Research Article

ACTA ZOOLOGICA BULGARICA
Acta zool. bulg., Suppl. 10, 2017: 65-76

Updated Distribution and Ecological Requirements of the Native Freshwater Turtles in Bulgaria

Yurii V. Kornilev[1,2], Georgi Popgeorgiev[1,3], Borislav Naumov[4], Andrey Stoyanov[1,†] & Nikolay Tzankov[1,†]

[1]National Museum of Natural History, Sofia, 1 Tsar Osvoboditel Blvd., 1000 Sofia, Bulgaria;
E-mails: yurii.kornilev@nmnhs.com; georgi.popgeorgiev@gmail.com
[2]Department of Integrative Zoology, Faculty of Life Sciences, University of Vienna, Althanstrasse 14, A-1090 Vienna, Austria
[3]Bulgarian Society for the Protection of Birds / BirdLife Bulgaria, Yavorov Complex, Bl. 71, Vh. 4, PO Box 50, 1111 Sofia, Bulgaria
[4]Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences, 2 Gagarin Street, 1113 Sofia, Bulgaria;
E-mail: herpetology_bg@yahoo.com

To Andro, Dobri and Niki, true friends

Abstract: The two native freshwater turtles, the European Pond Turtle *Emys orbicularis* and the Balkan Terrapin *Mauremys rivulata*, are locally abundant and widespread in parts of Bulgaria. However, their distribution and ecological requirements still remain understudied. To ameliorate these issues, we present an up-to-date distribution, combining 1,833 unpublished field observations of *E. orbicularis* and 217 of *M. rivulata*, supplemented by 270 and 71 localities, respectively, from a literature review. We mapped the locations on the 10×10 km MGRS grid: 352 squares contain *E. orbicularis* (roughly 1/3 of the country) and 45 squares – *M. rivulata.* 65% and 38% of these squares, respectively, were previously unpublished. We updated the maximum elevations for Bulgaria: 1,221 m for *E. orbicularis* and 474 m for *M. rivulata*. We investigated the turtles' potential distributions and ecological requirements within part of their ranges using Maxent. The Environmental Niche Models had a high degree of predictability (AUC>0.954). We estimated that, although widely spread, suitable habitats for *E. orbicularis* comprise only 11.7% of Bulgaria (Medium [M] and High [H] suitability categories = 5%); suitable habitats for *M. rivulata* are 1.7% overall (M + H = 0.5%). We calculated that the M and H suitable habitats within the Sites of Community Importance (SCIs) of Natura 2000 are only 30% and 42% for *M. rivulata*, and 64% and 71% for *E. orbicularis*. Our results will aid any future evidence-based conservation measures for the native freshwater turtles.

Key words: Maxent, modeling, Species Distribution Models, *Emys orbicularis*, *Mauremys rivulata*

Introduction

Two of the five freshwater turtles native to Europe occur in Bulgaria. The European Pond Turtle *Emys orbicularis* (Linnaeus, 1758) is widespread, while the Balkan Terrapin *Mauremys rivulata* (Valenciennes, 1833) is found only in some southern regions. A third turtle species, the Pond Slider *Trachemys scripta* (Thunberg in Schoepff, 1792), is an allochthonous competitor introduced via the pet trade and consequent releases, both intentional and unintentional (see Tzankov et al. [2015] for a review).

Several efforts to map the distribution of both species have been made. The first records for the species in Bulgaria were provided by Hristovich (1892) (*E. orbicularis*) and Buresch & Zonkow (1933) (*M. rivulata*). The first national distribution mapping was also done by Buresch & Zonkow (1933). The localities for *M. rivulata* were later updated in Beškov & Beron (1964) and Beshkov (1985). The potential distributions of both species were presented through deductive models by

Petrov (2007a, b) and Stojanov et al. (2011). The most recent maps were based on the 10×10 km UTM grid, for *E. orbicularis* by Mollov et al. (2013) and for *M. rivulata* by Stojanov (2015); however, they include data only until 2010.

Locally, chelonians face multiple threats, including collection for the pet trade, killing by fishermen or road traffic, and loss of (aquatic) habitats. Therefore, both native species are protected nationally (Annexes II, III of Biological Diversity Act, 2016) and internationally (Annexes II and IV of Council Directive 92/43/EEC; Appendix II of the Convention on the Conservation of European Wildlife and Natural Habitats, BERN). In addition, *E. orbicularis* is listed as Lower Risk/Near Threatened (ver. 2.3) in the IUCN Red List of Threatened Species, but the assessment is outdated (1996). *Mauremys rivulata* is evaluated as Vulnerable (VU) in the national Red Data Book (Stojanov 2015).

To ensure turtles' long-term protection through the implementation of adequate conservation measures, precise and current data on local distribution and accurate knowledge of their ecological requirements are needed.

Here we present updated maps for the distributions of the two native chelonians, by combining published and unpublished observations. In addition, we produced ecological niche models to a) identify areas of potential occurrence, b) identify the most important factors predicting the species distribution, c) estimate the niche overlap, and d) assess the extent to which the Natura 2000 network matches the potential distribution of both species.

Materials and Methods

The study area in SE Europe encompassed the territory of Bulgaria – ca. 111,000 km^2; covering 970 whole and 287 partial squares of the 10×10 km Military Grid Reference System grid (MGRS). We combined into a GIS database previously unpublished observations and georeferenced published data, to update the known distribution of the native species and produce Ecological Niche Models (ENMs).

Unpublished locality data

Although the field data collected by the authors and colleagues span the period 1982–2016, the precise presence records (collected with a GPS) were obtained after 2000. Overall, the search effort has been uneven and increased in time and scope. Sampling was biased, with favoured herpetological regions and habitats in proximity to roads being visited more. However, field work was carried out by multiple researchers (often independently) through an extended period and was performed to serve different goals. Therefore, we regard the data collection as semi-haphazard.

We actively searched for individuals, usually through visual surveys, focusing on suitable macro- and micro-habitats (e.g. fallen logs in pools of water). Individuals were also unintentionally captured in submerged minnow-traps set for newt surveys. Each recorded individual was identified unambiguously to the species level. Precise geographic coordinates (error ±10 m) were obtained with dedicated hand-held GPS units (Garmin, Olathe, Kansas, USA) or with smartphones with integrated GPS (e.g. by using the mobile application SmartBirds Pro; Popgeorgiev et al. 2015). As an exception, coordinates were obtained through geo-referenced high-quality aerial or satellite imagery. Overall, we collected 1,833 previously unpublished presence records for *E. orbicularis* and 217 for *M. rivulata*.

Published locality data

We reviewed herpetological publications related to Bulgaria (~750 publications from 1892–2015) for turtle presence records. We considered as a separate presence record every original description of a location where an individual was found and which was different from other descriptions in a publication. In most sources names of settlements or geographic objects were given as reference points for the locations; we assigned these as best as possible to a UTM 10×10 km grid using the MGRS naming of cells (UTM zone 35N, datum WGS 1984). Some presence records were already provided as cells in the 10, 5, 2, or 1 km UTM/MGRS grid; few had precise coordinates. Presence records from the literature were used only for mapping.

Ecological Niche Models (ENMs)

As published observations and our data prior to 2000 lack precise coordinates, we modeled the ecological niches for both species only using the unpublished field observations collected post-2000. For manipulation, visualization, and analysis of the digital layers we used ArcGIS v. 10.3 (ESRI, Redlands, CA, USA).

Parameters used and transformations of layers

We used 27 continuous variables of three types for modeling: climatic, topographic, and habitat (distance to water bodies). The climatic variables were the *19 bioclimatic parameters* of the freely available WorldClim v. 2 (original resolution ≈ 1 km^2

cell; average for 1970–2000; Fick & Hijmans 2017). Although slightly outdated, this is the best climatic database available for Bulgaria. Additionally, turtles are long-lived, resilient animals, so even if certain climatic conditions have changed slightly, they would most likely influence the reproductive capabilities and not survivability; thus, the current distribution should be properly reflected. We also included the *Global Aridity Index* and the *Global Potential Evapotranspiration* (CGIAR-CSI Global-Aridity and Global-PET Geospatial Database; Trabucco & Zomer 2009). The topographic variables were *elevation* (m above sea level), *aspect* (°) and *slope* (°), derived from a 40-m resolution Digital Elevation Model (DEM) using Spatial Analyst in ArcGIS. We included yearly *solar radiation* (in kJ m^{-2} day^{-1}) by summing the monthly values from WorldClim v. 2.

We downscaled the original rasters (except the DEM-based ones) to 40 m cells, using "cubic convulsion" resampling in ArcGIS. We chose to downscale for several reasons. First, this resolution fits known specific ecological requirements of the species – they inhabit water bodies, which, based on our field experience, in most cases are rather small (< 40 m width and/or length). At lower resolutions (that is, larger pixel size), these crucial habitats cannot adequately be included in the model. Second, the chosen pixel size also includes some terrestrial habitats important for the species (for aerial basking and egg-laying) bordering the aquatic habitat; thus, we chose not to include strictly terrestrial habitats in the model. Third, we are considering a relatively small territory, with the primary goal to use the results for future conservation work at the local scale.

The habitat layers were separated into natural and artificial *running waters* (e.g. streams, primary and secondary rivers, canals) and *standing waters* (e.g. ponds, lakes, reservoirs). We used JICA (2008) for the running waters and JICA + Land Parcel Identification System (LPIS 2016; maintained by the Ministry of Agriculture, Food and Forestry) for the standing ones. We converted the categorical data to continuous by calculating the Euclidian distance (ArcGIS tool) to each habitat type in the original vector layers and rasterizing the results to 40 m grids.

Model options selection

To correct sampling bias, we used systematic sampling as it consistently outperforms other methods (Fourcade et al. 2014), especially because we do not know precisely the type of sampling bias in our data; thus, we matched presence records to a 1×1 km MGRS grid and randomly sampled one occurrence per grid cell. Therefore, from the original 1,833 observations for *E. orbicularis* and 217 for *M. rivulata*, we used for modeling 700 and 59, respectively (descriptive statistics based on available GIS layers available in Appendix 1).

The Ecological Niche Model (ENM) for each species was generated using software Maxent 3.4.1 (Phillips et al. 2017). We used the projected coordinate system WGS 84, UTM zone 35N. To minimize collinearity in the ENMs, we utilized the "Absolute value of correlation coefficients (|r|)" method (Dormann et al. 2013). In ArcGIS, we generated 100,000 random points and associated to them the corresponding values from all the variables. We calculated the Spearman Rank Order Correlations (Statistica v. 10; StatSoft, Tulsa, OK, USA), setting |r| = 0.7 as a threshold. We created preliminary ENM for each species with the following settings: all variables included, 10 repetitions with „Bootstrap", 25% of the presence records randomly chosen for verification in each repetition, 100,000 background points. We then kept or removed variables as follows: we kept the variable with the highest % contribution to the ENM, and removed all correlating variables; we kept the remaining variable with the 2nd highest % contribution and removed all remaining correlating variables. This continued until all variables were considered. Thus, 12 variables remained for *E. orbicularis*, and 11 for *M. rivulata* (Table 1).

For the final ENMs, we ran 100 repetitions with „Bootstrap", with 25% of the points randomly chosen for verification in each repetition, 100,000 background points, logistic output. For both ENMs we used a regularization multiplier = 1 as the results best reflected our biological knowledge of the species (Merow et al. 2013), after evaluating the products of prior tests with values of 0, 0.5 and 1.

Final models

The resultant "mean values" ENMs were thresholded into unsuitable/suitable space using the "Maximum test sensitivity plus specificity logistic threshold" calculated by Maxent, as maxSSS is one of the best threshold selection method for presence/absence data (Liu et al. 2005, 2016). The remaining data were assigned to three classes of suitability (Low, Medium, and High) for data analysis, using Jenks Natural Breaks.

Niche overlap

We measured overlap of the spatial predictions of the ENMs using the Schoener's *D* (Schoener 1968), *I* statistic (Warren et al. 2008), and relative rank (*RR*; Warren & Seifert 2011), calculated by the "Niche overlap" tool of ENMTools 1.4.4 (Warren et al. 2010).

Table 1. Average Percent contribution (%) and Permutation importance (PI) of uncorrelated variables, estimated by Maxent in Ecological Niche Models (ENMs) for *Emys orbicularis* and *Mauremys rivulata*. The average test Area Under Curve (AUC) is presented with the Standard Deviation (SD). Variables excluded from both ENMs due to collinearity were: Global Aridity Index; Yearly solar radiation; and the Bioclim layers (BIO*x*): Annual mean temperature [T] (1); T seasonality (4); Max T, warmest month (5); T annual range (7); Mean T, warmest quarter (10); Mean T, coldest quarter (11); Annual precipitation [P] (12); P, wettest month (13); P, driest month (14); P, wettest quarter (16); P, coldest quarter (19)

	Emys orbicularis					***Mauremys rivulata***			
AUC (SD)	**0.940 (0.008)**					**0.994 (0.002)**			
Variable	**%**	**min-max**	**PI**	**min-max**		**%**	**min-max**	**PI**	**min-max**
Pot. Evapotranspiration	6.0	0.4–11.4	2.8	0.0–21.0		6.3	0.5–29.9	1.4	0.0–10.9
Elevation	22.2	12.6–31.4	23.8	11.0–49.0		5.2	1.1–15.2	0.8	0.0–20.1
Aspect	0.6	0.1–1.1	0.5	0.0–1.9		1.0	0.0–3.4	0.1	0.0–0.8
Slope	2.4	0.3–7.9	3.2	0.7–8.8		1.2	0.0–6.4	0.3	0.0–2.7
Water, flowing	38.1	33.2–43.9	42.2	28.2–55.1		27.1	16.4–37.8	9.1	1.8–34.1
Water, stagnant	14.5	8.3–22.1	10.3	6.1–17.2		2.2	0.3–9.1	0.7	0.0–2.7
Temperature (BIO*x*)									
Mean, diurnal range (2)	3.3	1.2–6.2	4.1	1.1–9.1		–	–	–	–
Isothermality (3)	–	–	–	–		0.9	0.1–2.2	1.7	0.1–5.0
Min, coldest month (6)	2.8	1.1–4.7	3.2	0.5–11.0		–	–	–	–
Mean, wettest quarter (8)	1.0	0.2–3.2	1.7	0.4–4.5		3.6	0.0–11.4	0.6	0.0–7.3
Mean, driest quarter (9)	4.1	0.6–7.7	4.4	1.2–9.0		–	–	–	–
Precipitation (BIO*x*)									
Seasonality (15)	1.5	0.6–2.9	1.9	0.4–4.9		0.6	0.0–4.2	0.4	0.0–3.1
Driest quarter (17)	3.6	1.3–8.1	1.8	0.0–4.8		1.1	0.0–2.7	0.3	0.0–1.3
Warmest quarter (18)	–	–	–	–		50.7	18.4–64.3	84.5	58.6–93.6

Results and Discussion

The accumulation of multiple unpublished records and a thorough literature review allowed us to compile the most up-to-date distribution maps for *E. orbicularis* and *M. rivulata*. Overall, our knowledge on the distribution of both turtles has increased greatly after the year 2000. This advance was aided through the implementation of more funded projects (often for mapping biodiversity), the increase in the amount of field work and the number of field workers, as well as improved methods for data collection and storage.

