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SIZE-AT-AGE VARIABILITY AND SEXUAL DIMORPHISM OF MORPHOMETRIC CHARACTERISTICS IN THE LATE ONTOGENESIS OF THE MARSH FROG, *PELOPHYLAX RIDIBUNDUS* (ANURA, RANIDAE), FROM TERRYTORY OF CRIMEA

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Size-at-Age Variability and Sexual Dimorphism of Morphometric Characteristics in the Late Ontogenesis of the Marsh Frog, *Pelophylax ridibundus* (Anura, Ranidae), from Territory of Crimea. Peskov, V. N., Petrenko, N. A., Reminnyi, V. Yu. — We study size-at-age and sexual variability of morphometric characteristics of the marsh frog. According to the size of the body, males were divided into three size-age groups (juvenis, subadultus, adultus), females — into four groups (juvenis, subadultus, adultus, adultus-I). We found that the chronological age of frogs (skeletochronology) does not always correspond to their biological age (size and proportions of the body). We noted that the semi-adult males are reliably larger than females by mean values of 26 studied morphometric characters. Males and females of "adultus" group do not differ by linear body size, significant differences were found in body proportions (7 characters). For the females of "adultus-I" group, the mean values of 26 characters are significantly larger than for "adultus" males. The results of our study showed that with the age of the marsh frog, the level of exhibition, directionality and structure of morphometric sex differences changes.
Key words: marsh frog, morphometric characteristics, age, size, variability, sex differences.

Introduction

Marsh frog, *Pelophylax ridibundus* Pallas, 1771, is the largest species of green frogs of the genus *Pelophylax* in the batrachofauna of Ukraine (Pisanets, 2007), which is distributed throughout its entire territory being extremely polymorphic. The studies on different aspects of variability of marsh frogs are the subject of many research papers, which are partly summarized in monographic publications devoted to Ukrainian herpeto- and batrachofauna (Taraschuk, 1959; Scherbak, 1966; Scherbak, Scherban, 1980; Pisanets, 2007). At the same time, size-at-age and sexual variability of *P. ridibundus* has been poorly studied yet. In this work, we follow the traditional view on the taxonomy of *P. ridibundus* from the Crimea (sensu Pysanets, Kukushkin, 2015). However, according to the results of mitochondrial and nuclear DNA analyses, several cryptic forms of the marsh frog (*Pelophylax ridibundus* complex) occur in the territory of the Crimea (Kukushkin et al., 2018).

Males and females of the marsh frog differ both by secondary sexual characters (sexual dimorphism) and by mean values of many morphometric characters (sex differences). Secondary sexual characters have a discrete distribution, they are present in males (vocal sacs, amplexusory pads, etc.) and are absent in females, that is, their presence or absence in the phenotype mark two sexual morphs (dimorphism). Morphometric characters have a continuous distribution; therefore, such sex differences may be described by a level of exhibition, directionality and structure (Peskov et al., 2017).

Directionality of sex differences of frogs means that females are bigger than males in most species of the Ranidae family: in contrast only for several species, males are bigger than females (Shine, 1979). For five species of frogs in the Ukrainian fauna, mean body length of females is reliably larger than body length of males. Only males of moor frog are bigger than females (Peskov, Petrenko, 2014). Sex differences in size of moor frogs

are formed during ontogenesis due to the difference in growth dynamics and physiological maturation of different sexes, the time of their involvement in the reproductive process and death rates in the terrestrial phase of the life cycle (Lyapkov et al., 2007).

Females are bigger than males in most populations of *P. ridibundus* (Alexandrovskaya 1981; Peskov, Kotserzhinska, 2004; Mikitinets, Suryadna, 2007), at the same time, according to Nekrasova and Morozov-Leonov (2001), on the contrary, in the Prydniprovya populations, males are bigger than females (males 84.2 ± 1.37; females 79.9 ± 0.80).

The exhibition of sex differences means a certain degree of their realization in different species of frogs (Peskov, Petrenko, 2014), in different populations of the same species (Lyapkov et al., 2009), depending on age (Peskov, Kotserzhinska, 2004) and the influence of other biotic and abiotic factors. It is an extremely changeable characteristic.

The structure of sex differences is a ratio of various characters of sex differences by the level of exhibition and directionality. It may vary in both ontogenetic and geographical aspects.

Based on the foregoing, the aim of our work was to study ontogenetic and sexual variability of morphometric characteristics by the level of exhibition, directionality and structure of differences during the late ontogenesis of the marsh frog.

