NAT. CROAT. | VOL. 31 | No 2 | 207-216 | ZAGREB | December 30, 2022

original scientific paper / izvorni znanstveni rad
DOI 10.20302/NC.2022.31.14

VALORIZATION OF THE NEWLY DISCOVERED EUROPEAN SNAKE-EYED SKINK POPULATION (*ABLEPHARUS KITAIBELII*) ON STINICE, PAPUK MOUNTAIN IN CROATIA

Krešimir Mandić[1], Frano Barišić[2] & Olga Jovanović Glavaš[1,*]

[1]University of Osijek, Department of Biology, Cara Hadrijana 8/A, Osijek, Croatia
[2]Catholic primary school, Ulica pape Ivana Pavla II. 6, Požega, Croatia

Mandić, K., Barišić, F. & Jovanović Glavaš, O.: Valorization of the newly discovered European snake-eyed skink population (*Ablepharus kitaibelii*) on Stinice, Papuk Mountain in Croatia. Nat. Croat., Vol. 31, No. 2, 207-216, 2022, Zagreb.

The European snake-eyed skink (*Ablepharus kitaibelii*) is an endangered lizard species in Croatia, limited to a very small area in Papuk Nature Park, and several localities in the town of Ilok and the surrounding area. On Mt Papuk, the species is limited to an area of the warm southern slopes of the Turjak-Mališćak-Pliš peaks, above Velika. In the year 2019, the species was documented in a new location, on Stinice. The aim of this study is to analyse morphometric measures, relative density, predatory pressure, and to determine the sustainability of this population. Data obtained were compared with the previous research into the European snake-eyed skink on Turjak, the most researched European snake-eyed skink site on Papuk so far. The population on Stinice has lower density, and is under higher predatory pressure than the population on Turjak. Also, there are differences in some morphometric measures between these two populations that should be further explored.

Key words: Papuk Nature Park, morphometric data, population density, Reptilia, Scincidae

Mandić, K., Barišić, F. & Jovanović Glavaš, O.: Valorizacija novootkrivene populacije ivanjskog rovaša (*Ablepharus kitaibelii*) na Stinicama na Papuku, Hrvatska. Nat. Croat., Vol. 31, No. 2, 207-216, 2022, Zagreb.

Ivanjski rovaš (*Ablepharus kitaibelii*) je ugrožena vrsta guštera u Hrvatskoj, prisutna na vrlo malom području u Parku prirode Papuk te na nekoliko lokaliteta u gradu Iloku i bližoj okolici. Na Papuku je vrsta ograničena na područje toplih južnih padina vrhova Turjak-Mališćak-Pliš, iznad Velike. U 2019. godini vrsta je zabilježena na novom lokalitetu, na Stinicama. Cilj ovog rada je analizirati morfometrijske mjere, relativnu gustoću, predatorski pritisak te utvrditi opstojnost ove populacije. Podaci su uspoređeni s prethodnim istraživanjima ivanjskog rovaša na Turjaku, do sada najistraženijem nalazištu ivanjskog rovaša na Papuku. Populacija na Stinicama je manje gustoće od populacije na Turjaku i pod većim je predatorskim pritiskom. Također, postoje razlike u morfometrijskim mjerama između ove dvije populacije.

Ključne riječi: Park prirode Papuk, morofometrijski parametri, gustoća populacije, Reptilia, Scincidae

