NAT. CROAT. | VOL 2 | No 1 | 27 - 46 | ZAGREB | 1993

ISSN 1330-0520
UDK 597.6 : 591.5 (234.422.1)

Original Scientific Paper
Izvorni znanstveni rad

VERTEBRATES OF THE VELEBIT MOUNTAIN (CROATIA) PART I: AMPHIBIANS

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Tvrtković, N. & Kletečki, E.: Vertebrates of the Velebit mountain (Croatia), Part I: Amphibians. Natura Croatica Vol. 2, No 1, 1993, Zagreb

As a result of several years the of the Velebit karst mountain fauna research (Croatia), here are published finds of 11 species of amphibians: (*Salamandra salamandra, Triturus carnifex, Triturus vulgaris cf. meridionalis, Triturus alpestris, Proteus anguinus, Bufo bufo, Bufo viridis, Bombina variegata, Hyla arborea, Rana dalmatina, Rana ridibunda*). Their distribution were analized according to their appearance at various altitude belts on the continental and coastal side of the mountain. In the case of the *Salamandra salamandra* and *Triturus alpestris*, essential differences in phenology between the populations in the Mediterranean and continental area were recorded. Vicarism was recognized in spatial distribution of *Bufo viridis* and *Bombina variegata*.

Key words: amphibians, Croatia, karst mountain, distribution, phenology.

Tvrtković, N. & Kletečki, E.: Kralješnjaci planine Velebita (Hrvatska), I dio: vodozemci. Natura Croatica Vol. 2, No 1, 1993, Zagreb.

Kao rezultat višegodišnjih istraživanja faune planine Velebita (Hrvatska) zabilježeno je ukupno 11 vrsta vodozemaca (*Salamandra salamandra, Triturus carnifex, Triturus vulgaris cf. meridionalis, Triturus alpestris, Proteus anguinus, Bufo bufo, Bufo viridis, Bombina variegata, Hyla arborea, Rana dalmatina i Rana ridibunda*). Analizirano je njihovo rasprostranjenje u različitim visinskim pojasevima s kontinentalne i primorske strane planine. Među mediteranskim i kontinentalnim populacijama *Salamandra salamandra* i *Triturus alpestris* zabilježene su očite razlike u fenologiji. Utvrđen je i vikarizam u rasprostranjenju *Bufo viridis* i *Bombina variegata*.

Ključne riječi: vodozemci, Hrvatska, krška planina, rasprostranjenje, fenologija.

INTRODUCTION

Specific nature of Velebit (**Fig. 1**), Croatia's longest mountain, has attracted many naturalists. Nevertheless, the lack of water, the wildness of the mountain resulting from its limestone build and karst relief, and its cruel climate, have resulted in the relatively poor knowledge about its animal life despite the fact that Velebit has been proclaimed a biogenetical reservation. Even less is known about how animals of Velebit live. Since quite a lot of data has been collected by now about the vertebrates of Velebit, we belive that their publication would help in the planning and protection of this Nature Park, and at the same time indicate the specific points that deserve more intensive study. The first contribution in this series, about the animals of Velebit, treats the group of vertebrates that is least known about, amphibians.

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THE AMPHIBIANS STUDY HISTORY

The first record of an amphibian on Velebit was made by the Hungarian botanist PAUL KITAIBEL (HORVATH 1918, according to FEJERVARY 1943) in 1802, but it has not been confirmed yet whether this was really a *Rana temporaria* or some other species of frog. BRUSINA (1880) was the first to publish the discovery of the Olm (*Proteus anguinus*) on the very edge of Velebit, in the sinkhole of the Gacka near Otočac. The first finds of the *Salamandra maculosa* (*S. salamandra*) in the vicinity of Paklenica was published by the curator of the Zadar National Museum M. KATURIĆ (1889), and of the *Triturus alpestris* finds in Baške Oštarije by the D. HIRC (1900).

Figure 1. Geographical position of Velebit Mts in Croatia. According POLJAK (1969) mountain is divided on four parts: northern (N), medial (M), southern (S) and southern-east (SE) Velebit. Settlements around Velebit Mts: 1 = Senj; 2 = Jablanac; 3 = Karlobag; 4 = Starigrad/Paklenica; 5 = Obrovac; 6 = Gračac; 7 = Gospić; 8 = Otočac; 9 = Žuta Lokva

Most of Velebit's amphibians were discovered soon afterwards, thanks to the efforts of many collectors of Croatian fauna who were active at that time. These includes the animal trader DOBIAŠ (PADEWIETH) from Senj, the forester B. SCHREIBER from Jablanac, the high-school teacher L. TRGOVČEVIĆ in Gospić, Dr. MATIĆ, B. GUSIĆ, and the Croatian zoologists M. HIRTZ, E. RÖSSLER, A. LANGHOFFER and K. BABIĆ. M. HIRTZ in 1908 and E. RÖSSLER in 1911 organized hikes across Velebit, lasting several days, from Krasno to Jablanac as well as from the village of Medak to Starigrad. List of the material they collected and deposited in the National Museum in Zagreb was partly published by KARAMAN (1921). He thus made it known that *Hyla arborea, Rana ridibunda, Bufo viridis* and *Bufo bufo* also live on Velebit. Later, J. PAVLETIĆ (1964) added the finds of *Triturus cristatus* (= *carnifex*), *Triturus vulgaris* and *Rana dalmatina* to this list. Notes on *Rana esculenta* (HIRC, D. 1900), *Rana temporaria* (HORVATH 1918) and *Salamandra atra* (WETTSTEIN 1928, HIRTZ 1930, BABIĆ 1942) are dubious today after more systematic investigations. The most recent Velebit species discovered, *Bombina variegata* was found in 1926 on the northern edge of the mountain during the Austrian zoological expedition made possible by Prince LIECHTENSTEIN, the Association of Friends of the Natural History Museum in Vienna, and the Austrian Ministry of Education (WETTSTEIN 1928). Beside individual notes in various herpetological articles (KARAMAN 1928, DELY 1966, DOLCE 1977, HENLE 1985), the first more comprehensive attempt to present amphibian distribution on Velebit was made by SCHMIDTLER & SCHMIDTLER (1983). TVRTKOVIĆ (1984) presented the preliminary results of distribution by altitude on northern Velebit. SCHMIDTLER (1988) pointed tO the "phenomenon of Velebit" - the unexpected finds of the *Triturus alpestris* on the coastal side in the belt of Oriental hornbeam (*Querco-Carpinetum orientalis*) at an altitude of only 190 m. KALEZIĆ et al (1990) and DŽUKIĆ et al. (1990) published the finds of neotenous populations of *Triturus alpestris.*

VEGETATION OF VELEBIT MTS.

There is exhaustive bibliography about the natural characteristics of the Velebit massif (for example POLJAK 1969, MILAN 1969, BERTOVIĆ 1975, TRINAJSTIĆ 1976). We have singled out the vegetational characteristics that reflect the climatic and geological conditions of the habitats. **Fig 2** shows the spatial distribution of certain vegetational belts along the coastal and continental slopes of Velebit, mostly according to TRINAJSTIĆ (1970). The collin belt on the coastal side rises to 450 and 550 m above sea level and belongs to the vegetational belt of the Pubescent oak and Oriental hornbeam (*Querco-Carpinetum orientalis*). During summer and the beginning of autumn the climate here is very hot with temperatures above 20°C, and most of July and the beginning of August are very arid. On the continental side collin belt is very narrow (up to about 600 m) and is part of the continental belt of the Sessile oak and Hornbeam (*Querco-Carpinetum*), with thermophylic composites of the *Querco-Ostryetum* in places of exposed western areas. Along the very edge, towards the lowland plateau, is a beech forest (microclimatic inversion). The coastal side has a pronounced submontan belt rising up to 850-900 m