Material and methods

We use the data of studying the collection of marsh frogs from the territory of Crimea, which is stored in the Department of Zoology of the National Science and History Museum of the National Academy of Sciences of Ukraine (Kyiv). In total, 213 pecimens of *P. ridibundus* were morphologically studied (118 males, 95 females).

The measurements were carried out with an accuracy of 0.1 mm according to the standard methods (Bannikov et al., 1977) with some changes (Peskov et al., 2004, 2009) (fig.1): L. — body length; L. c. — head length, Lt. c. tym. — head width at tympanum level; D. r. n. — a distance from the nostrils to the end of the snout; Sp. n. — a distance between the nostrils; D. r. o. — a distance from the anterior margin of the eye to the end of the snout; D. n. o. — a distance from the nostril to the anterior margin of the eye; L. o. — eye slit length; L. tym. — tympanum length; Sp. oc. — a distance between the anterior margins of the eyes; A. — forearm length; H. — upper arm length; M. — front foot length(the distance from the wrist to the end of the third digit); D. p. m. — a length of the first digit of the forelimb; Lt. m. — wrist width; F. — thigh length; T. — shank length; L. t — tarsus length; L. p. — hind foot (pes) length; Lt. p. — hind foot

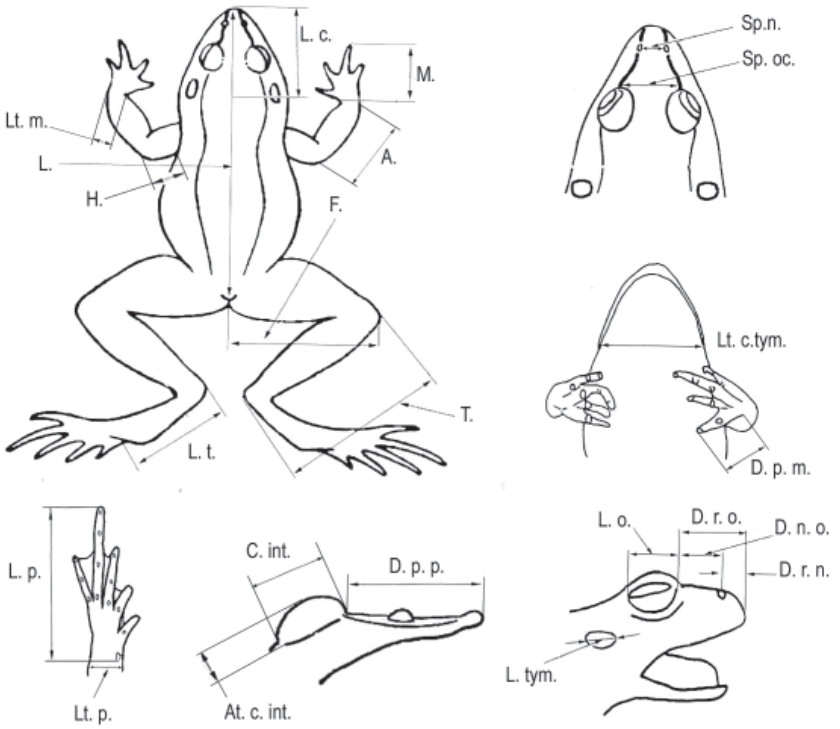

Fig. 1. Measurement system for tailess amphibians according to the standard methods.

width; D. p. p. — a length of the first toe of the hind limb; C. int. — a length of interior tuberculum calcanei; At. c. int. — a width of interior tuberculum calcanei; Cr. a. c. — diameter of the elbow joint; Cr. a. g. — diameter of the knee joint; Cr. f. t-t. — diameter of the ankle joint.

For each character, the main statistical parameters of the variation series (min, max, M, m, σ) were calculated in all size, age and sex groups. We compared mean values of the characters between the groups using Student's t-test (Lakin, 1990).

Differentiation of individuals according to the absolute values of morphometric characters was studied using hierarchical cluster analysis. Generalized differences between individuals were calculated using the Euclidean quadratic distance (SqDE). Generalized differences between individuals of different age and gender were evaluated using the Mahalanobis quadratic distance — SqMD (Squared Mahalanobis Distances).

