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Distribution of European Cat Snake Telescopus fallax (Fleischmann, 1831) (Reptilia: Colubridae) in South-Western Bulgaria

Lyuben D. Domozetski[1], Alexander N. Pulev[1*], Lidia G. Sakelarieva[1], George N. Manolev[1], Borislav Y. Naumov[2]

1 - South-West University "Neofit Rilski", Faculty of Mathematics and Natural Sciences, Department of Geography, Ecology and Environmental Protection, 66 Ivan Mihailov Street, 2700 Blagoevgrad, BULGARIA
2 - Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences, 2 Yurii Gagarin Street, 1113 Sofia, BULGARIA
[*]Corresponding author: pulev.alex@abv.bg

Abstract. The European Cat Snake is one of the most recently discovered representatives of the Bulgarian herpetofauna, and one of the rarest snakes in Bulgaria. The research presented aims to update the data about the distribution of *Telescopus fallax* in south-western Bulgaria. Many new records from the Struma River valley are reported. To the north the species reaches the city of Blagoevgrad and its surroundings. Some data on the biology and ecology of the snake in this part of the country are also reported.

Key words: colubrid snakes, new localities, UTM grid, highest altitude, biogeography, nocturnal activity, Balkan Peninsula.

Introduction

The geographical range of *Telescopus fallax* (Fleischmann, 1831) includes south-eastern Europe, Middle East and south-western Asia: extreme NE Italy, Slovenia, Croatia (including many islands), extreme S Bosnia-Herzegovina, S Montenegro, W Albania, Macedonia (now North Macedonia), SW Bulgaria, Greece (including many islands), Cyprus, Malta, Turkey, N Syria, Lebanon, N Israel, NE Egypt, SW Russia (Dagestan), S Georgia, S Armenia, Azerbaijan, Turkmenistan, Iraq and Iran (WALLACH *et al.*, 2014). The species distribution in Europe is mainly in the Balkan Peninsula. The species is polytypic, and in Bulgaria the nominate form (*T. fallax fallax*) occurs.

The European Cat Snake is one of the most recently discovered representatives of the Bulgarian herpetofauna and one of the rarest snakes in the country. The first record was in 1958 (BESHKOV, 1959; 1961). The known distribution of the species includes the southern part of the country: the valleys of the Struma and Arda Rivers (BESHKOV & NANEV, 2002; PETROV *et al.*, 2002; STOJANOV *et al.*, 2011; BALEJ & JABLONSKI, 2006-2019) up to about 700 m a.s.l. (BESHKOV, 1959; 1985; BESHKOV & NANEV, 2002).

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Data about the occurrence of *T. fallax* in south-western Bulgaria are reported by BESHKOV (1959; 1961; 1974; 1981; 1985), BESHKOV & BERON (1964), KANTARDZHIEV (1992), BISERKOV (1995), PETROV & BESHKOV (2001), BESHKOV & NANEV (2002), STOJANOV *et al.* (2011), CAS (2010-2019), BALEJ & JABLONSKI (2006-2019), and DYUGMEDZHIEV *et al.* (2019). According to BESHKOV (1981), PETROV & BESHKOV (2001), and BESHKOV & NANEV (2002) the northern boundary of the species range in the Struma River valley spreads to Kresna Inn (in the middle of Kresna Gorge).

Only 8 specimens of *T. fallax* had been registered in the period 1958-1981 (BESHKOV, 1981), and till 1985 the number of known records was 12 (BESHKOV, 1985). The species was included in the Red Data Book of Bulgaria – in its first edition (1985) in category Rare species, and in the second one (2015) in category Vulnerable species. The species was included by NANKINOV (2000) in the list of the threatened animals of Bulgaria. According to BESHKOV (2015) 437 individuals belonging to 11 snake species were collected around the village of Gorna Breznitsa and Kresna Gorge in 1971-1975, and *T. fallax* was presented by 2 specimens only (0.45%); in the 1980s, approximately 15 individuals were registered; and in 2000-2015, several individuals were recorded each year.

The research aims to update the data about the distribution of *T. fallax* in south-western Bulgaria.

