SALAMANDRA	44	3	153-161	Rheinbach, 20 August 2008	ISSN 0036-3375

Triturus cristatus (Laurenti, 1768): a new species for Bulgaria from its southernmost known localities

Nikolay Tzankov & Andrei Stoyanov

Abstract. Recently, *Triturus cristatus* has been discovered in northwest Bulgaria. The species' distribution is discussed with regard to the new findings. Species identity is proved by means of colouration, number of rib-bearing vertebrae, vomeral teeth arrangement and Wolterstorff Index data. Its conservation status is discussed.

Key words. Salamandridae, *Triturus cristatus*, southernmost localities, Bulgaria.

Introduction

Bucci-Innocenti et al. (1983) suggested that the former subspecies of *Triturus cristatus* (Laurenti, 1768) be treated as distinct taxonomic units at the species level. Species rank was supported by data obtained through morphological (Kalezić et al. 1990, Crnobrnja-Isailović et al. 1997, Arntzen & Wallis 1999), ethological and cytogenetic (Macgregor et al. 1990) and molecular (Wallis & Arntzen 1989, Zajc & Arntzen 1999) studies. All these related taxa, *Triturus cristatus* (Laurenti, 1768), *T. carnifex* (Laurenti, 1768), *T. dobrogicus* (Kiritzescu, 1903) and *T. karelinii* (Strauch, 1870) are found in the central northern part of the Balkan Peninsula where their ranges overlap (Wallis & Arntzen 1989, Kalezić et al. 1997). In addition, Arntzen et al. (2007) elevated *T. carnifex macedonicus* (Karaman, 1922) to the species level while the status of another Balkan taxon is questionable: *Triturus karelinii arntzeni* Litvinchuk, Borkin, Džukić & Kalezić, 1999 was described from the vicinity of the village Vrtovać (Fig. 1, locality 42), close to the Bulgarian-Serbian border (Litvinchuk et al. 1999). At the northeastern edge of its distribution in central and eastern Serbia, *karelinii*-specific mitochondrial DNA was found to occur in *T. dobrogicus, T. cristatus* and *T. macedonicus* (Wallis & Arntzen 1989, Arntzen & Wallis 1999, Arntzen et al. 2007) (Fig. 1).

So far, two *Triturus* related to the above mentioned group of taxa have been listed for Bulgaria only, *T. dobrogicus* and *T. karelinii* (Kowatscheff 1912, Buresch & Zonkow 1941, Beškov & Beron 1964, Beshkov & Nanev 2002). The distribution of the first mentioned is along the Danube River, while the second inhabits the remaining parts of the country. In Serbia and Macedonia, both *T. cristatus* and *T. carnifex* do occur in the close proximity of the western Bulgarian border. The localities of *T. cristatus* south from the Danube River are in eastern Serbia, Carpathian province (Jabukovac, Klokočevac, Bor, Negotin, Štubik, Manastirište and Zaječar; Wallis & Arntzen 1989, Kalezić et al. 1990, 1997, Arntzen 2003). They are in close proximity to the Bulgarian border area to the west of the Timok River (Figs. 1, 2). There is apparently no geographic barrier to the east. Similar climatic conditions and habitats make it likely that these species also occur in western Bulgaria.

In fact, we report here for the first time on *T. cristatus* from Bulgaria and expand its known geographic range by about 100 km to the south-east from the closest known records in Serbia and those in southernRomania (Cogălniceanu 1991, Lazăr et al. 2005). At the same our findings represent the

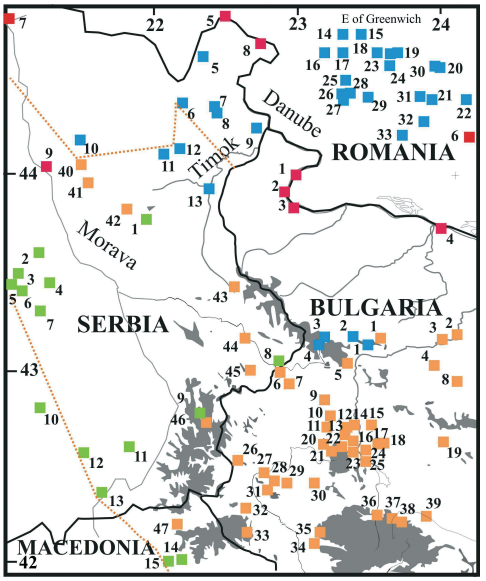

Fig. 1. *Triturus cristatus* superspecies localities in the northern-central part of the Balkan Peninsula. Numbers correspond to the locality names and description given in the Appendix. Square colours correspond to the species: *T. macedonicus* – green, *T. cristatus* – blue, *T. dobrogicus* – red, *T. karelinii* – orange. Black line – country border, dark gray areas are above 1200 m elevation, small dotted line – approximate distribution of the *T. karelinii* mtDNA haplotypes in Serbia and Macedonia (according to Wallis & Arntzen 1989, Arntzen & Wallis 1999).

