A review of eleven short-term reptile surveys in the Western Balkans

Pregled jedanaest kratkotrajnih istraživanja faune gmazova na području zapadnog Balkana

ANAMARIJA ŽAGAR[*1,2,3], VESNA CAFUTA[1,4], KATARINA DRAŠLER[1,5], TOMAŽ JAGAR[1,6], MIHA KROFEL[1,2], MARTINA LUŽNIK[1,7], ERIKA OSTANEK[1,8], VESNA PETKOVSKA[9], GRIŠA PLANINC[1,4], MAJA SOPOTNIK[1,10], MELITA VAMBERGER[1,11]

[1] *Herpetološko društvo - Societas herpetologica slovenica, Večna pot 111, SI-1001 Ljubljana, Slovenia*
[2] *Biotechnical Faculty, University of Ljubljana, Večna pot 111, SI-1001 Ljubljana, Slovenia*
[3] *CIBIO, Centro de Investigação em Biodiversidade e Recursos Genéticos, Universidade do Porto, Campus Agrário de Vairão, 4485-661 Vairão, Portugal*
[4] *Škofjeloška cesta 25, SI-1215 Medvode, Slovenia*
[5] *Ulica bratov Mivšek 32, SI-1353 Borovnica, Slovenia*
[6] *Tomšičeva 1a, SI-3310 Žalec, Slovenia*
[7] *Faculty of Mathematics, Natural Sciences and Information Technologies, University of Primorska, Glagoljaška 8, SI-6000 Koper, Slovenia*
[8] *Mali Otok 7, SI-6230 Postojna, Slovenia*
[9] *Institute for Water of the Republic of Slovenia, Hajdrihova 28c, SI-1000 Ljubljana, Slovenia*
[10] *Frenkova pot 26, SI-1231 Ljubljana Dobrunje, Slovenia*
[11] *Museum of Zoology, Senckenberg Dresden, Dresden, Germany*
**Corresponding author: anamarija.zagar@gmail.com*

Abstract

In this paper we present distributional data for reptiles from different localities in the Western Balkans. During an 11 year period (2002-2012) we collected new data in the frame of spring student research camps organized by the Biology Students' Society (DŠB). Surveys were conducted by members of the herpetological groups that were mostly biology students. Surveys were located on five islands Dugi otok, Brač, Korčula, Mljet, and Pag, one peninsula Pelješac (Croatia), in the continental area around Kamenovo and Lake Skadar (Montenegro), Dojran Lake (Macedonia), at lower Neretva Delta (Croatia) and around Niš (Serbia). Altogether 34 different

reptile species were recorded in the surveys. The species lists comprised of 7-22 different species per single locality. The highest reptile biodiversity was recorded around Dojran Lake in Macedonia.

Key words: Reptiles, Reptilia, Distribution, Western Balkans

Sažetak

U radu se prikazuju distribucijski podatci za gmazove sa različitih lokaliteta na području zapadnog Balkana. Tijekom razdoblja od 11 godina (2002. – 2012.) prikupili smo nove podatke u okviru studentskih istraživačkih kampova organiziranih od strane Društva studenata biologije (DSB). Istraživanja su provedena od strane pripadnika herpetološke sekcije koju većinom čine studenti biologije. Istraživanja su provedena na pet otoka, Dugi otok, Brač, Korčula, Mljet i Pag, jednom poluotoku, Pelješac (Hrvatska), na kontinentalnom području oko Kamenova i Skadarskog jezera (Crna Gora), okolici Dojranskog jezera (Makedonija), na području donjeg dijela rijeke Neretve (Hrvatska) i oko grada Niša (Srbija). Istraživanjem je ukupno zabilježeno 34 različite vrste gmazova. Na pojedinim lokalitetima zabilježeno je od 7 do 22 vrste gmazova, a najveća raznolikost zabilježena je oko Dojranskog jezera u Makedoniji.