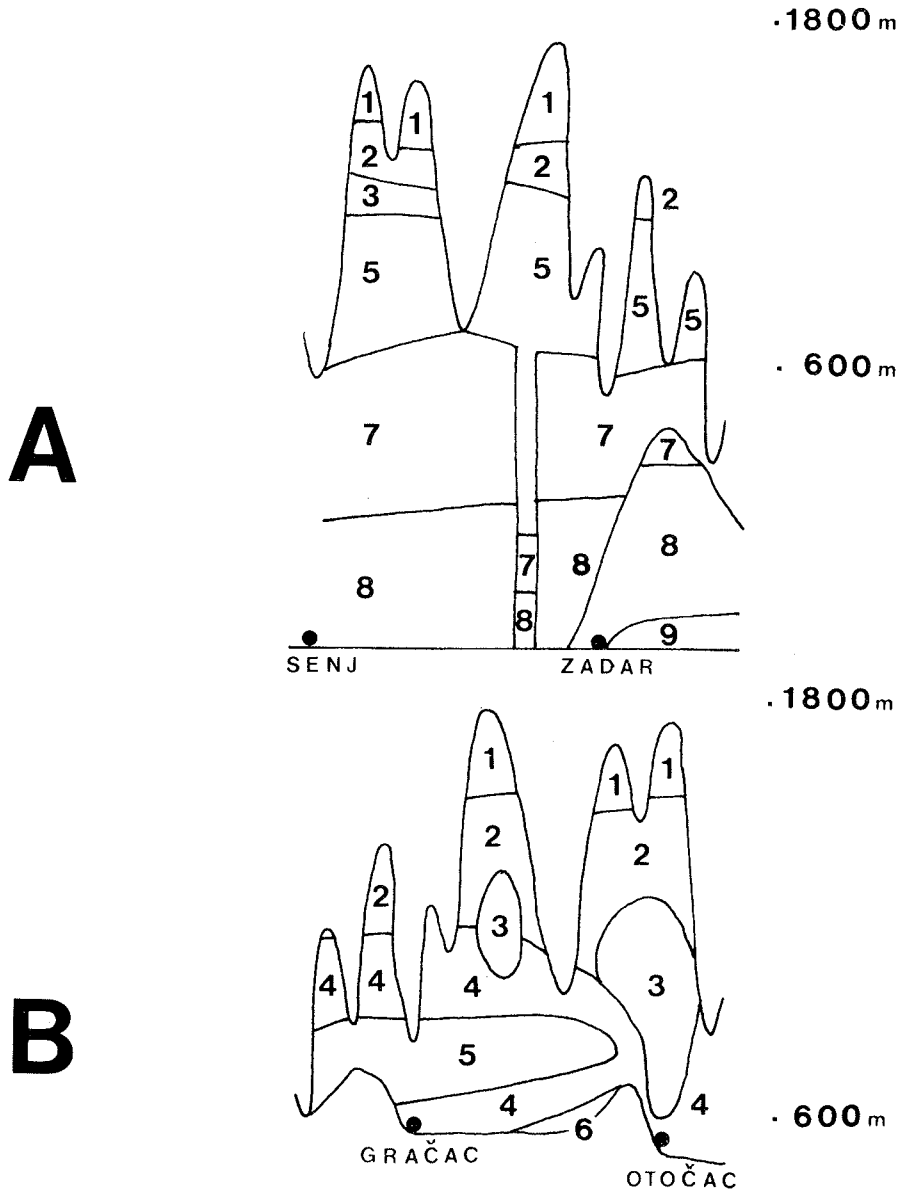

Figure 2. A sketch of the spatial distribution of certain vegetational belts along the coastal (A) and continental (B) slopes of Velebit Mts according TRINAJSTIĆ (1970). 1 = *Pinetum mughi*; 2 = *Fagetum subalpinum*; 3 = *Abieti-Fagetum*; 4 = *Fagetum montanum*; 5 = *Seslerio-Fagetum*; 6 = *Querco-Ostryetum*; 7 = *Ostryo-Quercetum*; 8 = *Querco-Carpinetum orientalis*; 9 = *Orno-Quercetum ilicis*

with a border of Mediterranean vegetation, a forest of Pubescent oak with Hop hornbeam (*Ostryo-Quercetum*). The montane belt has beech forests, a maritime beech forests (*Seslerio-Fagetum*) on the coastal side and mountain beech forests (*Fagetum montanum*) on the continental side. On southern Velebit, due to the influence of warm currents across relatively low saddles, there is a *Seslerio Fagetum* on the northern continental side. The altimontan belt is clearly expressed only on the continental slopes of northern Velebit (fir-beech forest, *Abieti-Fagetum*) from 500/800-1200 m. It loses itself on central Velebit to reappear, as a large oasis under the highest peaks of southern Velebit (1000-1300 m). Belt of the fir-beech forests, the larger depressions (frostplaces!) of northern and central Velebit also contain the mountain spruce forest (*Piceetum montanum*, for example in Štirovača). On the littoral side there is fir/beech forest only on northern Velebit (1300-1350/1400 m). The lower part of the highest subalpine belt is composed of subalpine beech forest (*Fagetum subalpinum=Acereto-Fagetum*; 1300-1400/1550 m), and on northern Velebit also of subalpine spruce forest (*Piceetum subalpinum*). Mountain pine forest (*Pinetum mughi*) continues right up to the very peaks. This belt also contains mountain meadows with Alpine vegetation. Winter lasts for at least six months here, and the snow remains on the ground for an average of as many as 138 days.

RESEARCH METHODS AND ITINERARY

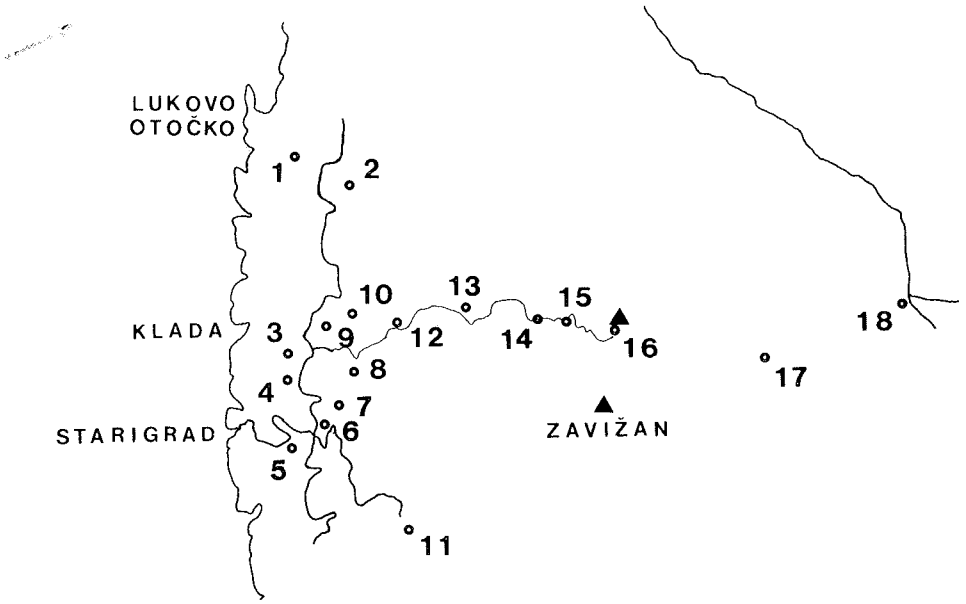

Figure 3. Pools and rock-pools on the northern Velebit Mts 1 = Gučinac bunar; 2 = Ažić lokva; 3 = Bilović bunar; 4 = Legački bunar; 5 = Rogića lokva; 6 =Antinović lokva i bunar; 7 = Bunar kod Vučića; 8 = Lokvina; 9 = Lokvica kod Dragičevića; 10 = Četrnja u Kućanskoj dragi; 11 = Velike Brisnice; 12 = Bunar pod Biondinovačom; 13 = Babrovača; 14 = Žive vodice; 15 = Glamočeva duliba; 16 = Vučjak; 17 = Zavižansko jezero; 18 = Krasno

Amphibians on Mt. Velebit have been observed intermittently for 16 years, from 1975 to 1991. Besides individual finds, four detailed investigations were performed on the transversal transects of Karlobag - Baške Oštarije - Brušani (in 1980), Obrovac - Mila voda - Sv. Rok (in 1982), Malovan - Bunjevac - Medak (in 1983) and Donja Klada - Vučjak - Krasno - Otočac (in 1984). The region around Gornja Klada and Gornji Starigrad (northern Velebit) was the most researched: in spite of seeming aridity, in surrounding of these settlements, 15 pools and rock-pools were discovered that are occasionally or permanently inhabited by amphibians (Fig 3). A total of 168 observations were made (species, locality, date), mostly of the *Triturus alpestris*, *Salamandra salamandra* and *Bufo bufo*. The material is kept in the Croatian Natural History Museum in Zagreb.