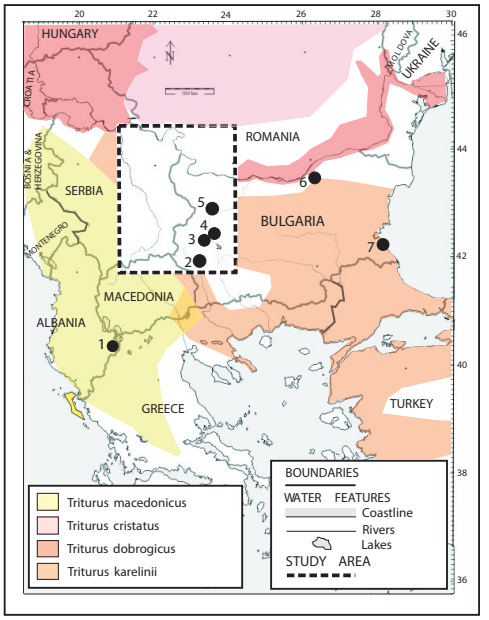

Fig. 2. Material studied for RBV-number. Distribution of the *Triturus cristatus* superspecies following Arntzen (2003) with some additions. Localities data, voucher information and sample size: *Triturus macedonicus*: 1. Albania, distr. Korcha, v. Progĕr, 03.10.94., coll. P. Beron (N = 1), *T. karelinii*. 2. Bulgaria, Rila Mt., above v. Smochevo, 1350 m, 21.06.05., coll. N. Tzankov & A. Stoyanov (N = 1). 3. Vitosha Mt., place Dendrariuma, 1300 m, coll. N. Tzankov (N = 2). 4. Sofia distr., v. Ravno Pole, 600 m (no voucher and data) (N = 1), *T. cristatus*. 5. Vrachanska Mt., 26.06.2005., 1375 m, coll. N. Tzankov & A. Stoyanov (N = 1), *T. karelinii*. 6. Ruse distr., v. Nisovo, 17.05.03., coll. I. Nikolov (N = 1). 7. Burgas distr., Primorsko, 06.05.05., coll. N. Tzankov (N = 1). Materials are housed in National Museum of Natural History, Sofia (NMNHS).

southernmost records for the species even compared to those from France (Brogard et al. 1996).

Triturus cristatus in Bulgaria

The species was discovered on 26 June 2005 on the ridge of Vrachanska Mountain (Fig. 1), which is part of the western Balkan Range, at an altitude of 1375 m a.s.l., UTM-GN07. The locality's coordinates are 43°8′21′′ N and 23°27′44′′ E, in close proximity to Parshevitsa Hut. Specimens were found in a man-made watering pool with approximate dimensions of 65 m by 40 m and a maximum depth of about 120 cm. Proximate to the locality, the highest part of the mountain is denuded of forest. About 200 m to the west and 1 km to the north there are beech (*Fagus sylavaticus*) forests. Banks are partly overgrown and most of the pool area lacks vegetation. The level of visibility is not more than 20 cm because of the regular visits of sheep, cattle and horses. About 20 specimens were observed (but not collected except four subadults), concentrated in the deepest part of the body of water.

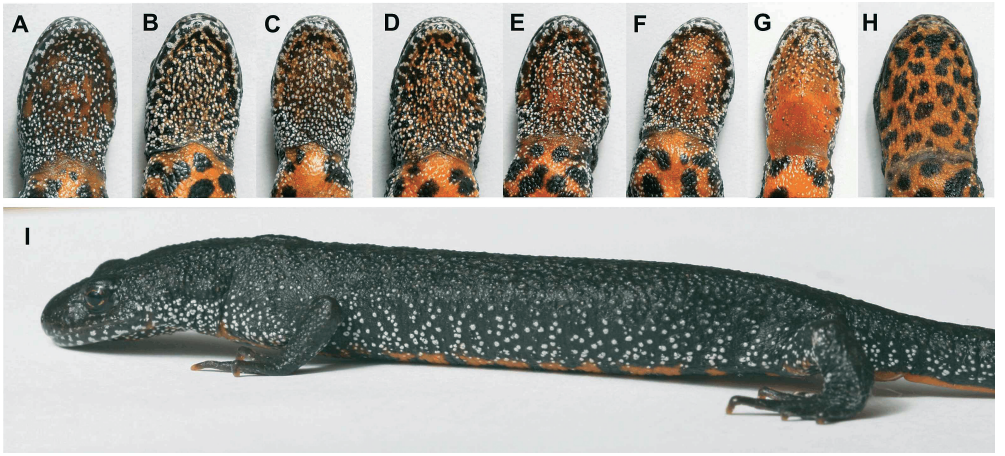

Fig. 3. Throat coloration in *Triturus cristatus* (A to G) (Vrachanska Mt.) and *T. karelinii* (H) (Lozenska Mt.) and heavily white-stippled sides in *T. cristatus* (I).