Age of frogs was evaluated using the skeletochronology method (Kleinenberg, Smirina, 1969; Smirina, 1989). In order to clarify the number of lines of arrested growth (LAGs) that corresponds to the number of hibernation periods, by the freezing microtome we made thin cross sections (30 μm) from the middle part of the diaphysis of the fifth phalange of the fourth toe of the hind limb. Frogs, which wintered once, were considered one-year-olds (1+); two wintering — two-year-olds (2+), etc. If the animal did not winter at all, we treated them as under yearlings (0+) (Kleinenberg, Smirina, 1969; Smirina, 1989; Reminnyi, 2007). The LAGs were counted

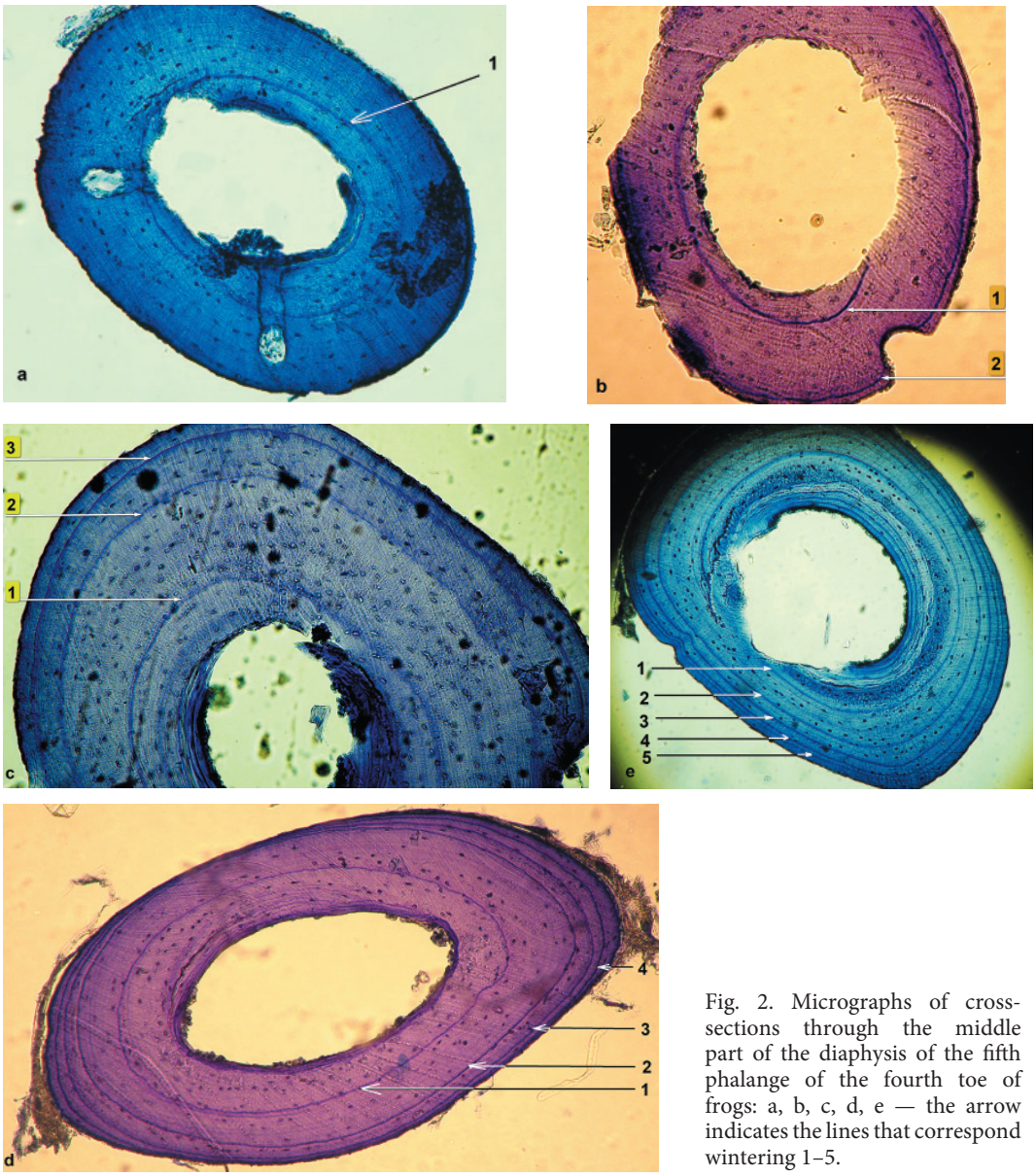

Fig. 2. Micrographs of cross-sections through the middle part of the diaphysis of the fifth phalange of the fourth toe of frogs: a, b, c, d, e — the arrow indicates the lines that correspond wintering 1–5.

using a Carl Zeiss Primo Star microscope (Germany) with magnifications of x100 and x400. The results of using the skeletochronology method are presented in fig. 2.