Distribution mapping: published records

We identified locality records from 82 publications (listed in Appendix 2). Until 1950 data on *E. orbicularis* were published for 38 MGRS squares and on *M. rivulata* for 4 squares; in 1951–2000, 31 and 14 squares were added, respectively, and in 2001–2015, the dataset was complemented with 53 and 10 squares.

We identified 270 separate localities of *E. orbicularis*, obtained from 75 publications; 253 of these could be georeferenced to 122 squares in the 10 km MGRS grid (Fig. 1; Appendix 2). For *M. rivulata* we found 71 localities, from 26 publications (Fig. 2; Appendix 2). We related all the localities except one to 28 MGRS squares. The locality „Kurgali“ (= Kardzhali) in Belcheva et al. (1992) relates to the administrative district and not the city; the specimens were collected around the Arda River, further east of the city (V. Beshkov, pers. comm.).

In addition, we elaborate here on several technical errors present in the map in Stojanov (2015). Square MG31 refers to the locality “The swamplets near Svilengrad” (Buresch & Zonkow 1933), which should belong to MG32. Square MG41 is for the locality “The microreservoir in Toprakdere river” (Beshkov 1985), which belongs to MG42. Squares NG58 and NG68 denote the locality “The road near Arkutino swamp” (Bartosik 1981), but we consider they should be attributed only to NG68.

Distribution mapping: new records

Overall, we mapped 352 squares (10×10 km) with localities of *E. orbicularis* (Fig. 1) and 45 of *M. rivulata* (Fig. 2); with this publication, we add 230 (65% of all squares with localities) and 17 (38%) previously unpublished squares, respectively (Appendix

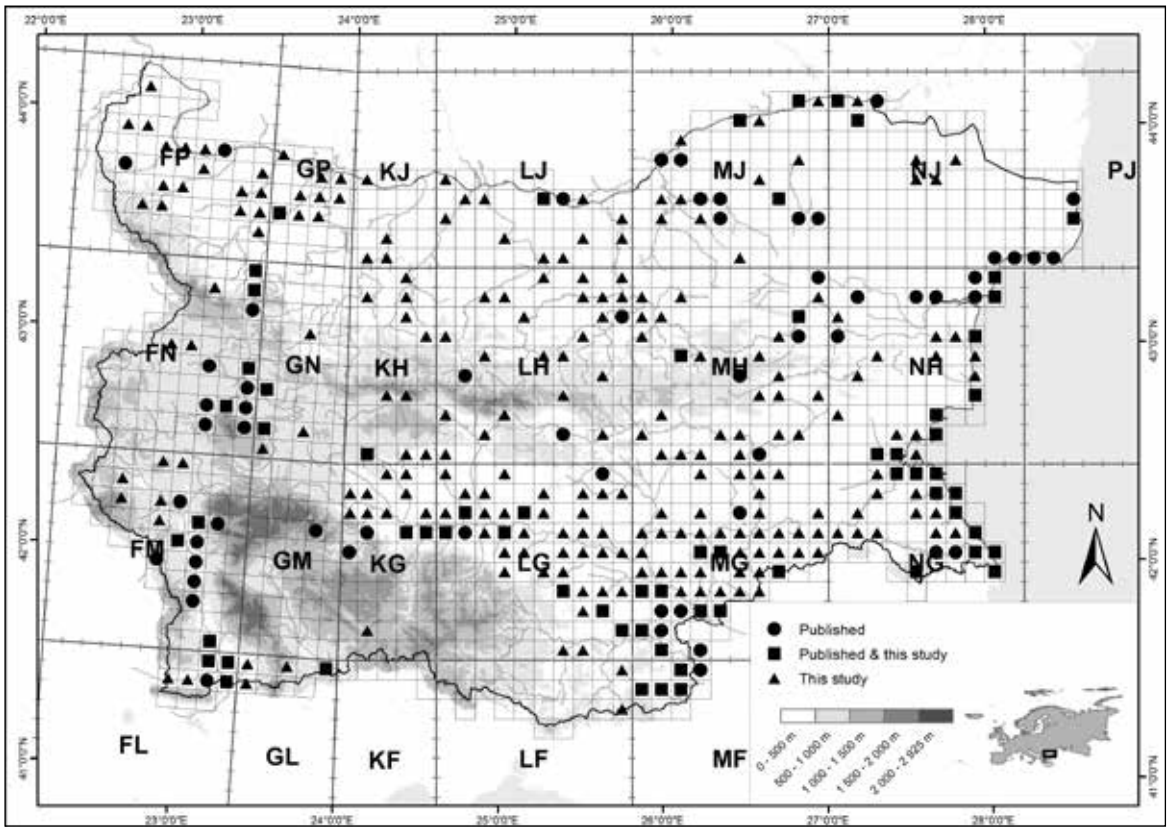

Fig. 1. Distribution of *Emys orbicularis* in Bulgaria, based on a 10 km MGRS grid

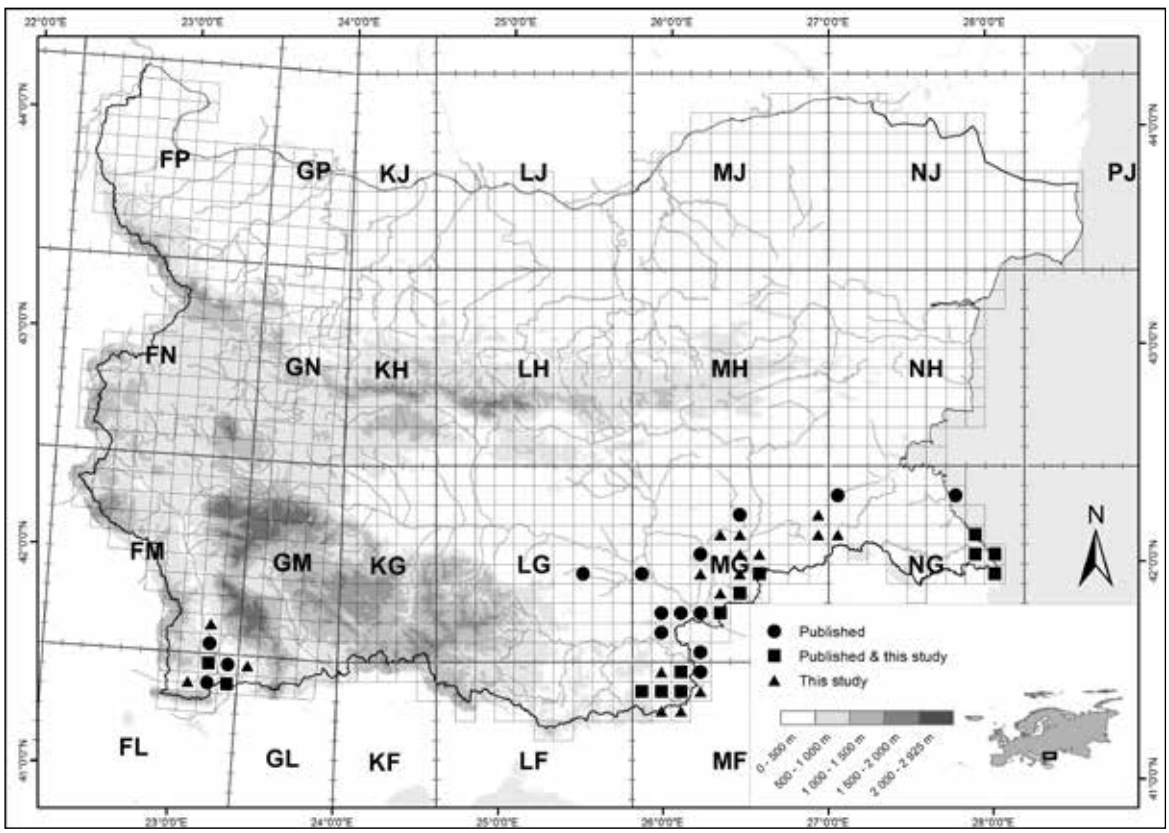

Fig. 2. Distribution of *Mauremys rivulata* in Bulgaria, based on a 10 km MGRS grid

3). For *E. orbicularis* we confirmed 65 squares, and did not confirm 57; for *M. rivulata* – 13 and 15, respectively.

In respect to *E. orbicularis*, the new data confirm our understanding that the species is widely distributed throughout the country except for the high elevation mountainous areas. The new data for *M. rivulata* show that in the Struma valley the species reaches the city of Kresna (Fig. 2; FM81), which expands the known local range to the north (for comparison see Beshkov [1985]; Stojanov [2015]). It still remains unresolved whether the most northern localities in the Eastern Rhodopes and the Black Sea coast (respectively, squares LG74 and NG68, Fig. 2) reflect the real local range of the species or are a result of incidental observations – in both cases only a single roadkill individual was observed (Bartosik 1981, Petrov et al. 2001).

New observations could bring local expansions of the range – e.g. in 2017, N. Kolev (pers. comm.) recorded an adult *M. rivulata* at an oxbow of the Sazliyka River north of Haskovo (N42.061, E25.867, MG05; data not included in the rest of the paper); this observation fits the ENM's prediction.

Altitudinal distribution

Based on all unpublished data, the maximum elevations recorded for the two species are 1,221 m for *E. orbicularis* (near Zmeitza village, Western Rhodopes) and 474 m for *M. rivulata* (near Zhelezino village, Eastern Rhodopes). However, 95.6% of *E. orbicularis* records are below 425 m, and 95.7% of *M. rivulata* – below 275 m (Fig. 5). Excluding the maximums, eight observations of *E. orbicularis* were made between 1,013–1,089 m, all from the region of Vitosha and Plana Mnts.; three observations of *M. rivulata* were above 300 m: two in the region of Ivaylovgrad, Eastern Rhodopes, and one near Pashovo village, Sakar Mnt.

This altitudinal distribution closely matches published data. For *E. orbicularis*, of the 245 published observations for which we could estimate a potential elevation range, 214 (87.4%) were between 0–499 m, 27 (11.0%) were between 500–999 m, and only 4 (1.6%) were above 1,000 m. Previously, the highest realistic elevation published for the species was erroneously given as 1,100 m for a location in Lozenska Mnt. (neighboring Vitosha and Plana Mts.) (Buresch & Zonkow 1933, Beshkov & Nanev 2002, designated as "Karleva doupka" in Stoyneva & Michev 2007); however, the true elevation is 1,054 m. Two other localities are respectively at 1,025 m near Kladnitsa village and 1,064 m near Iglika hut (Tzankov et al. 2014). Stoyneva & Michev 2007 reported *E. orbicularis* at 1,350 m (IBW 0675) from the region of Yundola between Rila and Western Rhodopes; a "?" was placed after the species name, with no additional comment. We consider this locality highly questionable and in need of confirmation because of the extreme elevation, and because it is from a peatland, a habitat where the species has not been found until now.

For *M. rivulata* all 72 published observations were below 500 m; in Petrov (2007b) and Stojanov et al. (2011), all observations were reported as below 250 m.

Therefore, here we increased our knowledge of the altitudinal distribution of both species in Bulgaria. Given the geographic location of Bulgaria, our results are expected. In the southern parts of their range both species reach higher altitudes: for example, *E. orbicularis* up to 1,700 m in Morocco (Pasteur & Bons 1960), and *M. rivulata* up to 800 m in Greece (Valakos et al. 2008).

ENMs: Predictive power

Both final models had very high average test AUC values (Area Under the Curve): 0.940 (SD = 0.008) for *E. orbicularis* and 0.994 (SD = 0.002) for *M. rivulata* (Table 1), signifying the model's high degree of predictability of the potential distribution.

ENMs: Variables contributions

The obtained ENMs identified topographical, climatic, and habitat variables explaining the known distribution of the turtles and suggesting important factors related to their biology and ecophysiology (Table 1, Fig. 6).

For *E. orbicularis*, the variable's % contribution to the ENM clearly confirms the strong dependence of the species to proximity to open aquatic habitats (Flowing water, 38.1% and Stagnant water, 14.5). Since most open waters are situated on mostly flat and even terrains, the aspect and slope have a low contribution. Furthermore, other variables suggest that water bodies need to retain sufficient water during the active season (e.g. Pot. Evapotranspiration, Precipitation in the driest quarter). The Elevation is the second most important variable (22.2% contribution; see also discussion on Altitudinal distribution). In Bulgaria, within the environmental niche of species, elevation seems to account for most of the variation in suitable climatic conditions. Thus, temperature and precipitation variables have a small contribution to the ENM.

