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THE ATLAS OF CROATIAN BATS (CHIROPTERA) Part I

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The distribution of twelve resident species of bats in Croatia listed in Appendix II of the Habitats Directive 92/43/EEC was mapped in 10 km squares of the UTM projection grid: *Rhinolophus blasii, R. euryale, R. ferrumequinum, R. hipposideros, Myotis bechsteinii, M. blythii, M. capaccinii, M. dasycneme, M. emarginatus, M. myotis, Barbastella barbastellus* and *Miniopterus schreibersii.* A list of localities is provided with dates and references. A total of 828 UTM squares are connected with the land area of Croatia, of which 249 (= 30%) have records of bats. A total of 105 UTM squares have only one of the twelve species (42%), 103 squares have between two and four species (41%), 36 UTM squares have five to eight (14%) and only 5 UTM squares have nine species (2%). The number of localities varies between 2 (*Myotis dasycneme*) and 229 (*Rhinolophus ferrumequinum*). Depending on the species, these localities cover between 2 and 144 UTM squares (0.2%–17.3% of all 10 km squares of Croatia) with a central quartile range between 21 and 69 squares (2.5–8.3%).

Key words: Chiroptera, distribution, Croatia, status

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Kartirali smo rasprostranjenost dvanaest vrsta šišmiša iz Hrvatske koji se nalaze na Dodatku II Direktive o staništima (92/43/EEC). Areal vrsta prikazan je pomoću UTM kvadrata veličine 10 x 10 km: *Rhinolophus blasii, R. euryale, R. ferrumequinum, R. hipposideros, Myotis bechsteinii, M. blythii, M. capaccinii, M. dasycneme, M. emarginatus, M. myotis, Barbastella barbastellus* i *Miniopterus schreibersii.* Za svaku vrstu dat je popis lokaliteta sa podacima o datumu i referencama. Ukupno 828 UTM kvadrata pokriva kopnenu površinu Hrvatske, od kojih za njih 249 (= 30%) postoje podaci o nekoj od 12 vrsta šišmiša. Ukupno 105 UTM kvadrata ima podatke o samo jednoj vrsti (= 42%), 103 kvadrata podatke za dvije do četiri vrste (= 41%), 36 kvadrata podatke za pet do osam vrsta (= 14%) i samo 5 kvadrata podatke o devet vrsta (= 2%). Broj nalazišta varira među vrstama od 2 (*Myotis dasycneme*) 229 (*Rhinolophus ferrumequinum*). Ovisno o vrsti, ova nalazišta pokrivaju između 2 i 144 UTM kvadrata (= 0.2%–17.3% svih UTM kvadrata koji pokrivaju Hrvatsku), čiji je kvartilni raspon između 21 i 69 kvadrata (= 2.5–8.3%).

Ključne riječi: Chiroptera, rasprostranjenost, Hrvatska, status

INTRODUCTION

The oldest records of bats in Croatia are from foreign investigators and merchants who were collecting animals mostly along the Adriatic coast for natural museums in Austria, Italy and Germany. In the first half of the 19th century, while the country was still divided into three administrative regions – Croatia, Istria and Dalmatia, 12 bat species were recognized to inhabit the eastern Adriatic coast (BLASIUS, 1857; KOLENATI, 1860). Professor Juraj Kolombatović from Split made a significant contribution to the knowledge of the ecology and distribution of bats from Dalmatia resulting in a total of 22 known species (KOLOMBATOVIĆ, 1887). The following period was characterized by numerous collectors who sent material to collections in Vienna (J. Kolombatović), Budapest (J. Madarász, L. Mehely), Berlin (M. Padewieth) and London (Lord Lilford). Professor August Langhoffer organized the first systematic collection of cave fauna and therefore enriched the bat collection of the National Museum in Zagreb (today the Croatian Natural History Museum). Data on bats were collected mostly from Dalmatia (G. S. Miller, R. Sturany, F. Steindachner, Otto von Wettstein and B. Klaptocz) and Istria (G. B. dal Piaz, Fritz Wettstein and J. Matisz). The Hungarian chiropterologist G. Topal and the Italian zoologist B. Lanza made their contributions during the second half of the 20th century, but a new and important contribution connected with the first organized observations of bats in caves came from Beatrica Đulić in collaboration with the Speleological Section of the Mountaineering Club »Željezničar« from Zagreb.

The first systematic review of Croatian bats is given by B. Đulić (ĐULIĆ, 1959). In this work, the author gathered and analyzed data from the lists of bats and mammals collected by various researchers during the 19th century (Kolombatović, Mojsisovics, Mehely, etc.) and also summarized her own work resulting in 26 known species. The most comprehensive data were presented for cave dwelling species, among which those of the genus *Rhinolophus* were of particular interest. Since then, only regional reviews of bat fauna, mostly on the Adriatic coast and the islands, have been published (ĐULIĆ & FELTEN, 1964; ĐULIĆ & VIDINIĆ, 1964; DULIĆ, 1970; ĐULIĆ & TVRTKOVIĆ, 1970, 1979). In 1994, the first Red Book of Mammals of Croatia included a list of 27 species of bats (DRAGANOVIĆ, 1994). At the moment, 34 species of bats are known to occur in Croatia, with one species considered extinct (TVRTKOVIĆ *et al.*, 2006). The present review represents the first and most comprehensive data on the distribution of 12 threatened species in Europe. This considerable update is the result of intensive bat studies carried out by the Croatian Natural History Museum from 1996 onwards.

Study area

Croatia, with a land surface of 56,542 km² and a sea surface of 31,067 km², is a medium-sized European country situated on the border of two highly different floristic regions – the Mediterranean and Euro-Siberian-North American regions. Biogeographically, Croatia is part of the Palaearctic and is divided into three different regions according to the European Environment Agency (EEA, 2008). On account of the mostly low altitude of the Dinaric mountains, for our analysis we have combined the northern parts, the central and eastern European region and the mountainous region, making a basic division of only the Continental region and the Mediterranean region (Fig. 1). According to the general climatic factors (temperature, precipitation), Croatia belongs to countries natural covered with forest (TRI-

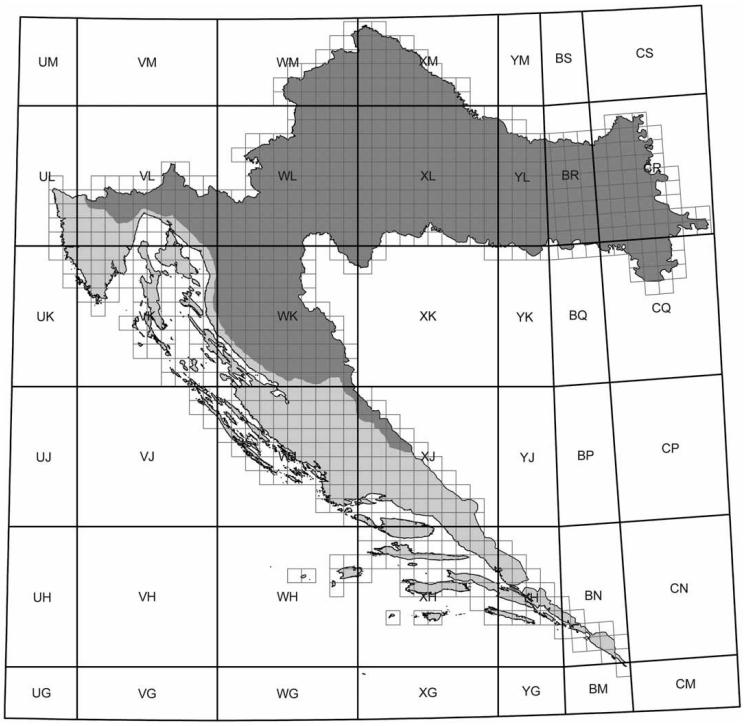

Fig. 1. Map of Croatia with a basic division into two parts – Continental (dark grey) and Mediterranean (grey). The border between the regions is at an altitude of 700 m a.s.l. in the NW, to 900 m a.s.l. in the SE part of the coastal area.

NAJSTIĆ *et al*., 1992). Large areas, as in most of Europe, fall under human influence, covered with secondary or anthropogenic vegetation types. Today, around 36% of the surface is covered with different types of forests – the most dominant species being beech (36%) and two oak species (*Quercus robur* and *Q. petraea*) (25%) (TRINAJSTIĆ *et al*., 1992). Forests are mainly well preserved and, considering their natural composition, they have remained similar to European virgin forests. Another important fact from the point of view of the richness and abundance of bat species is that a major part of Croatian territory (46%) is covered with karst relief which is extremely rich in numerous underground crevices, caves and caverns. Karst is a predominant landscape in the Mediterranean part and in the area south of the River Sava, while in the north only some small karst isolates exist. Over 7,000 caves have been recorded in Croatia and there are prospects for this number to at least double with new investigations (GOTTSTEIN MATOČEC *et al*., 2002). Morphologically, most of the investigated caves (70%) are pits (potholes) and only 305 are horizontal caves.

MATERIAL AND METHODS

The distributional status of the 12 resident species of bats in Croatia listed in Appendix II of Council Directive 92/43/EEC is presented based on the published data, unpublished data gathered by specialists and data collected during intensive field

work conducted as part of the NATURA 2000 project in the period from 2006 to 2009. All other available data are also included (i.e. field notes and museum specimens). Only one species from Appendix II – *Rhinolophus mehelyi* – is considered extinct in Croatia (TVRTKOVIĆ *et al*., 2006). For *Barbastella barbastellus*, we have also used data obtained from transects with bat detectors (Petterson D1000X model). Dubious records for all species were rejected or are commented on in the text. The gathered database consists of more than 60% of the total localities that have precise GPS coordinates, while the rest were taken from geographical maps. For population estimates and status analysis, the most recent data acquired by specialists were used.

Field surveys resulted in the clear identification of an animal at species level. The only problem for identification is presented by the complex of *Myotis myotis / M. blythii* since it is impossible to distinguish between the two (by mere observation or by photo) without confirmation from museum specimens proved by specialists.

Localities are given according to 10 km squares of the UTM projection grid. A total of 828 UTM squares are connected within the land area of Croatia, of which 249 (= 30%) have records of bats (Fig. 2). 10 km squares of the UTM grid were divided between the Continental (526 UTM squares = 63.5%) and the Mediterranean parts (302 squares = 36.5%) for the analysis.

Each record is accompanied by observation data (day/month/year) and the source. The latter includes published references, the collection's acronym and/or the name(s) of the person(s) providing the information. Data presentation on the maps is accompanied by a list of squares arranged starting from the bottom left and sorted numerically within a 100 km grid.

Taxonomy and nomenclature follow MITCHELL-JONES *et al*. (1999) and KRAPP (2001, 2004).

Acronyms	
ZMS	Natural History Museum, Skopje
PMS	Slovenian Museum of Natural History
NMW	Naturhistorisches Museum, Vienna
NMB	Museum of Natural History, Budapest
HPM	Croatian Natural History Museum

RESULTS AND DISCUSSION

Total of 828 UTM squares are connected with land area of Croatia, out of which 249 (= 30%) have records of bats (Fig. 2). Total of 105 UTM squares have only one of 12 species (= 42%), 103 UTM have between two and four species (= 41%), 36 UTM have five to eight (= 14%) and only 5 UTM have nine species (= 2%). Number of localities varies between two (*Myotis dasycneme*) and 228 (*Rhinolophus ferrumequinum*); central quartile range is between 23 and 81. Depending on the species, these localities cover between 2 and 144 UTM squares (= 0.2%–17.3% of all 10-km squares of Croatia) with central quartile range between 21 and 69 squares (= 2.5–8.3%).

Total of 140 squares (= 26.6%) have the records of bats within Continental part while 109 squares (= 36.1%) have the bat records within Mediterranean part. Abundance of the species recorded per square is also in favour of Mediterranean part – 66 UTM squares have only one record (= 47%) within Continental part, whereas within Mediterranean it is only 39 (= 36%).

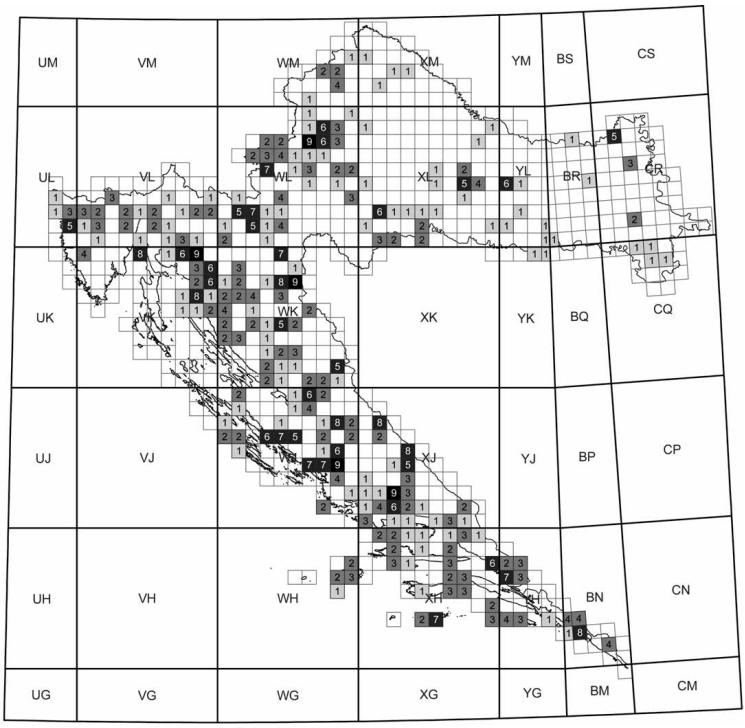

Fig. 2. Number of species analyzed that were recorded within a single UTM square. UTM squares are shaded (from light grey to black) according to the number of recorded species: 1, 2–4, 5–8 and 9.

Rhinolophus blasii Peters, 1853

Blasius's horseshoe bat / Blazijev potkovnjak	
Number of localities / broj nalazišta	21
Number of 10-km squares of UTM grid / broj 10-km UTM kvadrata	18
Number of maternity roosts / broj porodiljnih kolonija	6
Number of winter roosts / broj zimskih kolonija	9

This is the rarest of all species of the genus *Rhinolophus* found in Croatia. All findings are restricted to inland caves of the Mediterranean region with the exception of records from the islands of Cres, Krk and Rab. From Cres and Rab, bats flying near the caves were recorded with a bat detector. The record from the island of Krk has not been verified since the cave (Strassenhöhle near Baška) has not been found. Old records from unknown caves on the island of Lastovo (BOLKAY, 1926; ĐULIĆ, 1968) are considered questionable and were not confirmed during recent field work. Since the species is considered extinct in Slovenia (KRYŠTUFEK & DONEV, 2005), records from Croatia represent the northern limit of this widely distributed but rare species. Separation of this species from *R. euryale* without capturing it or using a bat detector could be problematic; therefore, some of the old findings not confirmed during this work should be taken with care.

Out of the nine wintering caves, only two are considered to be important (PAVLINIĆ & ĐAKOVIĆ, 2009), with more than 30 individuals recorded recently – Ćulumova cave and Vodena jama. A maximum of 120 bats was counted during November 2007 in Ćulumova cave, while during October 2008, 80 bats were counted. Bats were hanging singly or forming small clusters of up to 5 animals and were always in the same chamber at the end of the cave. Up to 50 bats were estimated during the visit to Vodena jama in October 2008. Mandalina, Pivčeva, Močiljska and Stražbenica caves housed, according to old data, colonies of up to 80 *R. blasii* during the winter, but after recent visits only a few single individuals were recorded in Stražbenica cave only. Other hibernacula sheltered only single individuals. Records are from sea level up to 450 m a.s.l.

Six records of *R. blasii* could be connected with maternity colonies/roosts, but at this moment only two are seriously considered – the record relating to Topla peć near Čikola River where 60 bats were counted during July 2000 and the record of *R. blasii* hunting during several consecutive nights in August 2009 just above the entrance to Medova buža cave on Rab island (P. Endl, personal comm.). Medova buža is a relatively small sea cave with two entrances housing huge maternity colonies of several species of bats such as *M. emarginatus* (estimate 100–150), *M. myotis* and *M. blythii* (estimate 1,500–2,000) and *R. ferrumequinum* and *R. euryale* (estimate 230–450). It seems possible that the specimens of *R. blasii* are together in the cluster with other horseshoe bats.

The total number of bats in hibernacula was estimated at *ca.* 200. The entire population in Croatia is therefore most likely less than 1,000 individuals. Population trends are not known. Recently, two winter colonies were discovered in Ćulumova and Vodena jama and both have been the subject of ongoing monitoring.

Localities / nalazišta

XH53 Unnamed locality, Lastovo island (ZMS: BOLKAY 1926); **Unnamed cave**, Lastovo island (09.07.–19.08.1965: ĐULIĆ 1968); **YH16 Špilja iznad Kopren dola** /cave/ (16.09.1995 /det. D. Kovačić/, JALŽIĆ *et al*. 1997); **BN62 Vilina špilja** (= Vilina kuća) /cave/, Ombla, Dubrovnik (16.12.1957: ĐULIĆ 1959; 16.01.2002, I. Pavlinić & M. Ćaleta); **BN63 Močiljska špilja** /cave/, Dubrovnik (17.12.1957, 06.12.1959: ĐULIĆ 1961); **Mokošica**, Dubrovnik (26.08. 1977: ČERVENÝ & KRYŠTUFEK 1988); **WJ68 Velika Kusača špilja** /intermittent spring cave/, Bukovica (19.07.2001, N. Tvrtković & I. Pavlinić); **WJ74 Mandalina** /marine cave/, Šibenik (04.12.1957, 30.11.1959: ĐULIĆ 1961; June 1968, February 1968: HENEBERG *et al*. 1968); **WJ83 Pivčeva pećina** /cave/, Vrpolje (29.11.1959: ĐULIĆ 1961, 1967; 29.11.1965: ĐULIĆ 1966, 1967; February 1968; HENEBERG *et al*. 1968); **Stražbenica** /cave/, Danilo (06.12.1957, 27.11.1959: ĐULIĆ 1961; 30.01.2002, I. Pavlinić *et al*.); **WJ84 Škarin Samograd** /cave/, Pokrovnik (05.09. 1977: ČERVENY & KRYŠTUFEK 1988); **WJ85 Topla peć** /cave/, river Čikola canyon (11.07.2000, B. Jalžić & D. Hamidović); **WJ96 Špilja na Promini** /cave/ (KOLOMBATOVIĆ 1884); **XJ17 Ćulumova pećina** /cave/, Kijevo, (06.02.1972: KRYŠTUFEK & ĐULIC 2001; 10.03.1999, B. Jalžić *et al*.; 02.02.2002 I. Pavlinić *et al*.; 01.11.2007, I. Pavlinić; 23.10.2008, I. Pavlinić & M. Đaković); **XJ22 Milićevica** /cave/, Split (13.12.1957; ĐULIĆ 1961); **XJ35 Vodena jama** /cave/, Rumin (24.10.2008, I. Pavlinić & M. Đaković); **XJ60 Špilja na Biokovu** (una grotta del monte Biokovo) /cave/, Biokovo Mt. (KOLOMBATOVIĆ 1884); **Špilja u Bastu** /cave/, Mt. Biokovo (01.02.1999, photo by R. Ozimec); **VK49 Ćampari špilja** /cave/, Cres island (14.04.2004, 19.04.2004, 22.04. 2004: BURGER *et al*. 2004; WINTERFELDT 2004); **VK86 Rab island** (07.08.2009, P. Endl); **VK88 Strassenhöhle** /semi-cave/, Baška, Krk island (02.06.1980, E. & M. Christian, NMW); **VK89 Zagorska pećina** (= Zagorska peć, = Novljanska pećina) /cave/, Novi Vinodolski (20.03.1902, NMB: FÖLDVÁRY 1906; 1903, HPM: LANGHOFFER 1912, PASZLAVSZKY 1918).

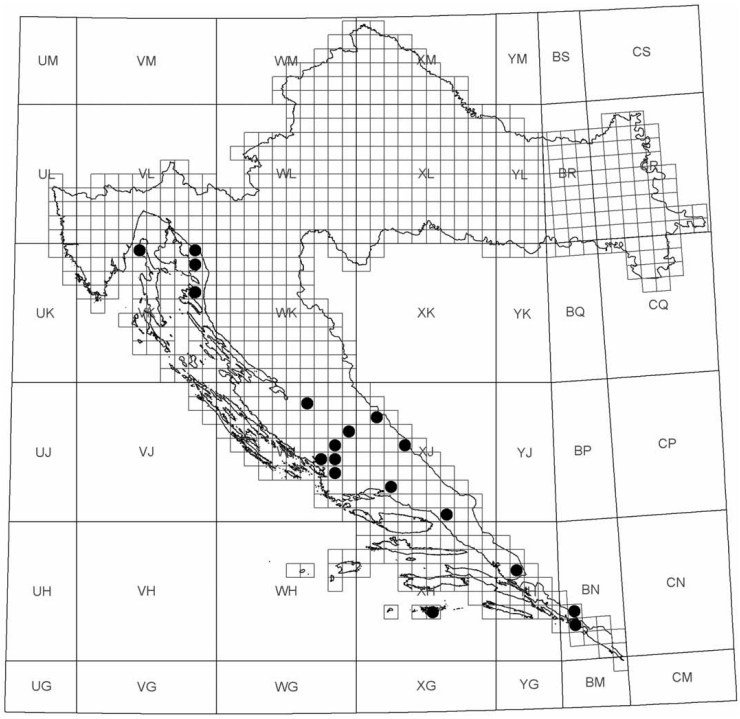

Fig. 3. Distribution of Blasius's horseshoe bat *Rhinolophus blasii* in Croatia.

Rhinolophus euryale **Blasius, 1853**

Mediterranean horseshoe bat / južni potkovnjak	
Number of localities / broj nalazišta	83
Number of 10-km squares of UTM grid / broj 10-km UTM kvadrata	55
Number of maternity roosts / broj porodiljnih kolonija	24
Number of winter roosts / broj zimskih kolonija	13

The Mediterranean horseshoe bat greatly resembles Blasius's horseshoe bat, not only in its appearance and size but also in its preference for the warm and comparatively dry Dinaric region where some of the largest agglomerations are known. The species has been recorded in all parts of Croatia, with the only exception being the Pannonian lowland. Most of the UTM squares (23) within the Mediterranean part where the bat is found are situated along the coast and on several larger islands. Most island records come from the distant past. The Continental records are restricted to warm southern karstic slopes, mostly along the larger rivers like the Dobra, Kupa and Korana. Records relate to areas from sea level up to 750 m a.s.l.

Thirteen caves were identified as hibernacula but only four seem to shelter colonies with more than 30 individuals. Data from the Veternica cave suggests a decline from almost 150 individuals recorded in 1966 to only 25 bats in 2007. While the estimate of 50–80 individuals in Vodena jama and 75 bats in the Matešića cave make them important winter shelters, the record of Jankonka pit is doubtful. The remaining known hibernaculum housed up to 10 individuals.

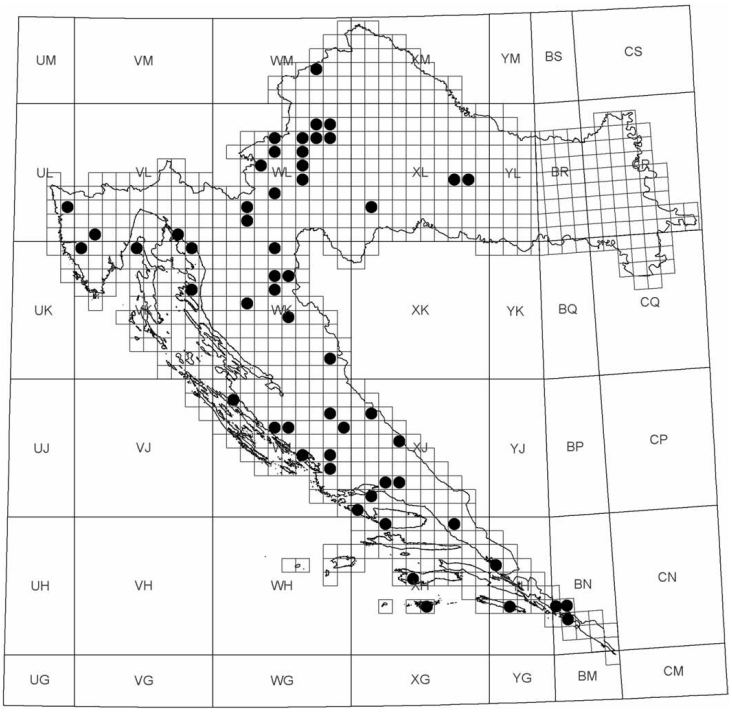

Fig. 4. Distribution of the Mediterranean horseshoe bat *Rhinolophus euryale* in Croatia.