Ključne riječi: Gmazovi, Reptilia, rasprostranjenost, zapadni Balkan

INTRODUCTION

The reptile species richness and composition as well as the distributional knowledge in the Western Balkans are highly diversified across the area. The Balkan peninsula is still one of the most understudied areas of Europe, despite the high species diversity reported here (DŽUKIĆ & KALEZIĆ, 2004). Assessment of six different areas in the Balkan peninsula revealed the highest diversity of reptiles in the »Adriatic triangle« (Montenegro and NW Albania), where DŽUKIĆ & KALEZIĆ (2004) also noted the highest concentration of endemics in the Balkans.

First surveys of the Balkan herpetofauna date back to the late 19th and the beginning of the 20th century (literature review in: JABLONSKI ET AL., 2012). From the middle of the 20th century on, several studies or reports focused on islands or archipelagos of Croatia (BRELIH & DŽUKIĆ, 1974, CVITANIĆ, 1984, ARNOLD, 1987, CORTI ET AL., 1999, GRILLITSCH ET AL., 1999, SCHMIDTLER, 1999, SEHNAL & SCHUSTER, 1999, TOTH ET AL., 2006, KLETEČKI ET AL., 2009, VERVUST ET AL., 2009, KOREN ET AL., 2011), as well as inland areas of Croatia (BRELIH & DŽUKIĆ, 1974, HENLE, 1985, ARNOLD, 1987, SCHMIDTLER, 1999, KRČMAR ET AL., 2007, KRYŠTUFEK &KLETEČKI, 2007, KRYŠTUFEK ET AL., 2008, BARIŠIĆ & BOGDANOVIĆ, 2011, JELIĆ & BOGDANOVIĆ, 2011, SZOVENYI & JELIĆ, 2011, JELIĆ, 2012, JELIĆ & KARAICA, 2012, KOREN ET AL., 2012), Serbia (BRELIH & DŽUKIĆ, 1974, TOMOVIĆ & DŽUKIĆ, 2003, KRČMAR ET AL., 2007, RISTIĆ ET AL., 2007, CRNOBRNJA-ISAILOVIĆ ET AL., 2011, RALEV ET AL., 2013), and Montenegro (BRELIH & DŽUKIĆ, 1974, DŽUKIĆ, 1991, CRNOBRNJA-ISAILOVIĆ & DŽUKIĆ, 1995, CRNOBRNJA-ISAILOVIĆ & DŽUKIĆ, 1997, DŽUKIĆ ET AL., 1997, TOMOVIĆ ET AL., 2000, CRNOBRNJA-ISAILOVIĆ, 2002, TOMOVIĆ ET AL., 2003, VAN DER VOORT, 2003, AJTIĆ ET AL., 2005, KRČMAR ET AL., 2007, LJUBISAVLJEVIĆ ET AL., 2007, JOVANOVIĆ, 2009, POLOVIĆ & LJUBISAVLJEVIĆ, 2010). Scarcer, but increasing in the last few years, are publications from Macedonia (PETKOVSKI ET AL., 2000, STERIJOVSKI, 2006, STERIJOVSKI ET AL., 2011) and Bosnia and Herzegovina (BRELIH & DŽUKIĆ, 1974, JELIĆ & LELO, 2011, JABLONSKI ET AL., 2012, KOREN ET AL., 2012). There are also few general distributional overviews of reptile species for former Yugoslavia (RADOVANOVIĆ & MARTINO, 1950, RADOVANOVIĆ, 1951, DŽUKIĆ, 1995), and for Western Palearctic, including the Balkan Peninsula, published by the *Societas herpetologica italica* (SINDACO & JEREMČENKO, 2008). Review for the genus *Vipera* in the Western and central Balkans was also published recently (JELIĆ ET AL., 2013).

