	43	41.61±0.50	41.00–42.00	34	41.42±0.50	41.00–42.00
10+	46	43.75±0.45	43.00–44.00	38	43.72±0.46	43.00–44.00
11+	36	45.50±0.51	45.00–46.00	36	45.27±0.67	44.00–46.00
12+	36	46.69±0.47	46.00–47.00	26	46.50±0.51	46.00–47.00
13+	20	48.07±0.27	48.00–49.00	20	48.08±0.28	48.00–49.00
14+	20	49.18±0.40	49.00–50.00	20	49.21±0.43	49.00–50.00
15+	21	50.14±0.36	50.00–51.00	20	50.10±0.31	50.00–51.00
16+	20	51.70±0.47	51.00–52.00	20	51.25±0.45	51.00–52.00
17+	20	52.86±0.36	52.00–53.00	20	52.30±0.48	52.00–53.00
18+	20	53.75±0.46	53.00–54.00	20	53.44±0.53	53.00–54.00
19+	20	55.29±0.47	55.00–56.00	19	55.14±0.36	55.00–56.00

Table 3. Length-weight relationships and condition factors of *A. brama* in the Kremenchug Reservoir, the Middle Dnieper, Ukraine

Year	Sex	*n*	Standard length (cm)		Wet weight (g)		Equation parameters					Growth type		Fulton's condition factor (*K*)		Relative condition factor (K_n)	
			Mean±SD	min-max	*Mean±SD*	min-max	*a*	*b*	*SE (b)*	*t-test*	*p value*		R^2	*Mean±SD*	min-max	*Mean±SD*	min-max
2009	F	223	35.2±5.68	15–55	1428.6±630.81	50–4620	0.0067	3.3460	0.0169	20.50	<0.0005	A+	0.9909	2.30±0.19	1.48–3.33	1.05±0.08	0.71–1.56
	M	226	33.8±5.53	14–55	1077.6±432.45	50–3410	0.0101	3.2028	0.0190	10.67	<0.0005	A+	0.9882	2.07±0.15	1.37–3.05	0.95±0.06	0.65–1.40
	All	449	34.5±5.61	14–55	1251.9±546.65	50– 620	0.0081	3.2800	0.0192	14.62	<0.0005	A+	0.9878	2.18±0.18	1.37–3.33	1.00±0.07	0.65–1.56
2010	F	164	33.0±4.90	16–56	1136.7±545.5	80–5360	0.0125	3.1825	0.0164	11.11	<0.0005	A+	0.9872	2.36±0.15	1.63–3.41	1.08±0.06	0.80–1.67
	M	145	31.7±4.79	17–53	938.8±419.34	80–3880	0.0127	3.1616	0.0144	11.22	<0.0005	A+	0.9911	2.22±0.12	1.49–3.17	1.02±0.05	0.78–1.56
	All	309	32.4±4.85	16–56	1043.8±492.09	80–5360	0.0123	3.1782	0.0160	11.17	<0.0005	A+	0.9884	2.29±0.14	1.49–3.41	1.05±0.06	0.78–1.56
2014	F	201	35.14±5.41	14–56	1303.53±558.17	60–5600	0.0163	3.0942	0.0175	7.02	<0.0005	A+	0.9875	2.28±0.15	1.71–3.45	1.04±0.07	0.82–1.56
	M	189	32.32±4.42	15–50	874.39±333.94	70–2710	0.0163	3.0691	0.0189	3.66	<0.005	A+	0.9722	2.10±0.12	1.17–2.96	0.97±0.06	0.56–1.44
	All	390	33.78±5.00	14–56	1095.56±474.98	60-5600	0.0154	3.0985	0.0199	4.73	<0.005	A+	0.9800	2.19±0.15	1.17–3.45	1.01±0.07	0.56–1.56
2015	F	144	32.94±4.56	14–51	959.97±324.83	56–3250	0.0145	3.1227	0.0181	6.79	<0.0005	A+	0.9881	2.23±0.13	1.19–3.22	1.03±0.06	0.55–1.31
	M	128	32.14±4.85	15–49	951.65±352.37	62–2700	0.0207	3.0800	0.0164	4.88	<0.005	A+	0.9827	2.15±0.12	1.18–2.88	0.99±0.06	0.54–1.47
	All	272	33.84±4.17	14–51	969.34±292.06	56–3250	0.0169	3.0728	0.0176	4.14	<0.005	A+	0.9856	2.19±0.13	1.18–3.22	1.01±0.06	0.54–1.47
All	F	732	34.07±5.14	14–56	1207.2±514.83	50–5600	0.0098	3.2545	0.0190	13.38	<0.0005	A+	0.9882	2.29±0.17	1.19–3.46	1.05±0.07	0.55–1.67
	M	688	32.49±4.88	14–55	960.61±384.53	50–3880	0.0133	3.1318	0.0207	5.99	<0.0005	A+	0.9832	2.14±0.14	1.17–3.17	0.98±0.06	0.54–1.56
	All	1420	33.63±4.90	14–56	1090.15±451.45	50–5600	0.0106	3.2098	0.0220	10.16	<0.0005	A+	0.9848	2.21±0.16	1.17–3.46	1.02±0.07	0.54–1.56