Eleven out of 24 maternity roosts (= 45.8%) housed 50 or more individuals with a maximum of 1,200 bats recorded in July 2001. Most of the records relate to caves and only a few findings come from lofts and basements. The total number of bats within maternity colonies in the Continental part (*ca.* 1,500) represents almost 50% of the total females recorded. Out of the seven caves that shelter large maternities, the largest are the Tradanj and Vilina caves (Mediterranean part), and the Barićeva and Dragina caves (Continental part). Two maternity colonies (the Vrlovka and Močiljska caves) have disappeared due to inappropriate cave gates, while another two probably vanished after the degradation of the natural feeding habitats around the caves (Vrelo pećina and Zagorska špilja). The colony found inside Vile Jezerkinje cave (Plitvička jezera NP) disappeared due to intensive tourist visits. The maternity colony in Dragina cave is also facing extinction due to construction works and the final submersion of the cave. Counts of maternity roosts yield *ca.* 3,500 adult females, which suggest that the national population, assuming a balanced sex ratio, numbers around 7,000 Mediterranean horseshoe bats. Winter counts show a great misbalance, with only a few hundred individuals recorded, most likely due to the profound dispersion of this species in hibernacula. Population trends are not known, although the data from Tradanj cave imply huge differences between seasons within the same roost.

Localities / nalazišta

XH29 Činjandra pećina /cave/, Nerežišće, Brač island (07.11.1954: ĐULIĆ 1959); **XH45 Vela Luka**, Korčula island (01.08.1955: DJULIĆ 1959); **XH53 Medveja špilja** /cave/, Lastovo island (28.08.1957: ĐULIĆ 1958, ĐULIĆ personal notes); **XH79 Baba špilja** (= Babina špilja) /cave/,

Biokovo Mt. (August 1983: MARKOVIĆ 1984); **YH06 Vištičina jama** /pit/, left entrance (04.08.2009, I. Pavlinić & M. Đaković); **YH13 Špilja Galičnjak** /semi-cave/, Prožura, Mljet island (23.03.1996, N. Tvrtković); **BN53 Ljubač**, stara mlinica /old mill/ (19.06.1998, N. Tvrtković); **Rafova špilja** (= Zatonska špilja) /marine cave/ (19.06.2007, I. Pavlinić & M. Đaković); **BN62 Vilina špilja** /cave/, Ombla, Dubrovnik (20.05.1999, N. Tvrtković *et al*.; 02.07.2001, N. Tvrtković & I. Pavlinić; 18.06.2007, I. Pavlinić & M. Đaković); **BN63 Močiljska špilja** /cave/, Dubrovnik (June 1956: ĐULIĆ 1959);. **WJ18 Zadar** (MILLER 1912); **WJ46 Jama u Madoni** /pit/, Biograd n/m (01.07.1957: ĐULIĆ 1961); **Vrelo pećina** (= Vrana pećina) /spring cave/, Vrana (23.07.1894, HPM: ĐULIĆ 1959; 30.06.1957: ĐULIĆ 1961); **WJ56 Baldina jama** /pit/ (15.10.2003, I. Pavlinić *et al*.); **WJ64 Tradanj špilja** /cave/ (31.07.2001, N. Tvrtković & I. Pavlinić; 29.08.2001, N. Tvrtković *et al*.; 04.07.2007, 10.07. 2008, I. Pavlinić *et al*.); **WJ83 Pivčeva pećina** /cave/, Vrpolje (29.11.1965: ĐULIĆ 1966, 1967); probably the same locality as Vrpolje (= Vrpolie) (SMF: FELTEN *et al*. 1977); **Stražbenica** /cave/, Danilo (30.01.2002, I. Pavlinić *et al*.); **WJ84 Škarin Samograd** /cave/, Pokrovnik (27.09.2007, I. Pavlinić & M. Đaković); **WJ87 Miljacka I** /spring cave/ (17.09.1998 B. Jalžić); **Miljacka II** /intermittent spring cave/ (29.08.2001, N. Tvrtković *et al*.); **WJ95 Slipica** /cave/, Velušić (10.07.1957: ĐULIĆ 1961); **Mandalina** /marine cave/, Šibenik (29.11.1954: ĐULIĆ 1959); **XJ00 Rogač**, kuća /house/, Šolta island (22.09.1958: Bakić 1958); **XJ11 Split** (= Spalato) (BLASIUS 1857); **Dioklecijanova palača** /palace cellar/ (12.09.1957: BAKIĆ 1958); **Marjan** /limestone crevice/ (13.09.1957: BAKIĆ 1958); **XJ17 Ćulumova špilja** /cave/, Kijevo (02.02.2002, I. Pavlinić; 28.09.2007, I. Pavlinić & M. Đaković); **XJ22 Pećina above river Jadro spring**, Solin (= cavita, sopra la sorgente del fiumicello Jadro /Salona/) (NMW: KOLOMBATOVIĆ 1884); **Milićevica pećina** (= Milićeva pećina) /cave/, Žrnovnica (27.09.1956, 29.01.1958, 24.05.1958: BAKIĆ 1958; February 1968: HENEBERG *et al*. 1968); **XJ32 Potkapina** /semi-cave/, Kučine, Mosor Mt. (24.05.1957: BAKIĆ 1958; 07.07.1957: ĐULIĆ 1961); **XJ35 Vodena jama** /cave/, Rumin, Troglav Mt. (24.10.2008, I. Pavlinić & M. Đaković); **VK09 Romualdova pećina** /cave/, Kloštar (= Rinaldova pećina! op. NT) (07.09.1961: ĐULIĆ & VIDINIĆ 1964); **Špilja iznad Romualdove pećine** /cave above Romualdova cave/ (01.10.2008, I. Pavlinić *et al*.); **VK49 Ćampari špilja** /cave/, Cres island (06.01.2001, B. Jalžić & D. Kovačić; 01.04.2004: BURGER *et al*. 2004); **VK86 Medova buža** /marine cave/, Rab island (02.08.2001, N. Tvrtković *et al*.; 14.06.2007, I. Pavlinić & M. Đaković); **VK89 Zagorska špilja** (= Novljanska pećina) /cave/, Novi Vinodolski (17.06.1956, 02.09.1956: ĐULIĆ 1959; 1956/58: ĐULIĆ 1963; 26.9.1997, D. Kovačić & D. Holcer); **WK25 Radina jama** /pit/, Studenci (02.05.1954: ĐULIĆ 1957; DJULIĆ 1959); **Runja ponor** /swallow hole/, Konopište, Studenci (01.05.1954: DJULIĆ 1959); **Rabakova pećina** /cave/ (18.06.1954: DJULIĆ 1959); **Špilja Pećina** /cave/, Pećina (14.10.2003, I. Pavlinić *et al*.); **WK46 Plitvica** (= Plitvice), in Höhlen /in caves/ (KOLOSVÁRY 1938); **Međeđa jama** /pit/, Plitvice (26.08.1957: ĐULIĆ 1958); **WK47 Kostelčeva pećina** /cave/, Plitvice (26.08.1957, SOPD Željezničar); **Mračna pećina** /cave/, Plitvice (11.11.1954, 01.05.1955: DJULIĆ 1959; 18.10.1965; ĐULIĆ 1966; ĐULIĆ 1967); **Smolčića pećina** /semi-cave/, Plitvice (26.07.2001, N. Tvrtković & I. Pavlinić); **Vila Izvor** /house/, Plitvice (11.7.2002, I. Pavlinić); **Vile Jezerkinje pećina** /water cave/, Plitvice (01.05.1955: DJULIĆ 1959); **WK49 Matešića pećina** /spring cave/, Slunj (15.07.1998, 17.07.2001, 27.07.2001, D. Holcer & D. Kovačić; 26.07.2001, I. Pavlinić & N. Tvrtković; 26.01.2003, I. Pavlinić *et al*.; 03.04.2006, I. Pavlinić; 08.07.2008, 20.04.2009, I. Pavlinić & M. Đaković); **WK54 Hrnjakova pećina** /intermittent spring cave/, Krbavsko polje (14.10.2000, N. Tvrtković**); Polupećina near Hrnjakova pećina** /semi-cave/, Krbavsko polje (26.07.2001, N. Tvrtković & I. Pavlinić); **WK57 Baićeva špilja** /intermittent spring cave/, Ličko Petrovo Selo, Lička Plješevica Mt. (10.07.2002, N. Tvrtković *et al*.; 19.09.2002 I. Pavlinić & M. Šašić; 10.05.2003, 18.05.2003, 25.10.2005, I. Pavlinić; 08.07.2008 I. Pavlinić & M. Đaković); **Drežnik grad**, Plitvice, polušpilja /semi-cave/ (16.07.2002, I. Pavlinić *et al*.); **Kukuruzovića špilja** /intermittent spring cave/, Plitvice (10.07.2002, N. Tvrtković & I. Pavlinić); **VK81 Miša pećina** /cave/, ad urbem Srb, Lička Plješevica Mt. (September 1865, Johann Zelebor, NMW); **UL92** Buie (= **Buje**) (DAL PIAZ 1927); **VL10 Grotta di Ceresetto** /cave/, Pisino (= Pazin) (DAL PIAZ 1927); **VL70 Punta Šilo pećina** /cave/, Krk island (August 1983: MARKOVIĆ 1984); **WL21 Tounjčica špilja** /spring cave/, Tounj (27.08.2001, N. Tvrtković & F. Spitzenberger); **WL22 Dragina špilja** /cave/, Grabrk (30.6.2006, I. Pavlinić; 24.05.2007, I. Pavlinić *et al*.; 26.08.2008, I. Pavlinić & N. Tvrtković; 12.05.2009, I. Pavlinić & M. Đaković); **Jankonka jama** /pit/, Bosiljevo (02.04.2000, R. Ozimec); **WL35 Špilja Rogovac** /cave/, Lović

Prekriški, Žumberak Mt. (18.09.2002, I. Pavlinić); **Vrlovka špilja** /cave/, Kamanje (10.05.1953: DJULIĆ 1959; 1956/1958, 1956/1958: ĐULIĆ 1963); **Ozalj,** gradina /castle/ (16.07.1902, HPM: KARAMAN 1929; FELTEN *et al*, 1977); **WL43 Karlovac,** crkva /church/ (20.04.1902, HPM); **WL46 Pećno**, škola /school attic/, Žumberak Mt. (12.06.2003, I. Pavlinić); **WL47 Stojdraga**, **Sv. Juraj** /church attic/, Žumberak Mt. (12.06.2003, I. Pavlinić); **WL64 Pisarovina /**church/ (24.03.1902, HPM: KARAMAN 1929); **WL65 Kupinec,** /church/ (24.03.1902, HPM); **WL67 Podsused**, Zagreb (25.03. 1902, HPM: DJULIĆ 1959); **Podsused – Stenjevec**, Zagreb (27.03.1902, HPM: KARAMAN 1929); **Borčec k. Zagreba,** pećina /cave/, Zagreb (18.03.1902, HPM: KARAMAN 1929); **Bizečka pećina** (= Goljak-Bizek) /cave/, Zagreb (ĐULIĆ: unpublished manuscript); **Veternica špilja** /cave/, Gornji Stenjevec, Medvednica Mt. (15.05.1952, 05.06.1953, 23.09.1956: ĐULIĆ 1959; 1956/1958, 1956/1958: ĐULIĆ 1963; 19.12.1992, D. Holcer & D. Kovačić; 16.01. 1993, D. Holcer & N. Tvrtković; 03.11.1995, 09.12.1995, D. Holcer; 24.07.2001, N. Tvrtković & I. Pavlinić; 20.9.2001, 25.06.2003, 22.02.2007, I. Pavlinić *et al.*); **WL77 Zagreb** (= Zágráb) (09.08.1883, HPM: KORLJEVIĆ 1904; NMW: PASZLAVSZKY 1918); **WL78 Rudnici galenita** /mines/, Medvednica Mt. (25.06. 1955: DJULIĆ 1959); **WL87 Sesvete**, Zagreb (15.11.1902, HPM: KARAMAN 1929); **WL88 Planina Gornja**, rudnik /mine/, Zagreb (ĐULIĆ: unpublished manuscript; 15.10.1972, N. Tvrtković & A. P. Kuzjakin; 31.05.2007, I. Pavlinić *et al.*;); **XL12 Gradusa špilja** /cave/ (21.04.2009, I. Pavlinić & M. Đaković; 20.08.2009, N. Tvrtković & M. Bučar); **XL74 Rastik špilja** /swallow hole/ (09.12.2008, I. Pavlinić & M. Đaković); **Trbušnjak špilja** /spring cave/ (12.03.2007, I. Pavlinić *et al.*; 09.12.2008, I. Pavlinić & M. Đaković); **XL84 Grižina špilja** /spring cave/, Sirač (06.06.2007, I. Pavlinić *et al.*); **WM72 Mačekova pećina** /cave/, Klenovnik, Ravna Gora Mt. (02.08.1953: DJULIĆ 1959); **Polupećina** under Mačekova pećina /semi-cave/, Klenovnik, Ravna Gora Mt. (02.08.1953: DJULIĆ 1959).

Rhinolophus ferrumequinum (Schreber, 1774)

Greater horseshoe bat / veliki potkovnjak	
Number of localities / broj nalazišta	229
Number of 10-km squares of UTM grid / broj 10-km UTM kvadrata	144
Number of maternity roosts / broj porodiljnih kolonija	42
Number of winter roosts / broj zimskih kolonija	57

The greater horseshoe bat is a widespread species mostly in the Mediterranean region where it inhabits mostly low altitudes and southern mountain slopes. Most of its localities have been recorded in the Mediterranean region. Only 9 localities (all of them caves) were found to be used both by wintering and nursery colonies – 5 were in the Mediterranean region (the Miljacka II, Tradanj, Vilina, Vištičina and Zagorska caves) and 4 were in the Continental region (the Dragina, Matešića, Barićeva and Vrlovka caves). In the Dinaric area, findings are restricted to the vicinity of caves and mines used for hibernation. The greater horseshoe bat was found from sea level up to 1,000 m a.s.l. Most records, however, were confined to levels under 700 m a.s.l.

Hibernacula were found mainly in caves and other underground objects (abandoned tunnels and mines). Out of a total of 55 hibernacula, 31 contained 10 or fewer animals (53.8%) and 6 housed 250 or more animals (an average of 450 animals). In total, 25 hibernacula have been found in the Mediterranean region (3 localities with 50 or more animals, with a maximum count of 400 on the island of Vis). In the Continental region, 30 winter roosts were found (10 of them with 50 or more animals, with an average of 290 animals) with a maximum of 600 hibernating *R. ferrumequinum*. Temperatures in the hibernacula were around 9 °C but went as low as 5.5 °C (Uviraljka swallow hole). On the other hand, the average maximum temperature would probably not exceed 12 °C.

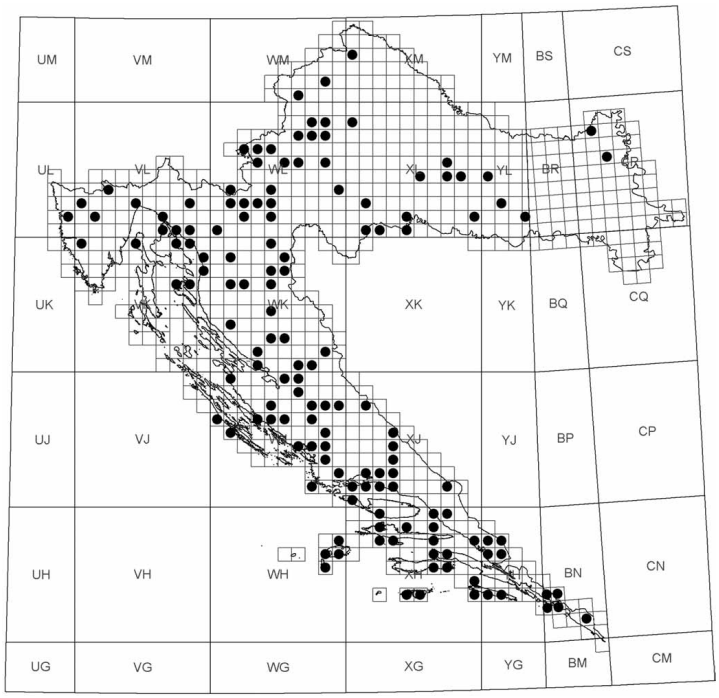

Fig. 5. Distribution of the greater horseshoe bat *Rhinolophus ferrumequinum* in Croatia.

For maternity roosts, the greater horseshoe bat seeks a high daily temperature found mostly in lofts and attics. Of the 42 maternity roosts, 13 housed 50 or fewer animals (3 of them were lofts, 1 tunnel and 1 mine and the rest were caves). 27 localities contained between 50 and 500 animals (8 of them were attics, 2 tunnels and the rest caves) and only 2 caves contained more than 500 individuals. In total, 27 nursery colonies were found in the Mediterranean region. Of these, 15 (= 68% of all nursery colonies with > 50 bats in Croatia) contained more than 50 animals (an average of 350 bats), making this region clearly the most suitable for nursery colonies. In the Continental region, 15 nursery colonies were found (5 with 50 or more bats, with an average of 150 bats). The number of bats per maternity roost varied between 5 and 4,000 (average *ca.* 250) with the largest aggregations in caves.

The population estimate is based on a total of 9,700 adult females counted in maternity roosts and 3,900 bats counted in hibernacula. Assuming a balanced sex ratio, the national population of *R. ferummequinum* is estimated at 20,000 bats, resulting in a population density of *ca*. 0.35 km^{-2}. The population trends are mostly unknown. Records from most of the hibernacula show relative stability. More problematic from the conservation point of view are artificial maternity roosts in attics and lofts, some of which are abandoned or destroyed.

Localities / nalazišta

WH85 Biševo island, tunel /tunnel/ (26.04.1996, D.Holcer & D. Kovačić); **Porat**, tunel /tunnel/, Biševo island (August 2006, photo by N. Šetina); **WH86 Stupišće**, vojni objekti, /military buildings/ Vis island (August 2006, photo by N. Šetina); **WH96 Punta noža špilje**

/caves/ between Taleška bay and Duboka bay, Vis island (30.07.1969, Vicko Marinković: ĐULIĆ & TVRTKOVIĆ 1979 wrong locality – Podšpilje); **Tuneli iznad Komiže** /tunnels/ Vis island (28.10.2006, I. Pavlinić); **Veliki rudnik** /mine/ Vis island (09.01.2000: JALŽIĆ *et al*. 2003; 01.02. 2002, I. Pavlinić; 04.10.2005: JAGARINEC 2007); **Špilja od Vore** /cave/, Vis island (09.01.2000: JALŽIĆ *et al*. 2003); **WH97 Kraljicina spila** /cave/, Vis island (07.10.2005: JAGARINEC 2007); **XH27 Draškova špilja** /marine cave/, Sv. Nedjelja, Hvar island (15.07.1997, D. Holcer); **XH28 Rt Kabal**, tuneli /tunnels/, Hvar island (13.08. 1995, 24.05.1996, 19.07.1997, D. Holcer); **XH29 Činjandra špilja** /cave/, Nerežišće, Brač island (07.11.1954: ĐULIĆ 1959); **Murvica napušteni samostan**, /abandoned monastery/ Brač island (30.07.2008, I. Pavlinić & M. Đaković); **(UTM?)** Lesina (=**Hvar island**) (KOLOMBATOVIĆ 1884); **XH37 Grabčeva špilja** /cave/, Umac (E Jelsa), Hvar island (02.09.1977: ČERVENY & KRYŠTUFEK 1988); **Špilja kraj Starigrada** /cave/, Hvar island (17.07.1970: ČERVENY & KRYŠTUFEK 1988); **Uvala Konvento**, bunar samostana /monastery well/, Šćedro island (BAKIĆ 1958); **XH43 Mrčara island**, vojni tuneli /military tunnels/ (12.6.1997, N. Tvrtković; 14.6.2001, D. Holcer; 07.08.2009, I. Pavlinić & M. Đaković); **XH48 špilja u uvali Vela Stiniva** /marine cave/, Hvar island (14.07.1997, D. Holcer); **XH53 Lastovo island** (= Lagosta) (KOLOMBATOVIĆ 1882); **Medveja špilja** /marine cave/, Lastovo island (09.07.– 18.08.1965: ĐULIĆ 1968, ĐULIĆ: unpublished manuscript); **Medviđa ropa** /marine cave/, Lastovo island (15.06.2001, D. Holcer & I. Pavlinić; 08.08.2009, I. Pavlinić & M. Đaković); **Rača pećina** /cave/, Lastovo island (26.02. 1899, HPM: KORLJEVIĆ 1903; TOPAL 1954 – wrong location on the map under Rača village in N Croatia; 06.08.1955: DJULIĆ 1959; 09.05.1997, N. Tvrtković); **XH65 Jama u Pupnatskoj luci**, /pit/, Korčula island (27.04.2004: JAZBEC 2005); **XH66 Samograd špilja** /cave/, Račišće, Korčula island (25.04.1999, M. Zagmajster); **XH67 Duboška Pazuha špilja** /cave/, Bogomolje, Hvar island (21.06.1999, D. Holcer & A. Žuljević); **XH68 Svađalica špilja** /cave/, Borova njiva, Hvar-Brusje, Hvar island (July 1957, 01.05.1958: BAKIĆ 1958); **XH69 Kotišina**, utvrđena polušpilja /fortified semi-cave/, Biokovo Mt. (16.04.1993, R. Karadžić & N. Tvrtković); **Osejava tunel** /tunnel/, Makarska (19.04.1993, R. Karadžić); **XH75 Kočije** (Žrnovo), Korčula island (22.07.1969: ĐULIĆ & TVRTKOVIĆ 1979); **Korčula**, tunnel above village, Korčula island (27.04.1999, M. Zagmajster); **XH76 Viganj**, Pelješac peninsula (31.07.1909, V. Martino); **Sv. Ilija**, jama /pit/, Pelješac peninsula (25.02.1996, D. Kovačić); **Pelješka Duba,** jama /pit/, Pelješac peninsula (27.04.2001: ŽIBRAT 2002); **XH79 Baba špilja** (= Babina špilja) /cave/, Biokovo Mt. (27.04.2002, I. Pavlinić *et al*.); **Jujnovića špilja** /cave/, Biokovo Mt. (17.10.2002, I. Pavlinić); **XH93 Vela Spila** /semi-cave/, Mljet island (1995, I. Grbac); **Špilja kraj Nerezina**, /cave/ Mljet island (02.12.2001, I. Pavlinić *et al*.); **XH94 Jama pod Veli vrh** /pit/, Mljet island (24.07.1996, T. Rađa); **XH97 Baćina** (08.08.1987: ČERVENY & KRYŠTUFEK 1988); **Peračko blato – Baćinska jezera**, tunel /tunnel/ (16.07.1994, D. Holcer; 12.08.1996: JALŽIĆ *et al*. 1997); **YH03 Špilja uz cestu Blato – Kozarica /**cave/, Mljet island (22.04.1998: ZAGMAJSTER 1999); **Ostaševica špilja** /cave/, Mljet island (10.04.1906: KLAPTOCZ 1911; 09.08.1968: ĐULIĆ 1989); **Movrica špilja** /cave/, Mljet island (10.04.1908: KLAPTOCZ 1911; 09.08.1968: ĐULIĆ 1989); **Babino Polje**, Mljet island (10.08.1955: ĐULIĆ 1959); **Babino Polje**, pukotine stijena /stone crevices/, Mljet island (10.08.1965: ĐULIĆ & TVRTKOVIĆ 1970); **YH06 Špilja Banja** /cave/, Banja (08.02.1998: JALŽIĆ *et al*. 1997); **Izvor špilja** iznad **Oblog vira** /spring cave/ (18.09.1995: JALŽIĆ *et al*. 1997); **Vištičina jama** /pit/ (04.07.1996, 09.08.1997, 11.10.1997, 08.02.1998, 19.04.1998, D. Kovačić & D. Holcer; 10.04.1997, 16.07.1997, D. Holcer; 19.01.2002, 13.01.2006, 17.03.2006, I. Pavlinić; 19.04.2009, 04.08.2009, I. Pavlinić & M. Đaković); **YH07 Špilja kod Šiljeza** /cave/, Nova Sela (08.01.1997 JALŽIĆ *et al*. 1997); **YH13 Galičnjak špilja** /semi-cave/, Mljet island (08.09.1995, N. Tvrtković & M. Baltić); **YH16 Nevakuša špilja** /cave/, Crni kuk, Dobranje (09.11.1997: JALŽIĆ *et al*. 1997); **Čekrk jama** /pit/, Glušci (27.08.1997, B. Jalžić); **Špilja iznad Kopren dola** /cave/ (16.09.1995, B. Jalžić; 19.01.2002, I. Pavlinić); **YH17 Pavičevica jama** /pit/, Dragovija (21.08.1997: JALŽIĆ *et al*. 1997); **BN52 Gornje Čelo** /stone crevices/, Koločep island (10.09.2000, E. Kletečki); **BN53 Aragonka špilja** /cave/, Ljubač (18.06. 1998, N. Tvrtković & B. Jalžić); **Jama za Gromačkom vlakom** /cave/ (06.03.1998, N. Tvrtković; 17.01.2002, I. Pavlinić & B. Jalžić); Zatonska špilja (=**Rafova spila**) /marine cave/ (August 1957 BAKIĆ 1958; June 1968 HENEBERG *et al*. 1968; 03.07.2001, N. Tvrtković & I. Pavlinić; 19.06.2007, I. Pavlinić & M. Đaković); **BN62 Vilina špilja** /cave/,