For *M. rivulata*, the climatic factor "Precipitation of warmest quarter" (50.7%) is the most important predictor. Along with the small contributions from

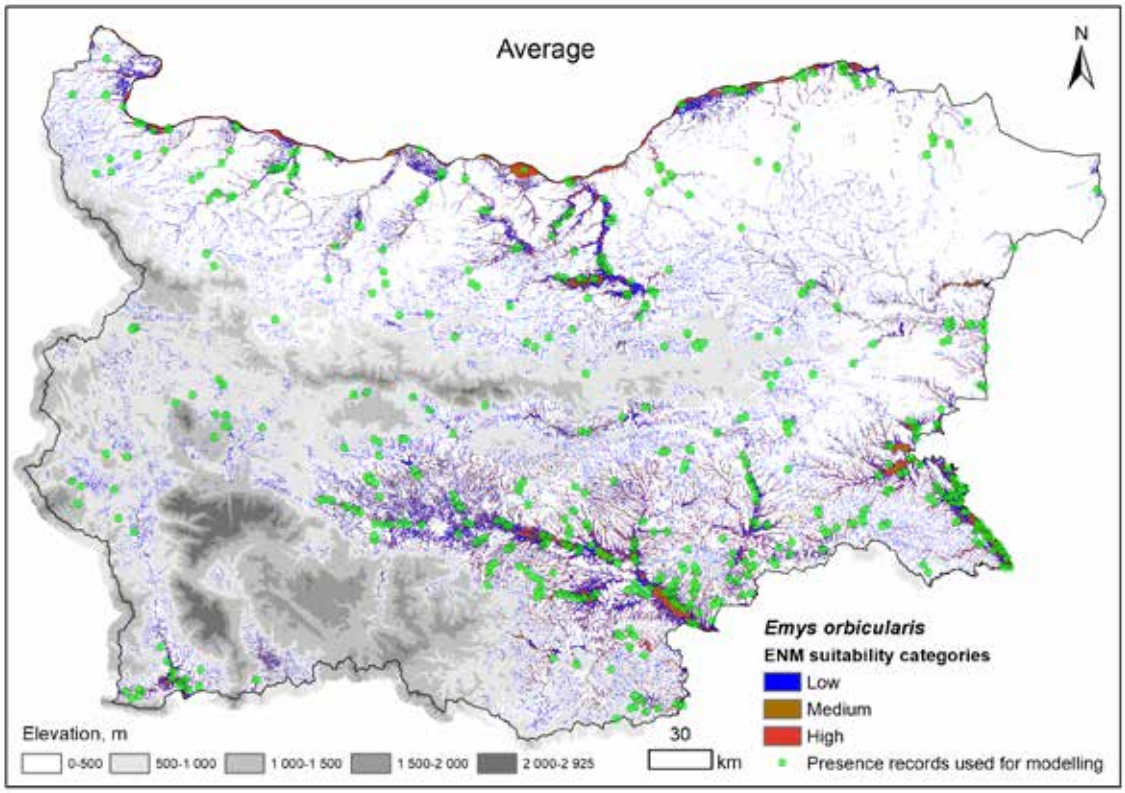

Fig. 3. Maxent average Ecological Niche Model for *Emys orbicularis* in Bulgaria. Presence suitability categories are: 0.149–0.315 (Low), 0.315–0.549 (Medium), and 0.549–1 (High)

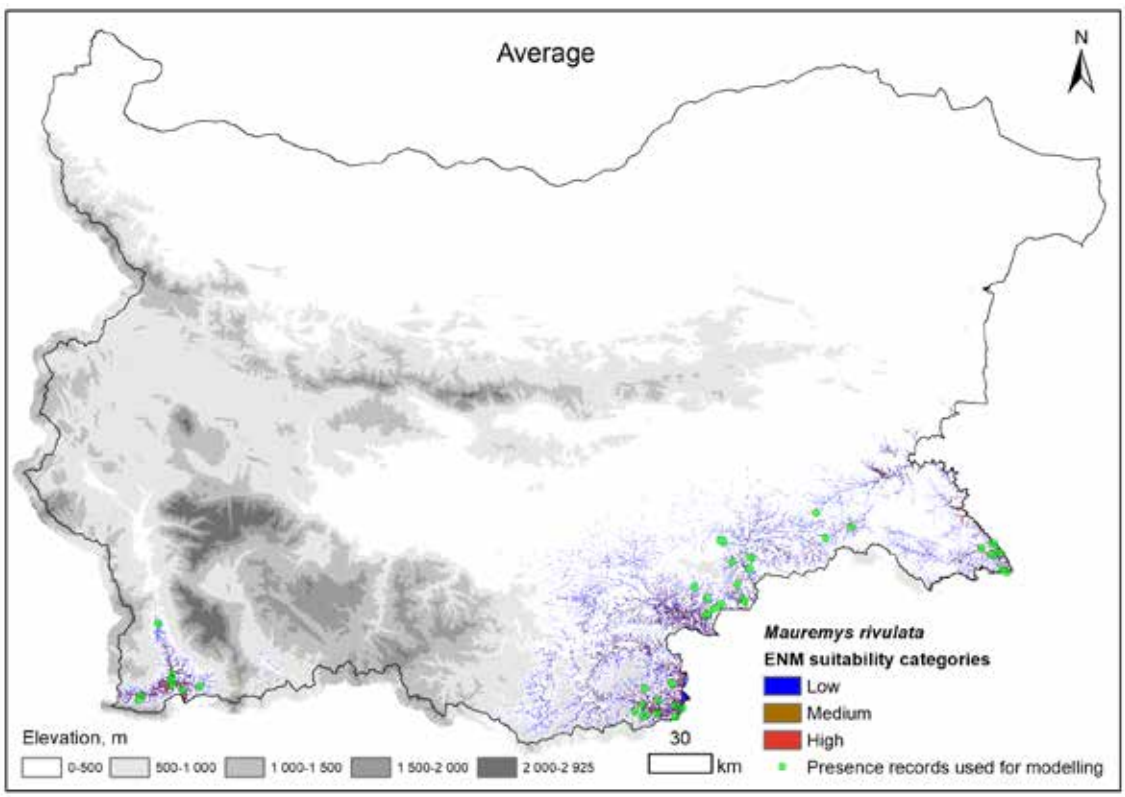

Fig. 4. Maxent average Ecological Niche Model for *M. rivulata* in Bulgaria. Presence suitability categories are: 0.079–0.241 (Low suitability), 0.241–0.495 (Medium), and 0.495–1 (High)

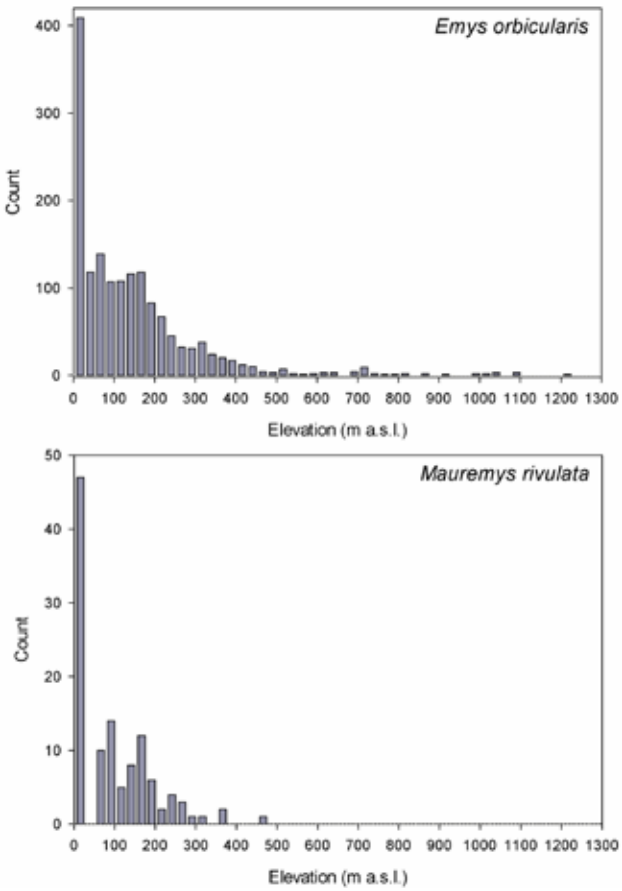

Fig. 5. Histogram of the altitudinal distribution in Bulgaria of *Emys orbicularis* and *Mauremys rivulata* based on unpublished data (1982–2016)

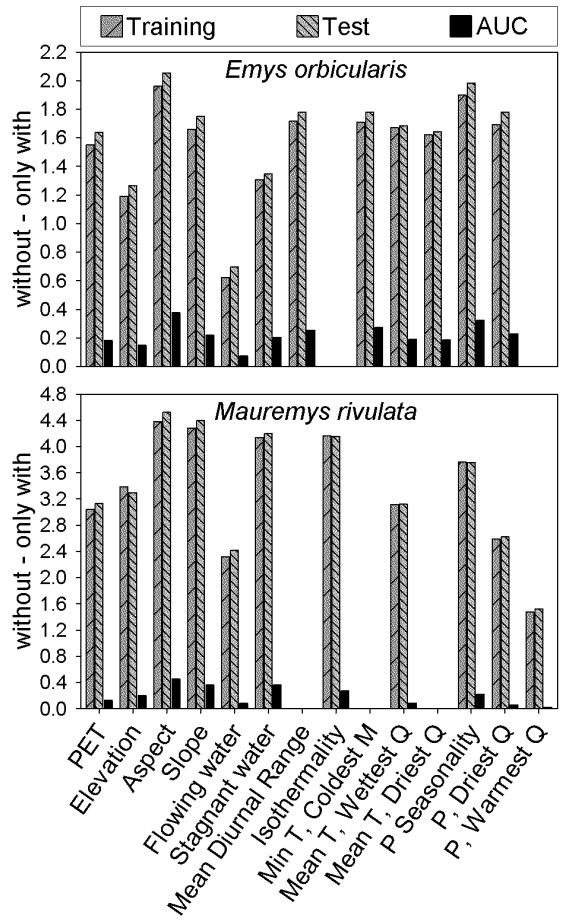

Fig. 6. Jackknife results for Maxent ENMs for *Emys orbicularis* and *Mauremys rivulata* in Bulgaria. Shown are differences in average gain and area under the curve (AUC) on test data between models built *without* and *only with* a given variable. Smaller differences both in gain and in AUC denote variables more highly related to the distribution of each species

the other climatic variables, these results fit well to the known distribution of the species in Bulgaria. *Mauremys rivulata* is limited to territories, characterized by warm temperatures and low amount of summer rainfall (Pontic climate at the Black Sea coast, and Mediterranean in the southern parts of the country).

Distance to water expectedly ranks on the 2nd place (Flowing water, 27.1%). Likely distance to stagnant water is of lower importance (2.2%) because a) we might have a low number of observations from such habitats due to sample bias, b) and, overall, there are fewer major stagnant water bodies within the known distribution of the species.

Although an important factor for *M. rivulata*, too, Elevation only contributes 5.2% to the overall model, while the other geographically related variables contribute even less. This is likely linked to the very narrow altitudinal range of the species.

The profiles of the response curves for major variables common for both species and related to their distribution allow an easy comparison between some of their eco-physiological requirements (Fig. 7). *Emys orbicularis* occurs most often between 0–175 m a. s. l., while *M. rivulata* – 0–50 m. Both species are most likely found < 100 m from water. *Mauremys rivulata* is much more specific about climatic conditions – preferring mean temperatures of the wettest quarter close to 10°C, while *E. orbicularis* tolerates a much wider range (7–21°C). *Mauremys rivulata* occurs most often in locations with Precipitation of the Driest quarter between 80–100 mm, while the range is extended for E. orbicularis from 80 to 130 mm. *Mauremys rivulata* also seems to be more particular about Precipitation seasonality.

ENMs: Suitability

Although *E. orbicularis* is widespread in the country, all three categories of suitable habitats still comprise only 11.7% of the territory, with the medium and high suitability only 5% (Table 2). The potential distribution for *M. rivulata* is even smaller: 1.7% overall; the medium suitability and the high comprise only 0.5%.

