SOME MORPHOLOGICAL CHARACTERS OF *TRITURUS ALPESTRIS* (LAURENTI, 1768) AT HIGH ALTITUDE (MT. POHORJE, SLOVENIA) (CAUDATA: SALAMANDRIDAE)

NUŠA VOGRIN

Vransko 121, SI-3305 Vransko, Slovenia

INTRODUCTION

Triturus alpestris (Laurenti, 1768) is widespread (e.g. Arnold & Burton 1980, Nöllert & Nöllert 1992) and well known in Europe and has been studied by many herpetologists especially in Central and in northern Europe, e.g. Glandt (1978), Glandt (1985), Joly & Miaud (1989), Miaud (1991), Gutleb (1991a), Gutleb (1992), Joly & Miaud (1993), Kletečki (1995), Faber (1996).

Sexual dimorphism in size of most species of newts is not great (e.g. Duellman & Trueb 1994). Customarily females are slightly greater than males, but the sexes are about the same size in many species. However in *Triturus alpestris* females appear to be evidently larger than males (e.g. Arnold & Burton 1980, Nöllert & Nöllert 1992).

The aims of this article are to present some morphometric characters and to test sexual size differences of the *T. alpestris* population from Mt. Pohorje. The results are compared with those found in the literature.

STUDY AREA AND METHODS

The research was conducted near the skiing centre of Areh on Mt. Pohorje in northeastern Slovenia (46°30'N 15°29'E). The study pond is located at 1160 m above sea level in the prealpine phytogeographical zone (Marinček 1987). It is 67 m long, 0.1 ha in size and is surrounded by boreal forest. The water level fluctuates, up to 50 cm, with the pond completely drying up in some summers. The bottom of the pond is covered with a mud layer of up to 40 cm. The vegetation includes as dominant species *Equisetum sp.* and *Potamogeton sp.*

The research was carried out in June and July 1995 and June to August 1996 during the newts' breeding season. The specimens were caught by dip-netting. 94 males and 38 females were measured. No specimen was killed or injured during the study.

To characterise the specimens' morphometry six variables have been considered: total length (tip of snout to tip of tail – L, snout-vent length (tip of snout to posterior margin of cloacal lips) – Lsv, tail length (posterior margin of cloacal lips to tip of tail) – Lcd, length of head (mouth length) – Lc (measured from the snout to the corner of the mouth), head width (largest width) – Ltc and distance between fore- and hind-limbs – D. All characters were recorded to the nearest 0.1 mm using dial calipers, except total length which was measured to the nearest millimeter. Abbreviations of characters are from Kalezić et al. (1990). All measurements were made by the author to avoid inter observer variability on the live specimens.

ANOVA test was used for statistic comparison (Sokal & Rohlof 1995). Pearson correlation coefficient was used to discover the correlation between the samples.

RESULTS AND DISCUSSIONS

Morphometric characteristics of *T. alpestris* males and females are presented in Table 1.

The total body length of the *Triturus alpestris* males is less than the total length of the females; the difference is statistically significant ($F = 187.84$, $P > 0.02$). Statistically significant (ANOVA, $P < 0.05$) is also all other parameters which are present in table 1.

Correlations between all characters in *Triturus alpestris* males is significant (all: $P < 0.005$). However in *Triturus alpestris* females only the following pairs of correlations are significant: length of head – head width, distance between fore- and hind-limbs – tail, distance between fore- and hind-limbs – total length, tail – body length, tail – total length, and body length – total length (all: $P < 0.02$).

Results from this study suggest that *T. alpestris* is morphometrically sexual dimorphic, even though seasonal secondary sexual characters were excluded from the analysis. After Krebs & Davies (1993) differences in size between sexes is presumably advantageous in reducing intersexual competition for resources. According to this, characters such as head length (Lc) and head width (Ltc) would expectedly be sexually dimorphic in *Triturus sp.* In this study this holds true also for *T. alpestris*. The same pattern was also observed by Kalezić et al. (1992). However Kalezić et al. (1992) point out that the food resource competition was unlikely to be a main factor in explaining sexual size difference in newts. Schabetsberger & Jersabek (1995) discovered that both sexes in *Triturus alpestris* showed a similar pattern of temporal changes in food choice during their aquatic phase. However some significant differences exist. However, after Duellman & Trueb (1994), in general, larger body size in females has been thought to be related to egg-carrying capacity.

The *Triturus alpestris* female/male size relations (table 2) of six morphometric characters are in general similar to the results from Kalezić et al (1992). Not only ratio but also morphometric characters of *Triturus alpestris* from other areas, e.g. Austria (Gutleb 1991b) are similar to those on Pohorje.

If we compare ratio of the total length (quotient of mean values of females and males) it is obvious that variation within groups from different geographic distribution does not exist (table 3).

This suggests the *Triturus alpestris* is not responding to local variations in selective factors.

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Table 1.

Some morphometrical characters of *Triturus alpestris*. N – sample size, f – female, m – male

	Mean		SD		Min		Max		N	
	f	m	f	m	f	m	f	m	f	m
L	90.7	79.5	4.40	3.82	84.0	69.0	101.0	88.0	38	94
Lsv	51.4	45.7	2.9	2.10	46.0	39.1	56.0	51.0	38	79
Lcd	39.2	33.6	3.09	2.58	31.0	26.0	45.0	40.0	38	79
Ltc	9.0	8.6	0.61	0.54	7.5	6.9	10.0	9.6	23	79
Lc	8.6	8.2	0.64	0.66	7.6	6.7	10.1	9.6	23	79
D	25.7	23.5	3.03	2.62	19.1	16.4	31.8	30.3	38	94

Table 2.