Ombla, Dubrovnik (February 1968: HENEBERG *et al*. 1968; 10.10.1997, B. Jalžić & E. Kletečki; 20.05. 1999, N. Tvrtković *et al*.; 02.7.2001, N. Tvrtković & I. Pavlinić; 16.01.2002, I. Pavlinić; 25.09.2007, I. Pavlinić & M. Đaković); **BN63 Močiljska špilja** /cave/, Dubrovnik (February 1968: HENEBERG *et al*. 1968; 16.01.2002, I. Pavlinić); **BN81 Dubravka** /abandoned house/, Orjen Mt. (11.07.1998, M. Milković); **WJ06 Golubinka** /marine cave/, Dugi otok island (12. 07.1999, B. Jalžić & E. Kletečki); **WJ15 Jezero Mir** /lake/, Dugi otok island (10/13.06.2000, bat-detector data, M. Grgurev); **WJ19 Bokanjac**, tunel za navodnjavanje /irrigation tunnel/ (summer 1989, E. Kletečki); **WJ36 Badanj špilja** /cave/ (17.04.2009, I. Pavlinić & M. Đaković); **WJ46 Höhle der Quelle** (=? Izvor pećina, Vrana) /spring cave/ (21.05.1891, R. Sturany, NMW); **WJ47 Mala Kličevica špilja** /cave/, Kličevica (6.08.2006, photo J. Božić); **WJ56 Baldina jama** /pit/ (15.10.2003, I. Pavlinić); **WJ59 Obrovac** (25.10. 1979, PMS: KRYŠTUFEK 1993); **WJ64 Tradanj špilja** /cave/ (01.07.2001, 31.07.2001, 29.08. 2001, N. Tvrtković & I. Pavlinić; 04.06.2006, I. Pavlinić & K. Čivić; 04.07.2007, I. Pavlinić *et al*.; 27.09.2007 I. Pavlinić & M. Đaković; 10.07.2008 I. Pavlinić *et al*.; 29.08.2001, 15.01.2002, 11.02.2006, 04.05.2006, 07.07.2006, I. Pavlinić); **WJ68 Mala Kusača špilja** /intermittent spring cave/, Bukovica (19.07.2001, N. Tvrtković & I. Pavlinić); **WJ69 Bezdanka jama** /pit/, Golubić (13.04.1984, B. Jalžić); **WJ71 Jamina** /pit/, Ražanj, Rogoznica (15.08.1996, T. Rađa); **WJ74 Mandalina špilja** /marine cave/, Šibenik (01.12.1956: ĐULIĆ 1959); **Šibenik** (KRYŠTUFEK 1993); **Šibenik**, napuštena tvornica /abandoned factory/ (summer 2001, EUROBATS report 2004); **WJ76 Roški slap** /semi-cave/ (August 1972, N. Tvrtković); **WJ83 Pivčeva špilja** /cave/, Vrpolje (February 1968: HENEBERG *et al*. 1968); **Stražbenica** /cave/, Danilo (30.1.2002, 05.07.2007, I. Pavlinić *et al*.); **Smokovača** /cave/, Perković (ĐULIĆ unpublished manuscript); **WJ84 Škarin Samograd** /cave/, Pokrovnik (08.09.1957, 05.01.1958, 06.02.1958: BAKIĆ 1958; 05.09.1977: ČERVENÝ & KRYŠTUFEK 1988; 21.06.1989: KOVAČIĆ & ĐULIĆ 1989; 13.02.1998, D. Holcer; 11.07.1998, D. Holcer & D. Kovačić; 13.03.1999, N. Tvrtković *et al*.; 30.01.2002, I. Pavlinić *et al*.; 27.09.2007, 21.06.2007, I. Pavlinić & M. Đaković); **WJ85 Špilja na Osoju** /cave/, Drniš (22.10.1989, D. Holcer); **WJ87 Miljacka II** /intermittent spring cave/ (11.07.1998, D. Holcer & D. Kovačić; 28.07.1998, D. Kovačić; 12.10. 1998, N. Tvrtković & Kovačić; 02.11.1998, B. Jalžić; 14.11.1998, D. Holcer & B. Jalžić; 09.03. 1999, B. Jalžić *et al*.; 22.05.1999, N. Tvrtković; 09.07.2009, I. Pavlinić *et al*.); **WJ92 Marčina jama** /pit/, Labin Dalmatinski (06.04.1997, T. Rađa); **WJ97 Izvor Krke** /tunnel/ (September 2005, N. Tvrtković & B. Jalžić; 05.07.2007, I. Pavlinić *et al*.); **Ključ** (ĐULIĆ: unpublished manuscript); **XJ00 Rogač**, kuća /house/, Šolta island (22.09.1957: BAKIĆ 1958); **Tiha špilja** /cave/, Nečujam bay, Šolta island (20.02.1958 BAKIĆ: 1958); **(UTM?) Brač island** (Isole Brazza) (KOLOMBATOVIĆ 1884); **XJ01 Grota špilja** /cave/, Čiovo island (17.01.1957, 30.08. 1957: BAKIĆ 1958); **XJ11 Split**: dintorni di Spalato (KOLOMBATOVIĆ 1882; SMF: DULIC & FELTEN 1964); **Groblje Sv. Stjepana**, bunker /bunker/, Split (16.03.1957: BAKIĆ 1958); **Marjan**, Split (01.07.1957, 12.09. 1957: BAKIĆ 1958); **Marjan** kula /tower/, Split (09.07.1957: BAKIĆ 1958); **Dioklecijanov podrum** /cellar/ (13.09.1957: BAKIĆ 1958); **Groblje Sv. Stjepana,** potkrovlje /attic/, Split (15.05.1958: BAKIĆ 1958); **Manuš**, potkrovlje kuće /house attic/, Split (12.12.1957: BAKIĆ 1958); **Ruševina crkve Sv. Jurja** /church/**, Marjan**, Split (30.09.1957: BAKIĆ 1958); **Zvonik kod bolnice** /church tower/, Split (24.02.1957, 04.03. 1957, 12.07.1957: BAKIĆ 1958); **Špilja kod sv. Jere** /semi-cave/, Split (July 1957, September 1957: BAKIĆ 1958); **XJ12 Blaca-Kozjak**, Split (August 1957: BAKIĆ 1958); **XJ17 Ćulumova špilja** /cave/, Kijevo (28.09.2007, 16.04.2009, I. Pavlinić & M. Đaković; 1.11.2007 I. Pavlinić); **Gospodska pećina** /cave/, Cetina (10.3.1999, B. Jalžić *et al*.); **XJ21 Crkva Sv. Jurja** /church/**,** Perun near Split (26.01.1957: BAKIĆ 1958); **XJ22 Žrnovnica** (= Zrnovnica) /river/ (SMF: DULIC & FELTEN 1964); **Milićevica spilja** (= Milićeva pećina) /cave/, Žrnovnica (30.10.1956: KRPAN 1962; February 1968: HENEBERG *et al*. 1968); **Mala špilja iznad Milićeve pećine** /cave/**,** Žrnovnica (BAKIĆ 1958); **Pećina iznad izvora Jadra /**cave/, Solin (04.08.1957, 04.08.1958: BAKIĆ 1958); **Podkapina pećina** /semi-cave/, Kučine, Split (27.12. 1957, 20.01.1958, 29.01.1958: BAKIĆ 1958); **Jama pod tvrđom** /pit/, Klis (24.03.1957: BAKIĆ 1958); **XJ31 Špilja u kanjonu Cetine** /cave/ (May 2004, Marco van den Hof); **XJ32 Vranjača špilja** /cave/, Kotluša, Mosor Mt. (04.01.1957, 4/5.05.1957, 21.07.1957, 4.01.1958, 23.02.1958: BAKIĆ 1958; February 1968: HENEBERG *et al*. 1968); **Mosor Mt.** (KOLOMBATOVIĆ 1884); **Pećine** /caves/, Mosor Mt. (GIROMETTA 1914); **XJ33 Trilj** (27.01.1958: BAKIĆ 1958); **XJ34 Mračna**

špilja I i II /caves/ (»Suhi Rumin«), Rumin Panj, Troglav Mt. (04.07.2001, N. Tvrtković); **XJ35 Suhi Rumin jama** /pit/, Rumin Panj, Troglav Mt. (04.07.2001, N. Tvrtković & I. Pavlinić); **Vodena jama /**cave**/**, Rumin, Troglav Mt. (11.03.1999, B. Jalžić *et al*.; 31.01.2002, I. Pavlinić); **XJ71 Špilja u Crvenom jezeru** /cave/, Imotski (03.10.1999, R. Ozimec); **VK09 Caverna di San Romualdo** (= Romualdova špilja), S Limski kanal (PAX 1937); **Špilja iznad Romualdove špilja /**cave**/**, S Limski kanal (01.10.2008, I. Pavlinić *et al*.); **Rinaldo-Grotte** (= Rinaldova špilja) /cave/, N Limski kanal (PAX 1938); **VK49 Cres island**, napuštena kuća /abandoned house/ (29.07.2001, I. Pavlinić); **Cres island**, tunel /tunnel/ (29.07.2001, I. Pavlinić); **Ćampari špilja** /cave/, Cres island (21.02.1997, 08.05.1997, B. Jalžić; 21.02.1997, 2001. D. Kovačić; 12/14.04. 2004: BURGER *et al*. 2004, WINTERFELDT 2004); **Beli**, Cres island (12/14.04. 2004: BURGER *et al*. 2004, WINTERFELDT 2004); **VK76 Špilja iznad Jamine Drage /**cave**/**, Rab island (18.05.1997, R. Ozimec); **VK79 Vrbničko polje**, tunel /tunnel/, Krk island (14.06.2007, 22.09.2007, 19.09.2008, I. Pavlinić & M. Đaković); **VK86 Medova buža /**marine cave**/**, Rab island (02.08.2001, N. Tvrtković *et al*; 26.01.2002, 04.08.2002, I. Pavlinić *et al*.; 14.06.2007, 21.09.2007, I. Pavlinić & M. Đaković); **VK89 Povilanka špilja ispod Povila /**marine cave/, (09.08.1899: MEHELY 1900, LANGHOFFER 1912; PASZLAVSZKY 1918; 01.08.1954: DJULIĆ 1959; 28.07.1997, D. Holcer & D. Kovačić); **Zagorska peć** (= Novljanska pećina, Pećina kod Novog, Novii bg.) /cave/, Novi Vinodolski (20.03.1902, HPM: LANGHOFFER 1912; NMB: TOPAL 1954; 04.09.1913, HPM; 27.02.1955: ĐULIĆ 1959; September 1972 N. Tvrtković; 26.09.1997, D. Kovačić & D. Holcer; 03.03.1999, N. Tvrtković *et al*.; 10.11. 2000, N. Tvrtković & B. Jalžić; 06.01.2002, 26.01.2002, I. Pavlinić & B. Jalžić; 17.03.2004, I. Pavlinić; 12.09.2007, 20.09.2008, I. Pavlinić & M. Đaković); **VK97 Sv. Juraj**, špilja uz more /marine cave/, Velebit Mt. (06.07.1906, MNM: PASZLAVSZKY 1918, TOPAL 1954); **VK98 Sveti Križ**, crkva /church/ (15.05.2009, I. Pavlinić & M. Đaković); **Vlaška peć** /semi-cave/, Kozica, V. Kapela Mt. (03.03.1999 N. Tvrtković *et al*.); **WK13 Ljubica**, Baške Oštarije, napuštena kuća /abandoned house/, Velebit Mt. (18.06.2005, N. Tvrtković *et al*.); **WK16 Otočac** (DULIC & FELTEN 1964); **WK18 Sinčić pećina** /cave/, Brinje, M. Kapela Mt. (12.08.1902: LANGHOFFER 1912); **WK26 Špilja Pećina** /spring cave/, Pećina, Velebit Mt. (14.10.2000, N. Tvrtković & J. Culver; 14.10.2003, I. Pavlinić); **WK30 Manita peć** /cave/, Velika Paklenica, Velebit Mt. (20.04.1956: PMS: KRYŠTUFEK 1993; 20.04.1962, Bilek & Sochurek, NMW); **Anića luka,** stari mlin /old mill/, Velika Paklenica, Velebit Mt. (04.07.1999, 26.03.2000, M. Grgurev); **WK42 Golubnjača jama** /pit/, Raduč (30.04.1956: ĐULIĆ 1959); **WK31 Parići**, stara kuća /old house/, V. Paklenica, Velebit Mt. (28.07.2005, N. Tvrtković & V. Elez); **WK44 Zelena pećina**, Bunić, Krbavsko polje (09.06.2004, N. Tvrtković & I. Pavlinić); **WK46 Milke Trnine pećina** /cave/, Plitvice (14.07.1952: REDENŠEK 1958); **WK47 Plitvice** (17.08.1904, HPM: DJULIĆ 1959); **Mračna pećina** /cave/, Plitvice (18.07.1952, REDENŠEK 1958; 11.11.1954, 02.05.1955: DJULIĆ 1959; 26.07.2001, N. Tvrtković & I. Pavlinić); **Plitvicai bg**. /caves/, Plitvice (NMB: TOPAL 1954); **Čorkova uvala**, tavan lugarnice /house attic/, M. Kapela Mt. (29.06.2003 I. Pavlinić *et al*.); **Kostelčeva pećina** /cave/, Plitvice (15.07.1952: REDENŠEK 1958; 02.05.1955: DJULIĆ 1959); **Rodića pećina** /cave/, Plitvice (11.01. 2005, I. Pavlinić & D. Holcer); **Šupljara pećina** /cave/, Plitvice (24.08.1904, HPM: LANGHOFFER 1912; 18.05.2002, I. Pavlinić & D. Holcer); **Vila Izvor** /house attic/, Plitvice (11.07. 2002, I. Pavlinić); **Vile Jezerkinje pećina** (= Crna pećina, Smrdeća pećina) /water cave/, Plitvice (19.07.1952: REDENŠEK 1958; 26.07.2001, I. Pavlinić & N. Tvrtković); **WK49 Matešića pećina** /spring cave/, Slunj (01.02.1998, D. Kovačić *et al*.; 15.07.1998, D. Kovačić & D. Holcer; 06.02.2002, 26.01.2003, 21.01.2006, 13.02.2006, 03.04.2006, 05.05.2006, 08.07.2008, 20.04. 2009, I. Pavlinić *et al*.); **WK52 Pčelina pećina** /cave/, Medak (19.04.1956: ĐULIĆ 1959); **WK57 Barićeva pećina** /intermittent spring cave/, Ličko Petrovo Selo, Lička Plješevica Mt. (July 1957: REDENŠEK 1958; 10.07.2002, N. Tvrtković & I. Pavlinić; 19.09.2002, 31.10. 2002, 30.01.2003, 18.05.2003, 25.10.2005, I. Pavlinić; 08.07.2008, I. Pavlinić & M. Đaković); **Kukuruzovićeva pećina** /intermittent spring cave/, Plitvice (25.07.1952: REDENŠEK 1958); **Hodakova pećina** /cave/, Lička Plješevica Mt. (27.07.1952: REDENŠEK 1958); **WK58 Kojina jama** /pit/, Rakovica (2000, photo B. Bukovčak); **Vukovićeva pećina** /cave/, Kremen Mt. (February 2001, H. Cvitković); **WK60 Gračac**, pećina /cave/ (02.11.1933, HPM: DJULIĆ 1959); **Brkina pećina** /cave/, Gračac (08.10.1934, HPM: ĐULIĆ 1959); **WK70 Donja Cerovačka pećina** /cave/, Velebit Mt. (29.11.1956: ĐULIĆ 1959); **Gornja Cerovačka pećina** /cave/, Velebit

Mt. (29.11.1956: ĐULIĆ 1959); **WK81 Miša pećina** /cave/, ad urbem Srb, Lička Plješevica Mt. (September 1865, Johann Zelebor, NMW); **UL91 Markova jama** /pit/, Tar (24.06.1999, B. Jalžić & N. Tvrtković); **VL02 Motovun** (17.08.1980, D. Kovačić); **VL11 Grotta di Ceresetto** /cave/, presso Pisino (= Pazin) (October 1922: DAL PIAZ 1927; GULINO & DAL PIAZ 1939); **VL23 Brest**, špilja /cave/, Ćićarija Mt. (January 1993, S. Legović); **VL42 Zamet pećina** /cave/, Kastav, (04.07.1928: ĐULIĆ 1959); **VL60 Biserujka špilja** (Vitezovićeva) /cave/, Krk island (24.05.1978, 14.06.1979, 6.06.1980, 17.04.1981: CHRISTIAN & POTOČNIK 1985); **VL61 Urinje**, špilja /cave/ (26.10.1913: ĐULIĆ 1959); **VL70 Novi Selec bg.** (= Selce cave), Selce (NMB: TOPAL 1954); **VL80 Bribir** /cave/, Novi Vinodolski (05.05. 1955: ĐULIĆ 1957); **VL82 Lipa pećina** /cave/, Lokve (29.11.1953: DJULIĆ 1959); **Medveđa pećina** /cave/, Lokve (13.11.1953: DJULIĆ 1959); **WL00 Vrelo** /crevices and semi-cave/, Jasenak (01.07.2004, N. Tvrtković); **WL12 Kuštrovka špilja** /cave), V. Kapela Mt. (12.02. 2006, 04.04.2006 I. Pavlinić); **WL13 Špilja Đot** /cave/, Bosiljevo (16.02.2003, I. Pavlinić); **WL21 Mandelaja**, /pit/, Oštarije, V. Kapela Mt. (03.04.1955: ĐULIĆ 1959; 18.11.2001, I. Pavlinić); **Tounjčica špilja** /spring cave/**,** Tounj (18.02. 1998, D. Holcer & B. Jalžić; 15.04. 1998, D. Holcer; 09.07.1998, D. Holcer & D. Kovačić; 08.07.2008, I. Pavlinić *et al*.); **WL22 Bosiljevo**, stari dvorac /castle/ (24.05.2007, I. Pavlinić *et al*.); **Dragina špilja** /cave/, Grabrk (27.02.2000, N. Tvrtković & B. Jalžić; 30.06.2006, I. Pavlinić; 24.05.2007, I. Pavlinić *et al*.; 26.08.2008, I. Pavlinić & N. Tvrtković); **WL26 Pečenjevka jama** /pit/, Žumberak Mt. (04.11.2001 I. Pavlinić); **Radatovići**, škola /school/, Žumberak Mt. (13.06.2003, I. Pavlinić); **WL32 Pećina Lipa na Protulipi** /cave/, Zvečaj (= Zvekaj) (SMF: DULIC & FELTEN 1964; FELTEN *et al*. 1977); **WL35 Ozalj**, gradina /castle/ (16.07.1902, A. Langhoffer; 24.10.1912: KARAMAN 1929; DULIC & FELTEN 1964); probably the same locality as **Ozalj**, dvorac /castle/ (30.06.2000, N. Tvrtković); **Ozaljska pećina** /cave/ (06.02.1955: ĐULIĆ 1957; 09.01. 1956, February 1957: ĐULIĆ 1959, 1963; 25.01.1998, D. Holcer; 09.07.1998, D. Holcer & D. Kovačić; 23.01.2002, I. Pavlinić); **Rogovac špilja** /cave/, Žumberak Mt. (18.09.2002, I. Pavlinić); **Vrlovka** /cave/, Kamanje (HIRC 1889; 25.10.1912: KARAMAN 1929; 01.03.1953, 10.05. 1953: ĐULIĆ 1959; winter 1958: ĐULIĆ 1963; 25.01.1998, D. Holcer *et al*.; 09.07.1998, D. Holcer & D. Kovačić; 23.01.2002, I. Pavlinić; 25.02.2002, I. Pavlinić & D. Holcer); **WL36 Crkva sv. Nikole /**church**/**, Žumberak Mt. (18.07.2002, 26.07.2002, I. Pavlinić); **Mrzlo polje**, garaža /garage/, Žumberak Mt. (17.07.2002, I. Pavlinić & M. Šašić); **Oštrc**, Čolnićevi dvori /house/, Samoborsko Mt. (13.06.2003, I. Pavlinić); **Sošice**, **crkva Marijina uznesenja**, /church/ Žumberak Mt. (13.06.2003, I. Pavlinić); **Zidana peć** /cave/, Žumberak Mt. (28.01. 2002, I. Pavlinić & B. Jalžić); **WL41 Gvozdenica špilja** /cave/ (05.03.2000, H. Cvitanović; 11.11.2001, I. Pavlinić); **Jopićeva jama** /pit/, Krnjak (27.02.2000, N. Tvrtković & D. Holcer; 06.02.2002, 03.03.2003, I. Pavlinić); **WL42 Vražić pećina** /cave/, Barilović (27.10.1912: KARAMAN 1929); **WL43 Karlovac** (07.05.1929, HPM: DJULIĆ 1959); **WL46 Pećno**, škola /school/, Žumberak Mt. (12.06.2003, I. Pavlinić); **Grabar**, crkva /church/, Žumberak Mt. (18.07. 2002, 12.06.2003, I. Pavlinić); **WL55 Crna Mlaka**, tavan /house attic/ (11.06.1984, W. Fiedler); **WL65 Kupinec** (ĐULIĆ 1959); **WL67 Pećina više Borčeca** (= Borčec) /cave/, Zagreb (18.03.1902, HPM: LANGHOFFER 1912; 1/15.04. 1924, ZMS: KARAMAN 1929); **Bizečka pećina** (= Žurenšćak) /cave/, Goljak-Bizek, Zagreb (28.06.1916, HPM: October 1927, J. Plančić, HPM; 16.11.1952: DJULIĆ 1959); **Podsused**, Zagreb (18.03.1902, HPM: KARAMAN 1929); **Podsused-Stenjevec**, Zagreb (27.03.1902, HPM); **Vetternica** /cave/, Gornji Stenjevec, Medvednica Mt. (1952: DULIĆ 1953; 11/12.04.1954, 9.01.1955, 23.01.1955, 1956, 1957: DULIĆ 1957, ĐULIĆ 1960a; 2.–5.02.1958, 21.–27.04.1958: ĐULIĆ 1963; 27.10.1965, 15.01.1966: ĐULIĆ 1966; 12.01.1983, 26.08.1983, 07.12.1983: MARKOVIĆ 1984; 21.03. 1992, 04.05.1992, 19.12.1992, 16.01. 1993, 01.04.1993, 25.04.1995, 03.11.1995, 09.12.1995., 03.02. 1996, D. Holcer; 20.09.2001, I. Pavlinić *et al*.; 28.01.2002, I. Pavlinić & B. Jalžić; 22.02.2007; I. Pavlinić *et al*.; 15.03.2008, I. Pavlinić & M. Đaković); **WL77 Zagreb** (09.12.1885, HPM: KARAMAN 1929; 18.07.1902 HPM; 16.11.1952, 23.01.1955: ĐULIĆ 1959; SMF: DULIC & FELTEN 1964); **Maksimir**, Zagreb (09.12. 1885, HPM: KORLJEVIĆ 1903); Sv. Saver (= Sv. Žaver, = **Sv. Ksaver**) /church/, Zagreb (15.05.1887, HPM: KORLJEVIĆ 1903); **WL78 Markuševac**, bunkeri /bunkers/, Medvednica Mt. (16.12.1992, 28.02.1993, 13.01.1994, 01.12.1994, 09.04.1995, 10.01.1998, 29.01.1999, D. Holcer *et al*.); **WL85 Vratovo**, lugarnica /house attic/ (12.06.1996, 20.06.1998, 03.09.1997, D. Holcer & D. Kovačić); **WL87 Sesvete**, Zagreb (ĐULIĆ 1959); **Šašinovec**, Sesvete,