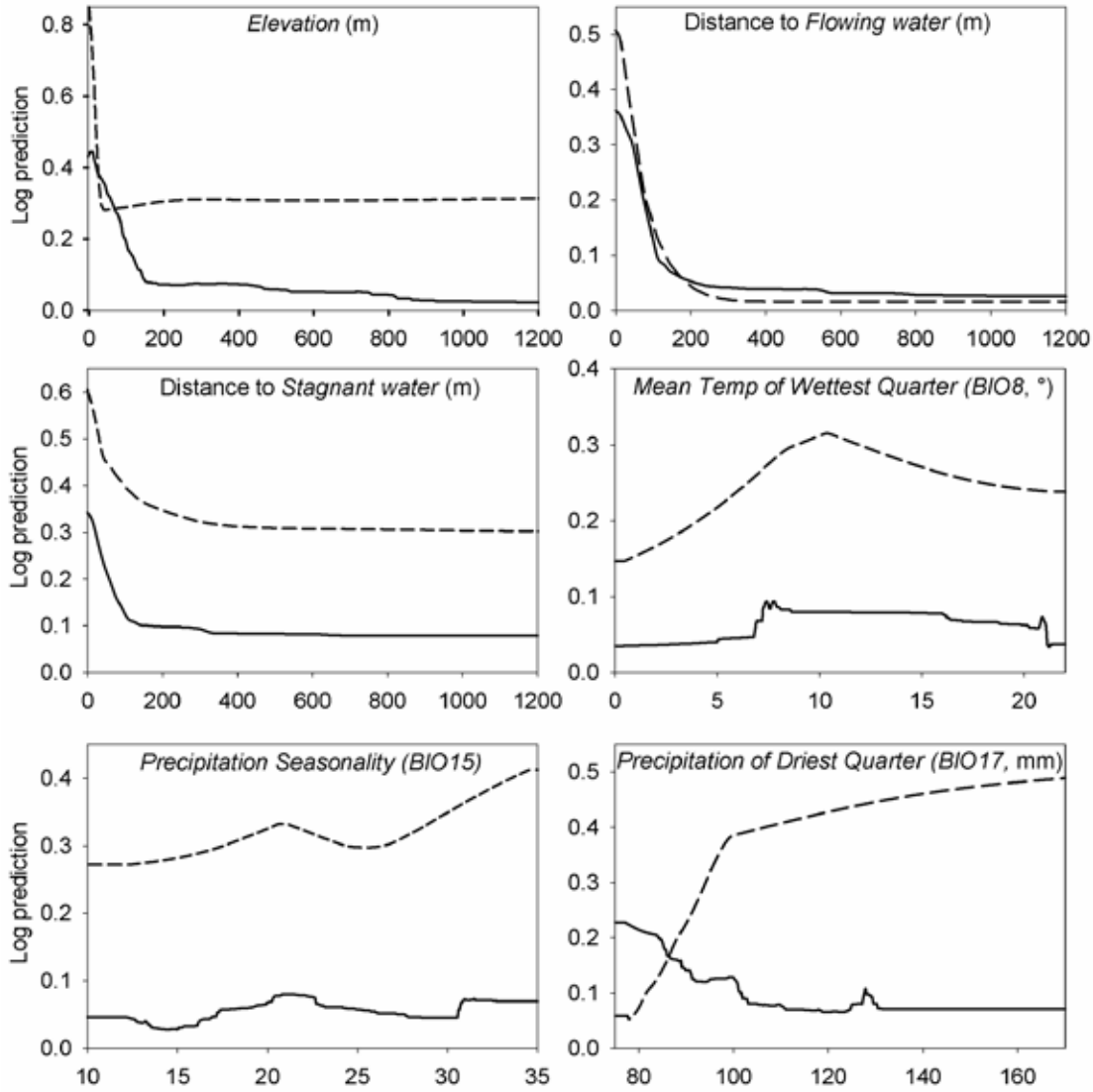

Fig. 7. Response curves of major variables contributing to the ENMs for both *Emys orbicularis* (–) and *M. rivulata* (- -)

The obtained ENMs adequately reflect our expert knowledge on the species (Figs. 3, 4). Important areas for *E. orbicularis* include most of the Danube River Plain and its tributaries, Struma River, the Thracian Lowlands, and the central-southern Black Sea Coast. Several regions, however, stand out as needing additional sampling. We can expect to find *E. orbicularis* further upstream at the Mesta River valley in SW Bulgaria, where we have limited records only close to the Greek border. In the NE, especially in Bulgarian Dobrudzha, we also have limited observations. This region is traditionally understudied, with isolated aquatic habitats, except in the most western parts. Some potentially suitable areas exist around the capital Sofia – although most herpetologists live in Sofia, we have observed few turtles. Either the habitat is of low quality overall and/or the high degree of historical urbanization has impacted.

Table 2. Area (in km²) of three classes of suitability, based on Maxent Ecological Niche Models for *Emys orbicularis* and *Mauremys rivulata* for Bulgaria (BG) and within Natura 2000 (SCI). Total BG area = 110,878.9 km²; total SCI area = 33,196.4 km²

	E. orbicularis		***M. rivulata***	
	BG	SCI	BG	SCI
Low	7,417.2	1,797.0	1,320.2	756.4
Medium	3,669.4	1,113.2	449.1	287.8
High	1,875.8	795.0	144.4	102.7

Based on the ENM, *M. rivulata* has a much broader potential niche than the known distribution. For example, the Mesta River region needs to be sampled further. Furthermore, the northern extent of the known range along the Black Sea Coast is the Ropotamo River, while continuous or patchy,

isolated suitable habitats are found along the coast as far north as Nessebar (and even Varna). However, the continued urbanization and fragmentation along the coastline is likely an impassable barrier for the turtle. Still, a possible range expansion may occur inland. In the region of the Struma valley, the ENM extends up to the northernmost presence record (Kresna); however, future climate change might provide suitable habitats upstream.

Clearly, high-elevation mountains (e.g. Rila and Pirin in the south-west) serve as barriers for both species. However, Stara Planina, which crosses Bulgaria from east to west roughly across the middle, does not constitute an impassable barrier for the herpetofauna (Beshkov 1984). Specifically for *E. orbicularis*, we support this hypothesis. Although the ridge of Western and Central Stara Planina through its substantial elevation (>1,000 m) forms a likely impassable barrier, it is pierced by the deep valley of the Iskar River, which serves as a biocorridor. In addition, the eastern mountain's ridge is much lower (only a single small section is >1,000 m) and has a dense river system which likely facilitates an N–S exchange of individuals. Future studies can add additional insight into a possible genetic separation of the species across Stara Planina.

ENMs: Overlap

The three niche overlap metrics (0, no overlap – 1, complete overlap) fit our knowledge of the species. The Schoener's *D* (0.29) and *I* statistic (0.57) signify the large areas of the ENMs that do not overlap, matching the extensive range of *E. orbicularis* and the much more limited range of *M. rivulata*. However, the high Relative Rank (0.71), calculated conceptually differently, supports our observations that within the common range the species ecological niches are similar.

According to Beškov (1987), in Bulgaria *M. rivulata* co-exists in almost all its known localities with *E. orbicularis*. Generally, such syntopy is also supported by our field observations. For example, we have observations from 30 squares (1 km^2, MGRS grid) where both species co-occur, and 29 squares in which only *M. rivulata* occurs. We stipulate that in some localities in which only *M. rivulata* was observed, *E. orbicularis* was not detected and not truly absent. This, however, is likely not the case for the populations in the Eastern Rhodopes, where *M. rivulata* is more common in the smaller, drying up rivulets. For example, in a tributary of the Byala River, above Meden Buk village, GP has observed 12 *M. rivulata* and only 1 *E. orbicularis*; a similar situation was observed along the tributaries to Luda River. Along the Southern Black Sea coast along Veleka River, *E. orbicularis* is more common downstream, close to the mouth, while *M. rivulata* is prevalent upstream, where the river decreases in width and the banks are more overgrown (Popgeorgiev et al. 2017). However, the precise proximate causes for such habitat partitioning are yet to be determined. For example, in Morocco, the congeneric *M. leprosa* likely outcompeted *E. orbicularis* after its arrival, related to a rapid decrease in the numbers of the latter (Velo-Antón et al. 2015).

ENMs: Habitats within designated Sites of Community Importance (SCIs)

Few publications so far have linked biodiversity (especially herpetofauna) and the SCIs of the Natura 2000 network in Bulgaria through robust numeric analyses (but see Nikolov et al. 2014 and citations therein; Popgeorgiev et al. 2014a, b). Thus, here we estimated the degree to which the existing SCIs' encompass the potential habitats of the freshwater turtles, as the first step in a future thorough evaluation of the ecological network. When considering the ENM only 64% of the Medium suitability, and 71% of the High suitability territories for *E. orbicularis* are within SCIs. For *M. rivulata*, the area is even less – 30% of the Medium suitability and 42% of the High suitability fall within SCIs (Table 2).

Assessing the importance of individual SCIs needs further studies. For example, for both species, some possibly very important SCIs with substantial suitable area based on the ENMs (~80–200 km^2) also tend to be some of the largest SCIs (~1,150–2,170 km^2): "Sakar", "Strandzha", "Rhodopes – Eastern". However, much smaller (~1–8 km^2) SCIs such as "Ostrov Bliznatsi", "Ostrovi Kozlodui" and "Ostrov Kutovo" (on the Danube River) exist, with a 100% of their territory of Medium and High suitability; whether these sites are sufficient to maintain the long term viable source populations of *E. orbicularis* is to be determined.

These results need to be treated with caution. The ENMs represent occurrence probabilities for part of the turtles' ranges (Bulgaria). Furthermore, given the turtle's extensive distribution and their plasticity, their species niches are likely broader and the relative importance of biotic and climatic factors may vary across their range. Continued improvements to the ENMs, the particular threats in different SCIs, robust local population assessments as a result of field work, and evaluation of the Natura 2000 connectivity, are just some additional considerations that need to be made. However, given the continuing lack of management plans for the SCIs and the

limited biodiversity law enforcement on a national level, the real threats to the long-term survival of the species may be greater than expected.

Acknowledgements: We are indebted to all colleagues that helped with field work through the years and (or) provided observations. We thank Christoph Plutzar and two reviewers that provided suggestions that improved the manuscript.

References

Bartosik M. 1981. Gady okolicy rzeki Ropotamo w Bulgarii. Przegląd zoologiczny 23 (3): 371–385.

Belcheva R., Bisserkov V., Ilieva H. & Beshkov V. 1992. Karyological studies on four species of turtles (Chelonia, Reptilia). Annuaire de l'Universite de Sofia "Kliment Ohridski" Faculte de biologie, Livre 1 - Zoologie 80: 212–219.

Beshkov V. & Nanev K. 2002. Amphibians and Reptiles in Bulgaria. Sofia-Moscow: Pensoft. 120 p. (in Bulgarian and in English)

Beshkov V. 1984. The effect of the Balkan range on the distribution of the herpetofauna in Bulgaria. Acta Zoologica Bulgarica 25: 9–15. (in Bulgarian)

Beshkov V. 1985. Amphibians (Amphibia). Reptiles (Reptilia). In: Botev B. & Peshev T. (Eds.): Red data book of the People's Republic of Bulgaria. Vol. 2. Animals. Sofia: BAS, pp. 32–41. (in Bulgarian)

Beškov V. & Beron P. 1964. Catalogue et bibliographie des Amphibians et des Reptilies en Bulgarie. Sofia: ABS. 39 p.

Beškov V. 1987. Number of the Stripe-necked Terrapin (*Mauremys caspica rivulata* (Valenciennes)) in Bulgaria. Ecology, Sofia 20: 58–64. (in Bulgarian)

Buresch I. & Zonkow J. 1933. Untersuchungen über die Verbreitung der Reptilien und Amphibien in Bulgarien und auf der Balkanhalbinsel. 1. Schildkrötten (Testudinata) und Eidechsen (Sauria). Mitteilungen aus den Königlichen Naturwissenschaftlichen Instituten in Sofia 6: 150–207. (in Bulgarian)

Dormann C. F., Elith J., Bacher S., Buchmann C., Carl G., Carré G., Marquéz J. R. G., Gruber B., Lafourcade B., Leitão P. J., Münkemüller T., McClean C., Osborne P. E., Reineking B., Schröder B., Skidmore A. K., Zurell D. & Lautenbach S. 2013. Collinearity: a review of methods to deal with it and a simulation study evaluating their performance. Ecography 36 (1): 27–46. DOI: 10.1111/j.1600-0587.2012.07348.x.

Fick S. E. & Hijmans R. J. 2017. Worldclim 2: New 1-km spatial resolution climate surfaces for global land areas. International Journal of Climatology. DOI:10.1002/joc.5086.

Fourcade Y., Engler J. O., Rödder D. & Secondi J. 2014. Mapping species distributions with MAXENT using a geographically biased sample of presence data: a performance assessment of methods for correcting sampling bias. PLoS ONE 9 (5): e97122. DOI: 10.1371/journal.pone.0097122.

Hristovich G. 1892. Materials for studying the Bulgarian fauna. Sbornik za Narodni Umotvoreniya, Nauka i Knizhnina 7: 413–428. (in Bulgarian)

JICA 2008. Results from the project "The study on integrated water management in the Republic of Bulgaria)". Japan International Cooperation Agency (JICA) & Ministry of Environment and Water, Bulgaria.

Liu C., Berry P. M., Dawson T. P. & Pearson R. G. 2005. Selecting thresholds of occurrence in the prediction of species distributions. Ecography 28: 385–393. DOI: 10.1111/j.0906-7590.2005.03957.x

Liu C., Newell G. & White M. 2016. On the selection of thresholds for predicting species occurrence with presence-only data. Ecology and Evolution 6 (1): 337–348. DOI: 10.1002/ece3.1878.

Merow C., Smith M. J. & Silander J. A. 2013. A practical guide to MaxEnt for modeling species' distributions: what it does, and why inputs and settings matter. Ecography 36 (10): 1058–1069. DOI: 10.1111/j.1600-0587.2013.07872.x.

Mollov I., Naumov B., Dobrev D. & Popgeorgiev G. S. 2013. Conservation activities for European Pond Turtles (*Emys orbicularis*) in Bulgaria. Herpetology Notes 6: 135–138.

Nikolov S. C., Kornilev Y. V., Popgeorgiev G. S., Stoychev S. & Georgiev B. 2014. Challenges for habitat and species conservation in the Natura 2000 network, Bulgaria: an overview from two special protection areas. Acta Zoologica Bulgarica, Suppl. 5: 3–8.

Pasteur G. & Bons J. 1960. Catalogue des reptiles actuels du Maroc. Révision de formes d'Afrique, d'Europe et d'Asie. Travaux de l'Institut Scientifique Chérifien. Série Zoologie. 132 p.

Petrov B. 2007a. European Pond Terrapin *Emys orbicularis* (Linnaeus, 1758). In: Biserkov V. (Ed.): A field guide to amphibians and reptiles of Bulgaria. Sofia: Green Balkans, pp. 69–71.