The *Triturus alpestris* female/male size relations of 6 morphometric characters to population sample (quotients of mean values) from Mt. Pohorje. For character symbols see text.

L	Lsv	Lcd	Ltc	Lc	D
1.14	1.12	1.17	1.04	1.05	1.09

Table 3.

Ratio of the total length (quotient of mean values of females and males) in *Triturus alpestris* from different localities. Only data obtained from population samples of 10 and more specimens of each sex were included. * - data from Kalezić et al. (1992)

Location	Ratio	Source
Hungary	1.13-1.18	*Dely 1960
Romania	1.18	*Fuhn 1960
Germany	1.18	*Feldmann 1981
Greece	1.12-1.20	*Breuil & Parent 1987
Italy	1.09	*Giacoma et al. 1988
Austria	1.20	Gutleb 1991b
Yugoslavia	1.10-1.11	Kalezić et al. 1992
Slovenia - Mt. Menina	1.11	orig.
Slovenia - Mt. Velika Planina	1.16	orig.
Slovenia - Mt. Matajur	1.20	orig.
Slovenia - Mt. Pohorje	1.14	this study

REFERENCES

Arnold, E.N. & Burton, J.A. (1980): *A Field Guide to the Reptiles and Amphibians of Britain and Europe*. Collins. London.

Duellman, W.E. & Trueb, L. (1994): *Biology of Amphibians*. The Johns Hopkins University Press.

Faber, H. (1996): Siasonale Dynamik der Geschlechterrelation beim Bergmolch, *Triturus alpestris alpestris* (LAURENTI, 1768), im aquatischen Lebensraum. *Herpetozoa* **8** (3/4): 125-134. Wien.

Glandt, D. (1978): Notizen zur Populationökologie einhemischer Molche (Gattung *Triturus*) (Amphibia: Caudata: Salamandridae). *Salamandra* **14** (1): 9-28.

Glandt, D. (1985): Verhaltensreaktion und Reprodultion adulter Molche, Gattung Triturus (Amphibia, Urodela) nach Langstreckenverfrachtung. *Bonn. zool. Beitr.* **26** (172): 69-79. Bonn.

Gutleb, B. (1991a): Phalangenregeneration und eine neue Methode zur Individualerkennung bei Bergmolchen, *Triturus alpestris* (LAURENTI, 1768) (Caudata: Salamandridae). *Herpetozoa* **4** (3/4): 117-125. Wien.

Gutleb, B. (1991b). Populationsoekologische Untersuchungen am Bergmolch im Nationalpark Nockberge. *Kärnter Nationalpark-Schriften*. Band **6**. pp. 43.

Gutleb, B. (1992): Die Lebensweise des Bergmolches auf dem Firstmoor (1920 m) in Nationalpark Nockberge. Carinthia II 182 (102): 93-100. Klagenfurt.

Joly, P. & Miaud, C. (1989): Fidelity to the breeding site in the alpine newt *Triturus alpestris*. *Behavioural Processes* **19**: 47-56.

Joly, P. & Miaud, C. (1993): How does a newt find its pond? The role of chemical cues in migrating newts (*Triturus alpestris*). *Ethology Ecology & Evolution* **5**: 447-455.

Kalezić, M.L., Džukić, G., Stamenković, S. & Crnobrnja, J. (1990): Morphometrics of the Crested newt (*Triturus cristatus* complex) from Yugoslavia: relevance for taxonomy. *Arh. biol. nauka*: **42** (1-2): 17-37. Beograd.

Kalezić, M.L., Crnobrnja, J., Dorović, A. & Džukić, G. (1992): Sexual size difference in *Triturus* newts: geographical variation in Yugoslav populations. *Alytes* **10** (3): 63-80. ISSCA.

Kalezić, E. (1995): Population density, space arrangement and sex ratio for sympatric populations of the three species of newts in two puddles in Zumberak, Croatia, pp. 141-153. In: Llorente, G.A., Montori, A., Santos, X. & Carretero, M.A. (eds.): *Scientia Herpetologica*. Barcelona.

Krebs, J.R. & Davies, N.B. (1993): *An introduction to behavioural ecology*. Blackwell Scientific Publ., Oxford.

Marinček, L. (1987): Bukovi gozdovi na slovenskem. Delavska enotnost Ljubljana. pp 153.

Miaud, C. (1991): Essai de synthese sur les caracteristiques demographiques des tritons du genre *Triturus*. *Bull. Soc. Herp. Fr.* **59**: 1-18.

Nöllert, A. & Nöllert, C. (1992): *Die Amphibien Europas*. Bestimmung-Gefahrdung-Schutz. Franckh-Kosmos. Stuttgart.

Schabetsberger, R. & Jersabek, C.D. (1995): Alpine newts (*Triturus alpestris*) as top predators in a high-altitude karst lake: daily food consumption and impact on the copepod *Arctodiaptomus alpinus*. *Freshwater Biology* **33**: 47-61.

Sokal, R.R. & Rohlof, F.J. (1995): *Biometry. The principles and practice of statistics in biological research*, W.H. Freeman and Company. New York.