For statistical data processing, we used Statistica 6.0 (Khalafyan, 2007) for Windows and Excel.

Results and discussion

Differentiation of individuals by the body measurements

Years of studying tailless amphibians convinces us that classification of individuals by the absolute values of morphometric characters using multidimensional statistics (hierarchical cluster analysis) allows to select at least three size and age groups of morphologically homogeneous individuals (primarily by body sizes): juvenile (juvenis), semi-adult (sub-

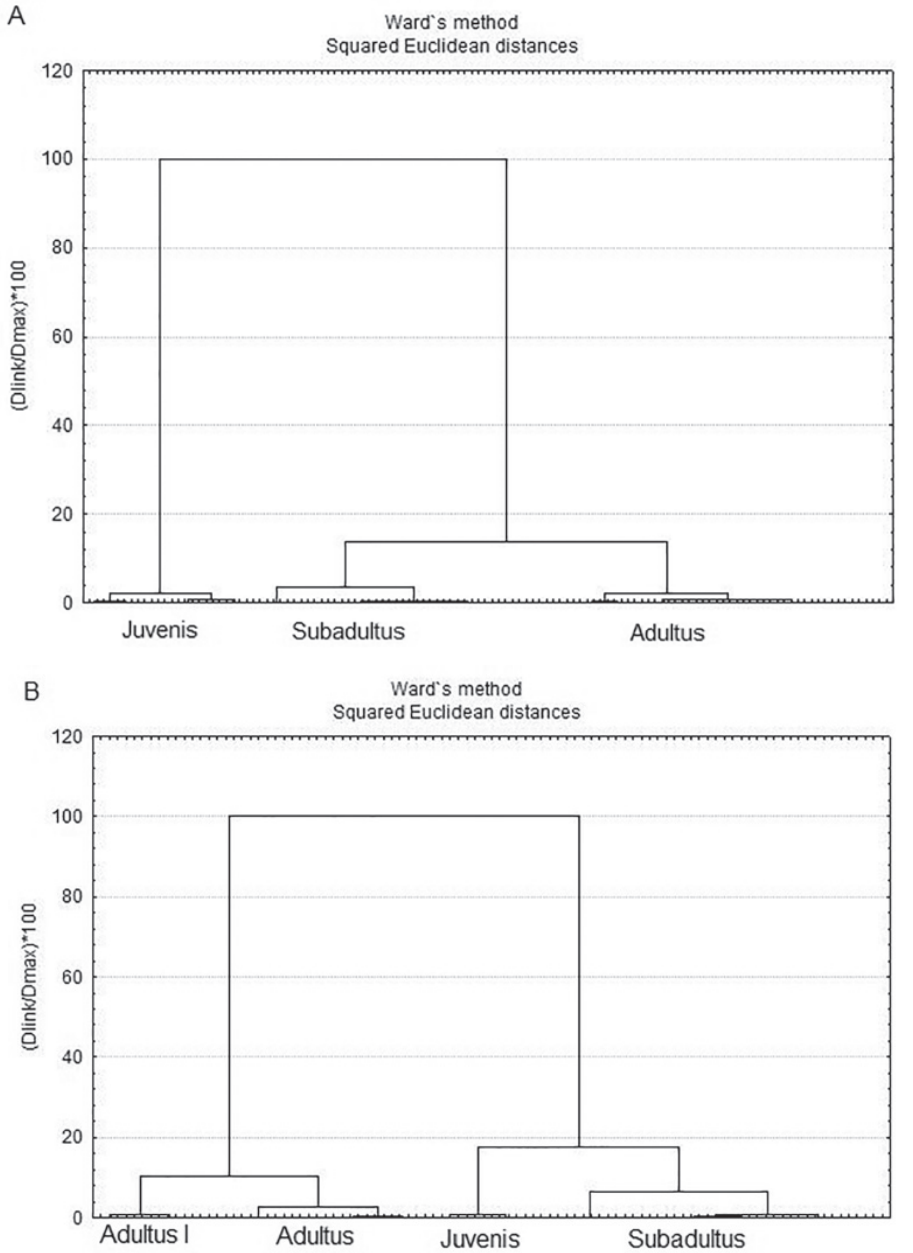

Fig. 3. The differentiation of males (A) and females (B) of the marsh frog according to the absolute values of the body measurements.