In the last decade information systems allow easy distribution of information via internet, including data on hepretofauna of the Balkan peninsula. Since 2006 an internet-based database of photos and records of

amphibians and reptiles from the Balkan area is available and annually up-dated with new records (BALEJ & JABLONSKI, 2006-2008). A similar database with a checklist of species was created for Montenegro (AJTIĆ ET AL., 2004) but the web-page is not working anymore today.

Our aim was to join and present the newly gathered distributional data for reptiles from different localities in the Western Balkans. New data was collected in the frame of the spring student research camps organized by the Slovene Biology Students' Society (Društvo študentov biologije – DŠB – from the Biotechnical faculty at the University of Ljubljana) in the period between 2002-2012. This collection of new records will contribute to the existing knowledge of reptile fauna in this understudied region of Europe.

METHODS

The basis for the preparation of this report was the data gathered by members of the herpetological groups that were conducting field work during the spring student research camps organized by DŠB in the period of 2002-2012. Each year the camp was organized in a different location in the Western Balkans and so reptile surveys were conducted in 11 different areas (Tab. 1, Fig. 1), among which seven were located in Croatia (five on the islands, one on a peninsula, and one in the continental region), two in Montenegro, one in Serbia and one in Macedonia.

In the first four years (2002-2005) the group surveying reptiles was also surveying amphibians, whereas after 2006 the group was focused only on reptiles and in the years 2007 and 2008 there were even two reptile groups working separately in order to gather more data. Groups were led by one to three mentors that were more experienced biology students (Tab. 1). Group's participants were biology students and their number varied between 3 and 10 (Tab. 1).

Table 1. Consecutive years, locations and exact dates of the spring student camps with information on mentors, number of participants (Part.) and number of field days (F. days) conducted by the herpetological or reptile groups.

Tablica 1. Godine, lokacije i točni datumi proljetnih studentskih kampova sa informacijama o mentorima, broju sudionika (Part.) te broju terenskih dana (F. days) koje su izvele herpetološke skupine ili skupine za gmazove.

Lable	Year	Location	Date	Mentor(s)	Part.	F. days
1	2002	Dugi Otok (Croatia)	20th April – 28th April	G. Planinc	6	8
2	2003	Brač (Croatia)	18th April – 26th April	V. Cafuta	6	7
3	2004	Korčula (Croatia)	24th April – 1st May	V. Cafuta	8	8
4	2005	Kamenovo (Montenegro)	23th April – 29th April	M. Lužnik	4	6
5	2006	Pelješac (Croatia)	23th April – 30th April	M. Lužnik, V. Petkovska, A. Žagar	5	6
6	2007	Pag (Croatia)	27th April – 5th May	M. Vamberger (1st gr.)	4	7
				A. Žagar (2nd gr.)	3	4
7	2008	Mljet (Croatia)	26th April – 3rd May	M. Vamberger (1st gr.)	6	6
				M. Sopotnik (2nd. gr.)	5	6
8	2009	Lake Skadar (Montenegro)	25th April – 2nd May	G. Planinc	10	7
9	2010	Dojran Lake (Macedonia)	24th April – 1st May	T. Jagar, E. Ostanek	10	6
10	2011	Neretva Delta (Croatia)	23rd April – 1st May	K. Drašler	8	5
11	2012	Niš (Serbia)	28th April – 5th May	K. Drašler	9	5

Our main goal was to survey various suitable habitats to detect different species of terrestrial and freshwater reptiles in the area. Groups checked a wide variety of habitats to ensure detection of the whole reptile community in the surveyed area; from dry and rocky parts to water bodies and overgrown areas at different altitudes. Open sea was not surveyed. When possible, reptiles were determined by sight and photographed. When species determination was not possible by sight, the individuals were captured either with the noose (for lacertids), hands (terrapins, legless lizards and non-venomous snakes) or with a hook (venomous snakes), and released after determination on the point of capture. For the determination of species we used literature available at the time (BRUNO & MAUGERI, 1979, ARNOLD & BURTON, 1985, MRŠIĆ, 1997, TOME, 1999, ARNOLD & OVEDEN, 2004, HUTINEC & LUPRET-OBRADOVIĆ, 2005). When needed, collecting permits were always obtained before the camp.