RESULTS

Salamandra salamandra salamandra L. 1758 - Fire salamander; pjegavi daždevnjak.

Material and observations: 1. Donji Lopci, 360 m, 1 ad., 1990:FEB 9, L. Vukušić obs.; 2. Lukovo Otočko (Gučinac bunar), 220 m, 3 larvae 1984:APR 17, N. Tvrtković obs.; 3. Gornja Klada (Žukovac /Bilović/ bunar), 270 m, 1984:APR 17, MAY 20; JUN 28, N. Tvrtković leg.; 4. Donji Legci, 290 m, 1 larva 1984:APR 17, N. Tvrtković leg.; 5. Gornji Starigrad (Modrići /Balini/), 370 m, 1 ad., 1983:NOV, J. Vukušić obs.; 6 ad., 1985:MAR, A. et L. Vukušić obs.; 2 ad., 1985:NOV 1, A. Vukušić obs.; 6. Žive vodice, 1270 m, 1 ad., J. Vukušić obs.; 7. Velike Brisnice, 530 m, 1 ad., 1984:JAN 8, A. Vukušić obs.; 8. Krasno, 1 ad., 1986, J. Vukelić obs.; 9. Živi Bunari, 240 m, 1 ad., 1984:APR 17, A. Vukušić obs.; 10. Štirovača (Crni padež), 1060 m, many larvae 1976:AUG 17, N. Tvrtković leg.; 11. Vidovac, 150 m, many larvae 1980:MAY 14, N. Tvrtković obs.; 12. Ledenik, 560 m, many larvae 1980:MAY 14; 1981:JUN 25, N. Tvrtković obs. et leg.; 13. Baške Oštarije (Crni ponor), 900 m, 2 ad., (70 m underground!) 1980:APR 19, B. Jalžić obs.; 14. Baške Oštarije - Brušani, 800 m, 1 ad., 1989:APR 12, G. Džukić leg. et coll.; 15. Smiljan, 560 m, 1 ad., 1985:JUN 2, G. Džukić leg. et coll.; 16. Velika Paklenica, 80 m, 1 ad., 1985:JUL 30, A. Grüll obs.; 270 m, many larvae 1986:MAY 22, N. Tvrtković obs.; 640 m, 1 ad., 1985:MAY 16, B. Jalžić leg.; 17. Riminići, 560 m, many larvae 1985:MAY 16, E. Kletečki obs.; 18. Bunjevac, 1190 m, 5 larvae 1983:JUL 13, N. Tvrtković obs. et leg. (without date 1989:AUG 23, N. Tvrtković obs.), 1 larva 1990:AUG 1, E. Kletečki obs.; 19. Crveni potoci, 840 m, many larvae 1982:JUL 6, N. Tvrtković obs.; 20. Mila voda, 805 m, many larvae 1982:JUL 6, N. Tvrtković obs.; 21. Zrmanja, 280 m, 1989, D. Ilić obs.

Although it has been known for a relatively long time that the Fire salamander lives in the Paklenica gorge near Starigrad (KATURIĆ 1889, 1907; SCHMIDTLER et SCHMIDTLER 1983; HENLE 1985), along the upper course of the Zrmanja River (KARAMAN 1928) and along the Ljubica stream in Baške Oštarije (DELY 1966), it was not previously found in localities distant from water sources. Even WETTSTEIN (1928) was convinced that it does not live on northern Velebit! By a persistent search for site suitable for the development of larvae we established that this species, although rarer than the alpine newt, is one of the more frequent amphibians on Velebit. The *Salamandra salamandra* was never found above 1300 m. In the montane belt adult specimens appear after the thaw, in about mid-April. Larvae are seen from the beginning of May to mid-August. There were no finds from September to the end of March since this is the time of hibernation. In lower altitudes on the coastal side, and especially in the collin belt, the adult period of activity shifts perceptibly to the colder and damper part of the year. Here finds are limited exclusively to the period from November to mid-April. There have been no finds during July, August, September and November (except in the Paklenica

gorge and in the sinkhole near Baške Oštarije); probably summer inactivity lasts during the summer months at least, because that is the time of the greatest heat and a very dry climate. The larvae are in the water from mid-April to the end of June.

Triturus alpestris alpestris LAURENTI 1768 - Alpine newt, planinski vodenjak.
Material and observations: 1. Ažić Lokva, 400 m, many ad., 1984:JUN 28, N. Tvrtković obs.; 2. Lukovo Otočko (Gučinac bunar), 220 m, 2 ad. + 1 neotenous specimen 1984:APR 17, N. Tvrtković leg.; 3. Gornja Klada, Lokvica, Dragičevići, 350 m, many ad., 1981:JUN 25; many ad., 1984:JUN 27, N. Tvrtković obs.; Lokvača, Legci, 390 m, many ad., 1981:JUN 25, N. Tvrtković obs.; Četrnja u Kućanskoj dragi, 440 m, 1 ad., + many larvae 1984:APR 17, many ad. +larvae 1984:JUN 27, N. Tvrtković obs.; 4. Gornji Starigrad (Antinović lokva), 320 m., many ad. + larvae, 1981:JUN 25, N. Tvrtković obs.; many ad., + neotenous specimens, 1984:JAN 19, N. Tvrtković obs.; many ad. + neotenous specimens, 1984:MAR 22, N. Tvrtković obs.; ad. + larvae + neotenous specimens, 1984:APR 17, N. Tvrtković obs.; many ad. + neotenous specimens, 1984:MAY 19, N. Tvrtković obs.; many ad + neotenous specimens, 1984:JUN 27, N. Tvrtković obs.; many ad. + neotenous specimens + larvae that have just got legs, 1991:JUL 28, N. Tvrtković obs.; 5. Donji Starigrad (Rogića lokva), 160 m, many ad., 1981:JUN 25, N. Tvrtković obs.; many ad., 1983:APR 23, N. Tvrtković obs.; no specimens, 1984:MAY 19, N. Tvrtković obs.; 6. Vukušić glavica, (pit), 500 m, 1 ad., 1984:.MAR 22, B. Jalžić leg.; 7. Bunar, 560 m, many ad., 1983:MAY 30, N. Tvrtković obs.; many ad. (under the ice), 1984:JAN 15, N. Tvrtković obs.; many ad. (courtship), 1984:MAR 21, N. Tvrtković obs.; many ad., 1984:JUN 26, N. Tvrtković obs.; many ad. + larvae, 1984:JUL 16, N. Tvrtković obs.; many ad. + larvae, 1984:OCT 18, N. Tvrtković obs.; 8. Babrovača, 925 m, many ad., 1976:AUG 20, N. Tvrtković obs.; many ad. (under the ice), 1984:MAY 20, N. Tvrtković obs.; larvae, 1990:JUL 15, N. Tvrtković obs.; 9. Žive vodice, 1270 m, many ad., 1976:AUG 19, N. Tvrtković obs.; 2 ad. + 3 larvae, 1978:NOV 4, N. Tvrtković obs.; many ad. (courtship), 1983:APR 21, N. Tvrtković obs.; 1983:MAY 30, N. Tvrtković obs.; 1983:JUN 28, N. Tvrtković obs.; many ad., 1984:JUN 26, N. Tvrtković obs.; 1985:AUG 11, N. Tvrtković obs.; many ad. + larvae, 1990:JUL 15, N. Tvrtković obs.; 10. Glamočka duliba, 1315 m, 1 ad. (out of the water), 1985:JUL 24, N. Tvrtković obs.; 11. Vučjak, 1590 m, 1 ad. (out of the water), 1983:MAY 5, A. Vukušić leg.; 12. Zavižansko jezero, 1380 m, many ad., 1983:APR 30, N. Tvrtković obs.; 13. Apatišanska duliba, 1150 m, many ad., 1986:MAY 2, N. Tvrtković obs.; 14. Krasno (Dolac), 750 m, many ad., 1986:MAY 2, N. Tvrtković obs.; 15. Kuterevo (Klanac), 580 m, many ad., 1986:MAY 2, N. Tvrtković obs.; 16. Begovača, 827 m, many ad., 1989:, N. Tvrtković obs.; 17. Alan, 1300 m, many ad. + larvae (at the cistern), 1976:AUG 16, N. Tvrtković leg.; 18. Vidovac (lokva Trnovača), 150 m, many ad. + larvae, 1981:JUN 25, B. Jalžić leg.; 19. Ledenik, 560 m, many ad. + larvae, 1981:JUN 25, N. Tvrtković obs.; 20. Baške Oštarije (sinkhole, -70 m), 920 m, 1 ad., 1980:APR 19, B. Jalžić leg.; 21. Riminići, 560 m, many ad., 1985:MAY 16, E. Kletečki obs.; 22. Malovansko jezero, 1600 m, larvae, 1989:AUG 23, N. Tvrtković leg.; 23. Ravne strane (Čaber sinkhole, -70 m), 740 m, 1 ad., 1982:JUL 8, B. Jalžić leg.; 24. Križ, 690 m, larvae, 1982:JUL 8, N. Tvrtković obs.; 25. Mila voda, 805 m, many ad. + larvae, 1982:JUL 6, N. Tvrtković obs.; 26. Prezid, 880 m, many ad., 1975:AUG 2, N. Tvrtković obs.; many ad. + 1 neotenous specimen, 1978:SEP 24, N. Tvrtković obs.; 27. Veselinovići, Golubić, 480 m, 1985:JUN 1, G. Džukić obs.; 28. Macure (Pajića lokva), 275 m, neotenous specimens (90%), 1985:MAY 31, G. Džukić obs.; 3 ad., 1986:APR 20, N. Tvrtković obs.; 29. Urukulovac, 265 m, 3 ad., 1986:APR 20, N. Tvrtković obs.; 30. Čengići-Jurišići, 260 m, 1 ad., 1986:APR 20, N. Tvrtković obs.; 31. Sv. Trojica (Sučevići, Želj. stanica Zrmanja), 600 m, many ad., 1987:MAY 21, N. Tvrtković obs.