INTRODUCTION

The European snake-eyed skink (*Ablepharus kitaibelii* (Bibron & Bory de Saint-Vincent, 1833) belongs to the largest lizard family, Scinicidae (Chapple *et al.*, 2021), and is the smallest lizard in Croatia and one of the smallest in Europe. Its total body length reaches a maximum of 12 to 13 cm and body weight is between 0.7 and 1.5 g (Gruber, 1981; LJubisavljević *et al.*, 2002). Juvenile individuals have a length of just 3-3.5 cm, and a typical red-orange tail colouration (Pasuljević, 1965). It is distributed in Europe from the southern parts of Slovakia through Hungary, most of Serbia (Arnold, 2002; Tomović *et al.*, 2001), the southern and eastern parts of Romania, Bulgaria, Macedonia, Albania and Greece (including the Aegean and Ionian islands) to the central and western parts of Turkey (Gruber, 1981). It mainly inhabits the thermophile and open or semi open habitats of lower areas, favouring steppes and hills, i.e. grasslands covered with small bushes, rocks and low-growing plants, and open forests and forest edges (Pasuljević, 1976). In Croatia, the European snake-eyed skink is limited to a very small area in Papuk Nature Park, and several localities in the town of Ilok and the surrounding area (Szoveny & Jelić, 2011). On Papuk, the species is limited to an area of the warm southern slopes of the Turjak-Mališćak-Pliš peaks, above Velika, and Stinice (Samarđić *et al.*, 2020) the site where this research was carried out. Although several localities with appropriate environmental conditions are present in the immediate vicinity, the European snake-eyed skink was not recorded there, probably due to the extremely high selectivity of the species for the microhabitats that mostly determine their distribution (Jelić *et al.*, 2010). During 2014 and 2016, 200 individuals were transferred from Turjak (100 in each year), to two new locations Lapjak (Velika Old Town) and Toplička glava. The aim of this translocation was to increase the number of subpopulations on Papuk.

Based on their morphological differences, four subspecies of the European snake-eyed skink have been described (e.g. Gruber, 1981; LJubisavljević *et al.*, 2002). *Ablepharus kitaibelii fitzingeri* Mertens, 1952 is a subspecies typical of the Pannonian Plain (Herceg *et al.*, 2004). It is also present in Croatia (Szövényi & Jelić, 2011).

The European snake-eyed skink is included in Bern Convention (Appendix II; Councile of Europe, 1994) and the EU Habitat Directive (Appendix IV; European Commission 1992). In Croatia, this species is listed as strictly protected (Official Gazette 80/13, 73/16) and is considered endangered on the national Red List (Jelić *et al.*, 2015), especially the Papuk populations, that are spatialy restricted to a few small sites. Because any catastrophic event would probably lead to the extinction of the European snake-eyed skink population in Papuk (Jovanović Glavaš *et al.*, 2022), the discovery of a new population is of great importance.

In our research we wanted to determine population density and sustainability of a population of the European snake-eyed skink on Stinice, Papuk Mountain, as well as analyze its predatory pressure. Furthermore, we wanted to compare the morphometric data of this population with the one on Turjak ridge, which is the most investigated population of the European snake-eyed skink in Croatia.

MATERIALS AND METHODS

Study area

Our study area (Stinice) is located in Papuk Nature Park, south-west of the known localities of the European snake-eyed skink, at an altitude of 550 - 650 meters (Fig. 1). The habitat is dominated by a thin and low forest of downy oak (*Quercus pubescens* Willd.), manna ash (*Fraxinus ornus* L.), common juniper (*Juniperus communis* L.), and Cornelian cherry (*Cornus mas* L.) trees. Large amounts of clearings are present on the locality and the ground layer of plants (e.g., *Festuca* sp., *Carex* sp.) is well developed and the habitat is open and semi-open (Fig. 2). The soil is quite shallow and covered with a layer of dry leaf litter, and a carbonate base (limestone) emerges in some places, more precisely large limestone rocks that are characteristically overgrown with several types of moss. According to the national classification of habitats, this forest community corresponds to the association *Orno-Quercetum pubescentis* Klika 1938 (forest of downy oak and manna ash) and is a remnant of the thermophilic tertiary vegetation common in steep, dry and warm southern slopes from Samobor to the Slavonian mountains (Szövényi & Jelić, 2011). At the top of the ridge of Južna terasa, the terrain gradually changes from a forest to an open habitat, and down the slope to a semi-open habitat, and gradually the vegetation changes, and the forest becomes denser and the grass thinner. Unlike the situation on Turjak, introduced black pine (*Pinus nigra* L.) is not present on Stinice.

Field research and data collection were conducted during 2020, between the second half of May and mid-September. Data were not collected with equal intensity, given the seasonal activity of the species. Individuals are most active when the air temperature is between 20°C and 30°C (Jovanović Glavaš *et al.*, 2022).