Table 1. Statistical characteristics (min–max. M. SD) of 26 morphometric characters in size and age groups of males of the marsh frog

Character, mm	Juvenis n = 23				Subadultus n = 46				Adultus n = 49			
	min	max	M	SD	min	max	M	SD	min	max	M	SD
L.	21.1	47.0	33.93	6.63	53.9	74.4	67.00	5.64	73.20	96.1	80.8	4.98
L. c.	7.4	15.9	11.48	2.05	18.1	25.1	21.73	1.84	22.10	30.7	25.6	1.76
Ltc. tym	7.6	17.3	12.27	2.47	19.7	27.5	24.03	2.06	25.80	35.5	29.3	1.84
D. r. n.	2.1	4.4	3.47	0.57	4.9	7.5	6.06	0.61	6.10	9.2	7.4	0.61
S. p. n.	1.9	3.5	2.62	0.39	3.4	5.2	4.15	0.42	4.00	5.6	4.7	0.40
D. r. o.	3.7	7.8	5.85	0.99	8.3	12.5	10.65	1.02	11.30	15.3	12.8	0.84
D. n. o.	1.8	3.7	2.83	0.47	4.0	6.2	4.98	0.47	5.10	7.1	5.9	0.47
L. o.	2.5	5.4	4.36	0.80	6.2	9.2	7.54	0.68	7.40	10.4	8.9	0.66
L. tym.	1.7	4.0	2.90	0.63	3.3	6.0	5.05	0.57	5.10	7.0	6.0	0.42
Sp. o. c.	3.8	7.1	5.76	0.78	8.0	11.4	9.26	0.86	9.00	12.7	10.8	0.78
A.	4.5	10.9	7.35	1.64	12.3	18.4	16.10	1.70	18.20	23.9	19.6	1.16
H.	3.9	9.7	6.58	1.60	10.6	18.2	14.27	1.75	13.00	23.7	17.6	1.87
M.	5.1	12.6	9.07	1.95	15.0	20.9	18.28	1.59	19.20	25.5	21.7	1.23
Lt. m.	2.0	4.3	3.03	0.61	4.5	8.6	6.07	0.85	5.60	9.4	7.5	0.74
D. p. m.	2.4	8.9	6.14	1.57	10.4	15.7	13.40	1.36	13.60	19.5	16.0	1.17
F.	9.6	22.3	15.70	3.49	27.6	39.3	33.46	3.02	35.30	47.7	40.2	2.60
T.	9.4	23.5	16.59	3.66	29.3	40.7	35.11	2.91	36.50	49.3	41.2	2.54
L. t.	5.4	14.0	9.49	2.16	12.1	23.1	19.98	2.03	21.00	28.5	23.6	1.36
L. p.	10.0	27.8	18.38	4.26	30.9	43.2	37.75	3.36	39.40	52.7	44.9	2.76
Lt. p.	2.2	4.7	3.23	0.68	5.4	7.9	6.63	0.61	6.80	9.3	8.0	0.63
D. p. p.	2.4	6.8	4.43	1.12	7.6	11.3	9.62	0.96	9.60	14.5	11.9	1.03
C. int.	1.1	3.0	1.77	0.42	2.4	4.6	3.68	0.52	3.30	5.6	4.3	0.45
At. c. int.	0.5	1.0	0.76	0.12	1.2	2.0	1.53	0.19	1.50	2.5	1.9	0.23
Cr. a. c.	1.3	3.4	2.15	0.53	3.5	5.7	4.60	0.55	4.80	6.8	5.7	0.45
Cr. a. g	1.8	4.4	2.87	0.63	4.7	7.3	6.00	0.54	6.20	8.4	7.1	0.46
Cr. f. t-t	1.5	4.2	2.81	0.60	4.9	6.9	5.85	0.45	5.90	8.5	6.8	0.51

adultus) and adults (adultus). In the studied Crimean marsh frog geographic population, adult females differentiated into two groups (fig. 3, b), which we named as adultus (L = 68.1–91.4 mm) and adultus-I (L = 92–110.5 mm).

According to the results of cluster analysis, the individuals with a body length of 21.1–47.0 mm form a group of the smallest males. Their age varies from 0+ (11 specimens of under yearling frogs, which had metamorphosed, but did not hibernate (collected in autumn) L = 21.1–35.5 mm) to 1+ (12 specimens of immature males, which wintered 1 times (collected in June) L = 30.7–47.0 mm. We regard them as juveniles (juvenis). We attributed a group of males with body length from 53.9 mm to 74.4 mm to semi mature males (subadultus) with an insignificant admixture of slow-growing mature animals (according to the terminology of Shabanov et al., 2014) (table 1).