The Alpine newt is surely the most frequently found species of amphibians on Velebit (HIRC 1900; KATURIĆ 1907, 1910; KARAMAN 1921, 1928; PAVLETIĆ 1964; DOLCE 1977; SCHMIDTLER & SCHMIDTLER 1983; TVRTKOVIĆ 1984; SCHMIDTLER 1988; KALEZIĆ et al 1990; DŽUKIĆ et al. 1990). It is found almost everywhere except right along the seashore. It also ventures into the karst underground (the pit on Vukušić glavica, the pit near Babrovača, the sinkhole near Baške Oštarije).

The great number of sightings allow better insight into the biology of this species. In the warmest collin belt some specimens were recorded in the water almost the whole year round (there are no data for August and September). Courtship and laying

spermatophores probably take place during January or February. Larvae had been found from mid-April to the end of July. A small number of larvae live through the winter. Some of the adult animals remain in the water the whole year round in the coastal submontane belt, too. Courtship was recorded only at the end of March, and the first larvae at the beginning of July. The last find of larvae was in mid-October. In the beech forest area the first amphibians were recorded in the water immediately after the early thaw (second half of April), when courtship was also recorded. Larvae were recorded from mid-July to the beginning of November.

Triturus carnifex LAURENTI 1768, Alpine crested newt, veliki alpski vodenjak.
Material: 1. Smiljan, 565 m, 1985:JUN 2, G. Džukić and M Kalezić leg. et coll.

In spite of several explorations of the locality of Štirovača, for which this species was recorded by J. PAVLETIĆ (1964) calling on an observation from 1908, the Alpine crested newt was not observed here again. SCHMIDTLER & SCHMIDTLER (1983) recorded it 3 km W of Švica (550 m). It is rare in the edge areas of Velebit near Gacko polje and western part of Ličko polje.

Triturus vulgaris meridionalis BOULENGER 1882, Southern smooth newt, mali ilirski vodenjak.
Material and observations: 1. Gacka, spring, 455 m, 1977:MAY 28, N. Tvrtković obs.; 2. Smiljan, 565 m, 1985:JUN 2, G. Džukić and M. Kalezić leg. et coll.

The Smooth newt lives only in the border areas of the continental side of northern and central Velebit. SCHMIDTLER & SCHMIDTLER (1983) recorder it at Švica. The 1911 record for Rujica remains unconfirmed (PAVLETIĆ 1964); it has not been established to which locality with a same or similar name it may refer. Since the *Triturus vulgaris meridionalis* lives on Velika Kapela and the *Triturus vulgaris vulgaris* to the south of Velebit, SCHMIDTLER determined the Lika and Gacko polje population as hybrid. In DŽUKIĆ et al. (1990) they are *T. vulgaris meridionalis.*

Proteus anguinus LAURENTI 1768 - Olm, čovječja ribica.

After BRUSINA (1880) published the find of this species in a sinkhole of the Gacka near Otočac (leg. M. Jurković), the Olm was never sighted again either at the foot of Velebit or in the underground formations of the mountain massif.

Bombina variegata variegata L 1758 - Yellow-bellied toad, žuti mukač.
Material and observations: 1. Kuterévo, Poljana, 650 m, many ad., 1986:MAY 2, N. Tvrtković leg.; Klanac, 580m, 2 ad., 1986:MAY 2, N. Tvrtković leg.; 2. Gornja Klada, (Lokvica, Dragičevići), 350 m, many ad.; 1981:JUN 25, 1 ad.; 1984:JUN 27, N. Tvrtković obs. et leg.; Bilović bunar, 270 m, 1 ad., 1984:JUN 28, N. Tvrtković obs.

After the find of the Yellow-bellied toad at Sv. Mihovil in Senjska Draga (WETTSTEIN 1928), and SW of Krasno (SCHMIDTLER & SCHMIDTLER 1983), we confirmed this species on northern Velebit only by finds in Kuterevo and Krasno. From literature, site Kekići by Starigrad (PAVLETIĆ, 1964) is not related to the Velebit Mt. but to an old castle at Žumberak mountains near Zagreb. In Kuterevo the *Bufo viridis* was found in the

same ponds. The Yellow-bellied toad is not native to the environs of Gornja Klada. It was introduced to Dragičevići (Gornja Klada) from Kuterevo. According to the testimony of Luka Vukušić, he and his brothers brought it there in the spring of 1981. In 1984 we still found it in the same pond, but it had also already spread to Bilović bunar 1 km away. Finds to date are only from the May-June period.