Material and Methods

The data about the distribution of *T. fallax* in south-western Bulgaria were gathered from 1988 to 2019. The species has been registered during herpetological field surveys in various habitats and in different seasons. The collection of the Regional Historical Museum in the city of Blagoevgrad (RHMB) was also inspected. All published and new data (alive individuals, dead specimens, shed skins) have been used to specify the distribution of the species in south-western Bulgaria.

The separate locations of the species (both new and published) were grouped according to their affiliations to the squares of the Universal Transverse Mercator (UTM) grid with a resolution of 5×5 km. The grid-cells were indicated by the codes of the 10-km quadrates of Military Grid Reference System (MGRS; spatially identical with UTM) and capital letters (A-D) were used to denote the separate 5×5 km squares within every 10×10 km square (A indicates the south-western square, B – the north-western, C – the south-eastern, and D – the north-eastern). Mapping and map visualization were done in the projection coordinate system "WGS 84 UTM 35N" by means of ArcGIS v. 10.1 (ESRI, Redlands, CA, USA).

All known data as locality, geographic coordinates, altitude, date and time, number, age and condition of the individuals are included in tables.

Most of the new records have been made by the authors of the paper: L. Domozetski [LD], A. Pulev [AP], G. Manolev [GM], B. Naumov [BN]. Some of the data have been collected separately or in collaboration with the authors by other colleagues (see the Acknowledgements). The collectors have been noted with their initials in Appendix 2.

Results and Discussion

The total number of records of *Telescopus fallax* from south-western Bulgaria until now is 78: 19 of them (more than 23 individuals) were published (see Appendix 1) and 59 (55 field observations and 4 museum specimens) are reported now (63 individuals altogether, presented in Appendix 2). A record of 2 pieces of shed skins from one locality (NW outskirts of General Todorov Village) is also reported for the first time (see Appendix 2).

Among the 55 individuals registered during the field trips, 18 have been road-killed (all of them "fresh"), and for 2 other specimens the cause of death was unknown. The proportion of the newly registered adults is 46% (n=29), followed by the proportion of juveniles (n=23 or 36%) and subadults (n=11 or 18%).

The published and new data on the distribution of *T. fallax* in south-western Bulgaria show that the species occur only in part of the Struma River valley and in the valleys in the lower reaches of some of its tributaries. All known localities of *T. fallax* in the study area fall into 21 squares of the 5 km UTM grid. The published localities refer to 10 grid squares (for 5 of them new data are presented as well), and the new ones fall in other 11 grid squares (Fig. 1).