Zagreb (Kepka 1960); **WL88 Planina Gornja**, rudnik /mine/, Zagreb (15.10.1972, N. Tvrtković & A. P. Kuzjakin; 31.05.2007, I. Pavlinić *et al.*); **WL93 Petrinja** (06.08.1930, V. Jašić, HPM); **XL08 Vrbovec** (26.05.1930: ĐULIĆ 1959); **XL10 Divuša – Dvor** (13.05.1902: KARAMAN 1929); **XL12 Gradusa špilja** /cave/ (21.01.2004, I. Pavlinić; 21.04.2009, I. Pavlinić & M. Đaković; 20.08.2009, N. Tvrtković & M. Bučar); **XL20 Hrvatska Kostajnica**, crkva /church/ (15.06.2009, 26.08.2009, I. Pavlinić & M. Đaković); **XL40 Hrvatska Dubica**, napuštena kuća /abandoned house/ (15.07.2009, I. Pavlinić & M. Đaković); **XL41 Krapje** (17.05.1930: ĐULIĆ 1959); **XL54 Nova Ploščica**, Garešnica (14.08. 1929 ĐULIĆ 1959); **XL74 Rastik špilja** /cave/ (12.03.2007, I. Pavlinić *et al.*; 09.12.2008, I. Pavlinić & M. Đaković); **Trbušnjak špilja** /cave/ (12.03.2007, I. Pavlinić *et al.*; 13.11.2008, 09.12.2008, 11.02.2009, I. Pavlinić & M. Đaković); **XL75 Daruvar**, tavan /house attic/ (19.04. 1928, 28.12.1931: ĐULIĆ 1959); **XL84 Grižina špilja**, Sirač /intermittent spring cave/ (07.01. 2001, N. Tvrtković *et al.*; 10.12.2008, I. Pavlinić & M. Đaković); **XL91 Staro Petrovo Selo**, tavan kuće /house attic/ (01.08.2007, 29.07.2009, I. Pavlinić & M. Đaković); **Rešetari** (ĐULIĆ 1959); **YL04 Uviraljka**, ponor /swallow hole/, Papuk Mt. (28.05. 1999, 18.01.2000, N. Tvrtković *et al.*: TVRTKOVIĆ *et al.* 2001; 07.01.2001, 28.01.2003, 22.01.2004, 10.11.2005, 13.12. 2005, 22.01.2006, 07.02.2006, I. Pavlinić *et al.*); **YL12 Jakšić**, Slavonska Požega (ĐULIĆ 1959); **YL31 Pljuskara špilja** /cave/, Zdenci, Dilj Mt. (05.02.2005, photo N. Šetina); **CR17 Banovo brdo,** rudnik /mine/ (29.01.2002, J. Mikuska; 08.02.2002, J. Mikuska *et al.*; 05.08.2.2002, N. Tvrtković *et al.*; 02.02.2003, I. Pavlinić & D. Holcer; 09.11.2005, I. Pavlinić; 01.08.2009, I. Pavlinić & M. Đaković); **CR25 Kopačevo**, tavan kuće /house attic/ (MIKUŠKA 1979, 1978); **WM60 Krapinske Toplice** (11.06.1956, female with ring from Veternica cave, Medvednica Mt.: ĐULIĆ 1957); **WM81 Ivanec**, rudnici /mines/ (09.04.1946, 02.01.1954: ĐULIĆ 1959); **XM03 Varaždin** (JURINAC 1884).

Rhinolophus hipposideros (Bechstein, 1880)

Lesser horseshoe bat / mali potkovnjak	
Number of localities / broj nalazišta	176
Number of 10-km squares of UTM grid / broj 10-km UTM kvadrata	111
Number of maternity roosts / broj porodiljnih kolonija	20
Number of winter roosts / broj zimskih kolonija	66

Considered as the most common and widespread *Rhinolophus* species, the lesser horseshoe bat is largely unknown in Croatia, especially when it comes to maternity roosts. Its range somewhat resembles that of the greater horseshoe bat, having most of its hibernacula in the Dinaric area (15 UTM squares) and none in the Pannonian region. Vertical distribution is similar to that of the greater horseshoe bat.

Numerous hibernacula are known but the average number of specimens recorded is low (6 bats per hibernaculum), with only 13 sites with 10 or more bats (= 19.7%) and only 4 with 30 to 60 bats (= 0.6%). All hibernacula are in caves and pits. Only in the most northern part of the Croatian range were hibernating individuals recorded in abandoned mines and tunnels and in a cellar. The largest new hibernating colony was discovered in Rastik cave in December 2008 which is less than 500 m from Trbušnjak cave that had been visited each month for two years and having a maximum of only 10 hibernating *R. hipposideros*.

Only four maternity colonies were found in church lofts (= 15%), a small number when compared to 82% in Slovenia (KRYŠTUFEK & DONEV, 2005). One colony from the church loft in Boljun (Istria) is known to host between 50 and 100 adult females, others are even smaller. During our intensive survey of churches within the Continental region, not one maternity colony was recorded. Only a few lofts hous-

ed the old remains of *R. hipposideros.* Further to the south, small maternity colonies are located in the attics of abandoned houses and only rarely in church lofts.

Although considered a common and widespread species in Croatia, it is very difficult to use the current data of both winter and maternity counts for a population estimate. Previous estimates were based mainly on the data and proposed population density of Slovenia (KRYŠTUFEK & DONEV, 2005), but the number of 20,000, in light of the newest data, seems an overestimate. Although historical data are scarce and no clear evidence of a decline can be presented, the specific needs of maternity roosts in church and house attics make this species highly vulnerable to human disturbance and to the destruction of shelters. The closing of church lofts together with the inappropriate renovation of church and house roofs seems to have a great negative effect on this species in particular.

Localities / nalazišta

WH86 Komiža, polušpilja /semi-cave/, Vis island (26.06.1996, D. Holcer); **Špilja K4** /cave/, Vis island (03.10.2007: JAGARINEC 2007); **WH96 Tuneli iznad Komiže** /tunnels/, Vis island (28.10.2006, I. Pavlinić); **Veliki rudnik** /mine/, Vis island (08.01.2001: JALŽIĆ *et al*. 2003); **Špilja od Vore** /cave/, Vis island (10.01.2001: JALŽIĆ *et al*. 2003); **XH19 Milna – S. Giuseppe**, crkva /church/, Brač island (23.07.1912, O. Wettstein, NMW); **XH53 Hum**, Lastovo island (10.09.1995, N. Vajdić); **XH66 Samograd** /cave/, Račišće, Korčula island (12.02.1998, D. Kovačić; 25.04.1999, M. Zagmajster; 27.04.2004: JAZBEC 2005); **XH68 Špilja Podrum** /cave/, Podgora, Biokovo Mt. (16.10.2002, I. Pavlinić & V. Jalžić); **XH75 Pišurka špilja** /cave/, Korčula island (12.02.1998, D. Holcer & D. Kovačić); **Čara**, Korčula island (ĐULIĆ: unpublished manuscript);

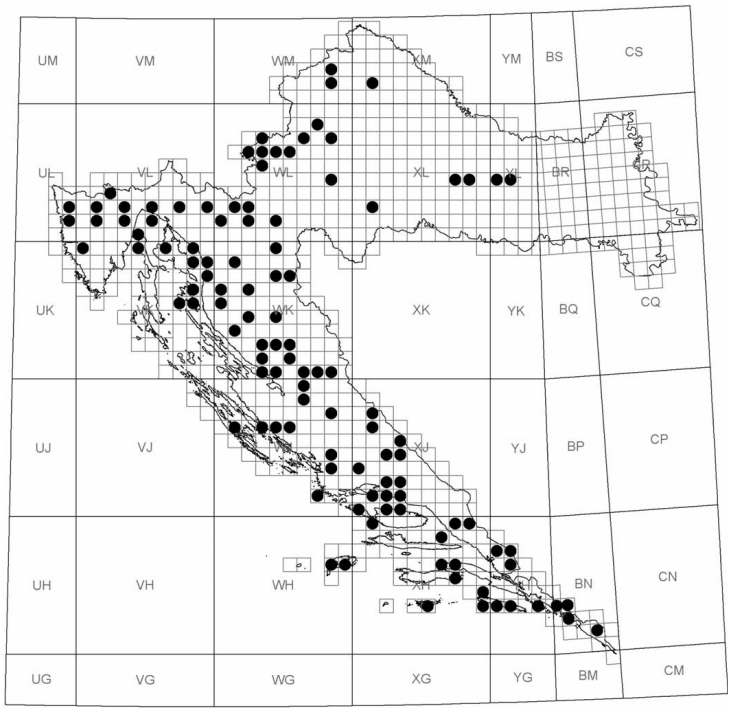

Fig. 6. Distribution of the lesser horseshoe bat *Rhinolophus hipposideros* in Croatia.

Crkva sv. Nikole /church/, Korčula island (28.04. 1999, M. Zagmajster); **Kočije – Žrnovo,** Korčula island (25.04.1999, M. Zagmajster); **Korčula,** bunker /bunker/, Korčula island (27.04. 2004, M. Zagmajster); **XH76 Orebić – Sv. Ilija**, kuća /house/ Pelješac peninsula, (25.04.2001: ŽIBRAT 2002); **Sv. Ilija**, jama /pit/, Pelješac peninsula (25.02.1996, D. Holcer); **XH79 Baba špilja** (=Babina špilja) /cave/, Biokovo Mt. (05.12.1975, N. Tvrtković: TVRTKOVIĆ & KLETEČKI 1993; 27.04.2002, I. Pavlinić *et al*.); **Jujnovića špilja** /cave/, Biokovo Mt. (17.10.2002, I. Pavlinić & V. Jalžić); **Antunovići** /cave/ (17.10.2002, I. Pavlinić & V. Jalžić); **XH93 Sparožni rat** /military tunnel/, Mljet island (24.03.1996, N. Tvrtković); **Špilja kod Nerezinog Dolca** /cave/, Mljet island (02.12.2001, I. Pavlinić *et al*); **Špilja Briježina** /cave/, Crna Klada, Mljet island (24.03.1996, N. Tvrtković); **XH94 Jama u uvali Bjejajka** /pit/, Mljet island (02.12.2001, I. Pavlinić *et al*.); **YH03 Jama ispod ceste Blato-Kozarica** /pit/, Mljet island (26.04.1998: ZAGMAJSTER 1999); **Ostaševica** špilja /cave/, Mljet island (04.12.2001, I. Pavlinić); **YH07 Banja selo** (08.02.1998, D. Holcer *et al*.); **YH13 Galičnjak špilja** /semi-cave/, Prožura, Mljet island (03.03.1996, N. Tvrtković; 04.12.2001, I. Pavlinić); **YH16 Kopren dol**, špilja /cave/ (19.01.2002, I. Pavlinić); **YH17 Vriještica,** kuća /house/, Metković (=Dodigovi stanovi) (24.07.1998 D. Holcer; 20.06.2007, 19.04.2009, 5.08.2009, I. Pavlinić & M. Đaković); **YH33 Velji vrh**, Šipan island (02.09.2000, E. Kletečki); **BN53 Jama za Gromačkom vlakom** /cave/ (13.08.1998, N. Tvrtković; 17.01.2002 I. Pavlinić & B. Jalžić); **Ljubač**, stara mlinica /old mill/ (19.06.1998, N. Tvrtković); **BN62 Vilina špilja** /cave/, Ombla, Dubrovnik (10.02.1998, D. Holcer; 16.01.2002, I. Pavlinić & M. Ćaleta); **BN63 Močiljska špilja** /cave/, Dubrovnik (February 1969: HENEBERG *et al*. 1968; 09.02.1998, D. Holcer; 16.01.2002, I. Pavlinić); **BN81 Dubravka,** napuštena kuća /abandoned house/, Orjen Mt. (11.07.1998, P. Miljković; 21.05.1999, N. Tvrtković); **WJ16 Dugi otok** island (07.06.2002, E. Kletečki); **WJ36 Biograd na moru** (SMF: FELTEN *et al*. 1977); **WJ46 Vransko jezero** /lake/ (KOLOMBATOVIĆ 1884); **Vrelo pećina** /spring cave/, Vrana (12.07. 1975, J. C. Hafner); **WJ56 Baldina jama** /pit/ (15.10.2003, I. Pavlinić *et al*.); **WJ68 Mala Kusača špilja** /cave/, Bukovica (01.07.2001, 19.07.2001, N. Tvrtković & I. Pavlinić); **Milića pećina** /spring cave/, Žegar, Bukovica (14.12.2002, N. Tvrtković & B. Jalžić); **Velika Kusača špilja** /cave/, Bukovica (19.07.2001, N. Tvrtković & I. Pavlinić); **WJ69 Bezdanka** /pit/, Golubić, Velebit Mt. (13.04.1984, B. Jalžić); **WJ71 Jamina** /pit/, Ražanj, Rogoznica (15.08.1996, T. Rađa); **WJ83 Smokovača pećina** /cave/, Perković (ĐULIĆ: unpublished manuscript); **Jama u Pothumcima** /pit/, Perković (DJULIĆ 1959); **Špilja uz Jama Zvekaču** /cave/, Perković (28.11. 1954: DJULIĆ 1959); **WJ84 Škarin Samograd** /cave/, Pokrovnik (08.09.1957, 05.01.1958: BAKIĆ 1958); 05.09.1977: ČERVENÝ & KRYŠTUFEK 1988; 13.02.1998, D. Holcer; 30.01.2002, I. Pavlinić & B. Jalžić); **WJ87 Miljacka II** /intermittent spring cave/ (14.11.1998, D. Holcer; 09.03.1999, B. Jalžić *et al*.; 16.04.2009, I. Pavlinić & M. Đaković); **XJ00 Tiha špilja** /cave/, Šolta island (20.02.1958: BAKIĆ 1958); **XJ03 Krivića peć** /cave/, Lečevica (23.05.1999, N. Tvrtković); **XJ11 Split** (= Spalato) (DAL PIAZ 1926); **Marjan**, Split (01.07.1958: BAKIĆ 1958); **Marjan,** kula /tower/, Split (09.07.1957: BAKIĆ 1958); **Prizidnica** /cave/, Čiovo island (15.07.1957: BAKIĆ 1958); **XJ16 Vrlika** (KOLOMBATOVIĆ 1882); **Gradina**, bunker /bunker/, Vrlika (10.03.1999, B. Jalžić *et al*.); **Špilja Izvor** /spring cave/, Vukovići (09.03.1999, B. Jalžić *et al*.); **XJ17 Ćulumova pećina** /cave/, Kijevo (10.03.1999, B. Jalžič *et al*.; 02.02.2002, I. Pavlinić; 16.04.2009, I. Pavlinić & M. Đaković); **Gospodska pećina** /cave/, Cetina (10.03.1999, B. Jalžić *et al*.); **XJ20 Sutivan**, kuća /house/, Brač island (14.08.1957: BAKIĆ 1958); **XJ21 Stražnica** /cave/, Split (February 1968, HENEBERG *et al*. 1968); **Barića Komin** /semi-cave/, Sumpetar Jesenice (20.11.1996, T. Rađa); **XJ22 Jadro** river, Solin (KOLOMBATOVIĆ 1884); **Pećina iznad izvora Jadra /**cave**/**, Solin (04.08. 1957: BAKIĆ 1958); **Milićevica pećina** (= Milićeva pećina) /cave/, Split (15.09. 1957; BAKIĆ 1958; February 1968: HENEBERG *et al*. 1968); **Podkapina pećina** /semi-cave/, Kučine, Mosor Mt. (27.12.1957: BAKIĆ 1958); **Bunarina spilja** /cave/, Split (KOLOMBATOVIĆ 1884); **XJ24 Bunarina jama** /pit/, Radošić (14.04.1912: GIROMETTA 1914); **XJ30 Minjera**, rudnik /mine/, Brač island (30.01.1997, N. Tvrtković); **XJ31 Jesenice**, pećine /caves/ (08.12.1912: GIROMETTA 1914); **XJ32 Vranjača** /cave/, Kotlenice, Mosor Mt. (21.08. 1957, 08.09.1957, 05.01.1958: BAKIĆ 1958; February 1968: HENEBERG *et al*. 1968); **Bradarići**, rudnik /mine/, Kotlenice, Mosor Mt. (23.01.1997, N. Tvrtković); **Mosor Mt**., dom /house/ (ĐULIĆ: unpublished manuscript; SMF: FELTEN *et al*. 1977); **Vilinska peć** (= Vilina p.) /cave/, Dugopolje, Mosor Mt. (19.10.1913: GIROMETTA 1914;

09.02.1983, T. Rađa); **XJ34 Mračna špilja I** and **II**, /caves/, Rumin, Troglav Mt. (31.01.2002, I. Pavlinić); **XJ35 Vodena jama** /cave/, Rumin, Troglav Mt. (06.11.1996, T. Rađa; 11.03.1999, B. Jalžić *et al*.; 31.01. 2000, I. Pavlinić); **VK09 Romualdova pećina** /cave/, Limski kanal (01.10. 2008, I. Pavlinić *et al*.); **VK49 Čampari špilja** /cave/, Cres island (06.01.2001, B. Jalžić & D. Kovačić; 22.04.2004: BURGER *et al*. 2004); **Niška**, napuštena kuća /abandoned house/, Cres island (1/4.06.2004: WINTERFELDT 2004); **Beli**, napuštena kuća /abandoned house/, Cres island (29.07.2001, I. Pavlinić); **Napušteni vojni tuneli** /abandoned military tunnels/, Cres island (29.07.2001, I. Pavlinić); **VK69 Dobrinj**, /church/, Krk island (ĐULIĆ & TVRTKOVIĆ 1970); **VK86 Medova buža** /marine cave/, Rab island (26.01.2002, I. Pavlinić & B. Jalžić); **VK88 Strassenhöhle** /semi-cave/, Baška, Krk island (02.06.1980, NMW: E & M Christian); **VK89 Zagorska špilja**, (Zagorska peć, Novljanska špilja) /cave/, Novi Vinodolski (20.03.1902, HPM: LANGHOFFER 1912; 04.09.1913, HPM: KARAMAN 1929; 27.02.1955: DJULIĆ 1959; 03.03.1999, N. Tvrtković *et al*.; 06.01.2002, I. Pavlinić & B. Jalžić); **VK97 Povile** (MEHELY 1900); **VK98 Vlaška peć** /semi-cave/, Kozica, V. Kapela Mt. (03.03.1999, N. Tvrtković *et al*.); **WK05 Lubenovac**, tavan napuštene kuće /house attic/, Velebit Mt. (31.07. 2002, I. Pavlinić *et al*.); **WK06 Krasno,** crkva /church/, Velebit Mt. (17.06.1999, D. Holcer); **WK13 Baške Oštarije** /house attic/, Velebit Mt. (personal comm.: M. Uhrin); **Ljubica**, Baške Oštarije, napuštena kuća /abandoned house/, Velebit Mt. (18.06.2005, N.Tvrtković *et al*.); **Höhle bei Bužim** /cave/, Velebit Mt. (1865, Johann Zelebor, NMW); **WK18 Sinčić pećina** /cave/, Brinje (12.08.1902, HPM: LANGHOFFER 1912; KARAMAN 1929); **WK24 Tabakuša** /cave/, Perušić (14.08.1902, HPM: LANGHOFFER 1912, KARAMAN 1929); **Perčevića pećina** /cave/, Perušić (05.06.1955: DJULIĆ 1959); **Medina pećina** /cave/, Perušić (01.05. 1956 DJULIĆ 1959); **WK26 Špilja Pećina** /spring cave/, Pećina, Velebit Mt. (14.10.2000, N. Tvrtković & J. Culver); **WK30 Anića luka**, Paklenica, Velebit Mt. (04.07. 1999, 26.03.2000, M. Grgurev); **WK31 Borisov dom** /house/, Velika Paklenica, Velebit Mt. (28.08.2005, N. Tvrtković); **Lugarnica /**house**/**, Velika Paklenica, Velebit Mt. (29.08.2001, I. Pavlinić & N. Tvrtković; 25.08.2005, N. Tvrtković & V. Elez); **WK32 Parići**, potkrovlje /house attic/, Velika Paklenica, Velebit Mt. (28.07.2005, N. Tvrtković & V. Elez); **Škiljića kuće**, potkrovlje /house attic/, Velebit Mt. (6.09.1981: FORENBACHER 2002); **WK40 Rovanjska špilja** /cave/, Velebit Mt. (14.01.2002, I. Pavlinić *et al*.); **WK42 Golubnjača jama** /pit/, Raduč (30.04. 1956 ĐULIĆ 1959); **WK44 Zelena pećina** /intermittent spring cave/, Bunić, Krbavsko polje (14.01.2002, I. Pavlinić *et al*.; 09.06.2004, N. Tvrtković & I. Pavlinić); **WK47 Čorkova uvala**, lugarnica /house/, M. Kapela Mt. (18.05.2002, I. Pavlinić); **Čorkova uvala**, napuštena kuća /abandoned house/, M. Kapela Mt. (18.05.2002, I. Pavlinić); **Vila Izvor** /house/, M. Kapela Mt. (17.05.2002, N. Tvrtković; 11.07.2002, I. Pavlinić); **WK49 Matešića pećina** /spring cave/, Slunj (01.02.1998, D. Holcer *et al*.; 26.01.2003, I. Pavlinić *et al*.; 06.02.2002, 21.01.2006, 13.02. 2006, 03.04.2006, 05.05.2006, I. Pavlinić); **WK51 Lovinac** (07.05.1935, V. Martino, ZIN); **WK52 Pčelina pećina** /cave/, Medak (29.04.1956: ĐULIC 1959); **WK57 Barićeva špilja** /intermittent spring cave/, Ličko Petrovo Selo, Lička plješevica Mt. (July 1952: REDENŠEK 1958; 31.10.2002 I. Pavlinić; 30.01.2003, I. Pavlinić & D. Holcer; 22.08.2008, I. Pavlinić & M. Đaković); **Kukuruzovića pećina** /intermittent spring cave/, Ličko Petrovo Selo (25.07. 1952: REDENŠEK 1958; 30.01.2003, I. Pavlinić & D. Holcer); **WK60 Gračac**, pećina /cave/ (02.11.1933: ĐULIĆ 1959); **Brkina pećina** /cave/, Gračac (08.10.1934, HPM: DJULIĆ 1959); **WK70 Gornja Cerovačka pećina** /cave/, Velebit Mt. (29.11.1956: ĐULIĆ 1959); **WK80 Velika Popina**, crkva /church/, (20.08.2008, I. Pavlinić & M. Đaković); **UL91 Baredine**, jama /pit/, Poreč (winter 1999, S. Legović); **Golubinka**, jama /pit/, Poreč (winter 1999, S.Legović); **UL92 Buje** (= Buie) (GULINO & DAL PIAZ 1939); **VL11 Grotta di Ceresetto** /cave/, presso Pisino (= Pazin) (10.1922: DAL PIAZ 1927); **VL12 Cotići**, Motovun, napuštena kuća /abandoned house/ (04.08.1980, E. Kletečki); **VL23 Rašpor**, ponor /swallow hole/ (14.03.2010, B. Jalžić); **VL31 Boljun**, crkva /church/ (31.08.1960: ĐULIĆ 1962; 15.07.2003, I. Pavlinić & M. Šašić; 20.06.2008, I. Pavlinić & M. Đaković); **VL32 Dolenja Vas**, crkva Sv. Martina /church/ (15.07.2003, I. Pavlinić & M. Šašić); **VL40 Moščenićka Draga** (SMF: FELTEN *et al*. 1977); **VL51 Draga**, Rijeka (ĐULIĆ: unpublished manuscript); **VL52 Rijeka** (= Fiume) (MATISZ 1896; DEPOLI 1899); **VL92 Stara Sušica**, dvorac /castle/ (29.05.2004, I. Pavlinić); **WL01 Vrelo** /semi-cave/, Jasenak, V. Kapela Mt. (28.06.2004, I. Pavlinić); **WL12 Kuštrovka špilja** /cave/ (22.01.2006, 12.02.2006, I. Pavlinić);