Petrov B. 2007b. Balkan Terrapin *Mauremys rivulata* (Valenciennes, 1833). In: Biserkov V. (Ed.): A field guide to amphibians and reptiles of Bulgaria. Sofia: Green Balkans, pp. 73–74. (in Bulgarian)

Petrov B., Stoev P. & Beshkov V. 2001. A review on the species composition and distribution of the amphibians (Amphibia) and reptiles (Reptilia) in the Eastern Rhodopes Mountain, Bulgaria. Historia Naturalis Bulgarica 13: 127–153. (in Bulgarian)

Phillips S. J., Dudík M. & Schapire R. E. 2017. Maxent software for modeling species niches and distributions (Version 3.4.1). Available from http://biodiversityinformatics.amnh.org/open_source/maxent/ (accessed on 2/08/2017).

Popgeorgiev G. S., Tzankov N., Kornilev Y. V., Naumov B. & Stoyanov A. 2014a. Amphibians and reptiles in Ponor Special Protection Area (Natura 2000), western Bulgaria: species diversity, distribution and conservation. Acta Zoologica Bulgarica, Suppl. 5: 85–96.

Popgeorgiev G. S., Tzankov N., Kornilev Y. V., Plachyiski D., Naumov B. & Stoyanov A. 2014b. Changes in agri-environmental practices pose a threat to the herpetofauna: a case study from Besaparski Ridove Special Protection Area (Natura 2000), southern Bulgaria. Acta Zoologica Bulgarica, Suppl. 5: 157–169.

Popgeorgiev G., Kornilev Y. V., Natchev N., Naumov B., Ivanchev I., Slavchev M., Stoyanov A. & Tzankov N. 2017. Spatial distribution of *Emys orbicularis* and *Mauremys rivulata* in the lower Veleka River, Bulgaria: first observations.Acta Zoologica Bulgarica, Suppl. 10: 129-132

Popgeorgiev G., Spasov S. & Kornilev Y. V. 2015. SmartBirds – Information system with biological information, BSPB. Available at http://www.smartbirds.org

Schoener T. W. 1968. Anolis lizards of Bimini: resource partitioning in a complex fauna. Ecology 49: 704–726.

Stojanov A. 2015. Balkan Terrapin *Mauremys rivulata* (Valenciennes, 1833). In: Golemansky V., Stoev P., Dobrev D., Beron P., Zhivkov M., Popov A., Popov V., Beschkov V., Deltshev C., Michev T. & Spassov N. (Eds.): Red Data Book of the Republic of Bulgaria. Volume 2. Animals. Sofia: BAS & MoEW, pp. 295.

Stojanov A., Tzankov N. & Naumov B. 2011. Die Amphibien und Reptilien Bulgariens. Frankfurt am Main: Chimaira. 588 p.

Stoyneva M. P. & Michev T. M. 2007. Database of Bulgarian non-lotic wetlands and their biodiversity. In: Michev T. M. & Stoyneva M. P. (Eds.): Inventory of Bulgarian wetlands and their biodiversity. Part 1: non-lotic wetlands. Sofia: Svetlostrouy, pp. 211–214.

Trabucco A. & Zomer R. J. 2009. Global Aridity Index (Global-Aridity) and Global Potential Evapo-Transpiration (Global-PET) geospatial database. CGIAR Consortium for Spatial Information. Available at: http://www.cgiar-csi.org/data/global-aridity-and-pet-database

Tzankov N., Popgeorgiev G., Kornilev Y., Natchev N., Stoyanov A., Naumov B. & Ivanchev I. 2015. First survey on the invasive Pond Slider (*Trachemys scripta*) in Bulgaria: historic development and current situation. Hyla 2015 (1): 18–27.

Tzankov N., Popgeorgiev G., Naumov B., Stoyanov A., Kornilev Y. V., Petrov B., Dyugmedzhiev A., Vergilov V., Draganova R., Lukanov S. & Westerström A. 2014. Identification guide to the amphibians and reptiles of Vitosha Nature Park. Sofia: Directorate of Vitosha Nature Park. 248 p. (in Bulgarian)

Valakos E. D., Pafilis P., Sotiropoulos K., Lymberakis P., Maragou P. & Foufopoulos J. 2008. The amphibians and reptiles of Greece. Frankfurt am Main: Edition Chimaira. 463 p.

Velo-Antón G., el Marnisi B., Fritz U. & Fahd S. 2015. Distribution and conservation status of *Emys orbicularis* in Morocco. Vertebrate Zoology 65 (1): 131–135.

Warren D. L. & Seifert S. N. 2011. Ecological niche modeling in Maxent: the importance of model complexity and the performance of model selection criteria. Ecological Applications 21 (2): 335–342.

Warren D. L., Glor R. E. & Turelli M. 2008. Environmental niche equivalency versus conservatism: quantitative approaches to niche evolution. Evolution 62: 2868–2883.

Warren D. L., Glor R. E. & Turelli M. 2010. ENMTools: a toolbox for comparative studies of environmental niche models. Ecography 33: 607–611.

Appendices (electronic version only)

A1: Descriptive statistics for variables obtained (after systematic sampling) from presence records of *Emys orbicularis* (N = 700) and *Mauremys rivulata* (N = 59) in Bulgaria and GIS layers.

A2: Published localities for *Emys orbicularis* and *Mauremys rivulata* in Bulgaria, 10×10 km MGRS grid (Military Grid Reference System, UTM zone 35N, datum WGS 1984). Cell names and the X, Y coordinates of the centroids are provided.

A3: Previously unpublished distribution data for *Emys orbicularis* and *Mauremys rivulata*, based on the 1×1 km MGRS grid (Military Grid Reference System, UTM zone 35N, datum WGS 1984). Cell names and the X, Y coordinates of the centroids are provided.

Appendix 1. Descriptive statistics for variables obtained (after systematic sampling) from presence records of *Emys orbicularis* (n = 700) and *Mauremys rivulata* (n = 59) in Bulgaria and GIS layers. CI = Confidence interval; SD = Standard deviation T = temperature; P = precipitation; M = month; Q = quarter

	Emys orbicularis				***Mauremys rivulata***			
Variable	**Mean**	**95% CI**	**Min–Max**	**SD**	**Mean**	**95% CI**	**Min–Max**	**SD**
Aspect	152.3	144.2–160.4	-1.0–357.0	108.8	155.2	127.3–183.1	-1.0–356.8	106.9
Elevation	163.7	150.9–176.4	-2.0–1,102.0	171.6	145.1	115.3–175.0	2.0–481.0	114.7
Solar Radiation, Yearly	164,672.9	164,195.7–165,150.2	152,276.0–177,794.0	6,398.8	173,515.7	172,663.2–174,368.2	165,642.0–178,105.0	3,271.4
Global Aridity Index	5,835.7	5,798.4–5,873.1	4,161.0–7,705.0	503.1	5,627.5	5,452.4–5,802.6	4,158.0–6,450.0	671.9
Pot. Evapotranspiration	995.5	991.5–999.4	814.0–1,126.0	53.0	1,039.4	1,025.0–1,053.8	957.0–1,127.0	55.3
Slope	2.8	2.6–3.1	0.0–20.9	3.2	4.1	3.1–5.1	0.0–15.6	3.8
Min Distance to Water	62.9	54.2–71.6	0.0–1,319.4	117.3	38.0	26.5–49.6	0.0–200.0	44.5
BIO*x*								
1: Annual Mean T	12.0	11.9–12.1	7.2–13.7	0.9	12.8	12.7–13.0	11.6–13.7	0.5
2: Mean Diurnal Range	10.6	10.5–10.7	6.7–12.3	1.2	10.3	9.9–10.7	7.8–12.2	1.4
3: Isothermality	32.3	32.2–32.5	24.6–36.9	2.2	33.0	32.6–33.4	30.2–34.7	1.4
4: T Seasonality	808.7	804.5–812.8	677.7–916.0	55.4	760.9	747.7–774.0	677.3–845.4	50.5
5: Max T, Warmest M	27.2	27.1–27.3	20.6–29.9	1.3	27.6	27.3–27.8	26.3–30.0	1.0
6: Min T, Coldest M	-5.4	-5.6–-5.3	-8.9–0.7	2.1	-3.5	-4.2–-2.9	-5.7–0.7	2.4
7: T Annual Range	32.6	32.5–32.8	25.6–36.6	2.5	31.1	30.3–31.9	25.7–35.4	3.2
8: Mean T, Wettest Q	14.4	14.0–14.8	3.6–21.4	5.3	8.9	8.5–9.2	6.9–17.6	1.5
9: Mean T, Driest Q	13.4	12.7–14.1	-1.2–23.2	9.3	21.7	21.5–21.9	20.4–23.2	0.7
10: Mean T, Warmest Q	21.9	21.8–22.0	15.6–24.0	1.1	22.3	22.1–22.5	21.1–24.0	0.7
11: Mean T, Coldest Q	2.0	1.9–2.1	-1.2–5.5	1.4	3.7	3.4–3.9	2.0–5.5	1.1
12: Annual P	561.1	558.6–563.6	458.1–670.9	33.4	566.1	553.8–578.4	458.1–624.5	47.1
13: P, Wettest M	65.0	64.6–65.4	51.8–84.3	5.6	67.7	65.7–69.7	50.5–78.8	7.8
14: P, Driest M	32.6	32.4–32.9	22.2–41.0	3.3	28.2	27.4–29.0	21.9–34.0	3.0
15: P Seasonality	21.8	21.5–22.0	12.7–33.9	3.5	25.5	24.2–26.7	18.5–34.5	4.8
16: P, Wettest Q	179.2	177.9–180.5	135.0–234.2	17.1	183.4	177.6–189.2	138.4–207.8	22.1
17: P, Driest Q	106.0	105.3–106.7	78.6–131.9	9.2	93.9	92.0–95.7	77.8–108.1	7.2
18: P, Warmest Q	140.1	138.0–142.1	89.5–208.2	27.6	105.5	102.9–108.0	87.8–124.8	9.7
19: P, Coldest Q	131.6	130.0–133.2	88.6–202.6	21.5	158.5	152.3–164.7	108.0–189.8	23.8

Cite: Kornilev Y., Popgeorgiev G., Naumov B., Stoyanov A. & Tzankov N. 2017. Updated distribution and ecological requirements of the native freshwater turtles in Bulgaria. Acta Zoologica Bulgarica, Supplement 10: 65-76 + i-xvii.

Appendix 2. Published localities for *Emys orbicularis* and *Mauremys rivulata* in Bulgaria, 10×10 km MGRS grid (Military Grid Reference System, UTM zone 35N, datum WGS 1984). Cell names and the X, Y coordinates of the centroids are provided.

Cite: Kornilev Y., Popgeorgiev G., Naumov B., Stoyanov A. & Tzankov N. 2017. Updated distribution and ecological requirements of the native freshwater turtles in Bulgaria. Acta Zoologica Bulgarica Supplement 10: 65-76 + i-xvii.

To minimize the text length, the original descriptions were usually shortened while allowing their identification within the original publications. Settlements (cities, villages, etc.) are provided only as given names; for all other geographic or other objects after the given name (rarely before) we provide a description, e.g. river, reservoir, swamplet, reserve, etc.; geographic directions are shortened, e.g. NE = Northeast.