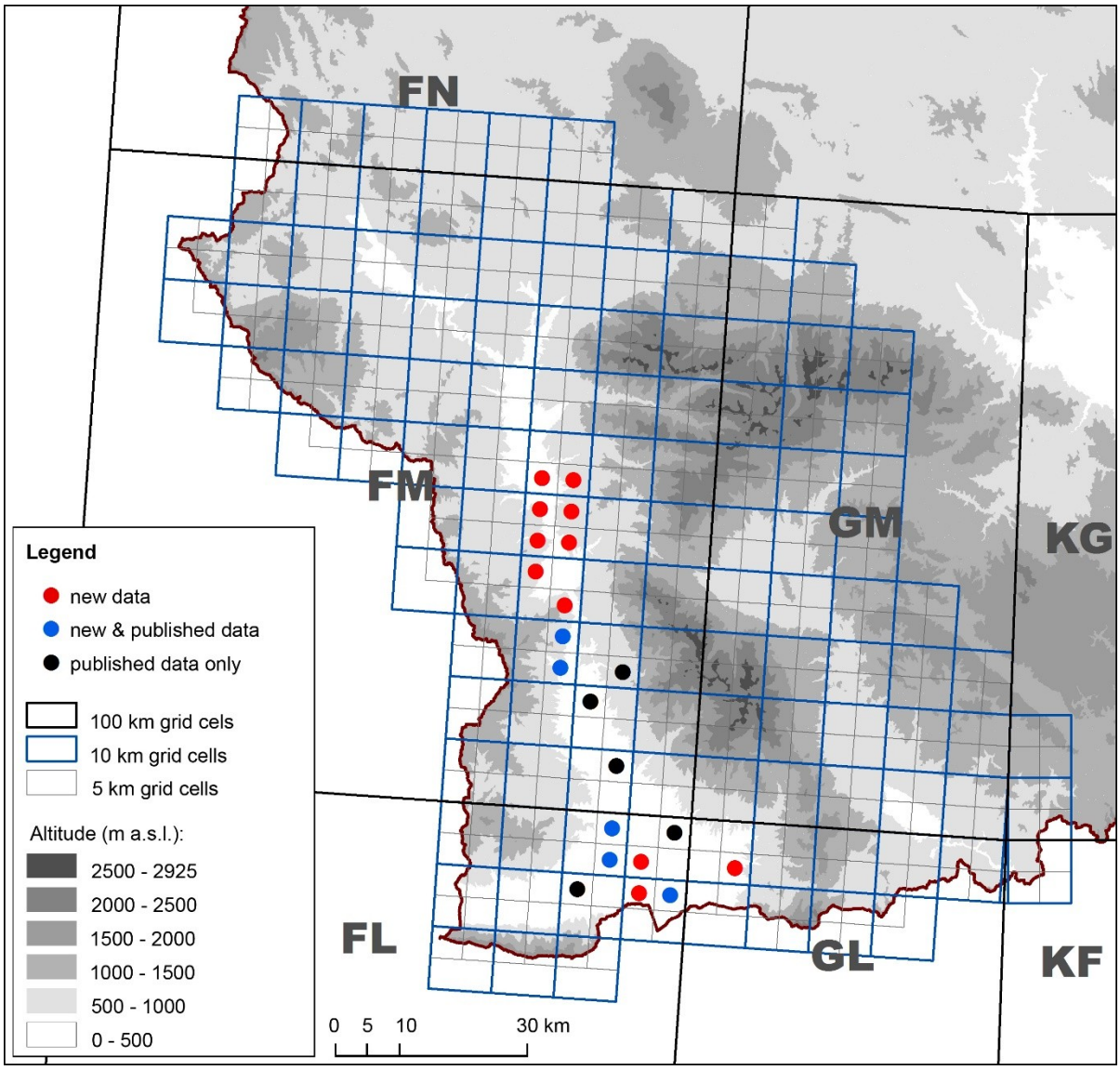

Fig. 1. Distribution of *Telescopus fallax* in south-western Bulgaria, based on a 5 km UTM grid.

The new distributional data from the Struma River valley show that the European Cat Snake occur about 25 km north of the middle of Kresna Gorge, which previously was considered to be the northern boundary of its range (Beshkov, 1981; 1985; Petrov & Beshkov, 2001; and Beshkov & Nanev, 2002). For the first time localities of *T. fallax* are reported from Oranovo Gorge and its surroundings (17 records). The species spreads northwards to the city of Blagoevgrad (two records) and to the village of Delvino (one record).

T. fallax fallax is a good *indicator subspecies* as its range delineates very well the boundaries of the Mediterranean area in the Struma River valley. The species can play a significant role in a future zoogeographical subdivision of Bulgaria as other snake species that are also good indicators – *Xerotyphlops vermicularis* (Merrem, 1820) (see PULEV *et al.*, 2018a) and *Malpolon insignitus* (Geoffroy Saint-Hilaire, 1827) (see PULEV *et al.*, 2018b). PULEV *et al.* (2018a) proposed two Mediterranean areas in south-western Bulgaria (Struma and Mesta) which suggests that *T. fallax* also inhabits the southern part of the Mesta River valley located in the country (Hadzhidimovo Gorge).

Probably, the maximum altitude (700 m) reported after the first species registration (BESHKOV, 1959) was wrong. The location described by BESHKOV (1959) is approximately at about 500 not at 700 m a.s.l. Therefore, the altitude of 656 m recorded from the Pashovtsi neighborhood (the village of Delvino) could be the highest one for the species in Bulgaria so far (see Appendix 2).

The new data show that the species is active from the third decade of March till the second decade of October, which confirms the information published by STOJANOV *et al.* (2011). The earliest spring registration is from March 25, and the latest autumn one is from October 11. The species is most active during the warmest and driest months of the year (July, August). More than the half of the records are from the second decade of July till the third decade of August, with a peak in the first decade of August (see Appendix 2). No winter activity of the species has been recorded, although two such observations were published by STOJANOV *et al.* (2011).

All alive individuals were observed at night (from 9:05 pm to 12:45 am), except one registered during the day at its shelter (under a stone) (see Appendix 2). These data confirm the predominantly nocturnal activity of the species indicated by BESHKOV & NANEV (2002) and STOJANOV *et al.* (2011).