Bufo viridis viridis LAURENTI 1768 - Green toad, zelena krastača

Material and observations: 1. Kuterevo (Poljana), 650 m, matching, 1986:MAY 2, N. Tvrtković obs.; Kuterevo (Klanac), 580 m, 1 ad., run over, 1986:MAY 2, N. Tvrtković obs.; 2. Zavižansko jezero, 1380 m, larvae, 1984:JUL 4, L. Vukušić leg.; 3. Žive vodice, 1270 m, 1 ad., in the water, 1984:JUN 26, Đ. Jalžić obs.; 4. Bunar under Biondinovača, 560 m, matching, 1984:JUN 26, N. Tvrtković obs.; larvae, 1984:OCT 18, F. Perović & N. De Luca leg.; 5. Gornji Starigrad (Rogića lokva), 160 m, matching 1981:JUN 25, N. Tvrtković obs.; matching, 1983:APR 23, N. Tvrtković obs.; matching + eggs, 1984:APR 18, N. Tvrtković obs.; 6. Gornji Starigrad, 300 m, 1 ad., 1991:JUL 28, E. Kletečki obs.; 7. Vidovac (lokva Trnovača), 150 m, ad., 1976:JUL 31, N. Tvrtković obs.; matching, 1981:JUN 25, N. Tvrtković obs.; 8. Ledenik, 600 m, 1 ad., 1976:JUL 31, N. Tvrtković obs.; 9. Sušanj, 640 m, 1 ad., 1981:JUN 27, N. Tvrtković obs.; 10. Malovan, 1600 m, 1 ad., 1983:JUL 15, N. Tvrtković leg.; 11. Malovansko jezero, 1600 m, larvae 1989:AUG 23, N. Tvrtković leg.; 12. Starigrad/Paklenica, 20 m, 1 ad., 1985:MAY 18, N. Tvrtković obs.; 13. Marasovići, 50 m, 1 ad., run over, 1986:MAY 21, N. Tvrtković obs.; 14. Mala Paklenica, 1973:MAY, N. Mršić, obs.

The find of *Bufo viridis* published by KARAMAN (1921) for Štirovača (1060 m) seemed problematical at first because of the great altitude and type of habitat (*Picetum montanum*, a frostplace), especially bearing in mind how widespread this species is in the Mediterranean, where it sometimes even enters the sea (Dugi otok, own records). However, a meeting with an adult female in the shrubby pine area (*Pinetum mughi*) on Malovan (1600 m), and later of tadpoles in Malovansko jezero lake, freed us of preconceptions about the height altitude of this species on Velebit. Like the *Bufo bufo*, this toad lives on the whole mountain, although it is rarer at great altitudes. In the lowest collin belt it begins to lay eggs as early as April, almost immediately after the *Bufo bufo*, but in the submontane belt the first finds in water were not until May, and in the montane belt even as late as June. The adults remain in the water right to the end of July. The tadpoles develop, in places from the end of June up to as late as mid-October. In the five colder months (November to March) the species was not recorded.

Bufo bufo L 1758 - Common toad, smeđa krastača.

Material and observations: 1. Žrnovnica, 2 m, 1 ad. + 1 gigant larva, 1981:JUN 22, N. Tvrtković leg.; 2. Jurjevo, 450 m, 1 ad., 1986:MAY, N. Tvrtković obs.; 3. Ažić lokva, 400 m, eggs, 1984:APR 17, N. Tvrtković obs.; 4, Gornja Klada (Čatrnja in the Kućanska draga), 400 m, eggs, 1984:APR 17, N. Tvrtković obs.; (Lokvica), 350 m, eggs, 1984:APR 17, N. Tvrtković obs.; 5. Gornji Starigrad (Rogić lokva), 160 m, many juv., 1981:JUN 25, N. Tvrtković obs.; larvae, 1984:APR 17, N. Tvrtković obs.; 6. Žive vodice, 1270 m, 1 ad. male at the water, 1983:APR 21, N. Tvrtković obs.; 7. Vučjak, 1560 m, 1 ad., 1976:AUG 19, A. Vukušić leg.; 8. Zavižansko jeyero, 1380 m, larvae, 1983:APR 30, L. Vukušić obs.; many juv., 1983:JUN 28, L. Vukušić obs.; 9. Krasno (Dolac), 750 m, 1 ad. male + larvae, 1986:MAY 2, N. Tvrtković leg.; 10. Kuterevo (Poljana), 650 m, larvae, 1986:MAY 2, N. Tvrtković leg.; (Klanac), 580 m, larvae, 1986:MAY 2, N. Tvrtković leg.; 11. Vidovac (lokva Trnovača), 150 m, many juv., 1981:JUN 25, N. Tvrtković obs.; 12. Segestin, 1460 m, 1 ad., 1983:JUL 14, N. Tvrtković leg.; 13. Velika Paklenica, 80 m, many juv., 1977:MAY 27, N. Tvrtković obs.; larvae, 1985:MAY 18, N. Tvrtković obs.; larvae, 1986:MAY 22, N. Tvrtković obs.; 270 m, 1 ad., 1986:MAY 22, N. Tvrtković obs.; 300 m, 1 ad., 1985:MAY 15, F. Perović obs.; 350 m, 1 ad., 1985:MAY 20, E. Kletečki obs.; 500 m, 1 ad., 1985:JUL 31, N. Tvrtković obs.; 680 m, 1985:MAY 16, F. Perović obs.; 14. Male Jasle, 805 m, 1 ad., 1982:JUL 7, N. Tvrtković obs.; 15. Macure (Pajića lokva), 275 m, larvae, 1986:APR 20, N. Tvrtković obs.; 16. Zrmanja, 520 m, gigant larvae,

1984:JUN 23, G. Džukić obs.; 620 m, 1 ad., 1984:JUN 23, N. Tvrtković obs.

Finds of this toad, besides those of the *Triturus alpestris*, were the most numerous on Velebit (KARAMAN 1921, 1928; WETTSTEIN 1928; PAVLETIĆ 1964; DOLCE 1977; SCHMIDTLER & SCHMIDTLER 1983; HENLE 1985; SCHMIDTLER 1988). Our own data, also numerous, added to our knowledge of its phenology. It is active from the end of March to the end of August. In the coastal collin belt it spawns from the end of March to April, and in the submontane and montane belts from the end of April to the beginning of May. Tadpoles were found from the middle of April to the beginning of May. Large tadpoles were found in June, and the metamorphosis finishes from the end of May (collin) to the end of June, i.e., the beginning of July (subalpin).

Hyla arborea arborea L , 1758 - Common tree frog, gatalinka

Material and observations: 1. Gornji Starigrad (Rogića lokva), 160 m, ad., 1981:JUN 25, N. Tvrtković obs.; 1984:APR 18, N. Tvrtković obs.; 1984:JUN 27, N. Tvrtković obs.; 2. Kuterevo (Klanac) 580 m, ad., at the meadow, 1986:MAY 2, N. Tvrtković obs.; 3. Kuterevo (Poljana), 650 m, ad. out of the water 1986:MAY 2, N. Tvrtković obs.; 4. Smiljan, 565 m, 1985:JUN 2, G. Džukić & M. Kalezić obs.; 5. Prezid, 780 m, ad. out of the water 1985:MAY 18, N. Tvrtković leg.; 6. Žegar-Nadvode, 70 m, calling 1986:APR 20, N. Tvrtković; 7. Bogunovići (Zrmanja spring), 300 m, ad. out of the water, 1984:JUN 24, N. Tvrtković obs.

After long-known individual finds for Gaj near Senj and Pazarište (KARAMAN 1921), it was DOLCE (1977) who published MÜLLER'S old find from the saddle of Mali Halan. We recorded this rather rare Velebit frog only several times on northern Velebit (Gornji Starigrad, Kuterevo) and on south-eastern Velebit (the spring of the Zrmanja, Prezid). All the finds are from the April-June period.

Rana dalmatina BONAPARTE 1840 - Agile frog, šumska žaba.

Material and observations: 1. Kuterevo (Poljana), 650 m, 2 ad. + eggs, 1986:MAY 2, N. Tvrtković obs.; 2. Kuterevo (Klanac), 580 m, eggs, 1986:MAY 2, N. Tvrtković obs.; 3. Medački dolac, 1300 m, 1 subadult 1983:JUL 14, N. Tvrtković leg.; 4. Modrića stan, 735 m, 1 ad., 1982:JUL 9, B. Jalžić leg.; 5. mouth of the river Krupa into the Zrmanja river, 37 m, numerous ad., 1981:JUN 3, E. Kletečki obs.; 6. mouth of the river Krnjeza into the Krupa river, 90 m, numerous ad. 1981:JUN 3, E. Kletečki obs.