For all of the years, the mentors prepared a report of the groups' work. The reports were so-far published in bulletins issued by the DŠB for all of the years, except for 2007, 2008 and 2011 (PLANINC, 2002, CAFUTA, 2005A, CAFUTA, 2005B, LUŽNIK, 2006, LUŽNIK ET AL., 2006, PLANINC, 2009, DRAŠLER, 2012, JAGAR & OSTANEK, 2012) and are available in pdf on the internet page of DŠB.

RESULTS

Localities of surveys are presented on Figure 1 with labels corresponding to the numbers in Table 1 (and to consecutive years from 2002 to 2012 when the survey was conducted). Surveys resulted in identification of 7-22 species of reptiles per survey. Jointly we recorded 34 different reptile species in the Western Balkans. Below in Table 2 we present the full species list with the number of individuals and the number of different localities recorded at each locality.

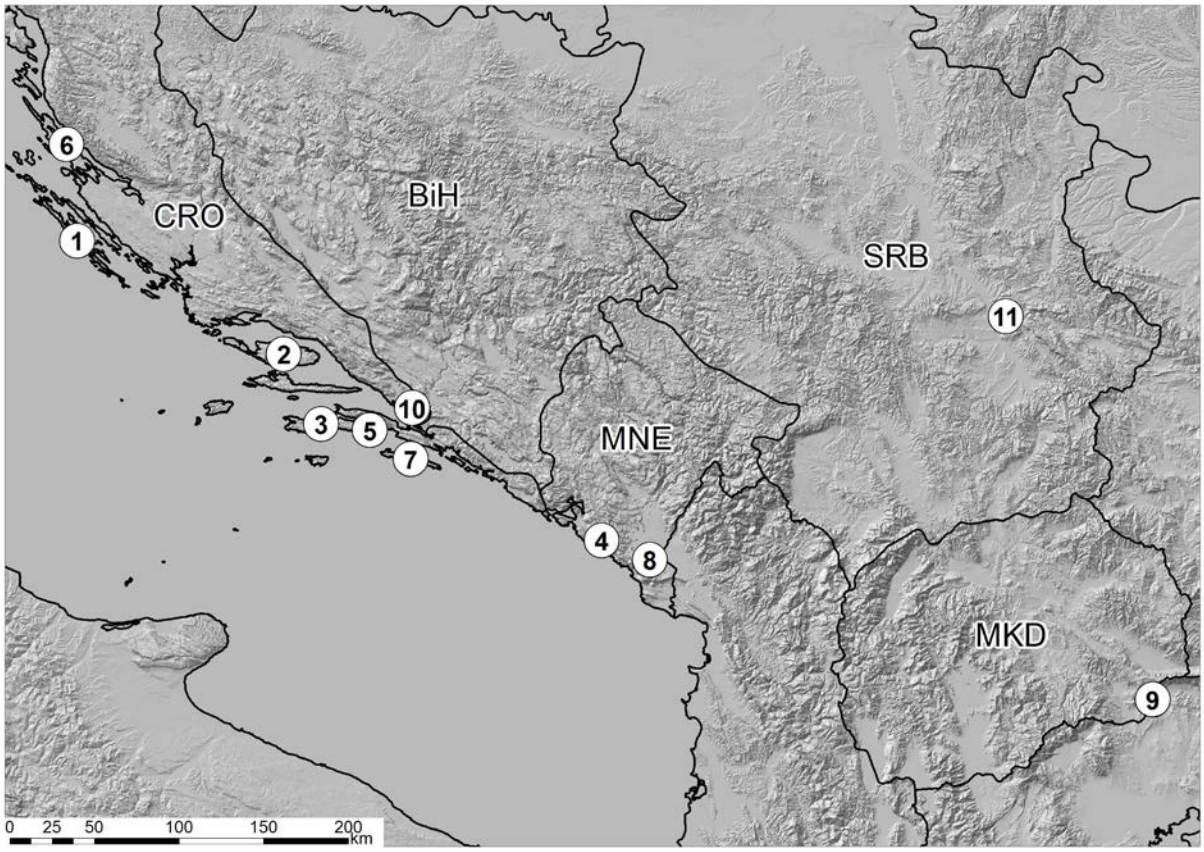

Figure 1. Map of the Western Balkans with localities that were surveyed by the herpetological or reptile groups during the spring camps. Labels correspond to the numbers in Table 1 and to consecutive years from 2002 to 2012.

Slika 1. Karta zapadnoga Balkana sa lokacijama koje su bile istraživane od strane herpetološke skupine ili skupine za gmazove tijekom proljetnih kampova. Oznake odgovaraju brojevima datima u Tablici 1 te godinama od 2002 do 2012.

Table 2. Full species list with the number of individuals (Ind.) and localities (Loc.) recorded by the herpetological groups at 11 spring camps. Labels 1-11 correspond to the numbers in Table 1 and to consecutive years from 2002 to 2012.