T. fallax was often found in urbanized places in the study area (BESHKOV, 1974; BISERKOV, 1995; BALEJ & JABLONSKI, 2006-2019). There are some new records from the city of Blagoevgrad, and from many smaller settlements (see Appendix 2). Probably this is greatly facilitated by the species nocturnal activity.

Interesting ecological note is the feeding of *T. fallax* with mainly daily active species of lizards. The observed subadult individual from Kresna Gorge on 03.08.2010 swallowed subadult *Podarcis erhardii* (Bedriaga, 1882), and the observed subadult individual from Rupite Area on 21.08.2010 regurgitated recently eaten juvenile *Lacerta viridis* (Laurenti, 1768). These observations coincide with the indicated by BESHKOV & DUSHKOV (1981) and BESHKOV & NANEV (2002) herpetophagy.

The study confirms the conclusion drawn by BESHKOV (1993) and BESHKOV & NANEV (2002), that the snake is not as rare as previously thought. In the same publications, the authors suggested that the species abundance was increasing along the Struma River valley. In our opinion, the late detection of *T. fallax* in Bulgaria and the scarce published data can be explained by both the hidden (nocturnal) way of life and the insufficiency of field studies focused specifically on this species. The large number of new observations of the species in its known range, as well as its registration in new places (such as Oranovo Gorge), are probably due not to the actual expansion of the range and increase in numbers, but to the higher intensity of field research in the recent years. In this sense, BESHKOV'S (2015) statement that the "separate populations are completely isolated from one another" does not seem to be true. The spatial distribution of known localities shows rather a continuity of the range of the species, and the lack of data from some UTM grid squares is likely to be filled by future research.

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Appendix 1. Published data about *Telescopus fallax* in south-western Bulgaria (data source, locality, geographic coordinates, altitude, date, time, observed individuals) and UTM (when it is possible to be determined) in Fig. 1

BESHKOV (1959): near Vlahi (at 200 m below the village, by the road to the Vlahinska River waterfall), 700 m a.s.l., 21.06.1958, 1 ad. – UTM: FM82C; **BESHKOV (1961):** same locality, 24.06.1960 – UTM: FM82C; **BESHKOV & BERON (1964):** Dolno Spanchevo – UTM: FL98D; **BESHKOV (1974):** Gorna Breznitsa (1971-1972), 200-400 m a.s.l., 2 spec. – UTM: FM72C; **BESHKOV (1981):** Vlahi – UTM: FM82C, Dolno Spanchevo – UTM: FL98D, Gorna Breznitsa – UTM: FM72C (probably repetition of previously published records; there are no sources cited), Kozhuh volcanic ridge – UTM: FL89C, near Kresna inn – UTM: FM72D; **BESHKOV (1985):** the gorge of Sheytan Dere (Dyavolska Reka) River, 500 m upstream from its mouth – UTM: FM72D, Kozhuh volcanic ridge – UTM: FL89C (information from an unpublished source was cited for this record); **KANTARDZHIEV (1992):** northern part of Kozhuh volcanic ridge – UTM: FL89C; **BISERKOV (1995):** Petrich – UTM: FL88B; **PETROV & BESHKOV (2001):** Kresna Gorge; **BESHKOV & NANEV (2002):** Kresna Gorge; **STOJANOV *et al.* (2011):** Kresna Gorge, 07.11-10.11.2010, 2 spec., Kozhuh volcanic ridge, 20.12.1980, 13.12.1981, 2 spec. – UTM: FL89C; **CAS (2010-2019):** Kresna, 21.05.1992, 1 subad. – UTM: FM72C; **BALEJ & JABLONSKI (2006-2019):** Melnik, 29.08.2013, 1 ad. – UTM: FL99D, Damyanitsa, 150-200 m a.s.l., 28.03.2005, 1 ad., 1 juv., Damyanitsa, 140 m a.s.l., 16.04.2006, 1 subad. – UTM: FL89D, Valkovo, 300 m a.s.l., 15.04.2006, 1 subad. – UTM: FM80D; **DYUGMEDZHIEV *et al.* (2019):** the vicinity of the town of Kresna, 41°43'N 23°10'E, 180 m a.s.l., 11.10.2018, 1 juv. – UTM: FM81B.