Emys orbicularis

FL88: Strumeshnitsa river near Petrich (Buresch & Zonkow 1933), Ivanik place and Kantona place (Katalan-Gateva & Dimitrov 1961); **FL89**: Ormana islet (Katalan-Gateva & Dimitrov 1961, Beškov 1987), the fishponds near Damyanitsa (Geissler & Brühl 1980), fishponds along the Struma river, the pits near the Kozhuha hill and the main drainage canal (Beškov 1987), IBW 5742 (Stoyneva & Michev 2007), Rupite (Stojanov et al. 2011); **FL98**: the thermal springs near Marikostinovo (Beškov 1987), IBW 0970 (Stoyneva & Michev 2007); **FL99**: Levunovo (Obst & Geissler 1982, Tzankov & Stojanov 2009), a fishpond near Kapatovo, pits near Novo Konomladi, the rivulet near Levunovo (Beškov 1987); **FM54**: Obel (Pulev & Sakelarieva 2011); **FM65**: Stoikovtsi reservoir, Zelen dol (Pulev & Sakelarieva 2011); **FM67**: IBW 5720 (Stoyneva & Michev 2007); **FM72**: the exit of the Kresna gorge (Petrov & Beshkov 2001); **FM73**: the entrance of the Kresna gorge (Petrov & Beshkov 2001); **FM74**: a reservoir on the right bank of the Struma river opposite the Blagoevgrad, SW of Blagoevgrad, the fishponds near Strumsko (Pulev & Sakelarieva 2011); **FM75**: Blagoevgradska Bistritsa river by the E79 road, NE of Riltsi, Pokrovnik (Pulev & Sakelarieva 2011), Blagoevgrad - city surroundings, sparsely populated and built up areas, the Loven dom Park and the Zoo (Pulev & Sakelarieva 2013); **FM76**: zone 1 (Peshev et al. 2005), N42º7'56" E23º9'15.5" (Tzankov et al. 2011); **FM80**: swamplets near Sandanski (Beškov 1987); **FM86**: the fishponds near Eleshnitsa hut, Zhabokrek place (Peshev et al. 2005), N42º7'0.7" E23º17'46.7", N42º7'23.5" E23º12'35.9" (Tzankov et al. 2011); **FN71**: FN7177, FN7185, FN7195 (Tzankov et al. 2014); **FN72**: IBW 0915 (Stoyneva & Michev 2007); **FN74**: Vreloto spring (Hristovich 1892), Reka Blato river near Sofia (Beshkov 1955); **FN82**: the swamplets near Pavlovo (Buresch & Zonkow 1933), Boyansko Blato swamplet (Beshkov 1955), Dolno Boyansko Blato swamplet (Kabisch 1966), IBW 5281 (Stoyneva & Michev 2007), near Iglika hut (Tzankov et al. 2014); **FN91**: FN9148, near Pancharevo reservoir (Tzankov et al. 2014); **FN92**: Borisova Gradina park (Buresch & Zonkow 1933); **FN93**: Vrazhdebna (Buresch & Zonkow 1933); **FN94**: IBW 5301 (Stoyneva & Michev 2007); **FN97**: Opletnya (2,4 km W), Opletnya (surroundings) (Naumov et al. 2016); **FN98**: Gorno Ozirovo (1,0 km E), Gorno Ozirovo (1,4 km SE), Gorno Ozirovo (1,8 km NW) (Naumov et al. 2016); **FN99**: Botunya (1,7 km SE), Stoyanovo (0,6 km SE), Stoyanovo (1,4 km NE), Stoyanovo (1,5 km NE), Stoyanovo (2,0 km NE) (Naumov et al. 2016); **FP24**: Rabisha swamp (Angelov 1956); **FP75**: near Lom (Buresch & Zonkow 1933); **GL49**: NE of Beslen (Domozetski 2013); **GM36**: IBW 0675 (Stoyneva & Michev 2007); **GN01**: Lozenska Planina mts. (Beshkov 1955, Beshkov & Nanev 2002), IBW 0746, IBW 5663, IBW 5710 (Stoyneva & Michev 2007); **GN03**: Chelopechene (Beshkov 1955); **GP02**: between Gromshin and Mihaylovo (Naumov 2005); **KG55**: E of Velingrad (Petrov et al. 2006); **KG66**: Banyata spring, Kalimana spring (Hristovich 1892); **KG86**: IBW 5735 (Stoyneva & Michev 2007), KG86C2 (Popgeorgiev et al. 2010), KG86b1, KG86C1 (Popgeorgiev et al. 2010, 2014), KG86B2, KG86C5, KG86D5 (Popgeorgiev et al. 2014); **KG96**: Krichimskata Kuria place, Tekira springs (Buresch & Zonkow 1933), Trivoditsi (Baltova et al. 1997), KG96A5 (Popgeorgiev et al. 2014); **KH60**: Panagyurishte (Buresch & Zonkow 1933 after Kovachev 1910); **LG06**: Tsarskia Ostrov islet (Buresch & Zonkow 1933); **LG16**: Maritsa river near Plovdiv (Buresch & Zonkow 1933 after Kovachev 1910), Ostrova place (Anguélov 1960), the hydrological station at Maritsa river near Plovdiv (Russev 1966), LG1607, LG1608, LG1619, LG1629, LG1649 (Mollov & Velcheva 2010); **LG17**: Cyprinus Fish Farm at Plovdiv (Kirin 2001), LG1710, LG1720, LG1762, LG1783 (Mollov & Velcheva 2010); **LG36**: protected area "Martvitsata" (Vasileva 2005); **LG47**: IBW 1749 (Stoyneva & Michev 2007); **LG63**: Kolets (Popgeorgiev & Kornilev 2009); **LG82**: Balkan, Tsareva Polyana, Zhalti Bryag,

Zvinitsa (Kirin 2001); **LG89**: the park "Krayrechen" and a drainage canal in Stara Zagora (Georgiev 2004); **LG91**: at the fork to Lyaskovets (Petrov et al. 2001); **LH14**: Cherni Osam (Beshkov 1955); **LH61**: Tundzha river near Kazanlak (Buresch & Zonkow 1933 after Kovachev 1910); **LH97**: Yantra river near Lyaskovets (Buresch & Zonkow 1933 after Kovachev 1910); **LJ53**: Belene island (Undjian 2000), IBW 0156 (Stoyneva & Michev 2007); **LJ63**: Svishtov (Werner 1898, Bolkay 1924); **MF08**: Gugutka (Petrov et al. 2001); **MF18**: between Lensko and Zhelezari, between Meden Buk and Zhalti Chal (Petrov et al. 2001); **MF28**: N of Mandritsa, a tributary of Byala Reka river near Mandritsa (Beškov 1987), 1.5 km from the bridge over the Oreshinsko Dere rivulet (Petrov et al. 2001); **MF29**: Ivaylovgrad (Bachvarov 1969), E of Ivaylovgrad (Beškov 1987), Drabishna (Kirin 2001); **MF39**: Slaveevo (Petrov et al. 2001); **MG01**: at the fork to Gorno Pole (Petrov et al. 2001); **MG03**: Ostar Kamak (Stojanov et al. 2011); **MG10**: 1.5 km W of Senoklas (Petrov 2004); **MG11**: between Borislavtsi and Malki Voden, N of Dabovets (Petrov et al. 2001); **MG12**: Malko Gradishte (Petrov et al. 2001); **MG13**: Biser (Kirin 2001); **MG22**: above Mezek (Petrov 2004); **MG30**: IBW 5733 (Stoyneva & Michev 2007); **MG32**: Maritsa river near Svilengrad (Buresch & Zonkow 1933), Karchovia Sazlak swamplet (Beškov 1987), Ururdere rivulet (Petrov et al. 2001), Svilengrad (Ayaz et al. 2007), IBW 5739, IBW 5741 (Stoyneva & Michev 2007); **MG35**: microreservoirs in the tributaries of Sokolitsa river (Chlebicki 1985); **MG42**: Toprakdere coomb - the small reservoir and a dam 0.3 km below the reservoir (Beškov 1987), IBW 2332 (Stoyneva & Michev 2007); **MG45**: Kara-Bair place (Buresch & Zonkow 1933), Topolovgrad (Ayaz et al. 2007); **MG57**: Drama (Peshev & Mitev 1987); **MG74**: between Golyam Dervent and Lesovo (Stoev 2000); **MH25**: Konstantin (Buresch & Zonkow 1933); **MH54**: Glogova Reka river near Kotel (Buresch & Zonkow 1933); **MH60**: Azmak-dere river near Yambol (Buresch & Zonkow 1933); **MH86**: Ticha reservoir (Beshkov 1994); **MH87**: Preslav (Stojanov et al. 2011); **MH99**: 2 km E of Shumen (Beshkov 1994); **MJ15**: Lom river at Ruse (Buresch & Zonkow 1933 after Kovachev 1910), Danube river at Ruse (Buresch & Zonkow 1933 after Kovachev 1910, Undjian 2000), Ruse port (Undjian 2000); **MJ25**: the marsh places near Obraztsov Chiflik (Kovachev 1894), Ruse - Batmishka Dolina coomb (Kovachev 1905), the fishpond near Obraztsov Chiflik (Kovachev 1912); **MJ33**: 4 km E of Pisanets (Mičev 1968); **MJ42**: between Tzar Kaloyanovo and Osenovo (Undjian 2000); **MJ43**: Beli Lom reserve (Boev & Pchelarov 1982); **MJ57**: IBW 9000 (Stoyneva & Michev 2007); **MJ73**: Mahzar-Pasha-Teke place (Buresch & Zonkow 1933); **MJ82**: Yasenkovo (Beshkov 1994); **MJ88**: IBW 0175 (Stoyneva & Michev 2007); **MJ92**: Venets (Beshkov 1994); **NG39**: near the oil refinery in Burgas (Tzankov & Stojanov 2009); **NG44**: NW of Malko Tarnovo (Boev et al. 2008); **NG49**: the mouth of the river near Kraymorie (Nöllert et al. 1986), Kraymorie (Schlüter 2005); **NG55**: Veleka river near Gramatikovo (Buresch & Zonkow 1933); **NG58**: a pit near Arkutino swamp (Beshkov 1955), Ropotamo river (Bartosik 1981), Arkutino swamp (Nöllert et al. 1986, Thieme 1986, Schlüter 2005), Alepu swamp (Thieme 1986, Schlüter 2005, Stojanov et al. 2011), IBW 0187 (Stoyneva & Michev 2007), Velyov Vir reserve (Tzankov & Stojanov 2009); **NG59**: Sozopol (Buresch & Zonkow 1933, Lenk et al. 1998, Ayaz et al. 2007), IBW 0177 (Stoyneva & Michev 2007); **NG65**: Veleka river near Kosti and Vurgari (Buresch & Zonkow 1933); **NG67**: Primorsko (Ayaz et al. 2007), IBW 3137, IBW 9771 (Stoyneva & Michev 2007); **NG68**: Ropotamo river (Beshkov 1955, Bartosik 1981, Thieme 1986, Ayaz et al. 2007), IBW 0186, IBW 5683 (Stoyneva & Michev 2007); **NG75**: Veleka river - 1-4 km before the mouth (Beškov 1987), Veleka river (Schlüter 2005, Rudloff 2007); **NG76**: Vasiliko (Tsarevo) (Buresch & Zonkow 1933, Kirin 2001), Ahtopol (Thieme 1986, Ayaz et al. 2007), the rivulet N of Ahtopol (Beškov 1987); **NG84**: the lower reaches of the Rezovska Reka river (Buresch & Zonkow 1933); **NG85**: Sinemorets (Gvoždík & Šnajdr 2001), IBW 0188, IBW 0925, IBW 9772, IBW 9773 (Stoyneva & Michev 2007), the lower reaches of the Veleka river (Tzankov et al. 2015a); **NH06**: between Kalnovo and Yankovo (Beshkov 1994); **NH18**: Markovo (Beshkov 1994); **NH20**: IBW 0191 (Stoyneva & Michev 2007); **NH30**: Burgas (Buresch & Zonkow 1933), IBW 0193 (Stoyneva & Michev 2007); **NH48**: Devnensko Ezero lake (Kovachev 1912); **NH51**: Pomoriysko Ezero lake (Todorov 2010); **NH52**: Nesebar (Lenk et al. 1998); **NH58**: Gebedzhensko Ezero lake (Buresch & Zonkow 1933 after Kovachev 1910); **NH73**: the swamplet near Irakli (Lepşi 1927); **NH76**: Kamchia river (Schlüter 2005), IBW 0985 (Stoyneva & Michev 2007); **NH78**: Varna (Buresch & Zonkow 1933, Ayaz et al. 2007), NH78d (Tzankov et al. 2009); **NH79**: IBW 5737 (Stoyneva & Michev 2007); **NH88**: botanical garden "Varna" (Delov et al. 2005), NH88c (Tzankov et al. 2009); **NH89**: the swamplet along Batova Reka river (Lepşi 1927), Zlatni Pyasatsi (Lindfors 1971), nature park "Zlatni Pyasatsi" (Trayanov & Filipova 2005), Uzun Kum place (Ayaz et al. 2007), NH89d (Tzankov et al. 2009); **NJ08**: Srebarna reserve (Paspaleva-Antonova 1961), Srebarna lake (Undjian 2000), IBW 0208 (Stoyneva & Michev 2007), Srebarna lake (9 points/locations in the given map) (Biserkov & Naumov 2012),

the W shore of the Srebarna lake (Mollov et al. 2013); **NJ17**: IBW 3074 (Stoyneva & Michev 2007); **NJ28**: Volna (Călinescu 1931); **NJ80**: Albena (Ayaz et al. 2007), IBW 0225 (Stoyneva & Michev 2007), NJ80b (Tzankov et al. 2009); **NJ90**: Balchik (Kabisch & Engelhard 1964); **PJ00**: the rivulet near Kavarna and the rivulet near Mihalbey (Lepşi 1927); **PJ10**: Bolata place (Lepşi 1927), PJ10b, PJ10d (Tzankov et al. 2009); **PJ22**: the swamps near Shabla (Buresch & Zonkow 1933 after Kovachev 1910), Shabla lake (Schlüter 2005), IBW 0219 (Stoyneva & Michev 2007), PJ22b, PJ22b (Tzankov et al. 2009); **PJ23**: the swamps near Durankulak (Buresch & Zonkow 1933 after Kovachev 1910), Durankulak (Băcesco 1934), IBW 0216 (Stoyneva & Michev 2007), PJ23d (Tzankov et al. 2009).

Unmapped localities: Plovdiv district (Shkorpil 1897); Rezovska Reka river (Buresch & Zonkow 1933); Michurin district (Beshkov 1955); Iskar river, Lom river, Ogosta river, Osam river, Rusenski Lom river, Skomlia river, Yantra river (Karapetkova 1994); Tundzha river (Stoev 2000); Dyavolska Reka river (Kirin 2001); Karazite/Primorsko (Ayaz et al. 2007); 25 km from Plovdiv (Dietrich 2008); Sofia (Tzankov et al. 2015b).