WL21 Tounj (probably Tounjčica cave) (24.04.1955: DJULIĆ 1959); **Jama u kamenolomu** /cave/, Tounj (18.11.2001, I. Pavlinić); **Mandelaja jama** /pit/ (18.11.2001, I. Pavlinić); **WL22 Bosiljevo**, Stari grad /castle/ (24.05.2007, I. Pavlinić *et al.*); **WL26 Badovinci**, crkva Sv. Nikola /church/, Žumberak Mt. (26.07.2002, I. Pavlinić & M. Šašić); **Kašt**, crkva /church/, Žumberak Mt. (22.07.2002, I. Pavlinić); **Pušina jama** /pit/, Žumberak Mt. (30.11.2002, B. Jalžić); **Radatovići**, crkva Uskrsnuća Gospodnjeg /church/, Žumberak Mt. (22.07.2002, I. Pavlinić); **Radatovići**, škola /school/, Žumberak Mt. (13.06.2003, I. Pavlinić); **WL35 Ozaljska špilja** /cave/, Ozalj (25.01.1998, D. Holcer; 09.07.1998 D. Holcer & D. Kovačić; 23.01.2002, I. Pavlinić & B. Jalžić); **Ozalj**, gradina /castle/ (16.07.1902, HPM: KARAMAN 1929); **Vrlovka špilja** /cave/, Kamanje (25.01.1998, D. Holcer *et al.*; 09.07.1998, D. Holcer & D. Kovačić; 25.02.2002, D. Holcer & I. Pavlinić); **WL36 Mrzlo polje**, garaža /garage/, Žumberak Mt. (17.07.2007, I. Pavlinić & M. Šašić); **Mrzlo polje**, škola i pomoćne zgrade škole /school buildings/, Žumberak Mt. (18.10. 2001, I. Pavlinić; 24.06.2002, I. Pavlinić & N. Tvrtković); **Sošice**, crkva Sv. Petra i Pavla /church/, Žumberak Mt. (18.07.2002, I. Pavlinić & M. Šašić); **Sošice**, crkva Marijina uznesenja, /church/ Žumberak Mt. (18.07.2007, I. Pavlinić & M. Šašić); **Zidana peć** /semi-cave/, Žumberak Mt. (28.01.2002, I. Pavlinić & B. Jalžić); **WL37 Židovske kuće** (= Židovska pećina) /semi-cave/, Budinjak, Žumberak Mt. (10/11.1954: ĐULIĆ 1957; August 1984, N. Tvrtković); **Budinjak**, škola /school/, Žumberak Mt. (12.06.2003, I. Pavlinić); **WL41 Gvozdenica špilja** /cave/ (05.03. 2000, H. Cvitanović; 11.11.2001, I. Pavlinić); **Jopićeva jama** /pit/, Krnjak (27.02.2000, N. Tvrtković & D. Holcer, 03.03.2003, I. Pavlinić); **WL46 Grabar**, škola /school/, Žumberak Mt. (18.07.2002, I. Pavlinić & M. Šašić); **Sv. Ivan** (Grabar), crkva /church/, Žumberak Mt. (18.07. 2002, I. Pavlinić & M. Šašić); **WL56 Sv. Martin pod Okićem**, crkva /church/, Samoborsko gorje Mt. (15.10.1997, D. Holcer & N. Tvrtković); **WL67 Veternica** /cave/, Gornji Stenjevec, Medvednica Mt. (14.01.1952, 30.12.–11.04./1952/1956: ĐULIĆ 1953, ĐULIĆ 1957, ĐULIĆ 1959; 30.03.1965: MIKUSKA 1966; 12.01.1983, 07.12.1983: MARKOVIĆ 1984; 16.01.1993, D. Holcer & N. Tvrtković; 01.04.1993, 03.02.1996, D. Holcer; 28.01.2002, I. Pavlinić *et al.*; 22.02.2007, 17.10.2007, 20.11.2007, 15.03.2008, I. Pavlinić & M. Đaković); **Žrvena peć** /semi-cave/, Medvednica Mt. (16.01.1993 D. Holcer & N. Tvrtković; 21.05.1993, 03.02.1996 D. Holcer; 10.01.1998, D. Holcer & D. Kovačić); **Podsused**, Zagreb **(**18.03.1902: HPM, KARAMAN 1929); **Borčec k. Zagreba**, pećina /cave/, Zagreb (18.03.1902, HPM: KARAMAN 1929); **Podsused – Stenjevec**, Zagreb (27.03.1902, HPM: KARAMAN 1929); **Bizečka pećina** /cave/, Zagreb (ĐULIĆ: unpublished manuscript); **WL78 Francuski rudnici** /mines/, Medvednica Mt. (13.03.1993, 27.12.1994, D. Holcer); **Lipa,** vrh /mountain top/, Medvednica Mt. (28.10. 1912, E. Rössler, HPM); **WL84 Prkovec**, klet /, Vukomeričke gorice (March 1975, N. Tvrtković & F. Perović); WL87 **Sesvete**, Zagreb (15.11.1902, HPM: ĐULIĆ 1959); **Markuševac**, bunkeri /bunkers/, Medvednica Mt. (16.12.1992, 01.12.1994, 27.12.1994, 29.01.1999, D. Holcer); **XL12 Gradusa špilja** /cave/ (21.01. 2004, I. Pavlinić *et al.*); **XL74 Rastik špilja** /cave/ (12.03.2007, I. Pavlinić *et al.*; 09.12.2008, I. Pavlinić & M. Đaković); **Trbušnjak špilja** /cave/ (12.03.2007, I. Pavlinić *et al.*; 13.11.2008, 09.12.2008, 11.02.2009, I. Pavlinić & M. Đaković); **XL84 Grižina špilja** /cave/ (07.01.2001, N. Tvrtković *et al.*; 10.12.2008, I. Pavlinić & M. Đaković); **YL04 Uviraljka**, ponor /swallow hole/, Papuk Mt. (28.10.1999, N. Tvrtković; 18.01.2000, N. Tvrtković & D. Holcer; 07.01.2001, N. Tvrtković; 28.01.2003, 22.01.2004, 10.11.2005, 13.12.2005, 07.02.2006, I. Pavlinić); **YL14 Špilja Maksima Bojanića** /cave/, Jankovac, Papuk Mt. (28.05.1999, N. Tvrtković & D. Holcer); **WM81 Ivanec**, rudnici galenita /mines/ (09.04.1946, HPM; 02.01.1954: DJULIĆ 1959); **WM82 Cerjanska (Repnjak) špilja** /cave/, Klenovnik, Ravna Gora Mt. (10.01.2002, I. Pavlinić *et al.*); **XM11 Mladina**, Varaždin (16.03.2008, I. Pavlinić).

Myotis bechsteinii (Kuhl, 1817)

Bechstein's bat / velikouhi šišmiš	
Number of localities / broj nalazišta	17
Number of 10-km squares of UTM grid / broj 10-km UTM kvadrata	16
Number of winter roosts / broj zimskih kolonija	4

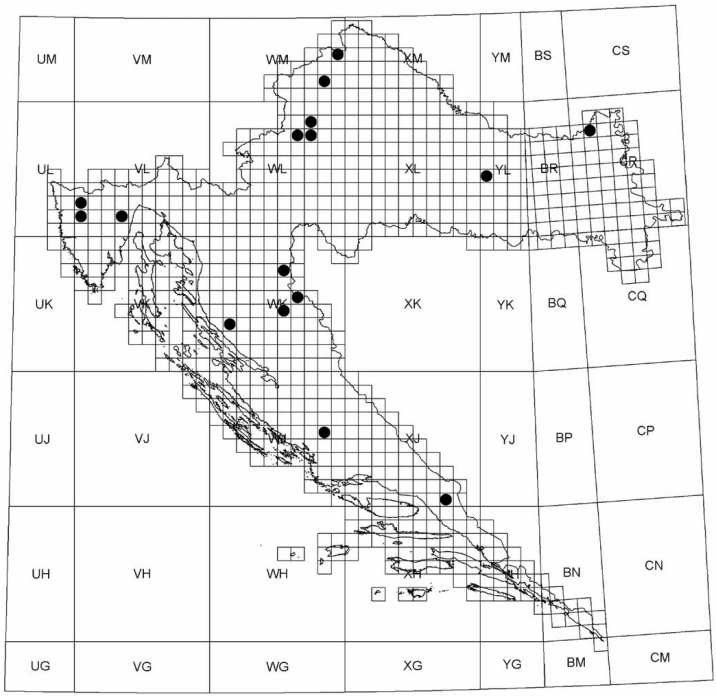

Fig. 7. Distribution of Bechstein's bat *Myotis bechsteinii* in Croatia.

Although found in all regions of Croatia, this forest-dwelling species seems to be very rare. Records of single hibernating specimens come from underground shelters (caves, mines, cellars) within the Continental region. Except for the data from owl pellets (LIPEJ & GJERKEŠ, 1992) and the finding of a dead bat near Baške Oštarije, other findings come from the result of mist netting within or near different types of forests. Findings in Boljun, near the River Čikola, Laudonov gaj and Biokovo Mountain were in Submediterannean pubescent oak forests, along the Mirna river valley in Istria in flooded common oak forests, in Zagreb and near Barićeva cave in the Lika region in continental oak forests, while the data from the Velebit, Lička Plješivica, Medvednica, and Papuk mountains are from beech forests. No maternity colony was found, but the capture of a pregnant female at the entrance of Barićeva cave (8 July 2008) is clear evidence of breeding. Other potential breeding sites could be within the forests of the Continental part – Laudonov gaj (Krbavsko polje) and Poljana (Lička Plješivica Mountain).

Localities / nalazišta

WJ85 Ključ, Čikola canyon (23.06.1984: KOVAČIĆ & ĐULIĆ 1984); **XJ70 Turija** /pond/, Biokovo Mt. (28.04.2005, mistnetted I. Pavlinić *et al.*); **WK13 Baške Oštarije**, Velebit Mt. (21.06.2006, E. Kletečki); **WK54 Laudonov gaj** /old grove forest/, Krbavsko polje (29.07.2004, 26.04.2005, mistnetted N. Tvrtković & I. Pavlinić); **WK57 Barićeva pećina** /intermittent spring cave/, Ličko Petrovo selo, Lička Plješevica Mt. (08.07.2008 mistnetted I. Pavlinić *et al.*); **WK65 Poljana** /pond/, Lička Plješivica Mt. (01.07.2004, 18.08.2005 mistnetted I. Pavlinić *et al.*); **VL01 St. Mihel – Brdo**, Mirna valley (in owl pellets: LIPEJ & GJERKEŠ 1992); **VL02 Motovun**, Livade /forest/ (03.08.1980, mistnetted D. Kovačić: KOVAČIĆ 1981, KOVAČIĆ & ĐULIĆ 1984); **VL31**

Mala peć /cave/, Vela Učka, Učka Mt. (19.06.1954, B. Đulić personal notes); **Boljun** /spring/ (05.07.2005, mistnetted I. Pavlinić); **WL67 Veternica** /cave/, Gornji Stenjevec, Medvednica Mt. (25.05. 1958: ĐULIĆ 1960; 12.01.1983, 26.08.1983: MARKOVIĆ 1984; 03.11.1995, 09.12.1995: D. Holcer; 22.05.2007, 17.10.2007; I. Pavlinić & M. Đaković); **WL77 Zagreb**, Demetrova 1 /house/ (12.08.1928: ĐULIĆ 1955, 1959); **WL78 Markuševac,** bunkeri /bunkers/, Medvednica Mt. (10.01. 1998, D. Holcer & D. Kovačić); **YL04 Uviraljka,** ponor /swallowhole/, Papuk Mt. (28.05.1999, mistnetted on the entrance: TVRTKOVIĆ *et al*. 2001; 28.01.2003, I. Pavlinić *et al*.); **CR17 Banovo brdo**, rudnik /mine/, Baranja (I. Grabovac); **WM81 Kraševski Zviri**, rudnik /mine/, Ivanec, (photo R. Ozimec: OZIMEC 1998); **WM93 Hruščica**, podrum /cellar/, Varaždin (September 1989, M. Petrić).

Myotis blythii (Tomes, 1857)

Lesser mouse-eared bat / oštrouhi šišmiš	
Number of localities / broj nalazišta	59
Number of 10-km squares of UTM grid / broj 10-km UTM kvadrata	48
Number of maternity roosts / broj porodiljnih kolonija	29
Number of winter roosts / broj zimskih kolonija	3

According to the new mitochondrial DNA analysis (RUEDI & MAYER, 2001; SIMMONS, 2005), species occurring in Europe and Croatia should probably be regarded as *M. blythii oxygnathus*. The earliest records that have no proof in museum material should be discarded since no reliable separation was known between this species and *M. myotis*. Even today, it is impossible to separate the two species by mere ob-

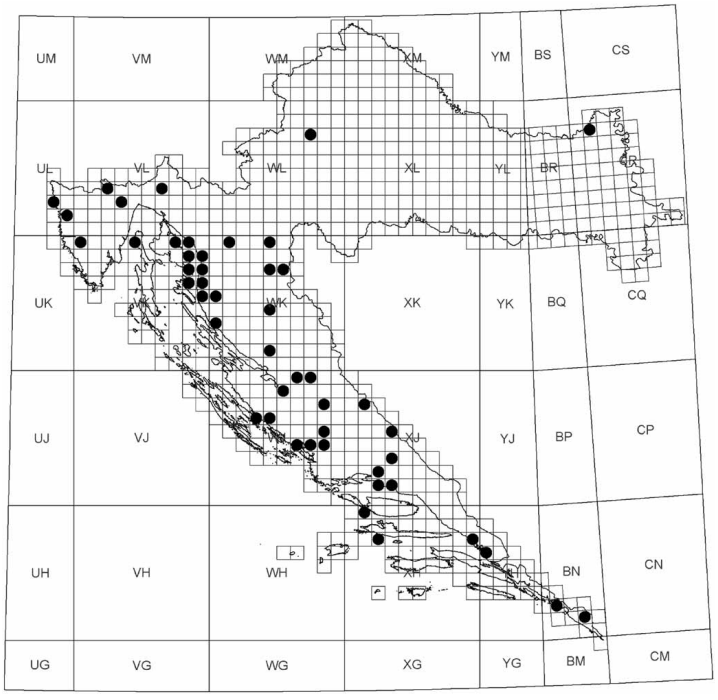

Fig. 8. Distribution of the lesser mouse-eared bat *Myotis blythii* in Croatia.

servation and it is necessary to capture and measure at least a few individuals from a colony. In Croatia, the lesser mouse-eared bat is restricted to the Mediterranean region and the Dinaric mountains, with only one bordering record in Matešića cave near Slunj, an old isolated finding in Zagreb (ĐULIĆ, 1959) and a new finding in Banovo brdo mine (Baranja, NE Croatia). For maternity shelters, the species prefers large and warm caves inside which it makes mixed clusters with other cave-dwelling bats, among which *M. myotis* (DIETZ *et al*., 2009).

Almost nothing is known about the winter colonies of this species. Only record of the small colony is from the Glogova jama pit where 40 bats were observed hibernating between icicles at a temperature of 1.5 °C. The findings of 30–50 animals in Ćulumova cave on 23 October could be evidence of migration or the remains of a large maternity colony. Wintering in Banovo brdo mine seems the only possibility for the isolated population.

All maternity roosts are situated within the Mediterranean region. The average colony size is *ca*. 450 bats, but the number varies from year to year and in some cases within the same season. Only two colonies were reported from lofts (Istria and Brač island), while the rest were found in caves and in two water tunnels. Three caves contained over 5,000 bats – Ćulumova, Tradanj and Zagorska peć. Large colonies of over 1,000 bats are reported from the islands of Rab and Krk.

Based on over 20,000 bats in maternity sites and numerous potential warm caves for maternity colonies, the overall population of lesser mouse-eared bats in Croatia is estimated at 50–60,000. This would mean a density of 1 bat per km2, which looks highly acceptable given the potential shelters and habitat requirements.

Localities / nalazišta

XH19 Milna, crkva /church/, Brač island (ĐULIĆ 1970; ĐULIĆ & TVRTKOVIĆ 1970); **XH27 Dubovsko pod Pazuho** (=? Dubovačka špilja) /cave/, Bogomolje, Hvar island (ĐULIĆ unpublished manuscript; 17.07.1997, D. Holcer); **Špilja u uvali Pišćena** /marine cave/, Hvar island (D. Holcer); **XH97 Baćina**, tunel /tunnel/ (06.09. 1993, 16.07.1994, D. Holcer); **Peračko blato – Baćinska jezera**, tunel /tunnel/ (16.07.1994, 03.08. 1996, 05.06.1997, D. Holcer); **YH06 Vištičina jama** /pit/, Opuzen (04.07.1996, 04.08.1996, D. Holcer; 09.08.1997, B. Jalžić & D. Kovačić); **BN62 Vilina špilja** (=Viline kuće) /cave/, Ombla, Dubrovnik (11.07.1957: ĐULIĆ 1958; 10.10.1997, B. Jalžić & E. Kletečki; 20.05.1999, 02.07.2001, 11.08.2000, N. Tvrtković *et al*.; 18.06.2007, I. Pavlinić & M. Đaković); **BN81 Glogova jama** /pit/, Sniježnica Mt. (09.10.1984, B. Jalžić; 18.01.2002, I. Pavlinić *et al*.); **WJ36 Badanj pećina** /cave/, Biograd n/m (29.06.1957: ĐULIĆ 1958, ĐULIĆ 1961); **WJ46 Grlo pećina** /cave/, Vransko jezero (30.06.1957, ĐULIĆ 1958); **Vrelo pećina** /spring cave/, Vrana (1893–1908, J. Kolombatovic, NMW; 30.06.1957, 10.11.1957: Đulić 1961; June 1968: HENEBERG *et al*. 1968); **WJ58 Bela voda pećina** /spring cave/, Karin (2007, B. Krstinić); **WJ64 Tradanj špilja** /cave/, Zaton (01.07.2001, N. Tvrtković; 31.07.2001, N. Tvrtković & I. Pavlinić; 29.08. 2001, N. Tvrtković *et al*.; 04.05.2006, I. Pavlinić & K. Čivić; 04.07.2007, 27.09. 2007, 10.07.2008, I. Pavlinić & M. Đaković); **WJ69 Topla peć** /cave/, river Krupa canyon, Velebit Mt. (08.08.1984 N. DeLuca; 24.07.2008 I. Pavlinić & M. Đaković); **WJ74 Mandalina špilja** /marine cave/, Šibenik (02.07.1957: ĐULIĆ 1958, ĐULIĆ 1961; 05.12.1957, 30.11.1959: ĐULIĆ 1961; 27.11.1959: ĐULIĆ 1960b; June 1968: HENEBERG *et al*. 1968); **WJ79 Kudin most**, špilja /cave/, river Krupa, Velebit Mt. (09.08.1984: PMS); **WJ84 Škarin Samograd** /cave/, Pokrovnik (04.07.1957: ĐULIĆ 1958, ĐULIĆ 1961; 08.09.1957: BAKIĆ 1958; 07.12.1957: ĐULIĆ 1961; 05.09.1977: ČERVENY & KRYŠTUFEK 1988; 21.06.1989: KOVAČIĆ & ĐULIĆ 1989; 11.07. 1998, D. Holcer & D. Kovačić; 21.06. 2007, I. Pavlinić & M. Đaković); **WJ85 Ključ**, river Čikola canyon (23.06.1989: KOVAČIĆ & ĐULIĆ 1989); **WJ87 Miljacka II** /intermittent spring cave/ (11.07.1998, D. Holcer & D. Kovačić; 17.09.1998, B. Jalžić; 12.10.1998, N. Tvrtković & D. Kovačić; 22.05.1999, N. Tvrtković; 09.07.2008,

I. Pavlinić *et al.*); **XJ17 Ćulumova pećina** /cave/, Kijevo (10.06.1999, N. Tvrtković *et al.*; 21.06. 2007, 28.09.2007, 01.11.2007, 16.04. 2009, 11.08.2009, I. Pavlinić & M. Đaković); **XJ21 Stražnica** /cave/, Split (June 1968: HENEBERG *et al.* 1968); **XJ22 Miličevića pećina** (= Milićeva pećina) /cave/, river Žrnovnica (07.07.1957: ĐULIĆ 1958, ĐULIĆ 1961; 02.02.1958: BAKIĆ 1958); **XJ31 Špilja u kanjonu Cetine** /cave/, (May 2004, Marco van den Hof); **XJ33 Trilj**, sušionica mesa /house/ (27.01.1958: BAKIĆ 1958); **XJ35 Suhi Rumin jama** /pit/, Rumin, Troglav Mt. (04.07. 1998, B. Jalžić; 04.07.2001, I. Pavlinić); **Vranjača pećina** /cave/, Kotluša, Mosor Mt. (21.08.1957: BAKIĆ 1958); **VK09 Romualdova pećina** /cave/, Limski kanal (28.08.1997, R. Ozimec; 18.06. 1999, S. Legović); **VK49 Ćampari špilja** /cave/, Cres island (29.07.2001, I. Pavlinić); **VK79 Novi Selec** bg. (= Selce cave) (NMB: TOPAL 1954); **Vrbničko polje**, tunel /tunnel/, Krk island (22.09.2007, I. Pavlinić & M. Đaković; 19.09.2008, I. Pavlinić); **VK86 Medova buža** /marine cave/, Rab island (02.08.2001, N. Tvrtković *et al.*; 04.08.2002, I. Pavlinić *et al.*; 14.06.2007, I. Pavlinić & M. Đaković); **VK87 Škujica** /marine cave/, Krk island (15.07.1965: MIRIĆ 1968, ĐULIĆ & TVRTKOVIĆ 1970; 07.06.1977, 25.05.1978, O. Moog & E. Christian, NMW; 04.06.1980, NMW: CHRISTIAN & POTOČNIK 1985); **VK88 Baška** /cave/, Krk island (05.08.2002, I. Pavlinić & B. Jalžić); **VK89 Zagorska špilja** (= Novljanska pećina) /cave/, Novi Vinodolski (July/August 1954: ĐULIĆ 1957; April 1956: ĐULIĆ 1963; 17.06.1956, B. ĐULIĆ, HPM; 04.09.1956: ĐULIĆ 1957; 24.06. 1958: ĐULIĆ 1963; 27.09.1975, N. Tvrtković; 28.07.1997, D. Kovačić; 13.06.2007, 20.06.2008, 20.09.2008, I. Pavlinić & M. Đaković); **VK95 Jablanac** /? cave/, Velebit Mt. (NMB: TOPAL 1954); **VK96 Žive vodice** /pond/, Velebit Mt. (06.06.2004. mistnetted N. Tvrtković & M. Vuković); **VK97 Pećina kod Sv. Jurja** (= Sv. Juraj bg.) /marine cave/, Velebit Mt. (NMB: TOPAL 1954); **Pijavica pećina** /cave/ (ĐULIĆ: unpublished manuscript); **VK98 Vlaška peć** (= Vlaška bg.) /semicave/, V. Kapela Mt. (NMB: TOPAL 1954); **Senj** /marine caves/, Velebit Mt. (HPM: DJULIĆ 1959; NMB: TOPAL 1954; **Pećina kod sv. Jelene** (= Sv. Jelena bg.) /marine cave/, Velebit Mt. (NMB: TOPAL 1954); **WK03 Ledenik**, /pond/ Karlobag, Velebit Mt. (24.08.2008, mistnetted N. Tvrtković & M. Vuković); **WK05 Apatišan** /spring/, Velebit Mt. (03.08.2002, I. Pavlinić; 26.07.2005 mistnetted N. Tvrtković *et al.*); **Slovačka jama** /pit/, Velebit Mt.: 28.07.1998, B. Jalžić; pit entrance: 24.09.1998, N. Tvrtković); **WK19 Vrh Kapele** (1900, Regimentsarzt, NMW); **WK41 Raduč** /cave/ (NMB: TOPAL 1954); **WK44 Zelena pećina** /intermittent spring cave/, Bunić, Krbavsko polje (09.06.2004, N. Tvrtković & I. Pavlinić; 15.04.2009, I. Pavlinić & M. Đaković); **WK47 Modra špilja** /cave/, Plitvice (18.05.2002, D. Kovačić *et al.*; 27.05.2003, D. Holcer & I. Pavlinić); **WK49 Matešića pećina** /spring cave/, Slunj (15.07.1998, D. Holcer; 13.02. 2006, I. Pavlinić *et al.*); **WK57 Barićeva špilja** /intermittent spring cave/, Ličko Petrovo Selo, Lička Plješevica Mt. (ĐULIĆ 1958; 19.09.2002, 18.05.2003, 08.07.2008 I. Pavlinić *et al.*); **Kuruzovića pećina** (= Kukuruzovićeva pećina) /intermittent spring cave/, Rakovica (ĐULIĆ 1958); **Kesićeva pećina** /cave/, Drežnik (ĐULIĆ 1958); **UL82 Novigrad**, kuća /building/ (1993, Lipej personal comm.); **UL91 Markova jama** /pit/, Tar (28.08.1997, 24.06.1999, B. Jalžić; 12.05.2001, S. Gottstein); **Grotta di Villanova** /cave/, Parenzo (= Poreč) (GULINO & DAL PIAZ 1939); **VL23 Novačka peć** /cave/, Dane, Ćićarija Mt. (March, 1967, PMS); **VL32 Pećina near Lanišće** /cave/, Ćićarija Mt. (30.08.1960 ĐULIĆ 1961, 1962); **VL63 Lividraga** (20.07.2004, mistnetted I. Pavlinić); **WL77 Zagreb** /house attic/ (04.05.1953: ĐULIĆ 1959); **CR17 Banovo brdo** /mine/ (29.01.2002, J. Mikuska; 08.02.2002, J. Mikuska *et al.*; 04.07.2002, N. Tvrtković *et al.*; 02.02.2003, I. Pavlinić & D. Holcer; 01.08.2009, I. Pavlinić); **Beli Manastir** (in owl pellets: MIKUSKA & VUKOVIĆ 1980).