Appendix 2. New data of *Telescopus fallax* individuals and shed skins in south-western Bulgaria.

Locality	Geographic coordinates (N/E)	Altitude (m)	Date and time of observation	Individuals observed	UTM 5x5 km
Dolno Spanchevo, museum number (*mn*) RHMB 7.3/4.89 (collected by Y. Ganev)	n/a	n/a	10.10.1963	1 ad.	FL98D
General Todorov, *mn* RHMB 7.3/4.92 (collected by D. Kantardzhiev)	n/a	n/a	25.03.1986	1 ad.	FL99A
General Todorov, *mn* RHMB 7.3/4.93 (collected by D. Kantardzhiev)	n/a	n/a	25.03.1986	1 ad.	FL99A
Rupite Area, *mn* RHMB 7.3/4.94 (collected by D. Kantardzhiev)	n/a	n/a	25.07.1986	1 ad.	FL89C
Blagoevgrad, the industrial area [LD]	42°00'32" 23°05'30"	360	05.09.2016	1 dead ad.	FM75A
Blagoevgrad, the industrial area [GM]	42°00'00" 23°05'19"	364	16.08.2019 9:40 pm	1 juv.	FM75A
Pashovtsi neighb., Delvino [MI]	42°00'43" 23°07'54"	656	15.08.2015 11:25 pm	1 subad.	FM75C
S/SE of Strumsko residential area [GM]	41°58'35" 23°05'30"	331	02.08.2018 10:50 pm	1 ad.	FM74B
S/SE of Strumsko residential area [AP, GM]	41°58'34" 23°05'32"	339	09.08.2016 10:30 pm	1 ad.	FM74B
NW of Tserovo [GM]	41°58'19" 23°06'06"	347	31.08.2016 11:15 pm	1 subad.	FM74B
NW of Tserovo [GM]	41°58'08" 23°06'05"	426	18.09.2016	1 subad. RK	FM74B
NW of Tserovo [GM]	41°58'18" 23°06'29"	484	06.08.2018 10:55 pm	1 ad.	FM74B
NW of Tserovo [GM]	41°58'19" 23°06'37"	490	25.07.2018 10:20 pm	1 juv.	FM74B
N/NW of Tserovo [GM]	41°58'17" 23°06'49"	500	05.08.2018 12:45 am	1 subad.	FM74D
N/NW of Tserovo [AP, GM]	41°58'13" 23°06'58"	509	10.08.2016 11:10 pm	1 juv.	FM74D