Most of the animals were subadults. Only two adult males were traced. The same pool is inhabited by *Lissotriton vulgaris, Hyla arborea* and *Rana dalmatina* (larvae). *Lissotriton vulgaris* was undoubtedly more common than *T. cristatus.* A visit by one of us (N.T.) on 7 July 2007 revealed that *Pelophylax ridibundus also* inhabits the pool. This time, 11 (8 males, 3 females) adult *T. cristatus* were found, caught with a scoop net between 21:15 h and 22:30 h, for which the Wolterstorff Index (WI = 100 × fore-limb length/inter-limb distance) was calculated. All specimens collected were kept in captivity. There are also two small ponds in the proximity to the study pool in which *L. vulgaris* were numerous but *T. cristatus* was absent.

All observed *T. cristatus* had pale dorsal sides, fawn with many large light dots. Their sides were heavily stippled with white (Fig. 3). The ventral surface was always bright orange with one row of small black dots on the peripheral parts. The throat in the subadults was a muddied mix of orange with fine white stippling. Transferred to the lab, all four subadults collected 26 June 2005 became darker with throats becoming a muddied mix of black and yellow with fine white stippling laterally (Fig. 4). In November 2005, one of the specimens collected developed secondary sexual male traits. First, a very visible pale blue stripe appeared on the tail. Then the cloaca swelled up, became black and two-lobed. At last, the ventral surface of the tail, originally orange-red, became darker with the orange visible only immediately behind the cloacal edge. Most of the adult animals collected (on 7 July 2007) had black throats with fine white stippling. Some animals possessed orange spots or orange areas on throat with variable dimensions (Fig. 3).

During the course of our studies, two more Bulgarian localities of *T. cristatus* have come to our attention, one near v. Botunya, distr. Varshets at the northwestern edge of Vrachanska Mt., at an altitude of 283 m a.s.l., UTM-FN99. There, our colleague Boyan Petrov took photos of couple of newts in a small cave. The second refers to an adult female traced in the collection of the University of Forestry, Wildlife Management Department (without inventory number) collected in a small man-made pool of water near v. Barzia, western Balkan Range (UTM-FN78).

To the best of our knowledge, this is the first report of *T. cristatus* for the species in Bulgaria and the southermost known populations.

Taxonomic remarks

The possibility may also be taken into account that the populations discovered belong to *Triturus macedonicus*, which is morphologically similar and whose easternmost localities are in eastern Serbia. *Triturus macedonicus* was cited for Dimitrovgrad (Radovanović 1964) and Vlasina (Kalezić et al. 1990, Crnobrnja et al. 1997). The specific identity of the newts we found was supported by a morphological comparison: (1) The throat colour of specimens we found (Fig. 3) does not correspond to *T. karelinii*, in which the throat and venter have the same colour and which lacks white stipples on the throat (Arntzen & Wallis 1999, Beshkov & Nanev 2002). (2) The vomeral teeth are arranged in two parallel rows slightly separated from each other, while in *T. karelinii* the vomeral teeth rows are clearly set apart at the end (Ananieva et al. 1998; Fig. 4). No data is available on the form of the palatine tooth rows in *T. macedonicus*, but our preliminary investigation of a newly discovered population of this species in Bulgaria suggest that that there are remarkable differences between *T. cristatus* and *T. macedonicus* (Naumov & Tzankov in press). (3) One animal was X-rayed (Fig. 5) with a "Siemens, Mammomat C3" at 14mAS and 22kV. Sixteen rib-bearing vertebrae (RBV) were counted, compared to the modal values observed in *T. karelinii* (14 RBV; Arntzen & Wallis 1999, Arntzen 2003) and in *T. macedonicus* (15-16 RBV; Crnobrnja et al. 1997, Arntzen & Wallis 1999) and in *T. dobrogicus* (17-18 RBV; Arntzen & Wallis 1999). For comparisons, seven specimens of *T. karelinii* from Bulgaria and of one *T. macedonicus* from Albania (for locality data see Fig. 2) were X-rayed (Fig. 5). All *karelinii* specimens exhibited 14 RBV except a specimen from Ruse (loc. 6; Fig. 1) which had 15 RBV, while *T. macedonicus* had 16 RBV. For this reason we also rejected the possibility that our specimens were hybrids of *T. karelinii* × *T. cristatus* or *T. macedonicus* × *T. cristatus*; moreover, *T. dobrogicus* is a lowland newt and *T. karelinii* is found at up