Myotis capaccinii (Bonaparte, 1837)

Long-fingered bat / dugonogi šišmiš	
Number of localities / broj nalazišta	43
Number of 10-km squares of UTM grid / broj 10-km UTM kvadrata	36
Number of maternity roosts / broj porodiljnih kolonija	19
Number of winter roosts / broj zimskih kolonija	13

Distribution in Croatia follows the general pattern determined by two closely connected factors – limestone caves and natural still or flowing water bodies. The

northernmost Croatian records in Bizečka, Ozaljska and Vrlovka caves were clearly conditioned by karstic isolates but are today considered extinct with only sporadic individual findings.

Almost nothing is known about the wintering sites of this species in Croatia. Furthermore, the average number of bats in all known winter roosts is fewer than 10. All known hibernacula in the Continental region were destroyed due to human activities (gates, garbage, destruction), making the survival of the respective population highly questionable. Reports from Bulgaria (DIETZ *et al*., 2009) of huge winter aggregations of up to 50,000 bats could mean that similar numbers could be expected in Croatia. It should be our priority to find such colonies as a first step towards efficient protection of the species.

Several large maternity colonies have been found in Croatia, all situated in large and warm caves in the Mediterranean region. The largest recorded number was in Tradanj cave near the River Krka where around 10,000 females and juveniles were found. Since this cave is regularly monitored, our estimate is that *ca*. 7,000 adult females regularly use this object. The next largest maternity aggregation is 26 km upstream of the River Krka in the Miljacka II cave where *ca.* 4,000 females nurse their young. Seasonal variation in numbers in both caves suggests that these two populations are closely connected. With the exception of Ćulumova cave where ca. 1,000 bats were found on one occasion, all other caves house a considerably smaller number of bats (an average of 140 bats). Only three colonies are known from the Continental region – Dragina cave above the River Dobra, Matešića cave on the River Korana and Modra cave near the Plitvice Lakes (the source of the Korana).

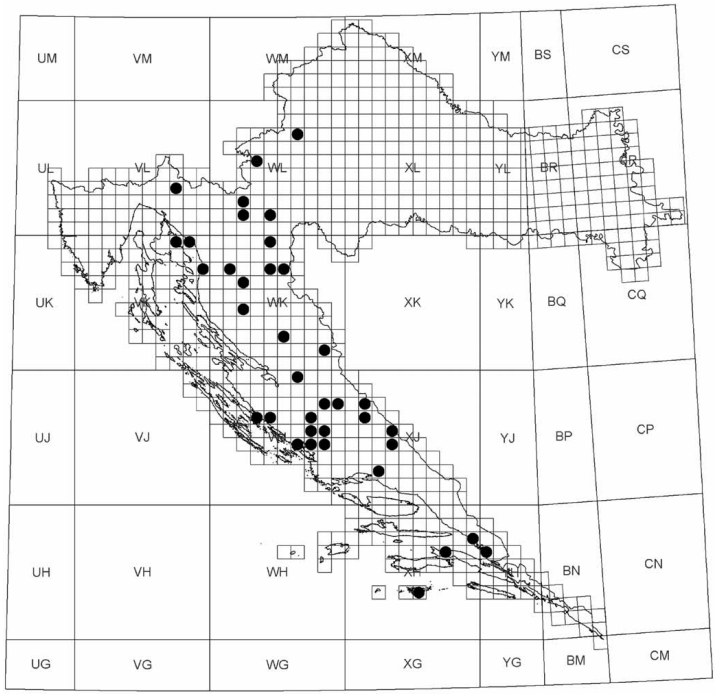

Fig. 9. Distribution of the long-fingered bat *Myotis capaccinii* in Croatia.

The latter two caves are highly endangered and Dragina cave was closed in 2009 for bats due to flooding for the purposes of a new power plant. Without effective conservation and necessary compensation measures, the whole continental population of *M. capaccinii* is facing extinction. The colony in Modra cave is under the protection of the Plitvice Lakes National Park, but is situated near a tourist trail.

The total population estimate is based solely on the number from the maternity colonies where over 18,000 bats were recorded. Therefore, the number of *ca.* 27,000 adult animals seems to be realistic. Numerous maternity roosts have already been lost, the last being in Dragina cave on the River Dobra. Considering known and potential threats and specific habitat demands, the species population is facing a serious decline overall with possible extinction in the northern part of the distribution area.

Localities / nalazišta

XH53 Rača pećina /cave/, Lastovo island (06.08.1955: ĐULIĆ 1959); **XH76 Jama pod brdom Sv. Ilije** /pit/, Pelješac peninsula (August 1956: ĐULIĆ 1959); **XH97 Baćina**, tunel /tunnel/ (06.09.1995, D. Holcer & D. Kovačić); **YH06 Vištičina jama** /pit/ (19.04.1998, D. Kovačić; 13.01. 2006, 17.03.2006, I. Pavlinić; 19.04.2009, 04.08.2009, I. Pavlinić & M. Đaković); **WJ36 Badanj špilja** /cave/, Biograd n/m (29.06.1957: ĐULIĆ 1961); **WJ46 Vransko jezero** (= Lago di Vrana) /lake/ (arround 1880, J. Kolombatovic, NMW: KOLOMBATOVIĆ 1884, 1885); **Vrelo pećina** (= Pećina kod Vrane, Vrana pećina) /spring cave/, Vrana (23.07.1894, HPM: KORLJEVIĆ 1903, LANGHOFFER 1912; 30.06.1957, 10.11.1957, B. Đulić (ĐULIĆ 1961); **WJ64 Tradanj špilja** /cave/, Zaton (31.07.2001, I. Pavlinić & N. Tvrtković; 29.08.2001, N. Tvrtković *et al.*; 04.05.2006, 07.07. 2006, 04.07.2007, 27.09. 2007, 10.07.2008, I. Pavlinić & M. Đaković); **WJ69 Topla peć** /cave/, Krupa, Velebit Mt. (24.07.2008, I. Pavlinić & M. Đaković); **WJ74 Mandalina špilja** /marine cave/, Šibenik (02.07.1957, 30.11.1959: ĐULIĆ 1960b, 1961; 15.01.2002, I. Pavlinić *et al.*); **WJ75 Skradinski buk** /stone crevices/, Skradin (09.04.1989: KOVAČIĆ & ĐULIĆ 1989); **WJ76 Roški slap** /above Krka river/, Drniš (04.08.1972, mistnetted N. Tvrtković: KOVAČIĆ & ĐULIĆ 1989: published wrongly as *M. daubentonii*) **WJ84 Škarin Samograd špilja** /cave/, Pokrovnik (04.07 .1957: ĐULIĆ 1961; 08.09.1957: BAKIĆ 1958; 21.06.1989: KOVAČIĆ & ĐULIĆ 1989: published wrongly as *M. daubentonii* – redetermination N. Tvrtković; 05.09.1977: ČERVENÝ & KRYŠTUFEK 1988; 21.06.1989: KOVAČIĆ & ĐULIĆ 1989; 11.07.1998: D. Holcer & D. Kovačić; 21.06.2007 I. Pavlinić & M. Đaković); **WJ85 Špilja na Osoju** /cave/, Drniš (22.10.1989, D. Holcer); **WJ87 Miljacka II** /intemittent spring cave/ (01.02.1998, 13.02.1998, 18.07.1998, D. Kovačić *et al.*; 17.09.1998 B. Jalžić; 11.10.1998, 22.05.1999, N. Tvrtković *et al.*; 09.07.2008, I. Pavlinić *et al.*); **WJ97 Izvor Krke**, /tunnel and cave/, Dinara Mt. (September 2005, N. Tvrtković); **XJ16 Gospodska pećina** /cave/, Cetina (10.03.1999, B. Jalžić *et al.*); **XJ17 Ćulumova špilja** /cave/, Kijevo (10.03.1999, B. Jalžić *et al.*; 10.06.1999, N. Tvrtković *et al.*; 28.09.2007, 01.11. 2007, 23.10.2008, I. Pavlinić & M. Đaković); **XJ22 Dolina rijeke Jadro** /river valley/, Solin (= Valle del Jadro /Salona/) (KOLOMBATOVIĆ 1882); **Milićevica** /cave/, Split (07.07.1957: ĐULIĆ 1961); **XJ34 Mračna špilja I** and **II /**caves/, Rumin, Troglav Mt. (04.07.2001, N. Tvrtković & B. Jalžić); **XJ35 Suhi Rumin jama** /pit/, Rumin, Troglav Mt. (04.07.2001, N. Tvrtković & I. Pavlinić); **Vodena jama** /cave/, Rumin, Troglav Mt. (1999 B. Jalžić *et al.*; 31.01.2002, I. Pavlinić; 24.10.2008, I. Pavlinić & M. Đaković); **VK79 Vrbničko polje**, tunel /tunnel/, Krk island (22.09.2007, 19.09.2008, I. Pavlinić & M. Đaković); **VK89 Zagorska špilja**, (= Novljanska pećina) /cave/, Novi Vinodolski (20.03.1902, HPM: LANGHOFFER 1912); 21.06.1954, 01.08.1954, 15.05.1955, 17.06.1956, 02.09.1956: ĐULIĆ 1957, 1959, 1963; 26.09.1997, D. Kovačić & D. Holcer; 10.11.2000, N. Tvrtković & B. Jalžić; 26.01.2002, I. Pavlinić & B. Jalžić; 12.09.2007, I. Pavlinić); **Kupari /**above Kupa river**/**, Risnjak Mt. (29.10. 2004 N. Tvrtković;); **VK97** Zenng (= **Senj**), Velebit Mt. (NMB: TOPAL 1954); **WK17 Brlog,** pećina /cave/ (HPM: KORLJEVIĆ 1904); **WK24 Medina pećina** /cave/, Perušić (02.05.1956: ĐULIĆ 1959); **WK26 Špilja Pećina** /spring cave/, Pećina, Velebit Mt. (14.10.2000 N. Tvrtković); **WK47 Modra špilja** /cave/, Plitvice (18.05.2002, N. Tvrtković *et al.*; 31.10.2002, I. Pavlinić; 27.05.2003, N. Tvrtković *et al.*); **WK49 Matešića pećina** /spring cave/, Slunj (01.02.1998, D. Holcer; 15.07.1998, D. Holcer & D. Kovačić; 17.07.2001, 26.07.2001, I. Pavlinić & N. Tvrtković; 06.02.2002, 26.01.

2003, 05.05.2006, I. Pavlinić); **WK52 Medak** (29.09.1953: ĐULIĆ 1959); **WK57 Baićeva špilja** /spring cave/, Ličko Petrovo Selo, Lička Plješevica Mt. (October 1972, Dj. Mirić & N. Tvrtković; 19.09.2002, N. Tvrtković *et al*.); **WL21 Tounjčica špilja** /spring cave/, Tounj (15.10.2000, 27.07.2001, 27.08.2001, N. Tvrtković); **WL22 Dragina špilja** /cave/, Grabrk (7.02.2000 N. Tvrtković & B. Jalžić; 30.06.2006, 24.05.2007, 26.08.2008, 12.05.2009, I. Pavlinić *et al*.); **WL35 Ozaljska pećina** /cave/, Ozalj (06.02.1955, 09.01.1956, ĐULIĆ 1957, 1959; 1963); **Vrlovka pećina** /intemittent spring cave/, Kamanje (LANGHOFFER 1912; 10.05.1953, 06.06.1954 (Đulić 1959; Đulić 1963; 23.01. 2002, I. Pavlinić, B. Jalžić); **Lipa na Protulipi** /cave/, Zvečaj (03.07.1955, 04.09.1955: ĐULIĆ 1959); **Karlovac** (07.05.1929, HPM: ĐULIĆ 1959); **WL41 Jopićeva jama** /pit/, Krnjak (27.02.2000, N. Tvrtković & D. Holcer; 06.02.2002, I. Pavlinić); **WL67 Podsused**, Zagreb (25.03.1902: HPM, KARAMAN 1924); **Bizečka pećina** /cave/, Zagreb (11.04.1952: ĐULIĆ 1953; 29.03.1954, 15.08. 1953, 09.10.1954, 09.11.1954, 23.09.1956: ĐULIĆ 1959, 1960b, 1963; 30.03.–5.06.1958: ĐULIĆ 1969); **Žrvena peć** /semi-cave/, Medvednica Mt. (20.07.1953, 06.08.1954, 27.07.1955: ĐULIĆ 1959).

Myotis dasycneme (Boie, 1828)

Pond bat / močvarni šišmiš	
Number of localities / broj nalazišta	2
Number of 10-km squares of UTM grid / broj 10-km UTM kvadrata	2
Number of maternity roosts / broj porodiljnih kolonija	0
Number of winter roosts / broj zimskih kolonija	1

Only one hibernaculum is known from Croatia – the Uviraljka swallow hole on Papuk Mountain (TVRTKOVIĆ *et al*., 2001). The dates of the records along with the number of bats are presented in Tab. 1. The pond bats were found hibernating very

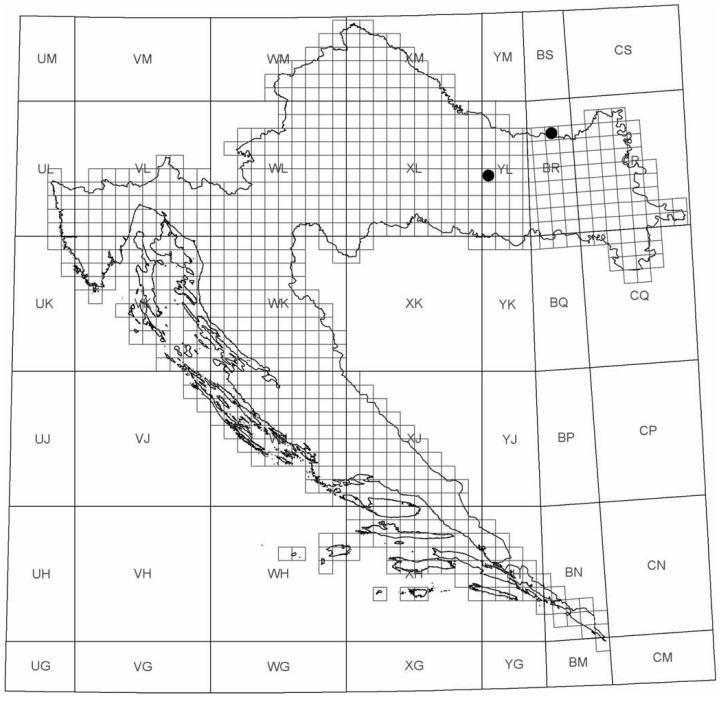

Fig. 10. Distribution of the pond bat *Myotis dasycneme* in Croatia.

near the entrance where the temperature is still influenced by outside conditions at an average of 6.3 °C during January and February, dropping to as low as 4.8 °C during December. Transect surveys with the help of bat detectors along the River Sava together with the inspection of church lofts and attics resulted in no proof of the *M. dasycneme* in this area (I. Pavlinić, unpubl. data). Distribution data on *M. dasycneme* from Hungary (DOMBI, 2003; BIHARI *et al*., 2007; GÖRFÖL, pers. comm) along the Danube near Batina (Béda, Kölked) and along the River Drava should be used as a basis for further investigation of this species in Croatia. Further field surveys along the Drava and the Danube and other water bodies in this area, together with inspections of the attics of available buildings, are needed to establish the actual status of this species in Croatia.

Tab. 1. Number of hibernating *M. dasycneme* found in Uviraljka swallow hole.

Date of visit	Number of *M. dasycneme* recorded
18.01.2000.	10
28.01.2003.	1
13.12.2005.	2
7.02.2006.	5

Localities / nalazišta

YL04 Uviraljka, ponor /swallow hole/, Papuk Mt. (18.01.2000: TVRTKOVIĆ *et al.* 2001; 28.01.2003, 13.12.2005, 07.02.2006, I. Pavlinić *et al.*); **BR87 Donji Miholjac** (11.05.2000, Z. Tadić: TVRTKOVIĆ *et al*. 2001).

Myotis emarginatus (Tomes, 1857)

Geoffroy's bat / riđi šišmiš	
Number of localities / broj nalazišta	64
Number of 10-km squares of UTM grid / broj 10-km UTM kvadrata	56
Number of maternity roosts / broj porodiljnih kolonija	22
Number of winter roosts / broj zimskih kolonija	6

This sedentary species has an interesting distribution pattern in Croatia where it clearly avoids the Continental Dinaric mountain part, inhabiting both the northern and southern part. Another similarity with overall distributions (DIETZ *et al*., 2009) is that in the Continental part summer roosts are in lofts, attics and roofs of churches and houses, while in the Mediterranean region it predominantly uses caves as roosts for colonies. Aggregations in the northern part are considerably smaller (around 100 bats) than those in the south (on average, more than 1,000 individuals). Altitudinal distribution is from sea level up to 800 m a.s.l with most of the findings (80%) below 400 m.

Up to 5,000 adult females were recorded in Tradanj cave in summer but the estimated number of adult females regularly using this cave is *ca.* 2,500. An old abandoned house near Metković sheltered 4,000 females in two consecutive seasons in May and June, but our visit on 5 August 2009 revealed an empty room because the colony dispersed immediately after the newborn became volant. *M. emarginatus*, usually together with *R. ferrumequinum*, forms the largest maternity aggregations on

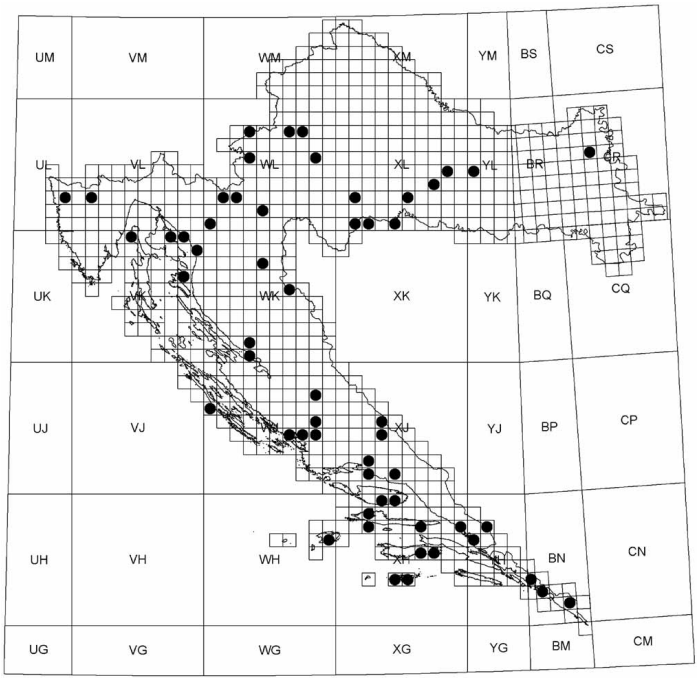

Fig. 11. Distribution of Geoffroy's bat *Myotis emarginatus* in Croatia.

the islands of Krk, Rab, Dugi otok, Hvar and Lastovo. In the Continental region we have evidence that some maternity colonies have disappeared from attics due to destruction (Maksimir, Kopačevo and Vratovo), and probably the same situation is found in an abandoned factory in Šibenik (Dalmatia).

The overall population estimate is based on maternity colony data among which over 20,000 females were recorded. Only 6% of this number were bats from the northern part, and if we take into account the numerous caves on the coast and on the islands, an estimate of around 55,000 seems to be realistic. Population trends are difficult to establish, but it is clear that the northern populations are more vulnerable to human impact.