Table 4. Age –length key of *A. brama* females from the Kremenchug Reservoir

SL intervals,	Ages																				Total
cm	0+	1+	2+	3+	4+	5+	6+	7+	8+	9+	10+	11+	12+	13+	14+	15+	16+	17+	18+	19+	
9-10	18																				18
11-12	12																				12
13-14		6																			6
15-16		9																			9
17-18		22	7																		29
19-20		11	20																		31
21-22			31	7																	38
23-24			6	26																	32
25-26				21																	21
27-28					29																29
29-30					32																32
31-32						32															32
33-34						21	6														27
35-36							44														44
37-38								35													35
39-40									24												24
41-42									11	43											54
43-44											46										46
45-46												36	11								47
47-48													25	19							44
49-50														1	20	18					39
51-52																3	20				23
53-54																		20	20		40
55-56																				20	20
Total	30	48	64	54	61	53	50	35	35	43	46	36	36	20	20	21	20	20	20	20	732

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Table 5. Age –length key of *A. brama* males from the Kremenchug Reservoir

SL intervals, cm	Ages																				Total
	0+	1+	2+	3+	4+	5+	6+	7+	8+	9+	10+	11+	12+	13+	14+	15+	16+	17+	18+	19+	
9-10	15																				15
11-12	12																				12
13-14		7																			7
15-16		11																			11
17-18		18	25																		43
19-20		2	24																		26
21-22			6	9																	15
23-24			1	48																	49
25-26				11																	11
27-28					30																30
29-30					33																33
31-32					1	33															34
33-34						4	4														8
35-36							45														45
37-38								39													39
39-40									31												31
41-42									6	34											40
43-44											38	3									41
45-46												33	13								46
47-48													13	19							32
49-50														1	20	18					39
51-52																2	20	14			36
53-54																		6	19		25
55-56																				20	20
Total	27	38	56	68	64	37	49	39	37	34	38	36	26	20	20	20	20	20	19	20	688

Table 6. Length-weight parameters of *A.brama* from FishBase (www.fishbase.org)