Both KARAMAN (1921) and PAVLETIĆ (1964) erroneously quoted the only certain old Velebit find from Oštri Kozjak (900 m) as having been in the nearest settlement of Brušani (Lika). It is possible that the record of the botanist P. KITAIBEL also refers to this species, and not to the *Rana temporaria*. We have to date recorded the Agile frog on the relatively poorly explored continental side from the foot to the subalpine belt, and only in south-eastern Velebit on the coastal side, too, above the river Zrmanja up to the montane belt. On northern Velebit a very late spawning was recorded in 1986, as late as the beginning of May. In mid-July the young frogs had already left the water.

Rana ridibunda PALLAS 1771 - Marsh frog, velika zelena žaba.

Material and methods: 1. Sv Trojica, Sučevići (Zrmanja, train station), 600 m, ad., 1984:JUN 24, N. Tvrtković obs.; ad., 1985:MAY 21, G. Džukić obs.; 2. Macure (Pajića lokva), 275 m, ad., 1985:MAY 31, G. Džukić obs.; 1986:APR 20, N. Tvrtković obs.; 3. Podprag (Meki bunar), 520 m, numerous ad., 1990:AUG 2, E. Kletečki obs.; 4. Smiljan, 565 m, ad., 1985:JUN 2, G. Džukić & M. Kalezić obs.

The works of KARAMAN (1928) and SCHMIDTLER & SCHMIDTLER (1983) already show that this is a very widely distributed species along the whole continental edge of Velebit, and also on the southern slopes of the south-eastern part of the mountain. We confirmed its range in the collin belt up to 520 m, under the saddle of Mali Halan. Its finds to date are only from the warmer part of the year, from April to September.

DISCUSSION

Velebit's amphibian fauna differs in composition from that of the more westernly neighbouring massifs of Učka and Velika Kapela. The more southerly coastal Dinaric mountains, as yet insufficiently explored, are probably more kindered to Velebit. Velebit's specific feature is the *Triturus alpestris*, whose great number and wide range in the Mediterranean belt of the coastal slopes, with the phenomenon of neoteny, give the mountain a special mark. Velebit (SCHMIDTLER 1988) and Bukovica (DŽUKIĆ et al, 1990) are the only regions on the eastern Adriatic coast where the Alpine newt lives below the boundary of the continental forests. This may be explained by the specific climate (colder Mediterranean climate due to the influence of the "bura" wind), the specific geological foundation (Jelar breccia that is partly impervious) and the absence of competition from other newts. Neotenous individuals and populations are probably more frequent than has been recorded to date (KALEZIĆ et al, 1990) and on Velebit they are exclusively in the Mediterranean belt (the collin and submontan belts of the littoral slopes). It is interesting to note that neotenia was already noted by KARAMAN (1921) although he did not explicitly stress this: "one Velebit specimen has a head like the *Molge reiseri*, only smaller".

The *Triturus alpestris*, *Bufo bufo* and *Bufo viridis* live in practically all altitude belts of Velebit and in all expositions, and the *Salamandra salamandra* also lives everywhere except in the subalpine belt **(Tab 1)**. We found the *Hyla arborea* and *Rana dalmatina* only in the montane belt of the continental side, and on the coastal side only on the edge of N and SE Velebit. The *Bombina variegata* lives on N Velebit, which is the southern edge of the areal for its nominal subspecies, and the *Rana ridibunda* lives on SE Velebit. Observations on the phenology of certain phases of amphibia life mostly confirmed previously known data (compare ENGELMANN et al. 1986). The specific characteristics observed are:

1. *Salamandra salamandra* activity in the collin coastal belt only during autumn, winter and spring (from November to April) and the somewhat earlier appearance of its larvae from mid-April to the end of June. The *Salamandra salamandra* of the montan belt are active from April to September, and the larvae are in the water from the beginning of May to the beginning of August.

2. There was pronounced difference in the time when *Triturus alpestris* larvae appeared. They were almost four months later in the montan and subalpin belts than in the Mediterranean belts.

A pronounced difference in the time of tadpole appearance was recorded for *Bufo bufo*

and *Bufo viridis*. Only when the metamorphosed tadpoles of the *Bufo bufo* leave the water (May, June) are they replaced, on the same localities, by the newly-hatched tadpoles of the *Bufo viridis*. Once *Bufo viridis* tadpoles were even found in mid-October at an altitude of only 560 m (Bunar). SCHMIDTLER and SCHMIDTLER's record (1983) of *Bufo bufo* spawn near Baške Oštarije at the beginning of June may refer to the *Bufo viridis*.

Table 1. Distribution of amphibians in different altitudinal belts on coastal (mediterranean, m) and continental (c) slopes of Velebit Mts.

collin	submontan	montan	subalpin	slope	species
*	*	*		m	*Salamandra salamandra*
*	*	*		c	
*	*	*	*	m	*Triturus alpestris*
*	*	*	*	c	
				m	*Triturus carnifex*
*				c	
				m	*Triturus vulgaris*
*				c	
				m	*Bombina variegata*
*	*			c	
*	*	*	*	m	*Bufo viridis*
*	*	*	*	c	
*	*	*	*	m	*Bufo bufo*
*	*	*	*	c	
*	*	*		m	*Hyla arborea*
*	*			c	
*	*			m	*Rana dalmatina*
*	*	*		c	
*				m	*Rana ridibunda*
*				c	

The widespread of the *Salamandra salamandra* **(Fig 4),** a species previously known here only from the gorge of Senjska draga (SCHMIDTLER and SCHMIDTLER 1983) and Velika Paklenica (KATURIĆ 1889), is also Velebit especiallity. It is especially numerous on the coastal slope in its lowest Mediterranean collin belt, in the *Querco-Carpinetum orientalis* zone. But whereas our research established that the *Salamandra salamandra* is frequent on Velebit, we could not confirm the presence of the *Salamandra atra*. After WETTSTEIN (1928) recorded the telling of local inhabitants about the black salamanders in "Paklanica bei Stari Grad", HIRTZ (1930), BABIĆ (1942) and POLJAK (1969) included it in the fauna of Velebit without documented finds.