N/NW of Tserovo [GM]	41°58'09" 23°07'13"	548	05.08.2018 12:35 am	1 juv.	FM74D
N of Tserovo [GM]	41°57'56" 23°07'34"	612	15.08.2016 11:05 pm	1 juv.	FM74D
W of Tserovo [AP]	41°57'19" 23°06'16"	317	23.07.2019	1 ad. RK	FM74B
Zheleznitsa [LD]	41°55'37" 23°06'18"	306	15.08.2013	1 ad. RK	FM74A
S/SE of Zheleznitsa [LD]	41°54'58" 23°06'49"	312	28.07.2017 10:35 pm	1 subad.	FM74C
S/SE of Zheleznitsa [LD]	41°54'56" 23°06'48"	316	28.06.2014 10:25 pm	1 juv.	FM74C
S/SE of Zheleznitsa [AP, GM]	41°54'27" 23°06'47"	306	05.08.2013 9:30 pm	1 ad.	FM74C
Oranovo residential area, Simitli [LD]	41°54'09" 23°07'38"	345	12.08.2009 11:05 pm	1 juv.	FM74C
Oranovo residential area, Simitli [LD]	41°53'39" 23°07'31"	306	11.10.2009	1 dead subad.	FM74C
W outskirts of Simitli [LP]	41°53'26" 23°06'12"	331	02.10.2018 9:05 pm	1 juv.	FM73B
Kresna Gorge (North) [AP, RI]	41°49'37" 23°09'06"	279	14.07.2003	1 ad. RK	FM73C
Kresna Gorge [AP, RI]	41°49'31" 23°09'09"	284	07.07.2003	1 ad. RK	FM73C
Kresna Gorge [AP]	41°49'14" 23°09'30"	270	08.08.2019	1 ad. RK	FM73C
Kresna Gorge [BN, MS]	41°48'24" 23°09'23"	483	1988 n/a	1 ad.	FM73C
Kresna Gorge [AP, RI]	41°48'18" 23°09'45"	257	26.05.2003	1 ad. RK	FM73C
Kresna Gorge [AP, RI]	41°47'40" 23°09'32"	251	14.07.2003	1 juv. RK	FM72D
Kresna Gorge [LD]	41°47'05" 23°09'18"	236	18.07.2005 10:45 pm	1 subad.	FM72D
Kresna Gorge [AP, RI]	41°46'39" 23°09'15"	220	02.06.2003	1 ad. RK	FM72D
Kresna Gorge [LD]	41°46'35" 23°09'19"	223	15.05.2011 11:20 pm	1 ad.	FM72D
Kresna Gorge (South) [LD]	41°46'24" 23°09'20"	225	03.08.2010 11:05 pm	1 subad.	FM72D
Kresna Gorge [LD]	41°46'15" 23°09'23"	225	24.08.2012 11:20 pm	1 juv.	FM72D
Kresna Gorge [LD]	41°46'10" 23°09'23"	223	25.06.2016 10:00 pm	1 juv.	FM72D
Kresna Gorge [LD]	41°46'09" 23°09'23"	226	03.08.2010 9:55 pm	1 ad.	FM72D
Kresna Gorge [BN]	41°45'54" 23°09'20"	208	25.08.1991 12:30 am	1 ad.	FM72D
Kresna Gorge [LD]	41°45'25" 23°09'11"	220	06.09.2010 9:55 pm	1 subad.	FM72D
Kresna Gorge [BN, MS]	41°45'12" 23°09'11"	206	09.06.1995 10:30 pm	1 juv.	FM72C
Kresna Gorge [BN, MS]	41°45'06" 23°09'11"	203	08.06.1995 11:30 pm	1 juv.	FM72C
Kresna Gorge [AP, RI]	41°45'02" 23°09'12"	200	28.07.2003	1 ad. RK	FM72C
Kresna Gorge [AP, RI]	41°44'56" 23°09'18"	198	28.07.2003	1 juv. RK	FM72C
Kresna Gorge [BN, MN]	41°44'56" 23°09'28"	207	24.05.2002 11:15 pm	1 juv.	FM72C
Kresna Gorge [AP, RI]	41°44'55" 23°09'31"	201	28.07.2003	1 juv. RK	FM72C
Kresna Gorge [AP, LD]	41°44'51" 23°09'46"	200	14.07.2003	1 juv. RK	FM72C
Kresna Gorge [AP, RI]	41°44'05" 23°09'32"	188	28.07.2003	1 subad. RK	FM72C
Kresna Gorge [AP, RI]	41°44'01" 23°09'33"	186	28.07.2003	1 ad. RK	FM72C
N outskirts of Kresna [AP, RI]	41°43'45" 23°09'12"	186	11.08.2003	1 juv. RK	FM72C
S of Damyanitsa [LD]	41°29'58" 23°15'56"	100	23.04.2011	1 ad., under stone	FL89D
Kozhuh volcanic ridge [LD]	41°27'45" 23°15'41"	100	17.08.2010	1 ad. RK	FL89C
Rupite Area [LD]	41°27'39" 23°15'46"	90	14.07.2013 10:50 pm	1 juv.	FL89C
Rupite Area [LD]	41°27'14" 23°15'59"	88	21.08.2010 12:25 am	1 subad.	FL89C
Rupite Area [LD]	41°27'19" 23°16'04"	89	18.08.2013 11:45 pm	1 ad.	FL89C
Rupite Area [LD]	41°27'23" 23°16'11"	92	18.08.2013 11:30 pm	1 ad.	FL89C
NW outskirts of General Todorov [LD]	41°27'23" 23°16'41"	89	22.08.2010	2 shed skin (ad.)	FL99A
Topolnitsa [AP]	41°24'17" 23°19'26"	91	28.04.2018 9:35 pm	2 ad.	FL98B
Petrovo [AP]	41°26'19" 23°30'09"	442	05.10.2014 n/a	4 juv.	GL09C
SE outskirts of Petrovo [BP]	41°26'13" 23°30'38"	425	12.09.1992	1 ad. RK	GL09C