Tablica 2. Cijelotni popis vrsta sa brojem jedinki (Ind.) i lokacija (Loc.) zabilježenih od strane herpetoloških skupina na 11 proljetnih kampova. Oznake 1-11 odgovaraju brojevima datima u Tablici 1 te godinama od 2002 do 2012.

		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Ablepharus kitaibelli	Ind.									3		6
	Loc.									1		3
Anguis fragilis	Ind.					2				4		1
	Loc.					1				1		1
Pseudopodus apodus	Ind.	10	4	1	21	26	5		21	13	20	
	Loc.	9	4	1	14	9	3		10	3	9	
Algyroides nigropunctatus	Ind.				8				13			
	Loc.				4				6			
Dalmatolacerta oxycephala	Ind.		8	47		1		NA	2		7	
	Loc.		2	12		1		7	1		5	
Lacerta trilineata	Ind.		30		22	11	1		29	23	24^	
	Loc.		13		11	7	1		15	6	13	
Lacerta viridis	Ind.				9					11		30^
	Loc.				2					4		10
Podarcis erhardii	Ind.									15		
	Loc.									4		
Podarcis muralis	Ind.				13				1			10^
	Loc.				4				1			7
Podarcis sicula	Ind.	8					31	NA				
	Loc.	4					12	2				
Podarcis melisellensis	Ind.	22	141	54	20	34	17	NA	4		10^	
	Loc.	13	16	13	5	13	7	9	1		12	
Podarcis tauricus	Ind.									3		
	Loc.									2		
Zootoca vivipara	Ind.											1
	Loc.	6										1
Hemidactylus turcicus	Ind.	1	2	7	2	5		4			5	
	Loc.		1	5	2	1		3			1	
Mediodactylus kotschyi	Ind.									20		
	Loc.									4		
Typhlops vermicularis	Ind.									2		
	Loc.									1		
Coronella austriaca	Ind.							2				1
	Loc.							2				1
Dolichophis caspius	Ind.				1					2		2
	Loc.				1					2		2
Elaphe quatuorlineata	Ind.		2			1				3	1	
	Loc.		2			1				3	1	