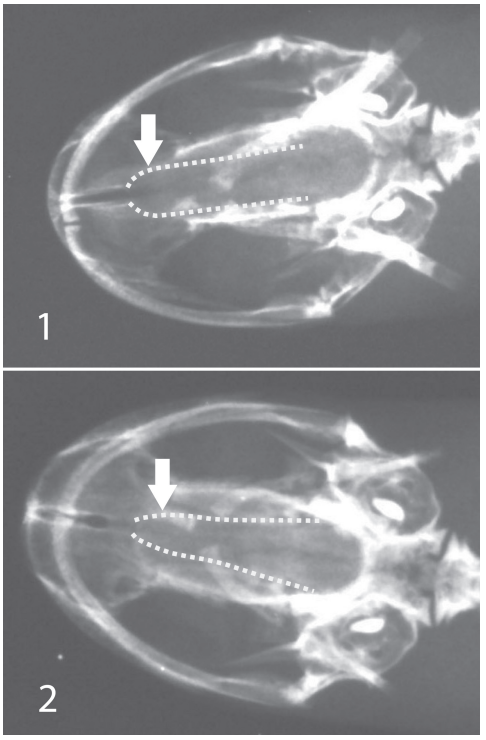

Fig. 4. Palatine teeth form in (1) *Triturus cristatus* (Vrachanska Mt.) and (2) *T. karelinii* (Rila Mt.). Palatine teeth rows are represented by dots and indicated with arrows.

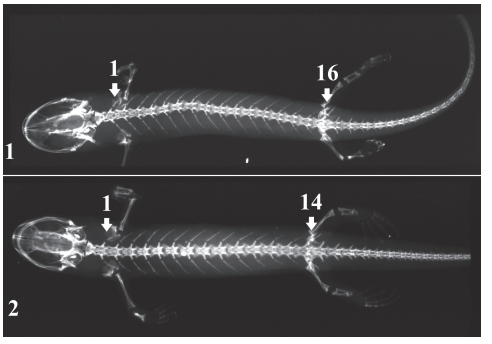

Fig. 5. Number of rib-bearing vertebrae in (1) *Triturus cristatus* (Vrachanska Mt.) and (2) *T. karelinii* (Rila Mt.). White arrow indicates the first and last vertebrae with ribs and the corresponding number.

to 1350-1400 m a.s.l. in Bulgaria (Beshkov & Nanev 2002), making hybridization between them unlikely. (4) WI data for the eleven specimens examined are: WI 49–55 (mean 51.38 ± 2.20) for males and 41–44 (mean 42.33 ± 1.53) for females. Data are quite comparable to the corrected values proposed by Arntzen & Wallis (1999) and are in agreement with the diagnosis of *T. cristatus*, i.e. 54.0-63.69 for males and 46.2-53.89 for females, respectively. As a result, our WI data are slightly lower than for *T. cristatus* and considerably lower than those for *T. macedonicus* males with 54-66 (mean 59.56 ± 4.10), females 49-56 (mean 52.63 ± 2.50) (Naumov & Tzankov in press) and *T. karelinii* (> 67.1 for males and > 59.2 for females) (Arntzen & Wallis 1999). So far, the possibility that *T. macedonicus* is also present in this region in Bulgaria has not been proven by external morphological data.

The discovery of *T. cristatus* in western Bulgaria has extended the known distribution of the species by 80 km further south. The new localities do not seem to be isolated from the previously known range because of the existence of suitable habitats (unpubl. data). Taking into account that at least the previously known southernmost populations of *T. cristatus* are genetically distinct from its conspecifics (Wallis & Arntzen 1989), it should require particular protection, most likely including the Bulgarian populations in the near future, because of their practical importance for phylogenetic diversity (Faith, 1992). One step towards this would be the future inclusion of the species in the second edition of the Bulgarian Red Data Book as "Vulnerable". Although Vrachanska Mountain (part of the western Balkan range) is already part of the "Vrachanski Balkan" Nature Park, the local *Triturus* populations will probably need special conservational efforts. In the closest suitable ponds near locality Botunya, non-natural populations of trout (*Salmo trutta*) exist. Carnivorous fish species are well known as a negative factor for newts (Joly et al. 2001, Van Buskirk 2005, Orizaola & Braña 2006, Hartel et al. 2007).

Acknowledgements

We are very thankful to A.W. Arntzen for his thorough and comprehensive review. The authors wish to thank also to Dr. M. Lesev who aided us in communicating with the department of radiology at the Aleksandrovska Hospital and are especially grateful to Dr. N. Chernev and her team for providing the facilities for obtaining X-rays of the animals. We are also thankful to our colleague B. Petrov for providing some personal photos and a map. We are also very indebted to the comments and suggestions of S. Lötters which greatly improved the final version of the manuscript. The fieldwork was partly supported by the "Bulgarian Red Data book – second edition" project. All permits were issued by the Ministry of the Environment and Water.

References

Ananieva, N.B., L.Y. Borkin, I.S. Darevskii & N.L. Orlov (1998): Amphibians and reptiles. – Russian nature encyclopedia, Moscow. [in Russian]

Arntzen, J.W. (2001): Genetic variation in the Italian crested newt, *Triturus carnifex*, and the origin of a non-native population north of the Alps. – Biodiversity and Conservation, **10**: 971-987.

Arntzen, J.W. (2003): *Triturus cristatus* Superspezies – Kammolch-Artenkreis (*Triturus cristatus* (Laurenti, 1768) – Nördlicher Kammolch, *Triturus carnifex* (Laurenti, 1768) – Italienischer Kammolch, *Truturus dobrogicus* (Kiritzescu, 1903) – Donau-Kammolch, *Triturus karelinii* (Strauch, 1870) – Südlicher Kammolch). – pp. 421-514 in Grossenbacher, K. & B. Thiesmeier (eds.): Handbuch der Reptilien und Amphibien Europas. Band 4/IIA. – Aula, Wiesbaden.