According to skeletochronological data, 87 % of the studied individuals were 2+, that is, they wintered twice. The growth after the second wintering was mainly insignificant due to a general slowdown in growth rates after the puberty (Smirina, 1989), which occurs at the age of 2–3 years. 11 % of the individuals (5 specimens) were relatively small three-year-old individuals (L = 72.2–74.0 mm). Also in this group there was a male at the age of 1+ (L = 70.5 mm), which can be considered as fast growing.

The group of males with the longest body length (73.2–96.0 mm) consists of three-, four- and five-year-old individuals, and several specimens of two-year-old (2+) individuals with a body length from 53.9 to 92.7 mm. In our opinion, they are fast growing individu-

Table 2. Statistical characteristics (min–max, M. SD) of 26 morphometric characters in size-age groups of females of the marsh frog

Character	Juvenis n = 13				Subadultus n = 41				Adultus I n = 29				Adultus II n = 12			
	min	max	M	SD	min	max	M	SD	min	max	M	SD	min	max	M	SD
L.	20.7	37.1	32.47	5.00	40.5	66.7	54.79	7.37	68.1	91.4	79.03	6.46	92.0	110.5	99.68	5.21
L. c.	8.0	12.9	11.13	1.54	13.9	23.8	18.33	2.32	20.8	28.9	24.61	2.37	26.2	33.6	29.85	2.39
Ltc. tym	8.0	13.8	11.88	1.79	14.7	25.1	19.73	2.94	24.7	33.5	28.63	2.27	31.4	38.4	35.02	2.28
D. r. n.	2.4	4.0	3.46	0.47	4.0	6.6	5.16	0.73	5.9	9.1	7.52	0.78	8.3	10.3	9.37	0.75
S. p. n.	2.0	3.1	2.65	0.28	2.9	4.3	3.59	0.38	4.2	5.7	4.73	0.43	4.7	6.5	5.83	0.57
D. r. o.	3.4	6.7	5.55	0.86	7.1	11.2	8.82	1.11	11.0	14.5	12.72	1.06	14.0	17.7	15.79	1.12
D. n. o.	2.0	3.2	2.81	0.34	3.2	5.5	4.25	0.60	5.3	6.8	5.76	0.39	6.2	8.5	7.11	0.67
L. o.	3.3	5.1	4.42	0.55	5.2	8.2	6.41	0.86	7.5	10.2	8.65	0.70	8.6	11.1	9.79	0.71
L. tym.	1.9	3.0	2.70	0.34	3.3	5.2	4.18	0.57	4.9	6.99	5.90	0.54	5.7	7.7	6.80	0.50
Sp. o. c.	4.3	6.3	5.50	0.58	6.6	9.9	7.95	0.84	9.0	12.7	10.50	0.93	11.9	14.5	13.25	0.87
A.	4.1	8.1	6.76	1.13	8.6	16.1	12.22	1.83	14.6	21.5	18.34	1.66	20.9	25.2	23.18	1.15
H.	3.8	7.9	6.32	1.10	7.7	14.4	10.94	1.71	12.6	19.3	15.80	1.63	17.0	22.2	19.66	1.74
M.	5.6	10.1	8.65	1.29	11.4	19.7	14.90	2.07	18.5	24.1	21.53	1.71	23.5	27.0	25.68	1.07
Lt. m.	1.4	3.9	2.71	0.65	2.8	6.4	4.58	0.78	5.6	8.7	6.88	0.72	7.7	9.4	8.53	0.57
D. p. m.	3.6	7.1	5.98	0.95	8.1	13.7	10.86	1.62	13.6	17.8	15.61	1.22	17.7	21.2	19.09	0.99
F.	9.6	17.6	15.35	2.38	19.7	33.9	26.52	3.94	33.5	46.7	39.37	3.59	42.2	50.8	47.76	3.01
T.	9.3	18.7	15.95	2.68	21.4	36.0	28.34	4.16	36.7	45.41	40.69	2.77	46.6	53.0	49.88	2.20
L. t.	5.5	10.5	9.09	1.41	4.6	20.4	15.86	2.96	20.7	26.9	23.38	1.60	26.2	30.4	28.60	1.18
L. p.	10.6	20.6	17.73	2.94	23.3	38.4	30.85	4.47	39.5	51.6	44.67	3.37	50.0	57.3	53.81	2.33
Lt. p.	2.0	3.8	3.07	0.54	4.0	6.9	5.33	0.84	6.8	8.7	7.74	0.63	9.0	10.3	9.54	0.46
D. p. p.	2.2	5.4	4.18	0.85	5.8	9.9	7.81	1.27	9.9	13.5	11.81	0.96	12.4	15.4	13.73	1.12
C. int.	1.2	2.2	1.72	0.27	1.9	4.0	2.88	0.47	3.2	4.9	4.10	0.39	4.6	7.0	5.48	0.68
At. c. int.	0.6	1.1	0.78	0.14	0.8	1.6	1.22	0.22	1.2	2.2	1.72	0.23	1.6	2.5	2.10	0.23
Cr. a. c.	1.1	2.4	2.03	0.32	2.7	4.6	3.46	0.51	4.5	5.8	5.08	0.40	5.7	7.2	6.48	0.56
Cr. a. g	2.0	3.2	2.72	0.37	3.6	6.5	4.88	0.78	6.0	7.9	6.89	0.47	7.4	10.1	8.64	0.90
Cr. f. t-t	1.5	3.1	2.55	0.45	3.3	6.2	4.74	0.79	6.0	7.4	6.76	0.42	7.7	9.5	8.39	0.54