Locality	*a*	*b*	Sex	Length (cm)	Length type	R^2	Country	Authors
Lake Balaton, northeast, 1982-83	0.04060	2.884	unsexed	10.0 - 35.0	SL	–	Hungary	Dauba and Biró, 1992
Lake Balaton, southwest, 1982-83	0.04150	2.887	unsexed	15.0 - 38.0	SL	–	Hungary	Dauba and Biró, 1992
Berounka river	0.02630	2.960	unsexed		SL	–	Czechia	Hanel, 1991
Lake Volvi (Macedonia), 1995-96	0.01110	2.970	unsexed	10.7 - 30.5	TL	0.941	Greece	Kleanthidis *et al*., 1999.
Isacova, Danube Delta	0.02400	2.980	unsexed	–	TL	–	Romania	Staras and Cernisencu, 1992
Azov Sea, brackish	0.02500	3.000	unsexed	–	SL	–		von Bertalanffy, 1951
Lake Balaton, 1995	0.02010	3.005	unsexed	–	SL	0.994	Hungary	Specziár. *et al*., 1997.
Ladoga Lake	0.02060	3.012	Mixed	7.0 - 53.0	SL	0.997	Russia	Morozova, 1956.
Lake Dabie (1974-1977)	0.02153	3.020	unsexed	–		–	Poland	Kompowski, 1982.
Puiu-Rosu, Danube Delta	0.01030	3.031	unsexed	–	TL	0.986	Romania	Staras and Cernisencu, 1992a.
Volga river estuary	0.01820	3.061	Mixed	8.0 - 45.0	SL	0.999	Russia	Tyurin, 1927.
Uzlina, Danube Delta	0.01800	3.070	unsexed	–	TL	–	Romania	Staras and Cernisencu 1992.
Gorgova, Danube Delta	0.00700	3.110	unsexed	–	TL	–	Romania	Staras and Cernisencu, 1992
Sinoe, Danube Delta	0.00800	3.130	unsexed	–	TL	–	Romania	Staras and Cernisencu, 1992.
River Regalica (1974-1977)	0.01373	3.145	unsexed	–	TL	–	Poland	Kompowski, 1982
Flanders (Yser, Scheldt and Meuse drainage basin), 1992-2009	0.00640	3.175	unsexed	3.4 - 59.0	TL	0.990	Belgium	Verreycken *et al*., 2011.
Lake Volvi, 1990	0.00820	3.180	male	11.7 - 32.0	FL	–	Greece	Kleanthidis *et al*., 1999.
Fortuna, Danube Delta	0.00500	3.190	unsexed		TL	–	Romania	Kleanthidis *et al*., 1999.
Ergis River (47°00'00"-49°10'45"N; 85°31'57"-90°31'15"E), 2008	0.01100	3.207	unsexed	7.0 - 38.0	TL	0.990	China	Huo *et al*., 2011
Lake Volvi, 1990	0.00750	3.210	female	11.9 - 36.3	FL	–	Greece	Kleanthidis *et al*., 1999.
Razim, Danube Delta	0.00653	3.211	unsexed	–	TL	–	Romania	Staras and Cernisencu, 1992a.
Trei Lezere, Danube Delta	0.00500	3.240	unsexed	–	TL	–	Romania	Staras and Cernisencu, 1992.
Terkos Dam, Marmara, 2000-2002	0.00450	3.250	unsexed	20.9 - 39.7	TL	0.993	Turkey	Tarkan *et al*., 2006.
Baclanesti, Danube Delta	0.00400	3.330	unsexed	–	TL	–	Romania	Staras and Cernisencu, 1992.
Matita-Merhei, Danube Delta	0.00300	3.380	unsexed	–	TL	–	Romania	Staras and Cernisencu, 1992.

Terkos Dam, Marmara (Tarkan *et al*., 2006), Flanders (Verreycken *et al*., 2011), Ergis River, China (Huo *et al*., 2011), water bodies in Danube Delta (Staras and Cernisencu, 1992, 1992a) and even fork length (*FL*) was reported for Lake Volvi (Kleanthidis *et al*., 1999). For this reason, we have to mention that length-length estimation is available in online services of Fishbase. For *A.brama* regression is TL= 1.296×SL (www.fishbase.org).

Growth in fish stocks is isometric when *b* value is 3.0. However, the growth depends on species, sex, age, seasons and feeding (Le Cren, 1951; Bagenal and Tesch, 1978) and may be lower or higher than 3 indicating negative and positive allometric growth, respectively. When the growth was evaluated in terms of length, it was found that the growth of males and females and for all specimens of *A. brama* in our investigations was positive allometric (*A*+ (*b*>3, P<0.05) on pooled data as well as in separate years of investigation. To compare our data with available (Table 6), we should note that many authors reported positive allometric growth as well. For example, there are 13 locations where the *b*-value for the populations are *b*>3 ranged 3.11–3.38, 10 locations where b=3 (2.96–3.07) and two – where b<3 (2.884; 2.887) respectively. Our findings accorded with the result obtained for Danube delta that could be explained by the same life conditions in these lacustrine freshwater ecosystems.

Condition factors of population may depend on not only its age and gender composition, but also environmental elements and season as well (Pravdin, 1966). Different authors use diverse condition factors. The main point is that *K* and K_n of *A.brama* have very different values therefore our main idea was to present information that will make possible to compare our data with other available. Fulton's condition factor (*K*) values for all specimens of *A. brama* ranged between 1.17 and 3.45 with an average of 2.21±0.15. Although the values for males and females varied insignificantly in different years with means of 2.12±0.13 and 2.29±0.16 respectively, but *K* was significantly (P<0.01) smaller for males in all years. Minimum *K* value was observed for male whereas maximum *K* value was noted for female specimen. Besides this, calculations of relative condition factor (K_n) looked slightly the same as *K*. Average for all specimens of *A. brama* was 1.01±0.07, the highest value (1.05±0.07) was noted for the females and the lowest (0.98±0.06) for the males. Although *K* and K_n calculated for *A. brama* were higher than in the references, feeding activities, sexes, environmental factors and seasonal differences might be effective for this occurrence.

In investigated area, this species has high commercial value, protected status by fishing rules and high pressure on population caused by fishing, human activities and habitat destruction. Findings of present research are very important for stock estimation and evaluation studies in future. Moreover, they will give an opportunity to comparison current bream population over time and between regions.

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