Arntzen, J.W., R.J.F. Butger, D. Cogălniceanu & G.P. Wallis (1997): The distribution and conservation status of the Danube crested newt, *Triturus dobrogicus*. – Amphibia-Reptilia, **18**: 133-142.

Arntzen, J.W. & G.P. Wallis (1999): Geographic variation and taxonomy of Crested newts (*Triturus cristatus* superspecies): morphological and mitochondrial DNA data. – Contributions to Zoology, **68**: 181-203.

Arntzen J.W., G. Espregueira Themudo & B. Wielstra (2007): The phylogeny of Crested newts (*Triturus cristatus* superspecies): nuclear and mitochondrial genetic characters suggest a hard polytomy, in line with the paleogeography of the center of origin. – Contributions to Zoology, **76**: 261-278.

Beškov, V. & P. Beron (1964): Catalogue et bibliographie des amphibiens et des reptiles en Bulgarie. – Académie Bulgaire des Sciences, BAN, Sofia.

Beshkov, V. & N. Nanev (2002): Amphibians and reptiles of Bulgaria. – Pensoft, Sofia-Moskva. [in Bulgarian]

Brogard J., M. Cheylan & P. Geniez (1996): Découverte du triton crêté *Triturus cristatus* (Laurenti, 1768) (Amphibia, Caudata) dans la région méditerranéenne française. – Bull. Soc. Herp. Fr., **80**: 9-13.

Bucci-Innocenti, S., M. Ragghianti & G. Manchino (1983): Investigations of karyology and hybrids in *Triturus boscai* and *T. vittatus*, with a reinterpretation of the species group within *Triturus* (Caudata: Salamandridae). – Copeia, **1983**: 662-667.

Buresch, I. & J. Zonkow (1941): Untersuchungen über die Verbreitung der Reptilien und Amphibien in Bulgarien und auf der Balkanhalbinsel. Teil III, Schwanzlurche (Amphibia, Caudata). – Mitteilungen aus den Königlichen Naturwissenschaftlichen Instituten Sofia (Izvestiya na Tsarskite prirodonauchni instituti v Sofiya), **14**: 171-237. [in Bulgarian with German summary]

Cogălniceanu, D. (1991): A preliminary report on the geographical distribution of amphibians in Romania. – Revue Roumaine de Biologie, sèrie de biologie animale, **36**: 39-50.

Crnobrnja-Isailović J., G. Džukić & M.L. Kalezić (1989): Genetic divergence in the Crested *newt (Triturus cristatus* complex) from Yugoslavia. – Biosistematika, **15**: 81-92.

Crnobrnja-Isailović J., G. Džukić, N. Krstić & M.L. Kalezić (1997): Evolutionary and paleogeographical effects on the distribution of the *Triturus cristatus* superspecies in the central Balkans. – Amphibia-Reptilia, **18**: 321-332.

Faith, D.P. (1992): Conservation evaluation and phylogenetic diversity. – Biological Conservation, **62**: 1-10.

Fuhn, I.E. (1960): Amphibia. Fauna Republicii Populare Romîne 14(1). – Bucharest, Editura Academiei republicii populare Romîne.

Fuhn, I.E. (1975): Amphibia and reptilia. – pp. 301-313 in: Anonymous (ed.): Fauna. The group for complex researches "Iron Gates". – Bucharest, Editura Academiei republicii populare Romîne. [in Romanian]

Hartel, T., S. Nemes, D. Cogalniceanu, K. Öllerer, O. Schweiger, C.-I. Moga & L. Demeter (2007): The effect of fish and aquatic habitat complexity on amphibians. – Hydrobiologia, **583**: 173-182.

Ivanović A., T.D. Vukov, G. Džukić, N. Tomašević, M.L. Kalezić (2007): Ontogeny of skull size and shape changes within a framework of biphasic lifestyle: a case study in six *Triturus* species (Amphibia, Salamandridae). – Zoomorphology, 126: 173-183.

Joly, P., C. Miaud, A. Lehmann & O. Grolet (2001): Habitat matrix effects on pond occupancy in newts. – Conservation Biology, **15**: 239-248.

Kalezić, M.L. & A.M. Stevanović (1980): Morphological variation in the Crested newt, *Triturus cristatus* (Urodela, Amphibia) from Kruševačka Župa (Central Serbia). – Biosistematika, **6**: 69-80.

Kalezić, M.L., G. Džukić, S. Stamenković & J. Crnobrnja (1990): Morphometrics of the Crested newt (*Triturus cristatus* complex) from Yugoslavia: relevance to taxonomy. – Arhiv Biol. Nauka, **42**: 17-37.