Localities / nalazišta

WH96 Podšpilje, /pond/ Vis island (25.07.1969 mistnetted N. Tvrtković & V. Šipoš: ĐULIĆ & TVRTKOVIĆ 1979); **Punta noža špilje** /caves/, between Taleška bay and Duboka bay, Vis island (30.07.1969, Vicko Marinković: ĐULIĆ & TVRTKOVIĆ 1979); **XH27 Draškova špilja** /marine cave/, Sv.Nedjelja, Hvar island (15.07.1997, D. Holcer & B. Lazar); **XH28 Rt Kabal**, tuneli /tunnels/, Hvar island (24.05.1996, D. Holcer & B. Lazar); **XH39 Gornji Humac** /pond/, Brač island (25.07.1970: ĐULIĆ & TVRTKOVIĆ 1979); **XH43 Mrčara island,** vojni tunel /military tunnel/ (12.06.1997, N. Tvrtković & D. Holcer); **XH49 Tudrica** /cave/, Velo Zvirje bay, Brač island (08. 07. 1996. photo V. Božić); **XH53 Medviđa ropa** /marine cave/, Lastovo island (13.06. 2001, D. Holcer & I. Pavlinić); **XH65 Pupnat,** Korčula island (ĐULIĆ & TVRTKOVIĆ 1979); **XH67 Duboška Pazuha** (kod Duboke), špilja /cave/, Hvar island (21.06.1999 D. Holcer & A. Žuljević); **XH75 Postrana**, Korčula island (ĐULIĆ & TVRTKOVIĆ 1979); **XH97 Baćina**, tunel jezero-more /tunnel/ (06.09.1993, 16.07.1994, D. Holcer); **YH06 Vištičina jama** /pit/, Opuzen (19.04.1998, D. Holcer; 17.03.2006, I. Pavlinić *et al.*); **YH17 Vriještica** kuća /house/, Metković (=Dodigovi stanovi)

(20.06.2007, 28.05.2008, I. Pavlinić & M. Đaković); **BN53** Zatonska špilja (= **Rafova spila**) /marine cave/ (June 1968, J. Bakić: HENEBERG *et al*. 1968; 03.07.2001, N. Tvrtković & I. Pavlinić); **BN62 Vilina špilja** /cave/, Ombla, Dubrovnik (20.05.1999, N. Tvrtković *et al*.; 02.07.2001, N. Tvrtković & I. Pavlinić; 18.06.2007, I. Pavlinić & M. Đaković); **BN81 Dubravka** (= Mrcine) /pond/, Orjen Mt. (04.07.2001, mistnetted N. Tvrtković & I. Mihoci); **WJ06 Golubinka** /cave/, Dugi otok island (30.06.1989, N. Tvrtković; 12.07.1999, B. Jalžić & E. Kletečki); **WJ64 Tradanj špilja** /cave/, Zaton (01.07.2001, 31.07.2001, N. Tvrtković; 18.03.2006, 07.07.2006, 04.07.2007, 10.07.2008, I. Pavlinić *et al*.); **WJ74 Skradin**, tvornica /abandoned factory/ (June 1999, D. Hamidović, EUROBATS report 2003); **WJ84 Škarin Samograd** /cave/ (08.09.1957, 5.01.1958: Bakić 1958); **WJ85 Ključ**, Čikola canyon (mistetted: KOVAČIĆ & ĐULIĆ 1989); **WJ87 Miljacka II** /intermittent spring cave/ (22.05.1999, N. Tvrtković & F. Spitzenberger); **XJ21 Stražnica špilja** /cave/, Split (June 1968, HENEBERG *et al*. 1968); **XJ22 Trojama kod Srijana** /pit/, Mosor Mt. (KOLOMBATOVIĆ 1884; GIROMETTA 1914); **Podkapina spilja** /semi-cave/, Kučine, Mosor Mt.: 27.12. 1957 BAKIĆ 1958); **XJ34 Mračna špilja I** and **II** /caves/, Rumin, Troglav Mt. (04.07.2001, N. Tvrtković & B. Jalžić); **XJ35 Suhi Rumin jama** /pit/, Rumin, Troglav Mt. (04.07.2001, N. Tvrtković & B. Jalžić); **XJ41 Gornji Dolac** (= Dolac kod Poljica), Mosor Mt. (NMW: KOLOMBATOVIĆ 1884); **VK49 Beli**, Cres island (bat-detector data: CORNACCHIA *et al*. 2004); **VK79 Vrbničko polje**, tunel /tunnel/, Krk island (14.06.2007, I. Pavlinić & M. Đaković); **VK86 Medova buža** /marine cave/, Rab island (29.05.2001, B. Jalžić & N. Tvrtković; 02.08.2001, N. Tvrtković & I. Pavlinić; 14.06.2007, I. Pavlinić & M. Đaković); **VK89 Povile,** špilja /marine cave/ (NMB: MEHELY 1900); **Zagorska peć (= Novi bg.)** /cave/, Novi Vinodolski (NMB: TOPÁL 1954); **VK98 Sveti Križ**, crkva /church/, Velebit Mt. (15.05.2009, I. Pavlinić & M. Đaković); **UL92 Buje** (= Buye Istria) (DAL PIAZ 1927); **VL12 Istarske toplice** (1998, D. Kovačić); **WL00 Jasenak**, V. Kapela Mt. (TOPAL 1954); **WL12 Kuštrovka špilja** /cave/ (07.05.2006 I. Pavlinić & D. Holcer); **WL22 Bosiljevo**, Stari grad /castle/ (24.05.2007, I. Pavlinić *et al*.); **Dragina špilja** /cave/ (30.06.2006, 12.05.2009, I. Pavlinić & M. Đaković); **WL35 Ozalj**, gradina /castle/ (16.07.1902, HPM: DJULIĆ 1959); **Vrlovka pećina** /cave/ (10.05.1953: DJULIĆ 1959); **WL37 Budinjak**, mrtvačnica /mortuary/, Žumberak Mt. (12.06.2003, I. Pavlinić & M. Šašić); **Kapelica Sv. Petke** /chapel/, Budinjak, Žumberak Mt. (26.06.2003, I. Pavlinić & M. Šašić); **WL41 Jopićeva jama** /pit/, Krnjak (03.03.2003, I. Pavlinić & J. Bedek); **WL67 Veternica** /cave/, Gornji Stenjevec, Medvednica Mt. (09.02.1956, 30.12.1956: ĐULIĆ 1959; February 1965, N. Tvrtković; 04.05.1992, 01.04. 1993, 25.04.1995, 03.11.1995, 03.02.1996, D. Holcer; 28.01. 2002, I. Pavlinić *et al*.; 20.11.2007, 15.03.2008 I. Pavlinić & M. Đaković); **WL77 Zagreb**, tavan /attic/ (15.07.1901: HPM); **Maksimir**, Zagreb, kuća /house/ (22.05.1887, HPM: KORLJEVIĆ 1903); **WL85 Vratovo**, lugarnica /house/ (20.06.1998, 13.07.1998, D. Holcer & D. Kovačić); **WK47 Mračna pećina** /cave/, Plitvice (1.05.1955: Đulić 1959); **WK30 Velika Paklenica** /creek/, Velebit Mt. (26.08.2005, mistnetted N. Tvrtković & I. Pavlinić); **WK31 Borisov dom**, /pond/, V. Paklenica, Velebit Mt. (27.05.2005, N. Tvrtković *et al*.); **WK65 Poljana** /pond/, Lička Plješevica Mt. (01.07. 2004, mistnetted I. Pavlinić *et al*.); **XL10 Divuša,** Dvor (13.05. 1902, HPM: DJULIĆ 1959); **XL12 Gradusa** špilja /cave/ (21.01.2004, I. Pavlinić *et al*.); **XL20 Hrvatska Kostajnica**, crkva /church/ (15.06.2008, 26.08.2009, I. Pavlinić & M. Đaković); **XL40 Hrvatska Dubica**, napuštena kuća /abandoned house/ (15.07.2009, I. Pavlinić & M. Đaković); **XL52 Novska,** crkva /church/ (04.05.1928, HPM); **XL73 Pakrac** (12.06.1928, HPM: DJULIĆ 1959); **XL84 Grižina špilja** /cave/, Sirač (07.01.2001, N. Tvrtković *et al*.); **YL04 Uviraljka** /swallow hole/, Papuk Mt. (30.04.1999, N. Tvrtković *et al*.; 14.05.1999, 28.05.1999, 08.07.1999, N. Tvrtković; 07.01.2001, N. Tvrtković *et al*.; 22.01.2004. I. Pavlinić); **CR25 Bilje**, dvorac /castle/ (MIKUSKA 1979); **Kopačevo**, tavan /attic/ (MIKUSKA 1979, 1981).

Myotis myotis (Borkhausen, 1797)

Greater mouse-eared bat / veliki šišmiš	
Number of localities / broj nalazišta	84
Number of 10-km squares of UTM grid / broj 10-km UTM kvadrata	75
Number of maternity roosts / broj porodiljnih kolonija	21
Number of winter roosts / broj zimskih kolonija	9

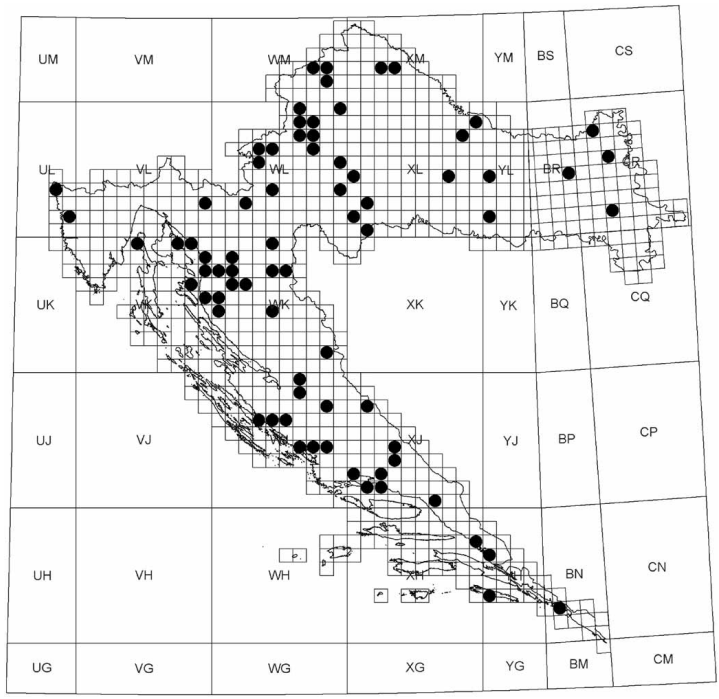

Fig. 12. Distribution of the greater mouse-eared bat *Myotis myotis* in Croatia.

Impossible to visually separate from *M. blythii*, the greater mouse-eared bat is more evenly distributed in the whole area of Croatia. Mixed colonies with *M. blythii* and other species are found only in the southern parts. A maternity roost was found on only one island – Rab, where in a sea cave a mixed maternity colony with *M. blythii* was discovered. Few records are available from an altitude above 600 up to 1.300 m a.s.l., with most of the findings (especially maternity colonies) coming from below 400 m a.s.l.

Mostly single individuals were found during hibernation in underground objects in the Continental region. Records from the Uviraljka swallow hole and Veternica cave both showed variation in numbers during the same winters, but also indicated a general decline. It is unclear where the animals from maternity colonies spend their hibernation periods – one possible explanation could be that single animals use rock crevices as their roosts (eg. DIETZ *et al.*, 2009). The largest number was recorded only in March 2009 (100 bats) in Trbušnjak cave (Dalmatia), but records from previous winters show that this month is already the time of maternity colony formation.

Maternity roosts of *M. myotis* were found in both regions and are quite large with an average of ca. 1,000 females per colony. Out of 11 records from the Continental part, 6 (55%) are from church and house attics. These colonies are far smaller (25–150) and bats are usually hidden between wooden beams or high in the tower. The largest maternity colony was in Trbušnjak cave with an average of 5,250 adult animals representing at least 10% of the total Croatian population estimate. A small colony in Zelena pećina cave seems to be isolated within the Dinaric mountain

area. The southern maternity aggregations in Dalmatia range in size from 400 (Badanj cave) (ĐULIĆ, 1961) up to 1,250 bats (Topla peć cave). The data from Badanj cave are old and have remained unchecked, but colonies from Mandalina cave and Vrelo cave have disappeared. The calculation of 1,000 greater mouse-eared bats from Ćulumova cave is questionable since we have identified only *M. blythii* from this cave during our recent yearly visits.

The population estimates are based on 16,200 females counted during the nursery period, leading us to believe that no more than 50,000 bats are in Croatia. The population from the northern part seems to be more endangered as it depends on a few underground sites and artificial shelters, while the bats in the south have much greater opportunities. In light of the recent intensive monitoring of churches within the Continental region where only one small colony was found and a few colonies have disappeared, it is reasonable to consider the northern population to be in decline while the southern one is probably stable.

Localities / nalazišta

XH97 Baćina, tunel /tunnel/, Peračko blato-Baćinska jezera (06.09.1993, 16.07.1994, 08.06. 1997, 07.09.1993, D. Holcer); **YH03 Mljet** island ĐULIĆ & TVRTKOVIĆ 1970); **YH06 Vištičina jama** /pit/ (09.08.1997, D. Holcer); **BN62 Vilina špilja** /cave/, Ombla, Dubrovnik (June 1968: HENEBERG *et al*. 1968); **WJ36 Badanj špilja** /cave/**,** Biograd (29.06.1957: ĐULIĆ 1961; 17.04.2009, I. Pavlinić & M. Đaković); **Pataljanova jama** /pit/, Zadar (ĐULIĆ: unpublished manuscript); **WJ46 Vrelo pećina** /spring cave/, (= Vrana pećina k. Zadra; Pećina kod Vrane, Vrana) (23.07.1894, HPM: KORLJEVIĆ 1903, LANGHOFFER 1912; 30.06.1957: ĐULIĆ 1961; June 1968: HENEBERG *et al*. 1968; 12.07.1975, N. Tvrtković); **WJ56 Baldina jama** /pit/ (15.10.2003, I. Pavlinić *et al*.); **WJ64 Tradanj špilja** /cave/ (04.05.2006, I. Pavlinić); **WJ68 Mala Kusača špilja** /cave/, Bukovica (19.07.2001, I. Pavlinić & N. Tvrtković); **Velika Kusača špilja** /cave/, Bukovica (19.07.2001, I. Pavlinić & N. Tvrtković); **WJ69 Topla peć** /cave/, Krupa (24.07.2008, I. Pavlinić & M. Đaković); **WJ74 Mandalina špilja** /cave/ (02.07.1957 ĐULIĆ 1961; June 1968: HENEBERG *et al*. 1968); **WJ84 Škarin Samograd** /cave/, Pokrovnik (04.07.1957: ĐULIĆ 1961; ČERVENY & KRYŠTUFEK 1988; 21.06.1989: KOVAČIĆ & ĐULIĆ 1989; 21.06.2007, I. Pavlinić & M. Đaković); **WJ87 Miljacka II** /intermittent spring cave/ (11.07.1998, D. Holcer & D. Kovačić); **XJ02 Bunarina jama** /pit/, Radošić (14.04.1912: GIROMETTA 1913); **XJ11 Split** (= Spalato) (DAL PIAZ 1926); **XJ17 Ćulumova špilja** /cave/, Kijevo (10.06.1999 N. Tvrtković); **XJ21 Stražnica** /cave/, Split (June 1968: HENEBERG *et al*. 1968); **XJ22 Bunarina spilja** /cave/, Split (KOLOMBATOVIĆ 1884); **XJ33 Trilj** (03.05.1957: BAKIĆ 1958); **XJ34 Košute,** Sinj (27.01.1957: BAKIĆ 1958); **XJ60 Stara Škola jama** /pit/**,** Biokovo Mt. (CNHM 5991); **VK49 Beli,** Cres island (bat-detector data: CORNACCHIA *et al*. 2004); **Čampari špilja** /cave/, Cres island (mistnetted: BUREGR *et al*. 2004); **VK79 Novi-Selce**, pećina /cave/ (17.08.1905, 10.07.1906, 16.07.1906, M. Padewieth, HPM); **VK86 Medova buža** /marine cave/, Rab island (14.06. 2007, I. Pavlinić & M. Đaković); **VK89 Zagorska peć** /cave/, Novi Vinodolski (16.07.1906: LANGHOFFER 1912); **VK95 Slovačka jama** /pit/, Velebit Mt. (2/3.08.1995 B. Šmida, D. Kotlaričeк; 24.09.1998, N. Tvrtković & Ž. Ludvig); **VK97 Senj** /marine caves and castle/ (10.08.1905, 06.07.1906, 07.09.1906, M. Padewieth, HPM: DJULIĆ 1959); **VK98 Vlaška peć** /semi-cave/, G. Kozica, V. Kapela Mt. (18.07.1906, M. Padewieth, HPM: DJULIĆ 1959); **Pijavica peć** /cave/, Sv. Jelena, Krivi put, V. Kapela Mt. (21.07.1906, M. Padewieth, HPM: LANGHOFFER 1912); **WK04 Solila** (Bubnica) /pool/, Velebit Mt. (mistnetted 15.07.1999, N. Tvrtković *et al*.); **WK05 Apatišan** /spring/, Velebit Mt. (mistnetted 03.08.2002, I. Pavlinić); **WK07 Lužina peć** /cave/, Žuta Lokva (10.11.1906, M. Padewieth, HPM: LANGHOFFER 1912); **WK16 Otočac** (ĐULIĆ: unpublished manuscript); **WK17 Brlog**, pećina (HPM: KORLJEVIĆ 1903); **WK18 Stajnica**, tavan crkve /church attic/, Stajničko polje (28.06.2004, I. Pavlinić); **WK26 Špilja Pećina** /cave/, Pećina, Velebit Mt. (14.10.2003 I. Pavlinić *et al*.); **WK44 Zelena pećina** /spring cave/, Bunić, Krbavsko polje (09.06.2004, N. Tvrtković & I. Pavlinić;

15.04.2009, I. Pavlinić & M. Đaković); **WK47 Modra špilja** /cave/**,** Plitvice (18.05.2002, I. Pavlinić *et al*.); **WK49 Matešića pećina** /spring cave/, Slunj (15.07.1998, D. Holcer & D. Kovačić; 17.07.2001, N. Tvrtković & I. Pavlinić; 13.02.2006, I. Pavlinić); **WK57 Barićeva špilja** /cave/, Ličko Petrovo Selo, Lička Plješevica Mt. (19.09.2002, I. Pavlinić & M. Šašić); **Drežnik grad**, Plitvice, polušpilja /semi-cave/ (16.07.2002, I. Pavlinić *et al*.); **WK81 Srb** (HPM: DJULIĆ 1959); **UL83 Umag**, štala /stable/ (LIPEJ 1992); **UL91 Markova jama** /pit/, Tar (24.06.1999, B. Jalžić); **VL92 Stara Sušica**, dvorac /castle/ (29.05.2004, I. Pavlinić); **WL22 Dragina špilja** /cave/, Grabrk (30.06.2006, I. Pavlinić; 24.05.2007, I. Pavlinić *et al*.; 12.05.2009, I. Pavlinić & M. Đaković); **WL35 Vrlovka špilja** /cave/, Kamanje (HIRC 1884 as *V. murinus*; LANGHOFFER 1912; ĐULIĆ 1963); **WL36 Sošice**, crkva sv. Petra i Pavla /church/, Žumberak Mt. (18.07.2002, 13.06.2003, I. Pavlinić); **WL43 Rječica,** Karlovac (14.04.1901, HPM: KARAMAN 1929); **Karlovac** (07.1904, F. Šmit, HPM); **WL46 Pećno**, crkva Uznesenja BDM /church/, Žumberak Mt. (15.05.1999, N. Tvrtković; 18.07.2002, 12.06.2003 I. Pavlinić); **WL67 Veternica** /cave**/**, Gornji Stenjevec, Medvednica Mt. (27.03.1955, 30.12.1956: DJULIĆ 1959); 12.1.1983, 26.08.1983, 07.12.1983: MARKOVIĆ 1984; 21.03.1992, 01.04.1993, 21.05.1993, 25.04.1995, D. Holcer); **Bizečka pećina** (= Žurenščak) /cave/, Zagreb (05.05.1912: LANGHOFFER 1915); **Podsusedsko Dolje**, tunel /tunnel/, Zagreb (spring 1972, B. Đulić & N. Tvrtković); **WL68 Gornja Bistra**, dvorac /castle/ (14.07.2005, A. Štefan); **WL69 Strmec k. Vel. Trgovišta** (09.04.1930, HPM: DJULIĆ 1959); **WL76 Velika Mlaka** (07.04.1929, HPM); **WL77 Zagreb** (10.09.1900, HPM: KORLJEVIĆ 1903; 06.06.1902, HPM: DJULIĆ 1959; 01.06.1929, HPM: DJULIĆ 1959; 22.10.1903, I. Cekuš, HPM; 04.07.1930, J. Macner, HPM); **WL78 Markuševac**, bunkeri /bunkers/, Medvednica Mt. (16.12.1992, 28.02.1993, 13.01.1994, 01.12.1994, 09.04.1995, 10.01.1998, D. Holcer); **WL93 Petrinja** (ĐULIĆ: unpublished manuscript)**;** **WL95 Peščenica**, crkva /church/ (June 1974, N. Tvrtković); **WL99 Sv. Ivan Zelina** (26.06.1935, HPM); **XL01 Prnjavor Čuntićki,** Petrinja /above creek/ (19.08.2009, mistnetted N. Tvrtković) **XL04 Sela**, crkva /church/ (July 1975, N. Tvrtković); **XL10 Divuša – Dvor** (13.05.1902, HPM: KARAMAN 1929); **XL12 Gradusa špilja** /cave/ (21.04.2004, I. Pavlinić *et al*.); **XL74 Rastik špilja** /swallow hole/ (09.12.2008, I. Pavlinić & M. Đaković); **Trbušnjak špilja** /spring cave/ (15.06. 2006, 29.06.2006, N. Tvrtković & I. Pavlinić; 12.03.2007, I. Pavlinić *et al*.; 06.06.2007, 12.03.2007, 01.07.2008, 30.09.2008, 13.11.2008, 09.12.2008, 11.02.2009, 19.03.2009, 11.05.2009, 30.07.2009, 10.06.2009, I. Pavlinić & M. Đaković); **XL87 Virovitica** (12.03.1913: DJULIĆ 1959); **XL98 Gradina**, crkva /church/ (24.06.2009, I. Pavlinić & M. Đaković); **YL01 Vrbova**, crkva /church/ (07.08. 2008 I. Pavlinić & M. Đaković); **YL04 Uviraljka**, ponor /swallow hole/, Papuk Mt. (28.05.1999, 18.01.2000, 07.01.2001 N. Tvrtković; 28.01.2003, 22.01.2004, 10.11.2005, 13.12.2005, 07.02.2006, 20.04.2006 I. Pavlinić *et al*.); **BR94 Valpovo** (01.05.1906, HPM: KARAMAN 1929); **CR17 Banovo brdo,** rudnik /mine/ (29.01.2002, J. Mikuska; 08.02.2002, J. Mikuska *et al*.; 04.07.2002, I. Pavlinić *et al*.; 01.08.2009, I. Pavlinić); **CR21 Prkovci**, Vinkovci (16.06.1914 HPM: KARAMAN 1929); **CR25 Bilje** (= Bellye), **Darda** (= Dárda) (NMB: PASZLAVSKY 1918); **WM72 Čardak pećina** /cave/, Klenovnik, Ravna Gora Mt. (04.08.1953: DJULIĆ 1959); **WM81 Ivanec** (15.09.1933 HPM: DJULIĆ 1959); **WM82 Vindija** /cave/, Donja Voća, Ravna Gora Mt. (04.08.1953: DJULIĆ 1959); **XM22 Ludbreg** (29.03.1933: DJULIĆ 1959); **XM32 Veliki Bukovec**, Ludbreg (28.08.1952: DJULIĆ 1959).

Barbastella barbastellus (Schreber, 1774)

Barbastelle bat / širokouhi mračnjak	
Number of localities / broj nalazišta	28
Number of 10-km squares of UTM grid / broj 10-km UTM kvadrata	25
Number of maternity roosts / broj porodiljnih kolonija	0
Number of winter roosts / broj zimskih kolonija	4

The limited distribution data on this typical forest species are available mostly as a result of intensive netting surveys in some areas. Additional data have been gathered by means of bat-detector transects from which this species can be unmistakably identified. Only single individuals were found hibernating in caves and in a

bunker near Zagreb, and in some caves in the Gorski kotar area. All the hibernation records were made from November to February and no animals were found later in the season. This is in accordance with observations from Slovenia where the barbastelle enters the caves only during the coldest months of the year (KRYŠTUFEK & DONEV, 2005). An exception could be the mating period when single males were captured at cave entrances (Barićeva cave). No nursery colony was found, but evidence of breeding was recorded in four localities – Vinkovci (Slavonija area), Kuselj, Gorsko vrelo and Krivi Javor (Lika area). All locations at which pregnant or lactating females were captured near ponds were inside or near old forest stands. Only exception is finding from Vinkovci (Tab. 2).

Tab. 2. Status and number of captured *B. barbastellus* females at four localities.