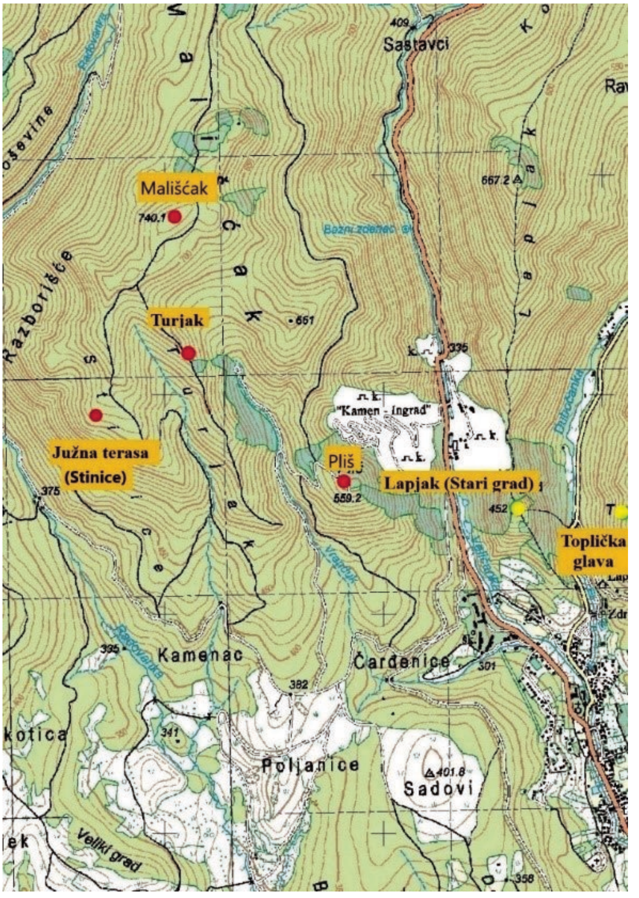

Fig. 1. Distribution of European snake-eyed skink on Papuk Mountain, Croatia.

Fig. 2. Habitat of European snake-eyed skink on Stinice, Papuk (Photo: KM)

Random field search and measurement of captured individuals

Sampling of lizards was carried out by a simple method of catching by hand during a random search of the terrain, taking care not to harm the individuals during the catch. At least two people were always involved in catching the lizards. The individuals are searched at different times of the day by systematic search of the terrain. For each individual caught body weight and the following morphometric parameters were measured: total length (TL), snout to vent length (SVL), tail length (TLL), snout to forelimb length (SFL), forelimb to hindlimb length (FHL), head length (HL), maximum head height (HH) and maximum head width (HW). In ten individulas, it was possible to determine sex based on morphological appereance, while in other individuals, it was not possible to determine the sex (see Jovanović Glavaš *et al*., 2018). For that reason, all individual measurements were analysed together. Body weight was measured using a *Diamond Series A04* digital scale with an accuracy of ± 0.01 g, and morphometric measurements were taken using a Powerfix profi hand calliper with an accuracy of ± 0.01 mm. Altitude and GPS coordinates were recorded using a GARMIN GPSmap 60CSx. Immediately after the catch tail condition (whole, discarded, regenerated, etc.) was recorded. Tails that have been completely regenerated one or more times, tails in the regeneration process, and those with injuries are classified in the same category. Affiliation to the age group (adults, juveniles), possible reproductive condition and observed injuries on the body were recorded. Body length from the top of the head to the cloaca (SVL) is used to determine the age category. For the lower limit of sexually mature individuals, data from the work of Jovanović Glavaš *et al*. (2018) was used, in which adult individuals are considered those with SVL of 20 to 55 mm. Juvenile individuals are those in which a characteristic orange-red coloration of the tail was visible. After measuring, all adult individuals were marked with blue nail polish, more precisely their front right foot was painted so that it could be recognized during recapture that the individual had already been measured and so that the same individual would not be measured twice. After measurement and marking, the individuals were released at the place where they were caught. Descriptive statistics were used to describe the basic data: sample size, mean (MEAN), minimum (MIN) and maximum values (MAX), standard deviation (SD) and standard error (SE). Mean values are presented below as the arithmetic mean ± standard error (MEAN ± SE). Microsoft Excel 2016 was used to calculate the stated values.

The collected morphometric data were compared with data from Turjak (Jelić *et al.*, 2010). In addition to the parameters listed in Table 1, the following ratios were also compared (SVL / SFL, FHL / SVL, HL / SVL, HH / SVL, HW / SVL). Data were compared using R 3.6.2 (RStudio Team 2020). Prior to processing, the data were tested with the Shapiro test for distribution. Two sample t-tests were used from parametric tests, and the Wilcox test from non-parametric ones.