Hierophis gemonensis	Ind.	2	6	2	3	1	7				5		
	Loc.	2	5	2	3	1	2				5		
Natrix natrix	Ind.		1		7		11		8	6	2	1	
	Loc.		1		4		6		3	4	2	1	
Natrix tessellata	Ind.				10	8			11	8	8	1	
	Loc.				6	2			6	2	2	1	
Malpolon insignitus	Ind.	1	1				5	1		2	1		
	Loc.	1	1				2	1		2	1		
Platyceps najadum	Ind.					1				2	1		
	Loc.					1				2	1		
Tellescopus fallax	Ind.	1				2							
	Loc.	(1)*				2							
Zamenis longissimus	Ind.		2							1	1	2	
	Loc.		2							1	1	2	
Zamenis situla	Ind.	1		7		2				1	1		
	Loc.	1		6		2				1	1		
Vipera ammodytes	Ind.		6		1	1	7		3	1	1	3	
	Loc.		4		1	1	3		3	1	1	2	
Vipera berus	Ind.											1	
	Loc.											1	
Emys orbicularis	Ind.				9	2	104"	4"		4	1	2	
	Loc.				4	2	3	1		1	1	2	
Mauremys rivulata	Ind.									3			
	Loc.									1			
Testudo graeca	Ind.									2			
	Loc.									2			
Testudo hermanni	Ind.			2	9	25	6	5	10	22	6^	2	
	Loc.			2	7	8	2	2	9	11	3	1	
Trachemys scripta elegans#	Ind.				1		1						
	Loc.				1		1						

*the origin of the specimen found is not clear (see the text below the table for additional information)
"*E. o. hellenica*
^minimal number of individuals recorded, more have been seen but the exact number was not recorded
#non-autochthonous species

ISLAND DUGI OTOK (CROATIA)

During the survey seven reptile species were found in nature (Tab. 2). According to the available literature we missed only two reptile species recorded in previous surveys: *Natrix natrix* (HIRTZ, 1930) and *Typhlops vermicularis* (GRILLITSCH ET AL., 1999, JANEV HUTINEC ET AL., 2006, KRYŠTUFEK & KLETEČKI, 2007). Among our finds was also a dead specimen of *Telescopus fallax* found in a glass jar by the main road near Sali. The exact origin of the specimen could not be determined. The presence of this species on the island Dugi otok was last mentioned in the literature in 1930 (HIRTZ, 1930).

ISLAND BRAČ (CROATIA)

Despite the short time of survey we managed to record most of the reptile species reported previously from island Brač (Tab. 2). According to the literature, we missed only *Telescopus fallax* and *Coronella austriaca* (SEE LITERATURE REVIEW IN THE INTRODUCTION).

ISLAND KORČULA (CROATIA)

Only seven species were found within the survey on the island Korčula (Tab. 2). According to the old literature data also *Lacerta trilineata, Elaphe quatuorlineata, Malpolon insignitus, Natrix natrix, Telescopus fallax* and *Vipera ammodytes* were present on Korčula (SEE LITERATURE REVIEW IN THE INTRODUCTION). However, it is known that the snake population on Korčula was reduced in the past by the alien species small Indian mongoose (*Herpestes auropunctatus*) that was introduced between 1921 and 1927 from India (KRYŠTUFEK AND TVRTKOVIĆ, 1992). In 2008, a reptile survey revealed that six species might have become extinct on Korčula: *L. trilineata, Hemidactylus turcicus, E. quatuorlineata, N. natrix T. fallax* and *V. ammodytes* (BARUN ET AL., 2010). Comparing our results from 2004 and results from BARUN ET AL. (2010) from 2008 reveal that in both years five otherwise common species were not found, with two exceptions: in 2004 we still found *H. turcicus* that was not found in 2008, and in 2004 we did not find *M. insignitus* which was found in 2008. During our survey we also spotted three specimens of mongoose at two localities in the eastern part of the island.

KAMENOVO (MONTENEGRO)

A six-day survey resulted in the detection of 15 autochthonous reptile species and one non-autochthonous species, *Trachemys scripta elegans* (Tab. 2). Species diversity in the area is high, with 37 reptile species (SEE LITERATURE REVIEW IN THE INTRODUCTION). We detected approximately 50 % of terrestrial lizards and turtles, but only 5 out of 15 snake species, most probably due to low detectability, relatively small survey area, and short survey time (6 days, Tab. 1).