Locality	Date	Status	Number of females
Vinkovci	27.05.1930.	pregnant	4
Gorsko vrelo	13.06.2002.	pregnant	1
	03.07.2002.	pregnant	1
Kuselj	10.07.2002.	lactating	2
	23.07.2003.	lactating	1
	28.07.2004.	lactating	1
	28.06.2007.	lactating	1
Krivi Javor	15.07.2005.	lactating	3

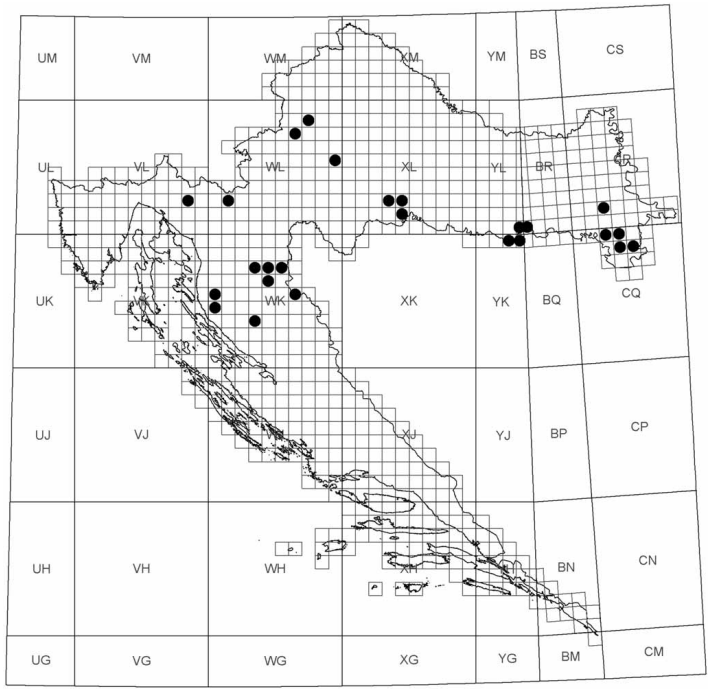

Fig. 13. Distribution of the barbastelle bat *Barbastella barbastellus* in Croatia.

Localities / nalazišta

WK04 Solila/Bubnica, lokva /pond/, Velebit Mt. (15.07.1999, mistnetted N. Tvrtković & D. Holcer); **WK05 Apatišan** /spring/, Velebit Mt. (03.08.2002, mistnetted I. Pavlinić & Z. Šeibl; 26.06.2005, mistnetted N. Tvrtković *et al.*); **WK33 Gospić** (20.10.1908, HPM: KARAMAN 1929); **WK37 Krivi Javor,** Mala Kapela Mt. (pool near road before Krivi Javor) (15.07.2005 mistnetted I. Pavlinić); **WK46 Gorsko Vrelo** /spring/, Babin potok, M. Kapela Mt. (13.06.2002, 03.07.2002 mistnetted I. Pavlinić *et al.*; 24.07.2003 mistnetted I. Pavlinić & M. Šašić); **WK47 Kuselj** /spring/, M. Kapela Mt. (10.07.2002, mistnetted N. Tvrtković *et al.*; 23.07.2003, mistnetted I. Pavlinić & M. Šašić; 28.07.2004, mistnetted N. Tvrtković & I. Pavlinić; 28.06.2007, I. Pavlinić et al.); **WK57 Barićeva špilja** /cave/, Ličko Petrovo Selo, Lička Plješevica Mt. (18.05.2003, mistnetted I. Pavlinić & I. Krivdić); **WK65 Poljana** /pond/, Lička Plješevica Mt. (01.07.2004, mistnetted I. Pavlinić *et al.*); **YK29 transect Šumeće** (06.08.2008, 29.07.2008, bat – detector data I. Pavlinić & M. Đaković); **YK39 transect Zbjeg** (06.08.2008, 29.07.2008, bat – detector data I. Pavlinić & M. Đaković); **CQ29 transect Spačva** (28.06.2008, bat – detector data I. Pavlinić & M. Đaković); **CQ38 transect Spačva** (28.06.2008, bat – detector data I. Pavlinić & M. Đaković); **CQ39 transect Spačva** (28.06.2008, bat – detector data I. Pavlinić & M. Đaković); **CQ48 transect Spačva** (28.06.2008, bat – detector data I. Pavlinić & M. Đaković); **VL82 Gerovska Rebar,** špilja /cave/, Lokve (30.11.1953; DJULIĆ 1954); **WL12 Kuštrovka** /cave/ (12.02.2003, 22.01.2006, I. Pavlinić *et al.*; 12.02.2006 I. Pavlinić); **WL67 Veternica** /cave/, Gornji Stenjevec, Medvednica Mt. (30.12.1956: ĐULIĆ 1959; 12.01. 1983, 07.12.1983: MARKOVIĆ 1984; 09.12.1995, 03.02.1996, D. Holcer); **WL78 Markuševac**, bunkeri /bunkers/, Medvednica Mt., (16.12.1992, 28.02.1993, D. Holcer; 13.01.1994, 01.12. 1994, D. Holcer *et al.*; 10.01.1998, D. Holcer; 29.01.1999, D. Holcer & M. Šašić); **transect Šupljak**, Medvednica Mt. (28.06.2006, 11.07.2006, 18.08.2006, 07.09.2006, bat – detector data I. Pavlinić), **transect Markov Travnik**, Medvednica Mt. (27.06.2006, 11.07.2006, 17.08. 2006 bat – detector data I. Pavlinić), **transect Stara Pila**, Medvednica Mt. (28.06.2006, 23.08.2006, 06.09.2006, bat – detector data I. Pavlinić); **WL 95 Turopoljski lug** (27.06.2002, bat – detector data G. Bartolić: BARTOLIĆ 2005); **XL32 transect Lonja** (26.06.2008, bat – detector data I. Pavlinić & M. Đaković); **XL42 transect Subocka** (26.06.2008, bat – detector data I. Pavlinić & M. Đaković); **XL41 transect Jasenovac** (26.06.2008, bat – detector data. I. Pavlinić & M. Đaković);); **YL30 transect Migalovci** (06.08.2008, 29.07.2008 I. bat – detector data I. Pavlinić & M. Đaković); **BR60 transect Slavonski Brod** (06.08.2008, 29.07.2008, bat – detector data I. Pavlinić & M. Đaković); **CR21 Vinkovci** (26.04.1930, 27.05.1930, HPM: DJULIĆ 1954).

Miniopterus schreibersii (Kuhl, 1817)

Schreiber's bat / dugokrili pršnjak	
Number of localities / broj nalazišta	76
Number of 10-km squares of UTM grid / broj 10-km UTM kvadrata	65
Number of maternity roosts / broj porodiljnih kolonija	25
Number of winter roosts / broj zimskih kolonija	21

Croatia is part of a continuous Mediterranean (in the extensive sense) distribution of this species (DIETZ *et al.*, 2009). Ringing data has revealed the existence of the Pannonian metapopulation consisting of bats from Hungary (TOPÁL 1956; ĐULIĆ, 1957), Austria (recently suffering a heavy decrease: SPITZENBERGER, 2001), Slovakia and Slovenia (KEPKA, 1960, 1981; BAUER & STEINER, 1960; SPITZENBERGER, 1981. This species makes up the largest known winter and maternity colonies of all bat species in Croatia. All the records of maternity colonies relate to altitudes below 750 m a.s.l., some individual specimens were found to 1.200 m a.s.l.

The largest nursery colony was in the most important shelter of the Pannonian metapopulation, Trbušnjak cave, an object of intensive monitoring in 2008 and 2009.

The estimated number of females varied during the season from 26,000 on 11 May to 35,000 on 30 July. The temperature in the chamber with the main colony averaged 17.7 °C during June. Although at first Trbušnjak cave was considered an important wintering shelter based on an estimated 1,000 bats found on 19 March, intensive field work revealed that these animals were in migration from wintering sites and had started to form a summer colony. The maximum number of females in Trbušnjak cave makes up almost 70% of the total Croatian population recorded during the summer period. An additional four caves housed more than 1,000 bats during the maternity period. One of these caves was the sea cave on the island of Rab (Medova buža cave). The rest of the maternity colonies averaged around 140 bats. The species rarely makes mixed colonies with other cave dwelling species. Most summer roosts are caves.

Large winter aggregations are known from Vištičina pit in the Mediterranean region and Kuštrovka cave in the Continental region. These two colonies, with a highly variable number of bats over the years, housed a maximum estimate of 57,500 bats (Tab. 3). Kuštrovka cave, with an ideal position, obviously at one moment provides shelter for most of the *M. scheibersii* from the Pannonian and Dinaric area of Continental Croatia and probably Slovenia, while Vištičina pit is an important winter site for island populations (Vis, Lastovo, Mljet) and probably populations from Bosnia and Herzegovina. The rest of the hibernacula had an average of fewer than 20 bats.

Overall estimates of bats in maternity roosts and those in hibernacula still favour hibernating bats, but the recent discovery of a large new maternity colony makes

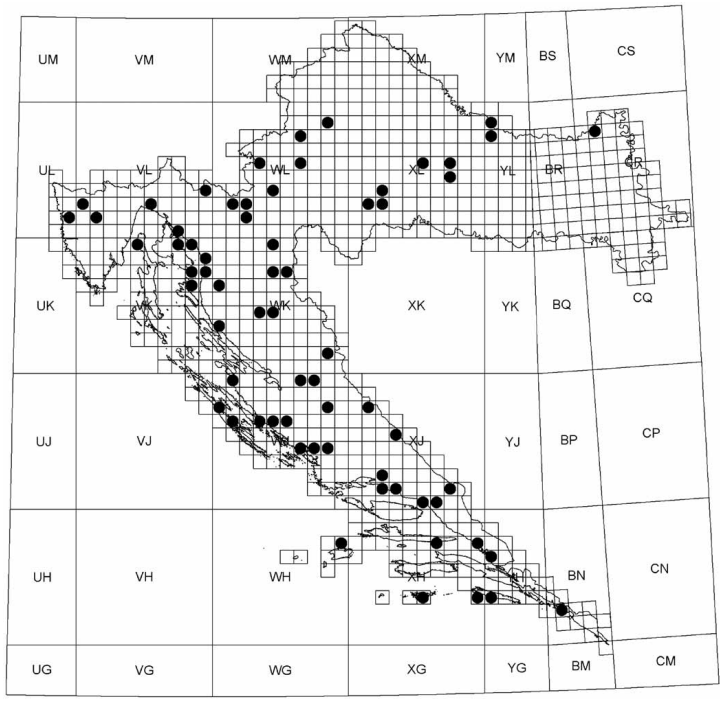

Fig. 14. Distribution of Schreiber's bat *Miniopterus schreibersii* in Croatia.

the numbers more equal. With 58,000 specimens in hibernacula and over 50,000 in maternity colonies, our estimate of *M. schreibersii* in Croatia is around 150,000. The status of the colony in Jamina pit (Biokovo Mountain) recorded during the migration period remains unclear, but since the estimated number of bats was 10,000 it could further raise the overall population estimate. Although new data have greatly improved our knowledge of the distribution and population size, it is still difficult to say that the population is stable, especially in light of the newest decline recorded in Spain and France (IUCN, 2009).

Tab. 3. Estimated number of hibernating *M. schreibersii* in Kuštrovka cave and Vištičina pit.

OBJECT	YEAR	DATE	ESTIMATED NUMBER
Kuštrovka špilja	2003	12.02.2003.	20,000–30,000
		19.02.2003.	23,000–32,000
		31.03.2003.	5,000
		13.12.2003	30,000
	2006	04.04.2006.	10,500
		07.05.2006.	1,550
		12.02.2006.	18,000
		22.01.2006.	12,000
Vištičina jama	1998	08.02.1998	10,000–18,000
	2002	19.01.2002.	>12,000
	2006	13.01.2006.	27,500
		17.03.2006.	13,000

Localities / nalazišta

WH97 Kraljicina spila /cave/, Vis island (03.04.1998, B. Jalžić & E. Kletečki; 29.10. 2006, I. Pavlinić *et al.*); **XH53 Medviđa ropa** (= Medveja špilja) /marine cave/, Lastovo island (19.08. 1965: ĐULIĆ 1968, ĐULIĆ & TVRTKOVIĆ 1970; 15.06.2001, D. Holcer & I. Pavlinić; 08.08.2009, I. Pavlinić & M. Đaković); **Rača špilja** /cave/, Lastovo island (27.05.1997, N. Tvrtković & D. Pelić); XH67 **Dubovska pod Pazuho** (= Duboška Pazuha) /cave/, Bogomolje, Hvar island (ĐULIĆ & TVRTKOVIĆ 1970; 21.06.1999, D. Holcer & A. Žuljević); **XH93 Vodice** /spring/, Mljet island (26.08.2007, mistnetted I. Pavlinić); **XH97 Peračko blato – Baćinska jezera**, tunel /tunnel/ (07.09.1993, D. Holcer); **YH03 Ostaševica špilja** /cave/, Mljet island (10.04.1906: KLAPTOCZ 1911; 28.04.2008, B.Jalžić); **Vodice** /pond/, Babino Polje, Mljet island (10.08.1968: ĐULIĆ 1970, 1989); **YH06 Vištičina jama** /pit/, Opuzen (08.02.1998: JALŽIĆ 1998; 19.04.1998 D. Holcer; 19.01.2002, 13.01.2006, 17.03.2006 I. Pavlinić *et al.*); **BN62 Vilina špilja** /cave/, Ombla, Dubrovnik (20.05.1999, N. Tvrtković *et al.*; 12.08.2000, N. Tvrtković & F. Kršinić; 02.07.2001 N. Tvrtković *et al.*; 16.01. 2002, I. Pavlinić *et al.*; 25.09.2007, I. Pavlinić & M. Đaković); **WJ07 Strašna peć** /cave/, Dugi otok island (HIRTZ 1931); **WJ16 Sali**, crkva /church/, Dugi otok island, (HIRTZ 1930); **WJ19 Bokanjac**, irrigation tunnel (15.08.1996, D. Holcer); **WJ36 Badanj špilja** /cave/ (17.04.2009, I. Pavlinić & M. Đaković); **WJ46 Lago di Vrana**, jezero /lake/ (1880, G. Kolombatović: NMW); **Vrelo pećina** /spring cave/, Vrana (30.06.1957, ĐULIĆ 1961); **WJ56 Baldina jama** /pit/ (15.10.2003, I. Pavlinić *et al.*); **WJ64 Tradanj špilja** /cave/, Zaton (04.05.2006, I. Pavlinić & K. Čivić); **WJ69 Topla peć** /cave/, Krupa (09.08.1984 N. DeLuca; 24.07.2008, I. Pavlinić & M. Đaković); **WJ74 Mandalina špilja** /marine cave/, Šibenik (01.12.1956: ĐULIĆ 1959; 02.07.1957, 05.12.1957: ĐULIĆ 1961); **WJ79 Kudin most**, Krupa river (09.08.1984, PMS); **WJ84 Škarin Samograd** /cave/, Pokrovnik (04.07.1957: ĐULIĆ 1961; 21.06.1989: KOVAČIĆ & ĐULIĆ 1989; 21.06.1995, N. Tvrtković *et al.*, 11.07.1998, D. Holcer & D. Kovačić; 13.03.1999, N.Tvrtković; 27.09.2007, I. Pavlinić & M. Đaković); **WJ87 Miljacka II** /intemittent spring cave/ (11.10.1998, N. Tvrtković & D. Kovačić; 09.03. 1999, B. Jalžić & D. Hamidović; 22.05.1999, N.

Tvrtković); **XJ17 Ćulumova pećina** /cave/, Kijevo (21.01.1999, B. Jalžić & D. Hamidović; 10.06.1999, N. Tvrtković *et al.*; 02.02.2002, I. Pavlinić & J. Bedek; 28.09.2007, 01.11.2007, 23.10.2008, 16.04.2009, 11.08.2009, I. Pavlinić & M. Đaković); **XJ21 Stražnica** (cave), Split (June 1968: HENEBERG *et al*. 1968); **XJ22 Jadro river**, above spring (28.02.1884, September 1884: KOLOMBATOVIĆ 1884); **Pećina nad Jadrom** /cave/ (14.08. 1957: BAKIĆ 1958); **Golića peć** /cave/, Klis (24.03.1957: BAKIĆ 1958); **Milićevica pećina** /cave/, Split (07.07.1957: ĐULIĆ 1961); **XJ31 Špilja u kanjonu Cetine** /cave/, (May 2004, Marco van den Hof); **XJ35 Vodena jama** /cave/, Rumin, Troglav Mt. (31.01.2002, I. Pavlinić; 24.10.2008, I. Pavlinić & M. Đaković); **XJ50 Jamina** /pit/, Biokovo Mt. (spring 199?, R. Ozimec); **WJ60 Stara škola jama** /pit/, Biokovo Mt. (04.09.1984, B. Jalžić); **XJ71 Špilja u Crvenom jezeru** /lake cave/, Imotski (03.10.1999, R. Ozimec); **VK49 Beli**, Cres island (bat detector data: CORNACCHIA *et al*. 2004); **VK79 Vrbničko polje**, tunel /tunnel/, Krk island (22.09.2007, I. Pavlinić & M. Đaković; 19.09.2009, I. Pavlinić); **VK86 Medova buža** /marine cave/, Rab island (02.08.2001, N. Tvrtković & I. Pavlinić; 04.08.2002, I. Pavlinić *et al.*; 21.09.2007, I. Pavlinić & M. Đaković); **VK87 Škujica špilja** /marine cave/, Baška, Krk island (15.07.1965: MIRIĆ 1968, ĐULIĆ & TVRTKOVIĆ 1970; 25.05.1978, 04.06.1980: CHRISTIAN & POTOČNIK 1985); **VK89 Zagorska špilja** (= Novljanska pećina) /cave/, Novi Vinodolski (27.02.1955, 15.05.1955, September 1956, June 1957: ĐULIĆ 1963, ĐULIĆ 1955; 13.08.1974, N. Tvrtković & D. Pelić; 28.07.1997, 26.09.1997, D. Kovačić & D. Holcer; 10.11.2000, N. Tvrtković & B. Jalžić; 17.03.2004, I. Pavlinić *et al.*; 12.09.2007, 13.06.2007, 20.06.2008, 20.09.2008, I. Pavlinić & M. Đaković); **VK97 Sv. Juraj feletti bg.,** špilja /marine cave/, Velebit Mt. (NMB: TOPAL 1954); **VK98 Sv. Jelena bg., špilja** /marine cave/, Velebit Mt. (NMB: TOPAL 1954); **Orlova Gniezdo** (= Orlovo gnijezdo: vrh/peak), špilja /cave/, V. Kapela Mt., (NMB: TOPAL 1954); **WK03 Karlobag**, Velebit Mt. (27.08.1906, HPM: ĐULIĆ 1956); **WK06 Apatišan** /spring/, Velebit Mt. (03.08.2002, mistnetted I. Pavlinić); **WK44 Zelena pećina** /intermittent spring cave/, Bunić, Krbavsko polje (14.01.2002, I. Pavlinić *et al.*; 15.04.2009, I. Pavlinić & M. Đaković); **WK47 Modra špilja** /cave/, Plitvice (24.07.2002, N. Tvrtković & I. Pavlinić; 31.10.2002, I. Pavlinić & B. Jalžić; 27.05.2003, D. Holcer & I. Pavlinić); **Mračna pećina** /cave/, Plitvice (11.11.1954, ĐULIĆ 1955); **WK49 Matešića pećina** /spring cave/, Slunj (15.07.1998, D. Kovačić & D. Holcer; 26.07.2001, N. Tvrtković & I. Pavlinić; 05.05.2006, 08.07.2008, I. Pavlinić *et al.*; 20.04.2009, I. Pavlinić & M. Đaković); **WK57 Barićeva špilja** /intermittent spring cave/, Ličko Petrovo Selo, Lička Plješevica Mt. (10.7.2002, I. Pavlinić & D. Hplcer; 19.9.2002, 31.10.2002, I. Pavlinić et al.; 30.1.2003, 18.5.2003, I. Pavlinić, 4.11.2004, 25.10.2005, 08.07. 2008, 22.02.2008 I. Pavlinić *et al.*); **WK81 Miša pećina** /cave/, bei Srb, Lička Plješevica Mt. (September 1865, NMW: PASZLAVSZKY 1918, TOPAL 1954); **UL91 Markova jama** /pit/, Tar (24.06.1999, B. Jalžić & N. Tvrtković); **VL11 Grotta di Ceresetto** /cave/, Pazin (= Pisino) (DAL PIAZ 1927); **VL52 Trsat,** gradina /castle/ (19.04.1902, HPM: KARAMAN 1929); **VL70 Crikvenica** (HPM: ĐULIĆ 1956); **VL93 Zapeć – Plemenitaš,** (August 1912, HPM: ĐULIĆ 1956); **WL12 Kuštrovka špilja** /cave/ (19.02.2003, I. Pavlinić; 31.03.2003, 13.12.2003, N. Tvrtković *et al.*; 22.01.2006, 12.02.2006, 04.04.2006, 07.05.2006, 04.07.2006, I. Pavlinić *et al.*); **WL21 Tounjčica špilja** /spring cave/, Tounj (15.04.1998, 09.07.1998, D. Holcer; 15.10.2000, N. Tvrtković; 20.01.2003, 08.07.2008 I. Pavlinić *et al.*); **WL22 Dragina špilja** /cave/, Grabrk (24.05.2007, I. Pavlinić *et al.*; 26.08.2008, I. Pavlinić & N. Tvrtković); **WL35 Ozaljska pećina** /cave/ (06.02.1955, 06.06.1954: ĐULIĆ 1956; winter 1956: ĐULIĆ 1963; June 1957: ĐULIĆ 1957); **Vrlovka špilja** /intermittent spring cave/ (winter 1956: ĐULIĆ 1956, ĐULIĆ 1963; 14.04.1957: ĐULIĆ 1957); **WL43 Karlovac,** crkva /church/ (20.04.1902, HPM: KARAMAN 1929; 07.05.1929 HPM: ĐULIĆ 1956); **WL65 Kupinec,** crkva /church/ (HPM: KARAMAN 1929); **WL67 Podsused – Stenjevec**, Zagreb (27.03.1902, V. Slabnik, HPM); **Podsused**, Zagreb (25.03.1902, HPM: KARAMAN 1929); **Borčec**, špilja /cave/, Zagreb (1/15.04.1924, ZMS: KARAMAN 1929); **Bizečka pećina** (= Žurenščak, Goljak-Bizek) /cave/, Zagreb (05.05.1912 HPM: LANGHOFFER 1915; ĐULIĆ 1953, ĐULIĆ 1955, ĐULIĆ 1960, ĐULIĆ 1963; KEPKA 1960; 30.03.–5.06.1958: ĐULIĆ 1969; 29.08.1965; J. Mikuska; **Veternica špilja** /cave/, Medvednica Mt. (winter 1956, September 1957, July 1958: ĐULIĆ 1963; 30.03.1965: MIKUSKA 1966; 30.07.1974, Hafner; 24.07.2001, N. Tvrtković, I. Pavlinić; 20.09.2001, I. Pavlinić *et al.*; 25.06. 2003, I. Pavlinić; 10.09.2007, 17.10.2007, I. Pavlinić & M. Đaković); **WL88 Planina Gornja**, rudnik /mine/, Zagreb (04.03.1957; ĐULIĆ 1957; 14.09.1972, N. Tvrtković & A. P. Kuzyakin; 05.05.1991, N. Tvrtković; 31.05.2007, I. Pavlinić *et al.*; 28.11.2007, I. Pavlinić & M. Đaković; 28.11.2007,

I. Pavlinić & M. Đaković); **XL12 Gradusa špilja** /cave/ (21.01.2009, D. Holcer et al.; 21.04.2009, I. Pavlinić & M. Đaković); **XL23 Letina** (= Donja Letina), Sunja (15.11.1931, HPM); **XL55 Hercegovac**, Bjelovar (30.07.1955: Topál 1956); **XL74 Rastik špilja** /swallow hole/ (12.03.2007, I. Pavlinić *et al.*); **Trbušnjak špilja** /cave/ (15.06.2006, N. Tvrtković & I. Pavlinić; 29.06.2006, 12.03.2007, 06.06.2007, N. Tvrtković *et al.*; 11.06.2009, I. Pavlinić *et al.*); **XL75 Daruvar** (ĐULIĆ 1956); **YL07 Cabuna**, Virovitica (03.08.1957: Đulić 1957); **YL08** Dethova (= **Detkovac**), Virovitica (07.08.1953: Đulić 1957); **CR17 Banovo brdo** /mine/ (18.02.2002, D. Holcer; 04.07.2002, J. Mikuska *et al.*; 02.02.2003, I. Pavlinić & D. Holcer; 09.11.2005, 01.08.2009, I. Pavlinić).

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