Transect search and population density study

During the field research, the method of observing individuals by random search of the terrain along the linear transect was used. Research of the transects began on August 16, 2020, and ended on September 11, 2020. A total of three linear transects with the length of 120 meters were placed. GPS coordinates of all starting and end points of transects were recorded. Although the research into the transects themselves can be carried out following an imaginary line, during this research, the transects were drawn with a green bar that was visible and thus made it easier to record the distance of the individuals from the transect. The transect was always searched by two people. One person passed on the left, and the other on the right side, about three meters away from the transect itself. This distance allows unobstructed searching, and it is possible to notice individuals that are up to 6 meters away from the transect. Also, it is important to note that a person who once passes the transect on the left side, will the next time pass it on the right side. During the research, the following data were recorded: the distance of the individual from the researcher, on which part of the transect it was observed, and whether the individual was an adult or a juvenile. The total area covered by the three linear transects is 1440 m^2.

Population density was determined by analyzing data collected during the search of the linear transects. We recorded for each individual the date and time when it was observed, on which of the three transects it was observed, the distance from the transect, and the length of the transect (expressed in meters). The data were entered into the Distance 7.3 program (Thomas *et al.*, 2010). Data analysis calculated the relative number of individuals on one hectare and the relative number of individuals on one square meter.

RESULTS AND DISCUSSION

Morphometry

During our research on Stinice, we caught in total 34 individuals, 32 adults and two juveniles. Morphometric variables were measured for all of them, and results of morphometric features from 32 adult individuals are shown in Tab. 1. The analysis of morphometric measurements revealed minor differences between individuals from Stinice and the population from Turjak. The mean values of BW, SFL, HL, HH and HW are higher in the population from Stinice, while the mean values of TL, SVL, TLL and FHL are higher in the individuals from Turjak. However, statistical analysis showed that there was a statistically significant difference only in head length (HL). Furthermore, it is noticeable that the mean values of the obtained indices SFL / SVL, FHL / SVL, HL / SVL, HH / SVL and HW / SVL are higher in individuals from Stinice. Statistical comparison showed a statistically significant difference between FHL/SVL, HL/SVL, HH/SVL and HW/SVL (Tab. 1). Using these differences, it can be concluded that individuals from Stinice have relatively larger heads and a greater distance between the snout and front limbs compared to individuals from Turjak. A statistically significant difference between head length and indices that include head proportions may be due to gender imbalance or the possibility that more males were caught during sampling at Stinice. Generally, males of the European snake-eyed skink have a larger and more robust head (Jovanović Glavaš *et al.*, 2018). Given that in 10 individuals for which the sex was determined, as many as seven of them were male, this data supports the fact that the difference in head size is influenced by gender structure. Statistically significant differences between samples can also be due to the small sample size on Stinice (32) compared to the sample size on Turjak (83), the nature of the statistical tests, or a significant difference has actually been proved. According to Jovanović Glavaš *et al.* (2018), females of the European snake-eyed skink are generally longer, and it is possible that individuals from Turjak have a higher total body length (TL) on average because the examined group from Turjak contained more females. Of the 34 individuals sampled, only two were juvenile. Therefore, a statistical comparison of juvenile individuals would not be relevant and there is a high probability of false positive results. Certainly, the data would be more relevant if the study was to be repeated with a larger number of individuals, especially juveniles. An examination of the measures of morphometric parameters revealed that the largest individual was 112 mm long, which corresponds to the conclusion that the European snake-eyed skink in Croatia is no larger than 13 cm (Jovanović Glavaš *et al.*, 2018). In all individuals with an intact tail, the SVL was

Tab. 1. Comparison of recorded morphometric values of adult individuals from Stinice with values of individuals from Turjak. Number of individuals (n), mean (MEAN), standard error (SE), minimum (MIN) and maximum (MAX); individuals of both sexes are included. Statistically significant differences are written in bold.