PELJEŠAC PENINSULA (CROATIA)

During reptile survey on Pelješac peninsula we recorded 15 species (Tab. 2), although we were not able to survey the entire peninsula during the six days of field work. Moreover, the second half of the survey was rainy and not very suitable for reptiles to be active and this could be an additional reason why we did not find all of the expected species. There is no exact list of reptiles of Pelješac available in the literature and since this is a peninsula, more species can be present here than on nearby islands. If we compare the data available for the nearby areas (SEE LITERATURE REVIEW IN THE INTRODUCTION), the species we did not find but could be expected on Peljšeac were: *Podarcis muralis, P. sicula,*

Coronella austriaca, Natrix natrix, Malpolon insignitus, and *Zamenis longissimus*.

ISLAND PAG (CROATIA)

On the island Pag we found 11 autochthonous and one non-autochthonous species (Tab. 2). From expected species according to literature data (SEE LITERATURE REVIEW IN THE INTRODUCTION), we did not find: *Hemidactylus turcicus, Telescopus fallax* and *Zamenis situla*. We were working in two groups where one of the groups worked with a special attention to *Emys orbicularis*. In this group we tried to assess the abundance of the European pond turtle (*E. orbicularis*) in the marshy area of Kolansko blato. In the first sampling we caught and marked 31 terrapins and in the second 43 terrapins, of which only seven were re-captured. In the same locality we also found one fish trap set by local fishermen with 21 dead *Emys orbicularis* (Fig. 2), two dead *Natrix natrix*, and one living *N. natrix* that we released at the site. Interestingly, seven out of 11 found *N. natrix* were with lateral stripes that are characteristic for the subspecies *N. n. persa*.

Figure 2. At Kolansko blato on the island Pag (Croatia) we found a fish trap with 21 dead *Emys orbicularis* inside. Photo: M. Vamberger

Slika 2. Na lokalitetu Kolanjsko blato na otoku Pagu (Hrvatska) pronašli smo vršu sa 21 mrtvih jedinki vrste *Emys orbicularis*. Fotografija: M. Vamberger

ISLAND MLJET (CROATIA)

During our survey we detected eight species (Tab. 2). From lizards we also expected to find the European glass lizard (*Pseudopus apodus*), that is known to have been historically present (SEE LITERATURE REVIEW IN THE INTRODUCTION), but was not found by our field work. As on the island Korčula, also on the island Mljet we did not find several expected species of snakes that were recorded before (SEE LITERATURE REVIEW IN THE INTRODUCTION), nor recently in 2008 (BARUN ET AL., 2010): *Elaphe quatuorlineata*, *Hierophis gemonensis*, *Telescopus fallax* and *Vipera ammodytes*. We assume they might be extinct or at least very rare. We also did not find *Zamenis longissimus* that was found in the same year by BARUN ET AL. (2010). The small Indian mongoose is the most abundant on Mljet, and Korčula, compared to other Croatian islands surveyed by BARUN ET AL. (2010). It has a big impact on the number of snakes present on these two islands (BARUN ET AL. 2010) and is probably the main reason for the small number and species richness of the snakes detected by our survey.

LAKE SKADAR (MONTENEGRO)

Ten species of reptiles were detected within our survey (Tab. 2). Diversity of reptiles around Skadar lake is known to be quite high (28 species), but still not fully known (SEE LITERATURE REVIEW IN THE INTRODUCTION). The reason for low number in our species list is mostly the fact that we had a short period of survey due to bad weather conditions.

DOJRAN LAKE (FYR MACEDONIA)

Our survey yielded in detecting 22 species (Tab. 2), of which two species were recorded by members of other biological groups working in the frame of the camp. Good weather conditions and many field working hours contributed to a relatively high species count; all species recorded previously, except *Eryx jaculus* and *Telescopus fallax* (SEE LITERATURE REVIEW IN THE INTRODUCTION), were detected.