Mauremys rivulata

FL88: Strumeshnitsa River near Petrich (Buresch & Zonkow 1933), Ivanik place and Kantona place (Katalan-Gateva & Dimitrov 1961), Petrich (Beshkov 1981), a puddle at the Strumeshnitsa river W of the bridge near Petrich (Beškov 1987); **FL89**: Ormana islet (Katalan-Gateva & Dimitrov 1961, Beškov 1987), the fishponds near Damyanitsa (Geissler & Brühl 1980), Starchevo (Beshkov 1981, 1985), fishponds along the Struma river, the drainage canals near the thermal springs of Rupite, the fishpond near Lebnitsa, the pits near the Kozhuha hill and the main drainage canal (Beškov 1987), IBW 5742 (Stoyneva & Michev 2007); **FL98**: Marikostinovo (Beshkov 1981, 1985, Fritz & Wischuf 1997), the thermal springs near Marikostinovo (Beškov 1987), IBW 0970 (Stoyneva & Michev 2007); **FL99**: near Malkia Kozhuh hill (Buresch & Zonkow 1933), Levunovo (Beshkov 1981), a fishpond near Kapatovo, pits near Novo Konomladi, the rivulet near Levunovo (Beškov 1987), a fishpond near Levunovo (Beshkov 1993); **FM80**: Swamplets near Sandanski (Beškov 1987); **LG74**: Klokotnitsa motel (Petrov et al. 2001); **MF08**: Vis (Petrov 2004); **MF18**: between Meden Buk and Zhalti Chal (Petrov et al. 2001), Meden Buk (Stojanov et al. 2011), protected area "Meandrite Na Byala Reka" (Stoychev & Petrova 2003); **MF28**: Mandritsa (Beshkov 1985), N of Mandritsa, Oreshinsko Dere rivulet - 2 km before the mouth, and a tributary of Byala Reka river near Mandritsa (Beškov 1987), Odrintsi - Oreshinska Reka rivulet, Oreshinsko Dere rivulet (Petrov et al. 2001); **MF29**: Ivaylovgrad (Bachvarov 1969), E of Ivaylovgrad (Beškov 1987); **MF39**: Slaveevo (Beshkov 1993, Petrov et al. 2001); **MG04**: SW of Harmanli (Obst 1973); **MG11**: N of Dabovets (Petrov et al. 2001); **MG12**: Malko Gradishte (Petrov et al. 2001); **MG22**: above Mezek (Petrov 2004); **MG30**: IBW 5733 (Stoyneva & Michev 2007); **MG32**: the swamplets near Svilengrad (Buresch & Zonkow 1933), Ururdere rivulet (Beshkov 1985, Beškov 1987, Petrov et al. 2001), Karchovia Sazlak swamplet (Beshkov 1985, 1987), 1 km from the Karchovia Sazlak swamplet (Beshkov 1993), IBW 5739 and IBW 5741 (Stoyneva & Michev 2007); **MG35**: 3 km of Hlyabovo (Chlebicki 1985); **MG35**: a microreservoir 0.2 km of Sokolitsa river (Chlebicki 1985); **MG42**: the microreservoir in Toprakdere river (Beshkov 1985), Toprakdere coomb - the small reservoir and a dam 0.3 km below the reservoir (Beškov 1987), IBW 2332 (Stoyneva & Michev 2007); **MG53**: Sladunska Reka river (Stoychev & Petrova 2003); **MG57**: Drama (Peshev & Mitev 1987); **MG64**: a small tributary of Tundzha river (Stoev 2000); **NG08**: Sredets (Beshkov & Nanev 2002); **NG68**: The road near Arkutino swamp (Bartosik 1981); **NG75**: Veleka river - 1-4 km before the mouth (Beškov 1987), Veleka river (Schlüter 2005; Rudloff 2007); **NG76**: Ahtopol (Beshkov 1985; Thieme 1986; Fritz & Wischuf 1997; Rudloff 2007), the rivulet N of Ahtopol, the mouth of a rivulet 4 km NW of Ahtopol (Beškov 1987), natural monument "Nakovo Kladenche" (Kamburov 2009); **NG84**: the lower reaches of the Rezovska Reka river (Buresch & Zonkow 1933), Rezovska Reka river (Schlüter 2005); **NG85**: IBW 0188, IBW 0925, IBW 9772, IBW 9773 (Stoyneva & Michev 2007), the lower reaches of the Veleka river (Tzankov et al. 2015a).

Unmapped localities: Kurgali (Belcheva et al. 1992).

Bibliography

Angelov, A. 1956. Hydrologische und hydrobiologische Untersuchungen über den Rabischa-See. – Annuaire de l'Université de Sofia, Faculté de Biologie, Géologie et Géographie, 49(1): 1-30. (In Bulgarian, German summary)

Anguélov, P. 1960. Études sur l'entomofaune du parc "Delassement et culture" (l'île au milieu de Maritza) près de Plovdiv, avec quelques notes faunologiques. – Annuaire des Musées de Plovdiv 3: 7-40. (In Bulgarian, French summary)

Ayaz, D., W. Fritz, M. Atatür. 2007. Morphological comparison of *Emys orbicularis* (Linnaeus, 1758) from European Turkey and eastern Bulgaria (Testudines: Emydidae). – Herpetozoa, 20 (1/2): 11-20.

Băcesco, M. 1934. Contribution á la faune des Reptiles de Dobrodgea. – Annales scientifiques de l'Université de Jassy, 19 (1-4): 317-330.

Bachvarov, G. 1969. On the Trematodofauna of some Reptiles in Bulgaria. – Bulletin of the Central Helminthological Laboratory, 13: 191-196. (In Bulgarian, English summary)

Baltova, S., A. Tachev, V. Alexandrov. 1997. Dynamics of serum amylase activity and isoenzyme specter in blood of terrapins. – Université de Plovdiv "P. Hilendarski" Travaux Scientifiques, 33(6): 79-84. (In Bulgarian, English summary)

Bartosik, M. 1981. Gady okolicy rzeki Ropotamo w Bulgarii. – Przegląd Zoologiczny, 23(3): 371-385. (In Polish)

Belcheva, R., V. Biserkov, H. Ilieva, V. Beshkov. 1992. Karyological studies on four species of turtles (Chelonia, Reptilia). – Annuaire de l'Universite de Sofia "Kliment Ohridski" Faculte de biologie, Livre 1 - Zoologie, 80: 212-219.

Beshkov, V. 1955. European pond turtle (*Emys orbicularis*). – Priroda i znanie, 8(5): 8-10. (In Bulgarian)

Beshkov, V. 1981. Distribution, relative numbers and the problems of protecting the rare and threatened by extinction amphibian and reptile species in the country of Blagoevgrad. – In: "Regional symposium at project 8 - MAB-UNESCO, 20-24.10.1980, Blagoevgrad" Collection of reports, Sofia, BAS, pp. 507-515. (In Bulgarian, English summary)

Beshkov, V. 1985. Amphibia, Reptilia. – In: Botev, B., T. Peshev (Eds.): Red data book of the People's Republic of Bulgaria. Vol. 2. Animals. BAS, Sofia, pp. 32-41. (In Bulgarian)

Beshkov, V. 1993. Amphibia and Reptilia. – In: Sakalian, M. (Ed.): National strategy for conservation of biodiversity. Basic reports. Vol. 1, Sofia, pp. 567-584. (In Bulgarian)

Beshkov, V. 1994. Reptiles. – In: Beshkov, V. et al. (Eds.): Red data book of the Shumen region. Publ. house "Slavcho Nikolov i sie", Shumen, pp. 84-92. (In Bulgarian)

Beshkov, V., K. Nanev. 2002. Amphibians and Reptiles in Bulgaria. Pensoft, Sofia-Moscow, 120 pp. (In Bulgarian)

Beškov, V. 1987. Number of the stripe-necked terrapin (*Mauremys caspica rivulata* (Valenciennes)) in Bulgaria. – Ecology, Sofia, 20: 58-64. (In Bulgarian, English summary)

Biserkov, V., B. Naumov. 2012. Changes after 1948 in the habitats of amphibians and reptiles in the area of the Srebarna lake biosphere reserve. – In: Uzunov, Y., B. Georgiev, E. Varadinova, N. Ivanova, L. Pehlivanov, V. Vasilev (Eds.) Ecosystems of the Biosphere Reserve Srebarna Lake. Sofia, Professor Marin Drinov Academic Publishing House, pp. 163-183.

Boev, Z., B. Georgiev, R. Raychev, U. Georgieva. 2008. The wetland zone of Malkotarnovska River near the town of Malko Tarnovo (Burgas District, SE Bulgaria) - an example of rich biodiversity (Vertebrate fauna) under intensive anthropogenic impact. – In: Seventh International Symposium "Ecology - Sustainable Development". Proceedings. Vratsa, Union of Scientists in Bulgaria, pp. 66-72. (In Bulgarian, English summary)

Boev, Z., G. Pchelarov. 1982. The nature reserve "Beli Lom". – Priroda, 1982, vol. 5: 65-69. (In Bulgarian)

Bolkay, S. 1924. A List of the Amphibians and Reptiles in the Bosnian-Hercegovian Land-Museum, with morphological, biological and zoogeographical Notes. – Spomenik srpske kralyevske akademiye, 61(1): 1-37. (In Serbian, English summary)

Buresch, I., J. Zonkow. 1933. Untersuchungen über die Verbreitung der Reptilien und Amphibien in Bulgarien und auf der Balkanhalbinsel. 1. Schildkrötten (Testudinata) und Eidechsen (Sauria). – Mitteilungen aus den Königlichen Naturwissenschaftlichen Instituten in Sofia, 6: 150-207. (In Bulgarian, German summary)

Călinescu, R. 1931. Cotribuţini sistematice şi zoogeografice la studiul Amphibiilor şi Reptilelor din Romînia. – Acad. Rom., mem. Sect. Ştiinţ., seria 3, 7(7): 1-173.

Chlebicki, A. 1985. Notatki herpetologiczne z gór Sakar (Tracija). – Przeglad Zoologiczny, 29(2): 193-198.

Delov, V., D. Peshev, A. Vasilev. 2005. Species composition and tendencies in the distribution of the vertebrates in the region of the Botanical garden - Varna. – Annuaire de l'Universite de Sofia "St. Kliment Ohridski", 96, livre 4 - 10ème session scientifique, Sofia '03, partie 2: 191-196.

Dietrich, N. 2008. … und wieder mal am Goldstrand. – Elaphe, 16(2): 50-53.

Domozetski, L. 2013. New localities of Eastern Montpellier Snake – *Malpolon insignitus* (Geoffroy Saint-Hilaire, 1827) from Southwestern Bulgaria. - ZooNotes, 41: 1-4.

Fritz, U., T. Wischuf. 1997. Zur Systematik westasiatisch-südosteuropäischer Bachschildkröten (Gattung *Mauremys*) (Reptilia: Testudines: Bataguridae). – Zoologische Abhandlungen Staatliches Museums für Tierkunde Dresden, 49(2): 223-260.

Geissler, L., A. Brühl. 1980. Zur Herpetofauna Südwest-Bulgariens. Teil 1. – Aquarien-Terrarien, Leipzig, 27(5): 172-173.

Georgiev, D. 2004. Material on the diet of otter (*Lutra lutra* L., 1758) from Bulgaria – Université de Plovdiv "P. Hilendarski" Travaux Scientifiques, 40(6): 165-172. (In Bulgarian, English summary)

Gvoždík, V., R. Šnajdr. 2001. Herpetofauna a batrachofauna Bulharska (1). – Akvárium Terárium, 44(8): 72-77.

Hristovich, G. 1892. Materials for studying the Bulgarian fauna. – Sbornik za Narodni Umotvoreniya, Nauka i Knizhnina, 7: 413-428. (In Bulgarian)

Kabisch, K. 1966. Herpetologische Exkursionen in die Umgebung von Sofia. – Aquarien-Terrarien, 13(4): 131-135.

Kabisch, K., H. Engelhard. 1964. Beobachtungen an Reptilien in der Umgebung von Varna-Goldsand. – Aquarien-Terrarien, 11(6): 194-197.

Kamburov, I. 2009. The nature of park "Strandzha". Directorate of NP Strandzhda, Burgas, 44 pp. (In Bulgarian)

Karapetkova, M. 1994. Wirbeltiere. – In: Russev, B. (Ed.): Limnologie der Bulgarischen Donauzuflüsse. Verlag "Paper Tiger", Sofia, pp. 175-185. (In Bulgarian)

Katalan-Gateva, C., G. Dimitrov. 1961. Recherches sur les Némathelminthes infestant des Tortues de la Région de Petrič. – Bulletin of the Central helmintological laboratory, 6: 110-118. (In Bulgarian, French summary)

Kirin, D. 2001. New data on the helminth fauna of *Emys orbicularis* L. (1758) (Reptilia, Emydidae) in South Bulgaria. – Comptes rendus de l'Académie bulgare des Sciences, 54(2): 95-98.

Kovachev, V. 1894. Materials for studying the Bulgarian fauna. – Periodichesko spisanie na Balgarskoto knizhovno druzhestvo, 47(9): 742-749. (In Bulgarian)

Kovachev, V. 1905. A contribution to the study of amphibians and reptiles in Bulgaria. – Sbornik za Narodni Umotvoreniya, Nauka i Knizhnina, 21: 1-13. (In Bulgarian)

Kovachev, V. 1912. The Herpetofauna of Bulgaria. "H. G. Danov" Publ., Plovdiv, 90 pp. (In Bulgarian)

Lenk, P., U. Joher, U. Fritz, P. Heidrich, M. Wink. 1998. Phylogeographic patterns in the mitochondrial cytochrome b gene of the European pond turtle (*Emys orbicularis*): first results. – In: Fritz U. et al. (Eds.), Proceedings of the EMYS Symposium Dresden '96, Mertensiella, 10: 159-175.

Lepşi, J. 1927. Beiträge zur Reptilienfauna der südöstlichen Dobrudscha. – Verhandlungen und Mitteilungen des Siebenbürgischen Vereins für Naturwisseschaften zu Hermannstadt, 77, Jahrg. 1926/1927: 1-24.

Lindfors, P. 1971. Herpetologisk "utflykt" till Bulgarien. – Snoken 1(1): 23-24.

Mičev, T. 1968. Über die Verbreitung und die Nistbiologie des Schmutzgeiers (*Neophron percnopterus* L.) in Bulgarien. – Bulletin de L'Institut de Zoologie et Musée, Sofia, 27: 65-79. (In Bulgarian, German summary)

Mollov, I., I. Velcheva. 2010. Spatial Distribution and a Retrospective Analysis of the Herpetofauna in the City of Plovdiv, Bulgaria. – Ecologia Balkanica, 2: 25-38.