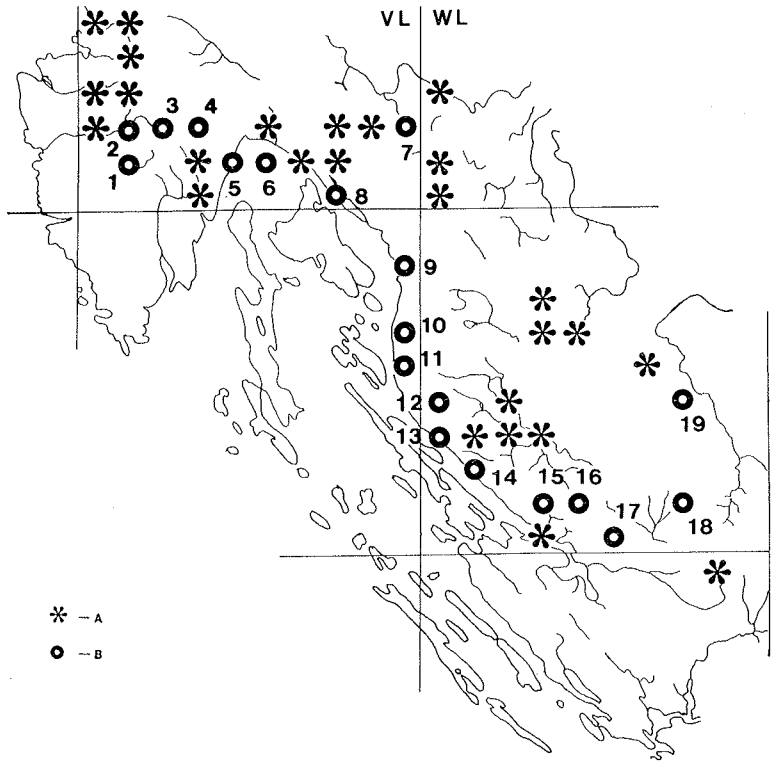

Figure 4. The widespread of the *Salamandra salamandra* in south-western part of Croatia A=data from B=own data. 1 = Beram, 250 m, VL11; 2 = Buzet, 35 m, VL12; 3 = Kuk, 100 m, VL22; Kotli-Brnobići, 200 m, VL22; 4 = Staraj, 300 m, Brgudac, 900 m, VL32; 5 = Mošćenička Draga, 200 m, VL41; 6 = Draga, 100 m, VL51; 7 = Stara Sušica, 720 m, VL92; 8 = Grižane, 240 m, VL70; 9 = Lopci, 800 m, VK98; 10 = Gornji Starigrad, 370 m, Gornja Klada, 270 m, Lukovo Otočko, 220 m, Žive vodice, 1270 m, VK96; 11 = Velike Brisnice, 530 m, Živi Bunari, 240 m, VK95; 12 = Crni Padež (Štirovača), 1060 m, WK04; 13 = Ledenik, 560 m, WK03; 14 = Baške Oštarije - Brušane, WK12; 15 = Marasovići, 1450 m, WK31; 16 = Bunjevac, 1190 m, WK41; 17 = Crveni Potoci, 840 m, WK50; 18 = Gutešino vrelo, 550 m, WK71; 19 = Lapačka Korita, WK74;

Only further research can confirm whether their listings are correct. Our present knowledge is that the areal of the *Salamandra atra,* similar to that of the *Rana temporaria,* stretches from Velika Kapela eastwards across Mala Kapela and Lička Plešivica towards Bosnia, and that Velebit and the southerly mountains along the Adriatic coast are avoided by both species. KATURIĆ (1906) gives evidence about almost completely black specimens of the *Salamandra salamandra* from Velika Paklenica; probably these are the "Black salamanders" of Velebit.

Thanks to the work of DOLCE and LAPINI (1987), BURLIN and DOLCE (1987) and SCHMIDTLER & SCHMIDTLER (1983), who treated the Friuli-Venezia Giulia and Istria regions more exhaustively, we can compare the height range of amphibian distribution along the north-eastern Adriatic coast (Tab 2).

Table 2.. The altitudinal range of amphibian distribution along the north-eastern Adriatic coast. 1 - after DOLCE and LAPINI (1987); 2 - after BURLIN and DOLCE (1987); 3 - after SCHMIDTLER and SCHMIDTLER (1983) and own our data.

area / species	1. Friuli-Venezia Giulia	2. Istra	3. Velebit
Salamandra salamandra	3-1500	5-1220	80-1270
Triturus alpestris	170-1980	650-1050	160-1600
Triturus carnifex	2-1442	15-960	450-565
Triturus vulgaris	2-1442	3-1050	455-565
Bombina variegata	4-1900	15-1020	580-750
Bufo viridis	1-929	3-12	1-1600
Bufo bufo	0.5-1900	2-1050	2-1460
Hyla arborea	1-1300	4-1050	70-1045
Rana ridibunda	313	2-24	275-600
Rana dalmatina	1-551	3-1050	37-1300
Maximal possible altitude (m)	**2200**	**1396**	**1758**

On Velebit the *Triturus vulgaris meridionalis, Triturus carnifex* and *Bombina variegata* reach an altitude of only 565-700 m, and the height range of their presence is narrowed down, too, which is understandable because this is the southern edge of their areal. In the Alps-Dinaric Mts direction these species are found at increasingly lower altitudes, while the *Rana dalmatina, Bufo viridis* and *Rana ridibunda* have an opposite tendency at the same gradients. Especially significant is the spatial distruibution of the *Bombina variegata* and the *Bufo viridis* (Fig 5), which we found in the same pond together only on two localities near Kuterevo.

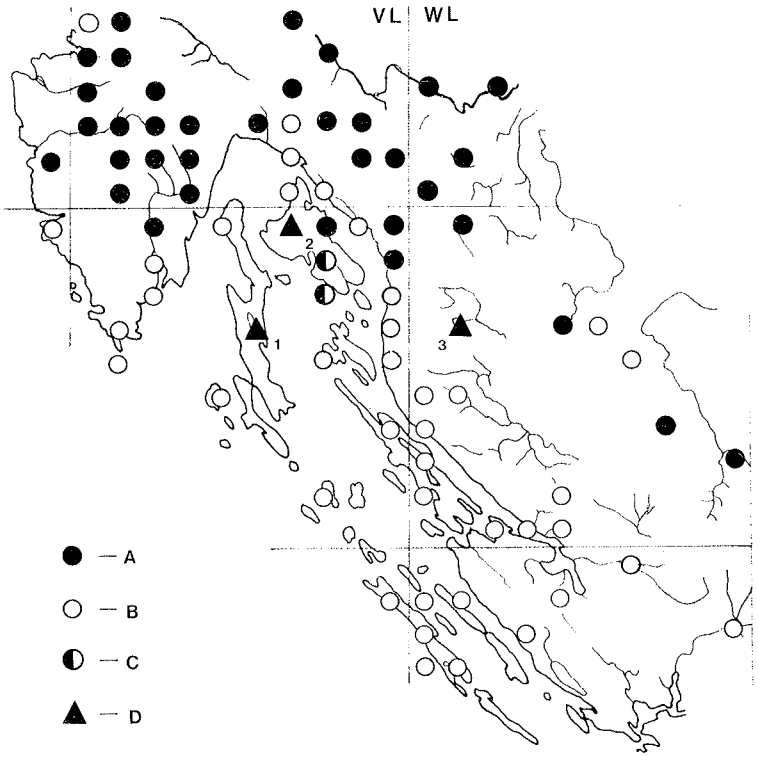

Figure 5. *Bombina variegata* and *Bufo viridis* in south western part of Croatia. A = only *B. varigeata*, B = only *Bufo viridis*, C = both spec, but not syntopic, D = syntopic data: 1 = Vransko jezero, Cres island (BRUNO 1980); 2 = Ponikve, Krk island (BRUNO 1980); 3 = Kuterevo, Klanac; Kuterevo, Poljana.

The *Bombina variegata*, as the permanent inhabitant of the more northern and western parts of Velebit, is almost vicariously replaced by the *Bufo viridis*. This can be explained by the influence of different foundations (flysh/limestone) in combination with climate, i. e. the unfavourable karst conditions for the *Bombina variegata*, whose way of life demands that in summer water remains in depressions of the land for longer time. In the wider

region of the north-eastern Adriatic coast the only localities beside Kuterevo where these species live together are Lake Vrana on the island of Cres and Ponikve on the island of Krk (BRUNO 1980). After the exhaustive analysis of data from literature and field research, it is our opinion that the *Bufo viridis* has retreated from the areal in which it was recorded at the beginning of the century (e.g. Velika Kapela), contrary to the opinion of SCHMIDTLER & SCHMIDTLER (1983) who doubt the determination of the older authors.