NERETVA DELTA (CROATIA)

With our survey we detected 16 species (Tab. 2), of which six species were found by other biological groups working at the camp. Species that we did not detect but had been found here in recent herpetological surveys were: *Anguis fragilis, Lacerta agilis, Podarcis muralis, Coronella austriaca* and *Telescopus fallax* (SEE LITERATURE REVIEW IN THE INTRODUCTION). Most probably we did not detect them because they are either difficult to detect or rare.

NIŠ (SERBIA)

With our survey we detected 14 species (Tab. 2) of which two were found by other biological groups. Surveys of different habitats ensured detection of different species, e.g. the group spent one day at higher

elevations (1700 m a.s.l.) and found species most typical of higher altitudes: *Zootoca vivipara* and *Vipera berus*.

DISCUSSION

Joint results of 11 reptile surveys performed in different localities of the Western Balkans in the period 2002-2013 comprised in a species list of 33 autochthonous species and one non-autochthonous species (*Trachemys scripta*).

Survey methods used were comparable among the years with a difference in the sampling effort (different number of participants in the groups and different number of field days). First constraint for a complete species list of individual locality is that reptiles, especially snakes, have a low detectability because of their secretive way of living. The second constraint was the duration of camps that lasted 3-8 days. Although the season of our surveys (late April-early May) is generally the best part of the field season for reptile surveys, there is also a high chance of rain or cold cloudy weather. In several years there were some days with bad weather conditions and surveys were limited and relatively short which resulted in lower number of species found.

The highest reptile species diversity was recorded in the area around Dojran Lake in Macedonia, where we identified 22 different species. PETKOVSKI ET AL. (2000) reported that especially the snake diversity is very high in Macedonia. Our results confirmed that, as our group recorded the highest number of different snake species (10) compared to other localities. The second locality in the number of snakes species detected was in the lower Neretva Delta in Croatia with nine different species. The locality with the highest diversity of lacertid species recorded amongst our surveys was around Kamenovo in Montenegro, with five lacertids. Regarding terrapins, the most impressive was the locality of Kolansko Blato on island Pag in Croatia, where we did a short mark-capture-recapture survey that suggests the abundance of *Emys orbicularis* there is very high.

Species-wise, the most common species of reptiles found at nine different localities was *Pseusopodus apodus*. Amongst lacertids (Lacertidae) we recorded *Podarcis melliselensis* at eight and *Lacerta trilineata* at seven different localities, others at less. The least common were *P. erhardii*, *P. tauricus* and *Z. vivipara* found only per one locality. Amongst snakes (Serpentes) our records do not necessarily correspond with actual prevalence in the surveyed localities, since the detection is lower than in lacertids. Nevertheless, we recorded at eight different localities V*ipera ammodytes* and at seven *Hierophis gemonensis* and *Natrix natrix* that suggest their common distribution across the surveyed localities in the Western Balkans. Surprising is that we found *Telescopus fallax* only at one locality, even though it was expected and should be common on most of the Croatian island and

around Neretva delta. From terrapins (Testudines) we frequently found *Testudo hermanni* (at eight different localities) and *Emys orbicularis* (at seven different localities). *Mauremys rivulata* and *T. graeca* were found at less than three localities.

Especially interesting were surveys conducted on islands Korčula and Mljet, where the Indian mongoose obviously has a negative impact on the reptile fauna. Comparisons with 2008 surveys of BARUN ET AL. (2010) showed similarity in the species list for Mljet that indicates that four species have been extinct. During our survey on Korčula in 2004 we still found *H. turcicus*, but the species was not found anymore in 2008 (BARUN ET AL., 2010). We cannot conclude if in this case there was an extinction of the species but such surveys also provide valuable data for comparison between years and in can suggest on a detrimental the impact of bringing an alien predator species to islands.

Overall, our work resulted in newly gathered records that are presented in 11 species lists for different localities in the Western Balkans. We believe that this data represent a better contribution to the knowledge of species distribution of this area.

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