	STINICE				TURJAK				
	n	MEAN ± SE	MIN	MAX	n	MEAN ± SE	MIN	MAX	P
BW (g)	32	1.111 ± 0.035	0.77	1.47	49	1.097 ± 0.042	0.54	1.7	0.8164
TL (mm)	32	87.36 ± 3.083	50.7	112	62	89.88 ± 2.138	44.24	117.1	0.2726
SVL (mm)	32	41.997 ± 0.707	32.3	52.9	83	43.608 ± 0.549	33.77	62.64	0.1697
TLL (mm)	32	45.038 ± 3.05	8.6	70	82	47.448 ± 1.71	5.49	69.98	0.6407
SFL (mm)	32	12.097 ± 0.182	9	13.6	83	11.923 ± 0.096	10.18	14.1	0.1255
FHL (mm)	32	27.775 ± 0.621	19	37.5	83	28.508 ± 0.447	21.5	38.76	0.7244
HL (mm)	32	7.031 ± 0.102	5.7	8.5	83	6.739 ± 0.043	5.73	7.58	**0.0022**
HH (mm)	32	3.231 ± 0.071	2	4	69	2.905 ± 0.025	2.41	3.49	0.1333
HW (mm)	32	4.331 ± 0.06	3.8	5	69	4.183 ± 0.048	2.04	4.98	0.1205
SFL/SVL (mm)	32	0.2898 ± 0.006	0.238	0.393	83	0.276 ± 0.003	0.193	0.336	**0.0302**
FHL/SVL (mm)	32	0.661 ± 0.009	0.543	0.771	83	0.652 ± 0.004	0.5497	0.721	0.3114
HL/SVL (mm)	32	0.169 ± 0.004	0.12	0.207	83	0.156 ± 0.002	0.107	0.198	**0.0016**
HH/SVL (mm)	32	0.077 ± 0.002	0.057	0.095	69	0.068 ± 0.001	0.051	0.093	**2.786^{-6}**
HW/SVL (mm)	32	0.104 ± 0.002	0.08	0.13	69	0.098 ± 0.002	0.045	0.128	**0.0492**

less than the length of the tail, and this is also in line with the fact that more than half (about 60%) of the total length of the European snake-eyed skink is the tail (Göcmen *et al*., 1996).

Population density

During the search of linear transects, a total of 40 adult individuals and three juvenile individuals were observed. The analysis of linear transects data showed that on Stinice on one hectare there are six individuals of the European snake-eyed skink with a standard error of 1.628 individuals, and the range of individuals per hectare with a 95% chance is from 4 to 11 individuals. Specifically, there are 0.62569^{-3} individuals per square meter with a standard error of 0.16977^{-3} individuals, and the number of individuals per square meter with a 95% chance ranges from 0.36491^{-3} to 0.10750^{-2} individuals. The probability of noticing individuals on transects was determined to be 60.7%, more precisely that 39.3% of individuals that were next to the transects were not noticed during the search of transects. The only available data on European snake-eyed skink population density are those from Turjak ridge, where a density of 97 individuals per hectare was recorded (Baškiera & Jelić, 2016; Jovanović Glavaš *et al*., 2022).

Predatory pressure

Out of a total of 34 caught individuals, 64.71% had a tail in the regeneration process or a tail regenerated one or more times (22 individuals). No individual had an injury without regeneration. Both caught juveniles had a complete tail. Frequency of injured and regenerated tails can be used to estimate predatory pressure on a species or population (Lovely *et al*., 2010). This model assumes that predators are not always successful in hunting and that some of the prey escape during hunting by dropping their tails, or with minor injuries (Jelić *et al*., 2009). Less successful predators leave more survivors with discarded or injured tails. Assuming that the ratio between individuals that escape and those that get killed is constant (predator efficiency is constant) and that injuries and autotomy are the result solely of predator attacks, the frequency of injured tails increases with predation intensity (Lovely *et al*., 2010). Analysis of the number of individuals with intact tails and individuals with tail injuries and varying degrees of regeneration, showed that 64.71% of individuals discarded their tail at least once. Kolarić (2013) states that at the Turjak location, out of all sampled individuals, there are a total of 34.10% of individuals with visible injuries and tail regenerations. Also, it is stated that this percentage is probably much higher because in some individuals included in the analysis the tail condition was not recorded. Comparing the results collected during this study with the study by Kolarić (2013), the assumption that the number of individuals with intact tails is much smaller, i.e., that the number of individuals with injuries and tail regeneration is probably much higher, is confirmed. The following species of reptiles that have been recorded in the study area on Stinice, are potential predators of the European snake-eyed skink (Rotter, 1962): *Podarcis muralis, Coronella austriaca, Zamenis longissimus, Anguis fragilis* and *Lacerta viridis.* The same species of reptiles have been listed as syntopic with the European snake-eyed skink in Szövényi & Jelić (2011). During the research on Lapjak from 2019, a mantis (*Mantis religiosa*) feeding on a dead individual of the European snake-eyed skink was observed and photographed for the first time. As well, predation of juvenile *L. viridis* on the snake-eyed skink was not recorded previously. During the research on Stinice, a significant number of mantises was noticed, so in accordance with these findings, we can also include the mantis as a potential predator on the European snake-eyed skink. (Fig. 3).