CONCLUSIONS

A total of eleven species of amphibians were recorded on Velebit, the most numerous being the *Triturus alpestris, Bufo bufo, Bufo viridis* and *Salamandra salamandra*. Older records about the finds of the *Rana temporaria* (HORVATH 1918; HIRTZ 1930) and *Salamandra atra* (WETTSTEIN 1928; HIRTZ 1930) have not been confirmed. Besides the *Proteus anguinus*, which is a typical subterranean species, the *Salamandra salamandra* and *Triturus alpestris* were also recorded below karst ground. The NW collin belt, into direction against the plateau of Gacka and NW Lika, is the richest by amphibians. Here optimaly exist all 11 species of the amphibians noted on Velebit: *Salamandra salamandra, Triturus alpestris, Triturus carnifex, Triturus vulgaris, Proteus anguinus, Bombina variegata, Bufo viridis, Bufo bufo, Hyla arborea, Rana dalmatina* and *Rana ridibunda*. The number of species along the continental edge of the mountain decreases in SE direction; *Triturus carnifex, Triturus vulgaris* and *Bombina variegata* disappear from fauna. The *Salamandra salamandra, Triturus alpestris, Bufo viridis* and *Bufo bufo* are the only species that live on the coastal slopes (collin, submontan and montan belts) and as very rare species the *Hyla arborea*. On south-eastern Velebit they are joined by the *Rana dalmatina* (collin and submontan belts) and the *Rana ridibunda* (collin belt). On the mountain as a whole the number of species decreases from the foot (5-10 species) to the subalpine belt, where only three species live: *Triturus alpestris, Bufo viridis* and *Bufo bufo*. No especial links were recorded with any individual altitudes or vegetational belt except that some species do not appear in the higher belts. In the species for which there were a large number of finds differences were recorded in the phenology of stages of development and in periods of activity (of two or even four months) in various altitude belts. This was especially investigated for the *Salamandara salamandra* and the *Triturus alpestris*. The *Bombina variegata* and *Bufo viridis* have been found to be mutually exclusive.

ACKNOWLEDGEMENTS

We were given valuable data about individual finds by our colleagues Branko Jalžić, Ante, Joso and Luka Vukušić, Franjo Perović and Georg Džukić, and we make use of this occasion to thank them.

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Received March 12, 1993

List of localities

(localities; UTM(10x10 km); part of Velebit Mts. according **Fig 1**)

Alan, VK95, N/M
Apatišanska duliba (=Apatišan), WK05, N
Ažić lokva, VK96, N
Babino (=Babje) jezero, WK31, S
Babrovača, VK96, N
Baške Oštarije (Ljubica potok), WK13, M/S
Baške Oštarije (Crni ponor), WK13, M
Baške Oštarije - Brušane, WK12, M/S
Begovača, WK05, N
Bogunovići, WJ89, SE
Bunar pod Biondinovačom, VK96, N
Bunjevac (=Bunovac), WK41, S
Crni Padež, Štirovača, WK04, M
Crveni potoci, WK50, SE
Čengići-Jurišići, WJ78, SE
Dolac, Krasno, WK06, N
Donji Legci (Legački bunar), VK96, N
Donji Lopci, Senjska Draga, VK98, N
Donji Starigrad (Rogića lokva), VK95 N
Dušice (=Dusici), WK40, S
Gacka, vrelo, WK25, N
Glamočeva duliba, VK96, N
Gornja Klada (Bilović bunar), VK96, N
Gornja Klada (Čatrnja u Kućanskoj dragi), VK96, N
Gornja Klada (Lokvica kod Dragičevića), VK96, N
Gornji Legci (Lokača), VK96, N
Gornji Starigrad (Antinović lokva i bunar), VK96, N
Gornji Starigrad (Bunar kod Vučića - Modrići), VK96, N
Jablanac, VK94/95, N/M
Jurjevo, VK97, N

Karlobag, WK03, M/S
Klanac, Kuterevo, WK16, N
Krasno, WK06, N
Krnjeza, WJ69, SE
Križ, WJ59, SE
Krupa (ušće u Zrmanju), WJ69, SE
Ledenik, WK03, M
Lukovo Otočko (Gučinac bunar), VK96, N
Macure (Pajića lokva), WJ78, SE
Mala Paklenica, WK40, S
Mali Halan (=Mali Alan), WK50, S/SE
Mali Halan (Meki bunar), WK50, SE
Male Jasle, WK50, SE
Malovan, WK41, S
Malovansko jezero, WK41, S
Marasovići, WK30, S
Medački dolac, WK41, S
Mila voda, WK50, SE
Modrića stan, WJ59, SE
Nadžak bilo, WK06, N
Obrovac, WJ59, SE
Oštri Kozjak, WK22, M
Pazarište, WK14 , M
Podprag (= Prag), WK50, S/SE
Prezid, WJ69, SE
Poljana, Kuterevo, WK16, N
Ravne strane, ponor Čaber, WJ59, SE
Riminići, WK30, S
Rujica, Segestin, WK41, S
Senj, VK98, N
Sklopina (v. Starigrad/Paklenica),
Smiljan, WK23, M
Starigrad/Paklenica, WK30, S
Sv. Mihovil, Senjska draga, VK98, N
Sv. Trojica (Sučevići, Želj. stanica Zrmanja), WJ89, SE
Sušanj, WK13, M
Štirovača, WK04, M
Švica, WK16, N
Urukulovac, WJ78, SE
Velika Paklenica, WK30, S
Velike Brisnice, VK95, N
Veliki Alan, VK95, N
Veselinovići, Golubić, WJ69, SE
Vidovac (lokva Trnovača), WK02, S
Vučjak (pl. dom Zavižan=Krajačeva kuća), VK96, N
Vukušić glavica, VK96, N
Zavižansko jezero, Jezera, WK06, N
Zrmanja, kanjon, WJ69, SE
Zrmanja, vrelo, WJ89, SE
Žegar - Nadvode, WJ78, SE
Žive vodice, VK96, N
Živi Bunari, VK95, N
Žrnovnica, VK97, N

SAŽETAK

Kralješnjaci planine Velebita (Hrvatska), I dio: vodozemci

N. Tvrtković & E. Kletečki

Najstarije podatke o vodozemcima Velebita bilježe god. 1802 mađarski botaničar KITAIBEL (FEJERVARY 1943), kustos Narodnog muzeja u Zagrebu BRUSINA (1880) i kustos Narodnog muzeja u Zadru KATURIĆ (1889). Zahvaljujući brojnim sabiračima faune koji su početkom ovog stoljeća darivali svoje nalaze muzeju u Zagrebu (KARAMAN 1928, PAVLETIĆ 1964), te austrijskoj ekspediciji na Velebit (WETTSTEIN 1928), relativno rano su bile poznate sve vrste koje tu žive. No o njihovom prostornom rasporedu tek su nedavno djelomično izvjestili SCHMIDTLER & SCHMIDTLER (1983) i TVRTKOVIĆ (1984).

Novija istraživanja nisu potvrdila navode o *Rana temporaria* i *Salamandra atra* (usp. HIRTZ 1930), tako da faunu vodozemaca čini ukupno 11 vrsta. Najbogatije su sjeverozapadne padine brdskog pojasa gdje optimalno obitavaju sve zabilježene vrste. Najbrojniji su nalazi *Triturus alpestris, Salamandra salamandra, Bufo bufo* i *Bufo viridis*. Na

većem dijelu primorske padine žive samo one. Osobitost planine je široka rasprostranjenost *T. alpestris,* koji u najnižim pojasevima primorske padine ima i neotenične populacije. Broj vrsta opada s nadmorskom visinom tako da u najvišem pretplaninskom pojasu žive samo *T. alpestris, B. bufo* i *B. viridis.* Kod *T. alpestris* i *S. salamandra,* vrsta koje su nađene i u krškom podzemlju, zabilježene su velike razlike u vremenu pojavljivanja ličinki u primorskom i gorskom pojasu. Kod *S. salamandra* utvrđena je čak obrnuta godišnja aktivnost (zima-ljeto). Za istu vrstu točnije je određen i južni rub areala. U usporedbi s faunom vodozemaca susjedne Istre i talijanske pokrajine Friuli-Venezija Giulia (BURLIN & DOLCE 1987, DOLCE & LAPINI 1989) uočljive su razlike u visinskoj rasprostranjenosti *Triturus vulgaris meridionalis, Triturus carnifex, Bombina variegata, Bufo viridis, Rana dalmatina i Rana ridibunda.* Zapažena je i pojava da se *Bombina variegata* i *Bufo viridis* prostorno isključuju, što se tumači prvenstveno različitošću sastava geološke podloge, tj. dužinom zadržavanja vode na staništu.