Kalezić, M.L., G. Džukić, G. Mesaros & J. Crnobrnja-Isailović (1997): The Crested newt (*Triturus cristatus* superspecies) in ex-Yugoslavia: morphological structuring and distribution patterns. – Univ. Thought. Nat. Sci., **4**: 39-46.

Karaman, S.L. (1948): Beitrag zur Herpetologie Nordserbiens. – Jugoslavenska Akad. Znanosti I Umjetnosti, **1948**: 6-27.

Kowatscheff, W. (1905): Beiträge zur Kenntnis der Reptilien und Amphibienfauna Bulgariens. – Verhandlungen der k. k. zoologisch-botanischen Gesellschaft in Wien, **55**: 31-32.

Kowatscheff, W. (1912): Die herpetologische Fauna Bulgariens. – Chr. G. Danoff-Verlag, Plovdiv. [in Bulgarian].

Lazăr, V., S-D. Covaciu-Markov, I. Sas, C. Pusta & E-H. Kovács (2005): The herpetofauna in the district of Dolj (Romania). – Analele Ştiinţifice ale Universităţii "Al. I. Cuza" Iaşi, s. Biologie animală, **51**: 151-158.

Litvinchuk S.N., L.J. Borkin, G. Džukić, M.L. Kalezić, M.D. Khalturin & J.M. Rosanov (1999): Taxonomic status of *Triturus karelinii* on the Balkans, with some comments about other crested newt taxa. – Russ. J. Herpetol., **6**: 153-163.

Macgregor, H.C., S.K. Sessions & J.W. Arntzen (1990): An integrative analysis of phylogenetic relationships among newts of the genus *Triturus* (family Salamandridae), using comparative biochemistry, cytogenetics and reproductive interactions. – J. Evol. Biol., **3**: 329-373.

Milchev, B. (1985): Is there a place for amphibians in Sofia? – pp. 195-203 in Anonymous (ed.): National student conference with international participation on the study of ecosystems and protection of the natural environment. Reports, May 1985. – Sofia University "St. Kliment Ohridski", Faculty of Biology, Sofia. [in Bulgarian]

Naumov, B. (2005): New Records of some herpetofauna species in Bulgaria. – Acta zoologica bulgarica, **57**: 391-396.

Naumov, B. & N. Tzankov (in press): First record of *Triturus macedonicus* (Laurenti, 1768) (Amphibia: Salamandridae) in Bulgaria. – Historia naturalis bulgarica.

Orizaola G. & F. Braña (2006): Effect of salmonid introduction and other environmental characteristics on amphibian distribution and abundance in mountain lakes of northern Spain. – Animal Conservation, **9**: 171-178.

Peshev, D., V. Delov, N. Tzankov & A. Vasilev (2005): Specific characteristic and distributional trends of the vertebrate fauna in the Rilska river basin. – pp. 177-189 in Anonymous (ed.): Annuaire de l'Universite de Sofia "St. Kliment Ohridski" 2004, 96, livre 4-10ème session scientifique. – University of Sofia "St. Kliment Ohridski", Sofia.

Peshev, Z. & S. Simeonov (1964): Vertebrate species of the Karash Village environs, Vratza District. – pp. 81-91 in Anonymous (ed.): Annuaire de l'Université de Sofia, Faculté de Biologie, Géologie et Géographie. – University of Sofia, Sofia. [in Bulgarian]

Radovanovic, M. (1941): Zur Kenntnis der Herpetofauna des Balkans. – Zool. Anz., **136**: 145-159.

Radovanovic, M. (1964): Die Verbreitung der Amphibien und Reptilien in Jugoslawien. – Senkenbergiana biologica, **45**: 553-561.

Stevanović A.M. & M.L. Kalezić (1980): Einige taxonomisch-biogeografische Merkmale des Kammolchs (*Triturus cristatus* Laur.) im Gebiet der Kruševačka Župa und ihrer Umgebung. – Bull. Mus. Hist. Nat. Belgrade, **35** B: 65-75.

Vukov T.D., A. Ivanović, N. Tomašević, G. Džukić & M. L. Kalezić (2007): Braincase-body size relations in European newts (*Triturus* spp., Salamandridae, Caudata,): does size matter? – Ann. Zool. Fennici, **44**: 232-239.

Wallis, G.P. & J.W. Arntzen (1989): Mithochondrial-DNA variation in the Crested newt superspecies: limited cytoplasmic gene flow among species. – Evolution, **43**: 88-104.

Wolterstorff, W. (1925): Katalog der Amphibien-Sammlung im Museum für Natur- und Heimatkunde zu Magdeburg. I. Teil: Apoda, Caudata. – Festschrift zu der Feier des 50-jährigen Bestehens des Museums für Natur- u. Heimatkunde in Magdeburg: 231-310.

Zajc, I. & J.W. Arntzen (1999): Phylogenetic relationships of the European newts (genus *Triturus*) tested with mitochondrial DNA sequence data. – Contributions to Zoology, **68**: 73-81.