Fig. 3. Potential predators of *A. kitaibelii* observed during research on Stinice: a) *Anguis fragilis*, b) *Podarcis muralis*, c) *Lacerta viridis*, d) *Zamenis longissimus*, e) *Coronella austriaca* and f) *Mantis religiosa* (Photo: FB & KM)

Sustainability of the population on Stinice

Baškiera & Jelić (2016), by searching linear transects and analyzing data, established that the population density at Turjak was 97 individuals per hectare. During the research on Turjak, the transects were placed in the zones where previous research determined the highest density of the European snake-eyed skink, in contrast to the research on Stinice, where the transects were placed randomly without prior knowledge of population distribution. Although the methodology is somewhat different, it is possible to compare the data from the two studies. Comparing the results obtained during this study with data from Turjak, a large difference in population density can be seen. The population density at Stinice is 6 individuals per hectare, which is significantly lower than the population density at Turjak. According to these data, it can be concluded that the relative number of individuals on Stinice is also smaller. Although the method of linear transects is the most accurate method of monitoring so far, it is quite sensitive and depends on the experience of the observer. Given that the difference in population density between these two localities is relatively large, it can be concluded that the experience did not affect the differences in population densities. Given that the population in Stinice has a lower density and consequently a lower relative number and possibly is under higher predatory pressure in relation to Turjak, it can be concluded that the population in Stinice is significantly more sensitive to natural disasters (e.g., forest fires) and negative anthropogenic impacts. During the research in Stinice, no specimen of alien black pine (*Pinus nigra*) was observed, so there is no danger of habitat degradation by spreading of this introduced species, and therefore the possibility of forest fire in relation to Turjak is reduced. Also, in the area of Stinice there is no tourist hiking trail and the probability of fires due to human and other negative anthropogenic influences (like pollution) is lower than on Turjak.

CONCLUSION

Our research showed that population density and the total number of individuals of European snake-eyed skink on Stinice locality in Papuk Nature Park, is very low. Despite that, this population is under low anthropogenic influence, since no tourist trails are present in its proximity, and the absence of alien black pine also reduces the risk of habitat degradation. However, it is under higher predatory pressure than the previously studied population on Turjak. Futhermore, there are differences in some morphometric measures between these two populations, but more research is needed for a better understanding of this phenomenon.

ACKNOWLEDGEMENTS

We thank Papuk Nature Park for permission to conduct field research within their area. The research was carried out with the permission of the Ministry of Environmental Protection and Energy of Republic of Croatia. We would also like to thank Dušan Jelić for advisory assistance in data analysis.

Received November 25, 2021

REFERENCES

Arnold, E. N., 2002: A field guide to the reptiles and amphibians of Britain and Europe. Second edition. HarperCollins Publishers, London. p 185–191.

Baškiera, S. & Jelić, D., 2016: Završno izvješće; Istraživanje staništa i provedba monitoringa ivanjskog rovaša, *Ablepharus kitaibelii*, na području Parka prirode Papuk, Udruga Hyla i Hrvatski institut za biološku raznolikost, Zagreb.

Gruber, U., 1981: *Ablepharus kitaibelii* (Bibron und Bory 1833) – Johannisechse. In: Böhme W, editor. Handbuch der Reptilien und Amphibien Europas Vol.1. Akademische Verlagsgesellschaft, Wiesbaden. p 297–302.

Göcmen, B., Kumlutas, Y. & Tosunoglu, M., 1996: A new Subspecies, *Ablepharus kitaibelii* (Bibron & Borry, 1833) *budaki* n. ssp. (Sauria: Scincidae) From Turkish Republic of Northern Cyprus. Turkish journal of Zoology **20**, 397–405.