Table 3. The results of determining the age of the marsh frog by skeletochronology

Frog age	1+	2+	3+	4+	5+
Our data	♂ 43.7–70.5 ♀ 49.0–64.5	♂ 53.9–92.7 ♀ 51.8–75.7	♂ 69.0–81.6 ♀ 88.4–104.6	♂ 87.1; 88.8 ♀ 100.9–110.5	♂ 76.8; 78.3 ♀ 87.4
Aleksandrovskaya, Kotova, 1986	–	♂ 64.0–67.0 ♀ 56.2–81.2	♂ 71.4–94.9 –	♂ 78.5–94.9 ♀ 88.3–105.4	♂ 84.5–95.5 ♀ 83.2–106.1
Savchuk, 2009	–	–	♂ 66.9–77.9 ♀ 66.0–98.7	♂ 91.4–108.8 ♀ 73.0–116.7	♂ 80.0–112.5 ♀ 81.0–120.5
Reminnyi, 2007	–	–	♂ 69.0–86.0 –	♂ 72.0–81.0 ♀ 71.0–86.0	♂ 74.0–83.0 ♀ 78.0–92.0
Yilmaz et al., 2005	–	♂45.0–58.0 ♀ 53.0	♂ 38.0–70.0 ♀ 78.0–80.0	♂ 52.0–81.0 ♀ 53.0–100	♂ 69.0–78.0 –

als with early puberty; therefore, we regard males of this group as adult mature individuals (adultus).

The smallest females formed the size and age group of young individuals (juvenis) with a body length of 20.7 to 37.1 mm (table 2). According to skeletochronology, one-year-old (1+) females have a longer body length (49.0–64.5 mm) than the above range, so we can assume that the group of juvenile females included under yearling frogs (0+), which had not wintered (table 3).

Females with a body length L = 40.5–66.7 mm hibernated once (60 %) and twice (40 %) (table 3). Females of the marsh frog become mature after the third and fourth wintering (Aleksandrovskaya, Kotova, 1986; Reminnyi, 2007), so we regard this size and age group as semi-adult, immature individuals (subadultus).

Big females have a body length of 68.1 to 110.5 mm. This group includes frogs whose age varies from 2+ to 5+. Among adult females (adultus), we select a subgroup of the biggest individuals that were named adultus-I. Several individuals with a body length from 75.1 to 75.7 mm were 2+ (fast growing). Three-year-old females have a body size from 88.4 mm to 104.6 mm. Females at the age of 4+ (L = 100–110 mm) have the greatest body length, while the five-year-old individual has a shorter body length — 87.4 mm (slow growing). Similar data were obtained in Turkey (Yilmaz et al., 2005).

Among the males and females, the slow growing individuals are the oldest (5+), whose body length fits into the size range of three-year-old individuals. At the same time, four-year-old individuals of males and females are significantly larger than five-year-olds ($t_{♂}$ = 9.17, with $p = 0.01$ and $t_{♀} = 3.17$, with $p = 0.09$).

Sex differences. When comparing males and females of the same age group, we obtained the following results, shown in table 4.