Appendix

List of localities of *Triturus cristatus* superspecies given in Figure 1

Abbreviations used: Multivariate statistical methods (MSM), National Museum of Natural History, Sofia (NMNHS), rib-bearing vertebrae (RBV), Wolterstorff Index (WI).

Triturus macedonicus

Serbia:

1. Rtanje - low WI, as *T. cristatus* (Kalezić et al. 1990) by means of MSM classified as *T. carnifex* (Kalezić et al. 1997), RBV = 14.94 (Crnobrnja et al. 1997). 2. Kruševac - Radovanović (1964), no description was given, Kruševacka Zupa - Kalezić & Stevanović (1980), WI. 3. Zupa (Rataje) - Kalezić et al. (1990), WI, Crnobrnja et al. (1997), RBV = 14.94. 4. Vitanovac - Arntzen & Wallis (1999), RBV = 15.00, with mixed *T. carnifex/T. karelinii* phenotype. 5. Aleksandovac - Stevanović & Kalezić (1980). 6. Brus - Kalezić & Stevanović (1980), WI. 7. Djurdjevac - Ivanović et al. (2007), skull morphology and shape. 8. Dimitrovgrad - Radovanović (1964), no description. 9. Vlasina - Crnobrnja et al.

(1989), electrophoresis, Kalezić et al. (1990), WI, Crnobrnja et al. (1997), RBV = 14.78. 10. Grmija - Crnobrnja et al. (1997), RBV = 14.96. 11. Vranje (Sv. Ilja) - Kalezić et al. (1990), WI, Crnobrnja et al. (1997), RBV = 14.94. 12. Novo Brdo - Kalezić et al. (1990), WI. 13. Lučane - Wallis & Arntzen (1989), considered as *T. carnifex*/*T. karelinii* with *T. karelinii* mtDNA, mean RBV = 14.67 (Arntzen & Wallis 1999), but through electrophoretic data classified as *T. carnifex* (Arntzen 2001),
Macedonia:
14. Lesnovo - Kalezić et al. (1990), with high WI, Kalezić et al. (1997), Arntzen 2003, stated as *T. karelinii*), Crnobrnja et al. (1997), RBV = 14.90. 15. Probištip - Arntzen & Wallis (1999) with high WI, RBV = 14.50.

Triturus cristatus
Bulgaria:
1. Vrachanski Balkan, above hut Parchevitsa - WI, RBV. 2. Tocheva Yama cave, Vrachanski Balkan - photos of pair courtesy of B. Petrov. 3. Barziya – WI. 4. Petrohan - Beshkov & Nanev (2002), specific status not given, here interpreted as *T. cristatus* (this locality was cited by Arntzen 2003, together with localities Vratsa and Cherven Bryag, and interpreted as *T. karelinii*).
Serbia:
5. Miroč Mt. - Ivanović et al. (2007), Vukov et al. (2007), skull morphology and shape. 6. Klokočevac - Wallis & Arntzen (1989), with *T. karelinii* mtDNA, Arntzen & Wallis (1999), RBV = 15.80, Arntzen (2001), electrophoresis. 7. Jabukovac - Wallis & Arntzen (1989), mtDNA, Arntzen & Wallis (1999), RBV = 16, Arntzen (2001), electrophoresis. 8. Štubik - Wallis & Arntzen (1989), mtDNA, Crnobrnja et al. (1989), electrophoresis, Kalezić et al. (1990), WI, Kalezić et al. (1997), MSM, Crnobrnja et al. (1997), RBV = 15.88, Litvinchuk et al. (1999), MSM, electrophoresis, Arntzen & Wallis (1999), RBV = 15.80, Arntzen (2001), electrophoresis. 9. Negotin - Kalezić et al. (1990), WI, Kalezić et al. (1997), MSM, Crnobrnja et al. (1997), RBV = 16, Litvinchuk et al. (1999), MSM, electrophoresis. 10. Milanovac - Arntzen & Wallis (1999), RBV = 15.90, *T. cristatus/T. karelinii* hybrid population (Arntzen 2001). 11. Manastirište-Zlot - Kalezić et al. (1997), MSM, Manastirište - Litvinchuk et al. (1999), genome size, MSM, electrophoresis. 12. Bor - Wallis & Arntzen (1989), with *T. karelinii* mtDNA, Arntzen & Wallis (1999), RBV = 16.10, Arntzen (2001), electrophoresis. 13. Zajecar - Litvinchuk et al. (1999), no description, cited in Kalezić et al. (1997) but not listed there.
Romania:
14-19, 21, 22. - Cogălniceanu (1991),. 20. Picăturile - Arntzen (2003), 23-33. (23. Braloștița, 24. Filiași, 25. Grecești, 26. Seaca de Pădure, 27. Carpen, 28. Răchita de Sus, 29. Voița, 30. Picăturile, 31. Simnicu de Sus, 32. Podari, 33. Radovan) - Lăzar et al. (2005).