Herceg, G., Tóth, T., Kovács, T., Korsós, Z. & Török, J., 2004: Distribution of *Ablepharus kitaibelii fitzingeri* Mertens, 1952 (Squamata: Scincidae) in Hungary. Russian Journal of Herpetology **1**, 99–105.

Jelić, D., Kapelj, S., Barišić, F., Karaica, D. & Burić, I., 2010: II. godina istraživanja populacije ivanjskog rovaša (*Ablepharus kitaibelii* Bibron & Bory, 1833) na području JU PP Papuk. Podnesak projekta, HHD-Hyla, Zagreb.

Jelić, D., Kuljerić, M., Koren, T., Treer, D., Šalamon, D., Lončar, M., Podnar Lešić, M., Janev Hutinec, B., Bogdanović, T., Mekinić, S. & Jelić, K., 2015: Crvena knjiga vodozemaca i gmazova Hrvatske, HHD- Hyla, Zagreb. p 130–132.

Jovanović Glavaš, O., Kolarić, A., Eross, M. & Jelić, D., 2018: Morphology and reproduction of the Snake-eyed Skink (*Ablepharus kitaibelii* Bibron & Bory De Saint-Vincent, 1833) in the western most parts of its range, North-western journal of zoology **14** (2), 185–192.

Jovanović Glavaš, O., Kolarić, A., Eross, M., Baškiera, S., Damjanović, I. & Jelić, D., 2022: Ecology, population density, and translocation of the snake-eyed skink (*Ablepharus kitaibelii*) in westernmost populations, Russian Journal of Herpetology **29**(2),76–84.

Kolarić, A. (2013): Morfološke značajke, spolni dimorfizam i reprodukcija ivanjskog rovaša (*Ablepharus kitaibelii* Bibron and Bory de Saint-Vincent, 1833) u Hrvatskoj, Prirodoslovno-matematički fakultet; Biološki odsjek, Sveučilište u Zagrebu.

LJubisavljević, K., Džukić, G. & Kalezić, M., 2002: Morphological differentiation of the Snake-eyed Skink *Ablepharus kitaibelii* (Bibron & Bory, 1833) in the north-western part of the species' range: systematic implications. Herpetozoa **14**, 107–121.

Lovely, K. R., Mahler, D. L. & Revell, L. J., 2010: The rate and pattern of tail autotomy in five species of Puerto Rican anoles. Evolutionary Ecology Research **12**, 67–88.

Pasuljević, G., 1965: Ritam dnevne i sezonske aktivnosti *Ablepharus kitaibelii* (Bibron et Bory) u Jugoslaviji, Glasnik Prirodnjačkog muzeja u Beogradu B **20**, 311–314.

Pasuljević, G., 1976: Characteristics of habitat and factors determining distribution and activity of the species *Ablepharus kitaibelii* (Lacertilia, Scincidae), Acta biologiae et medicinae experimentalis **1–2**, 57–63.

Rotter, J., 1962: Biologische Beobachtungen an der nördlichen Johannisechse, *Ablepharus kitaibelii fitzingeri* Mertens, 1952. Zoologische Garten **26**, 312–318.

RStudio Team, 2020: RStudio: Integrated Development Environment for R., RStudio, PBC, Boston, MA URL http://www.rstudio.com/

Samarđić, I., Barišić, F. & Galić, I., 2020: Vodozemci & gmazovi Požeške kotline i gorja. Javna ustanova za upravljanje zaštićenim područjem Požeško-slavonske županije, Požega. p 68–69.

Szövényi, G. & Jelić, D., 2011: Distribution and conservation status of snake eyed skink (*Ablepharus kitaibelii* Bibron & Bory, 1833) in Croatia. North-western Journal of Zoology **7**, 20–25.

Thomas, L., Buckland, S. T., Rexstad, E. A., Laake, J. L., Strindberg, S., Hedley, S. L., Bishop, J. R. B., Marques, T. A., & Burnham, K. P., 2010: Distance software: design and analysis of distance sampling surveys for estimating population size. Journal of Applied Ecology **47**, 5–14. DOI: 10.1111/j.1365-2664.2009.01737.x

Tomović, LJ., LJubisavljević, K., Ajtić, R., Aleksić, I. & Crnobrnja-Isailović, J., 2001: New records of the Snake-eyed Skink *Ablepharus kitaibelii* in Serbia. Biota **2**, 115–117.