Thus, in the size and age of "juvenis" group , by the average values of 26 morphometric signs, there were no sex differences detected, and the generalized morphological differences between males and females of this group were also insignificant (SqMD = 2.33). At the same time, the males of the "subadultus" group have significantly ($p < 0.001$) larger mean values of all characters compared with females of the same group (table 3). Generalized sex differences in this group are significantly larger than in the "juvenis" group (SqMD = 9.18), because of faster growth and puberty gaining of males in the first two years of their terrestrial life (Lyapkov et al., 2007).

In the size-age "adultus" group , the structure of sex differences has changed, and males have significantly larger mean values for only 7 morphometric characters (L. c, A., H., Lt. m., C. int., At. c. int., Cr. a. c) (SqMD = 10.22), and for 19 characters there was no significant differences. The maximum differences were noted for the following characters: A., H., Lt. m., Cr. a. c ($p < 0.001$). Such ranking of the differences is reasoned by female growth acceleration after the puberty, that makes females gradually reach males in body size. Contrary, males slow growth after they start breeding. (Avramova et al., 1976; Aleksandrovskaya, Kotova, 1986). This fact is confirmed by the comparing of the size and age groups of

Table 4. Comparison results of males and females of marsh frog of different ages by mean values of 26 morphometric characters (Student's t-test)

Character	Juvenis	Subadultus	♂ Adultus ♀ Adultus	♂ Adultus ♀ Adultus I
	M (33.93 ± 1.38; n = 23). F (32.47 ± 1.39; n = 13)	M (67.0 ± 0.83; n = 43). F (54.79 ± 1.15; n = 41)	M (81.57 ± 0.71; n = 49). F (79.03 ± 1.20; n = 29)	M (80.83 ± 0.71; n = 43). F (99.68 ± 1.50; n = 12)
L.	0.69	8.73***	1.39	11.65***
L. c.	0.53	7.61***	2.14*	6.94***
Ltc. tym	0.49	7.97***	1.53	9.12***
D. r. n.	0.07	6.24***	0.87	9.65***
S. p. n.	0.23	6.54***	0.29	8.02***
D. r. o.	0.93	8.00***	0.24	10.45***
D. n. o.	0.18	6.42***	1.75	7.04***
L. o.	0.24	6.81***	1.82	3.98***
L. tym.	1.08	7.12***	1.21	5.47***
Sp. o. c.	1.04	7.16***	1.73	9.36***
A.	1.14	10.24***	4.00***	9.53***
H.	0.52	8.97***	4.32***	3.45**
M.	0.69	8.58***	0.49	10.33***
Lt. m.	1.49	8.46***	3.50***	4.59***
D. p. m.	0.35	7.94***	1.37	8.42***
F.	0.33	9.29***	1.11	8.80***
T.	0.56	8.87***	0.85	10.86***
L. t.	0.59	7.66***	0.74	11.61***
L. p.	0.49	8.20***	0.31	10.33***
Lt. p.	0.76	8.31***	1.44	8.22***
D. p. p.	0.70	7.54***	0.36	5.40***
C. int.	0.42	7.46***	2.41*	7.01***
At. c. int.	0.36	7.19***	2.39*	3.42**
Cr. a. c.	0.75	9.94***	6.14***	5.06***
Cr. a. g	0.78	7.93***	1.60	8.58***
Cr. f. t-t	1.36	8.18***	0.06	9.88***

Note. *at $p < 0.05$; **at $p < 0.01$; ***at $p < 0.001$.

"adultus" and "adultus-I". The females have larger mean values for all 26 morphometric characters that coincide with the literature data for common frogs (Lyapkov et al., 2007).

Conclusions

1. In the population of *Pelophylax ridibundus* from Crimea, males and females by the general body measurements may be divided into three size-at-age groups: "juvenis", "subadultus" and "adultus". Among adult females we select a group of the largest individuals with body length 92–110.5 mm which we named "adultus-I".

2. A significant variability in the body size of individuals of the same age, and vice versa, the diversity of age in frogs similar in body size were recorded for Crimean geographic population of marsh frog. In our opinion, this is reasoned by two different ontogenetic strategies of the frogs, the fast and slow growth.

3. The maximum exhibition of sex differences in the marsh frog was found on subadultus stage. Semi-adult males are significantly larger than females by the 26 studied

characters, due to their faster growth in the first two years after metamorphosis. In the "adultus" group, differences were found in the proportions of the body (7 characters), the females of the size-age group "adultus-I" were significantly larger than the adult (adultus) males by all the characters.

4. Our results confirm the literature data that with age, in the marsh frog not only the performance of sex differences in morphometric characteristics changes, but also their directionality and structure differ.

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