Triturus dobrogicus
Bulgaria:
1. Vidin - Buresh & Zonkov (1941). 2. Between Vidin and Archar - Arntzen (2003), erroneously referring to Beshkov (1984) (V. Beshkov, pers. comm.). 3. Archar - Arntzen (2003), erroneously referring to Beshkov (1984) (V. Beshkov, pers. comm.), specimens were found at 29 June 1984. 4. Oryahovo - Kowatcheff (1905, 1912) Buresh & Zonkov (1941).
Romania:
5. Ada-Kaleh - Funh (1960, 1975), stated as extinct (Arntzen et al. 1997). 6. Tartal - Arntzen et al. (1997).
Serbia:
7. Smederovo - Radovanovic (1941), Karaman (1948), Arntzen et al. (1997). 8. Kladovo - Arntzen et al. (1997). 9. Svetozarevo - Arntzen et al. (1997).

Triturus karelinii
Bulgaria:
1. Vratsa - Kowatcheff (1905, 1912), Buresh & Zonkov (1941), first mentioned author gives the location "Skaklya" near Vratsa while second two authors describe the locality as "puddles near the town Vratsa". 2. Kunino - 2 larvae, NMNHS III-30-10. 3. Karlukovo, cave Svirchovitsa – 1 female, NMNHS III-30-21. 4. Karash - Peshev & Simeonov (1965). 5. Zimevitsa - informative photos confirmed by B. Petrov. 6. Kalotina – 1 female, NMNHS III-30-12. 7. Dragoman. 8. Dzhurovo (V. Karakashov, authors' data). 9. Petarch. 10. Voluyak. 11. Bankya. 12. Sofia, Orlandovtsi - Buresh & Zonkov (1941). 13. Perlovska river - Buresh & Zonkov (1941), *T. k.* forma *bureshi* "Prinz Boris Garden" (Wolterstorff 1925, Buresh & Zonkov 1941), 1 male, 1 female, NMNHS III-30-32. 14. Obradovtsi - Buresh & Zonkov (1941), NMNHS III-30-22. 15. Chepintsi - Buresh & Zonkov (1941), 4 juveniles, NMNHS III-30-37. 16. Sofia, multiple localities near the southern quarters - Milchev (1986), authors' data. 17. Kazichene - 2 juveniles, NMNHS III-30-1. 18. Ravno Pole (= Robertovo in Buresh & Zonkov 1941) - 2 males, NMNHS III-30-27, 2 males, III-30-11, III-30-15. 19. Makotsevo. 20. Dragichevo lake, Lyulin

Mt. - Naumov (2005), authors' data. 21. Dendrariuma place, Vitosha Mt. 22. Boyanko ezero, Vitosha Mt. - Buresh & Zonkov (1941), authors' data, 1 male, 1 female, NMNHS III-30-05, 23. Bistritsa. 24. Germanski ezera, Lozenska Mt.. 25. Pasarel. 26. Treklyano - 3 females, NMNHS III-30-36 (Buresh & Zonkov 1941). 27. Zemen. 28. Egulnitsa, Konyavska Mt. - Naumov (2005). 29. Klenovik. 30. Dolna Dikanya - 1 male, NMNHS III-30-16. 31. Choklyovo blato, Konyavska Mt. 32. Kyustendil - Kowatcheff (1912), Buresh & Zonkov (1941). 33. Novo Selo, Osogovska Mt., 900 m - Naumov (2005), authors' data. 34. Rila, Rila Mt. - Peshev et al. (2005). 35. Smochevo, Rila Mt., 1350 m. 36. Samokov, Rila Mt., 1300 m - Buresh & Zonkov (1941). 37. Borovets, Rila Mt., 1300 m - Buresh & Zonkov (1941), *T. k.* forma *rilaica* typus, 2 females NMNH-S III-30-14, 1 male, NMNHS III-30-06. 38. Raduil, Rila Mt., 1350 m, NMNHS III-30-14. 39. Kostenets.

Serbia:

40. Resaskaica Pecina (Resavica) - Arntzen & Wallis (1999), (Arntzen 2003), RBV = 14.67. 41. Sisevac - Arntzen & Wallis (1999), RBV = 14.25. 42. Lukovo - Arntzen & Wallis (1999), RBV = 14.00, but some specimens with mixed *T. karelinii/T. cristatus* phenotype. 43. Vrtovac - Kalezić et al. (1997), MSM (*T. karelinii arntzeni* type locality, Litvinchuk et al. 1999), genom size, MSM, electrophoresis. 44. Pirot - Ivanović et al. (2007), skull morphology and shape. 45. Vlasi - Litvinchuk et al. (1999), MSM, Ivanović et al. (2007), Vukov et al. (2007), skull morphology and shape. 46. Stojkovića mahala, Vlasinsko jezero - Kalezić et al. (1997), MSM.

FYR Macedonia:

47. Stracin - Litvinchuk et al. (1999), MSM.

Manuscript received: 12 January 2006

Authors' addresses: Nikolay Tzankov, Andrei Stoyanov, National Museum of Natural History, Tzar Osvoboditel 1, Sofia 1000, Bulgaria; E-Mail: n_tzankovbio@abv.bg.