Mollov, I., K. Kirov, S. Petrova, D. Georgiev, I. Velcheva. 2013. Assessing the Influence of the Automobile Traffic on the Amphibians and Reptiles in the Buffer Zone of Biosphere Reserve "Srebarna" (NE Bulgaria). – Ecologia Balkanica, 5(2): 31-39.

Naumov, B. 2005. New Records of Some Herpetofauna Species in Bulgaria. – Acta zoologica bulgarica, 57(3): 391-396.

Naumov, B., N. Tzankov, K. Donchev, B. Petrov, A. Stojanov, G. Popgeorgiev, I. Mollov, V. Beshkov. 2016. The Herpetofauna (Amphibia and Reptilia) of Vrachanska Planina Mountains - Species Composition, Distribution and Conservation. – In: Bechev, D., D. Georgiev (Eds.): Faunistic diversity of Vrachanski Balkan Nature Park. ZooNotes, Suppl. 3: 231-257.

Nöllert, A., C.Nöllert, A. Ritter. 1986. Einige Beobachtungen zur Herpetofauna der bulgarischen Schwarzenmeerkuste und Sudwestbulgariens (Teil 2 - Die Reptilien). – Herpetofauna, 8, 44: 30-34.

Obst, F.J. 1973. Die Mittelmeer-Erdkrote, *Bufo bufo spinosus* Daudin, neu fur Bulgarien. – Zoologische Abhandlungen Staatliches Museum für Tierkunde in Dresden, 32(9): 149-163.

Obst, F.J., L. Geissler. 1982. *Triturus vulgaris graecus* (Wolterstorff, 1905) neu fur Bulgarien. – Faunistische Abhandlungen Staatliches Museum für Tierkunde in Dresden, 9(10): 117-119.

Paspaleva-Antonova, M. 1961. Beitrag zur Ornithofauna des Reservats "Srebarna" im Bezirk Silistra. – Bulletin de l'Institut de Zoologie et Musée, 10: 139-163. (In Bulgarian, German summary)

Peshev, D., D. Mitev. 1987. Species composition of amphibians, reptiles and mammals. – Université de Plovdiv "P. Hilendarski" Travaux Scientifiques, 25(6): 101-106. (In Bulgarian, English summary)

Peshev, D., V. Delov, N. Tzankov, A. Vasilev. 2005. Specific characteristic and distribution trends of the vertebrate fauna in the basin of Rilska river. – Annuaire de l'Universite de Sofia "St. Kliment Ohridski", 96, livre 4 - 10ème session scientifique, Sofia '03, partie 2: 177-189.

Petrov, B. 2004. The herpetofauna (Amphibia and Reptilia) of the Eastern Rhodopes (Bulgaria and Greece). – In: Beron, P., A. Popov (eds) Biodiversity of Bulgaria. 2. Biodiversity of Eastern Rhodopes (Bulgaria and Greece). Sofia, Pensoft & Nat. Mus. Natur. Hist: 863-879.

Petrov, B., N. Tzankov, H. Strijbosch, G. Popgeorgiev, V. Beshkov. 2006. The herpetofauna (Amphibia and Reptilia) of the Western Rhodopes mountain (Bulgaria and Greece). – In: Beron, P. (ed.) Biodiversity of Western Rhodopes (Bulgaria and Greece). Sofia, Pensoft: 863-912.

Petrov, B., P. Stoev, V. Beshkov. 2001. A review on the species composition and distribution of the amphibians (Amphibia) and reptiles (Reptilia) in the Eastern Rhodopes Mountain, Bulgaria. – Historia Naturalis Bulgarica, 13: 127-153. (In Bulgarian, English summary)

Petrov, B., V. Beshkov. 2001. Amphibians (Amphibia) and Reptiles (Reptilia) in the Kresna Gorge (SW Bulgaria). – In: Beron, P. (ed.): Biodiversity of Kresna Gorge (SW Bulgaria)., Sofia, BAS: 297-303. (In Bulgarian; English summary)

Popgeorgiev, G., N. Tzankov, Y. Kornilev, B. Naumov, A. Stojanov. 2010. Species diversity of amphibians and reptiles in the special protected area "Besaparski ridove", Southern Bulgaria. – Biotechnology & Biotechnological Equipment, 24, Suppl. 1: 661-666.

Popgeorgiev, G., N. Tzankov, Y. Kornilev, D. Plachiyski, B. Naumov, A. Stoyanov. 2014. Changes in Agri-environmental Practices Pose a Threat to the Herpetofauna: a Case Study from Besaparski Ridove Special Protection Area (Natura 2000), Southern Bulgaria. – Acta zoologica bulgarica, Suppl. 5: 157-169.

Popgeorgiev, G., Y. Kornilev. 2009. Effects of a High Intensity Fire on the Abundance and Diversity of Reptiles in the Eastern Rhodopes Mountains, Southeastern Bulgaria. – Ecologia Balkanica, 1: 41-50.

Pulev, A., L. Sakelarieva. 2011. Testudines and Sauria (Reptilia) in the Territory of the Blagoevgrad Municipality. – In: Proceedings of the Fourth International Scientific Conference - FMNS2011 8 - 11 June 2011 Faculty of Mathematics and Natural ScienceVol. 1, South-West University "Neofit Rilski", Blagoevgrad, pp: 609-617.

Pulev, A., L. Sakelarieva. 2013. Herpetofauna in the city of Blagoevgrad, south-western Bulgaria. – BioDiscovery, 7(3): 1-6.

Rudloff, H.-W. 2007. Beitrag zur Verbreitungsgrenze der Kaspischen Bachschildkröten *Mauremys rivulata* an der Schwarzmeerküste Bulgariens. – Elaphe, 15(4): 59-61.

Russev, B. 1966. Hydrobiologische Untersuchungen der Marica. I. – In: Die Fauna Thrakiens, Band III. BAW, Sofia, pp. 231-291. (In Bulgarian, German summary)

Schlüter, U. 2005. Die Herpetofauna der bulgarischen Schwarzmeerküste - Teil 1: Natrraum und Schildkröten. – Elaphe, 13(3): 48-56.

Shkorpil, H. 1897. On the flora of Plovdiv (geological and faunistic notes). Publishing house "Saglasie", Plovdiv, 23 pp. (In Bulgarian)

Stoev, P. 2000. On the distribution, biology and ecology of am-

phibians and reptiles in the Derventski Heights and the Sakar Mountain, South-East Bulgaria. – Historia naturalis bulgarica, 12: 59-69.

Stojanov, A., N. Tzankov, B. Naumov. 2011. Die Amphibien und Reptilien Bulgariens. Frankfurt am Main, Chimaira, 588 pp.

Stoychev, S., A. Petrova. 2003. Protected Areas in Eastern Rhodopes and Sakar Mountains. BSBP/BirdLife Bulgaria, Conservation Series, Book 7, 49 pp. (In Bulgarian)

Stoyneva, M., T. Michev. 2007. Database of Bulgarian non-lotic wetlands and their biodiversity. – In: Michev T. M. and M. P. Stoyneva (eds.) Inventory of Bulgarian Wetlands and their Biodiversity. Part 1: Non-Lotic Wetlands, Publ., House Svetlostrouy, Sofia, 364 pp. + CD supplement.

Thieme, U. 1986. Die Amphibien- und Reptilienfauna der südostbulgarischen Küste. Teil III Reptilien II. – Sauria, 8(1): 7-9.

Todorov, O. 2010. Herpetofauna in Pomorie lake area. – In: Radev, R. et al. (Eds.): Collection of reports to the integrated management plan for the protected area "Pomorie Lake" BG0000152 and Protected Area "Pomorie" BG0000620. Green Balkans, pp. 112-116. (In Bulgarian, English summary)

Trayanov, R., D. Filipova. 2005. Fauna of "Zlatni Pyasatsi" Natural Park (amphibians, reptiles and mammals). NUG & PP "Zlatni Pyasatsi", Varna, 11 pp. (In Bulgarian)

Tzankov, N., A. Grozdanov, D. Peshev, A. Vasilev. 2011. Vertical distribution of the amphibians and reptiles in Rilska river basin (Rila Mountains, Soutwest Bulgaria). – Annuaire de l'Université de Sofia "St. Kliment Ohridski", Faculte de Biologie, Livre 1 - Zoologie, Tome 99: 103-110.

Tzankov, N., A. Stojanov. 2009. The European pond turtle in Bulgaria. – In: Rogner, M. (ed.) European pond turtle *Emys orbicularis*. Chimaira, Franfurt am Main, pp. 216-218.

Tzankov, N., B. Naumov, A. Grozdanov, D. Peshev, A. Vasilev. 2009. The herpetofauna of northern Black sea coast. – Biotechnology & Biotechnological Equipment, 23, Suppl. 1: 123-126.

Tzankov, N., G. Popgeorgiev, B. Naumov, A. Stoyanov, Y. Kornilev, B. Petrov, A. Dyugmedzhiev, V. Vergilov, R. Draganova, S. Lukanov, A. Westerström. 2014. Identification guide of the amphibians and reptiles in Vitosha Nature Park. Directorate of Vitosha Nature Park, Sofia, 248 pp. (In Bulgarian)

Tzankov, N., G. Popgeorgiev, Y. Kornilev, N. Natchev, A. Stoyanov, B. Naumov, I. Ivanchev. 2015a. First survey on the invasive Pond slider (*Trachemys scripta*) in Bulgaria: historic development and current situation. – Hyla, Vol. 2015 (1): 18-27.

Tzankov, N., G. Popgeorgiev, Y. Kornilev, B. Petrov, S. Zidarova, T. Stefanov. 2015b. Sofia. – In: Kelcey, J. (Ed.): Vertebrates and Invertebrates of European Cities: Selected Non-Avian Fauna. New York et al., Springer, pp. 179-206.

Undjian, E. 2000. Die Lurche und Kriechtiere des Lomtales und des Naturparkes "Russenski Lom" Bezirke Russe und Rasgrad Nordostbulgarien. Priroden Park "Rusenski Lom" Publ., Ruse, 88 pp. (In Bulgarian, German summary)

Vasileva, S. 2005. Research of the biodiversity in the protected area "Martvitsata", Popovitsa village, Sadovo district. – In: Yankov, P., A. Petrova (Eds.): Conservation of the biodiversity and management of the protected areas. BBF & Sofia University "St. Kl. Ohridski", Sofia, pp. 51-60. (In Bulgarian)

Werner, F. 1898. Prilozi poznavanju faune reptilija I batrahija Balkanskog poluostrva. – Glasnik Zemaljskog muzeja u Bosni I Hercegovini, Sarajevo, 10(1): 131-156.

Species	Square	X (centroid)	Y (centroid)
Emys orbicularis	FL88	23.212925	41.395267
Emys orbicularis	FL89	23.215986	41.485275
Emys orbicularis	FL98	23.33245	41.392905
Emys orbicularis	FL99	23.335676	41.482906
Emys orbicularis	FM54	22.869842	41.941754
Emys orbicularis	FM65	22.993216	42.029739
Emys orbicularis	FM67	22.998867	42.209759
Emys orbicularis	FM72	23.105051	41.757556
Emys orbicularis	FM73	23.108	41.847565
Emys orbicularis	FM74	23.110963	41.937572
Emys orbicularis	FM75	23.113939	42.027578
Emys orbicularis	FM76	23.116929	42.117582
Emys orbicularis	FM80	23.219062	41.575282
Emys orbicularis	FM86	23.23781	42.115287
Emys orbicularis	FN71	23.132086	42.567578
Emys orbicularis	FN72	23.135159	42.657572
Emys orbicularis	FN74	23.141348	42.837557
Emys orbicularis	FN82	23.257079	42.655234
Emys orbicularis	FN91	23.37556	42.562787
Emys orbicularis	FN92	23.378983	42.652766
Emys orbicularis	FN93	23.382422	42.742744
Emys orbicularis	FN94	23.385877	42.83272
Emys orbicularis	FN97	23.396338	43.102639
Emys orbicularis	FN98	23.399857	43.192608
Emys orbicularis	FN99	23.403393	43.282576
Emys orbicularis	FP24	22.552529	43.7475
Emys orbicularis	FP75	23.176426	43.827355
Emys orbicularis	GL49	23.933891	41.469194
Emys orbicularis	GM36	23.84198	42.101905
Emys orbicularis	GN01	23.497273	42.560197
Emys orbicularis	GN03	23.504487	42.740138
Emys orbicularis	GP02	23.537781	43.54979
Emys orbicularis	KG55	24.051918	42.009173
Emys orbicularis	KG66	24.15802	42.101905
Emys orbicularis	KG86	24.399639	42.107639
Emys orbicularis	KG96	24.520473	42.110316
Emys orbicularis	KH60	24.141791	42.461708
Emys orbicularis	LG06	24.641324	42.112865
Emys orbicularis	LG16	24.76219	42.115287
Emys orbicularis	LG17	24.759015	42.205282
Emys orbicularis	LG36	25.003965	42.119749
Emys orbicularis	LG47	25.122211	42.211805
Emys orbicularis	LG63	25.373614	41.855397
Emys orbicularis	LG82	25.616425	41.768513
Emys orbicularis	LG89	25.602661	42.398784
Emys orbicularis	LG91	25.73847	41.67985
Emys orbicularis	LH14	24.73638	42.835204

Emys orbicularis	LH61	25.355024	42.575609
Emys orbicularis	LH97	25.709272	43.120457
Emys orbicularis	LJ53	25.201871	43.653861
Emys orbicularis	LJ63	25.325826	43.655744
Emys orbicularis	MF08	25.863333	41.410937
Emys orbicularis	MF18	25.982963	41.412057
Emys orbicularis	MF28	26.1026	41.413053
Emys orbicularis	MF29	26.101357	41.503117
Emys orbicularis	MF39	26.221165	41.50399
Emys orbicularis	MG01	25.858591	41.681105
Emys orbicularis	MG03	25.855394	41.86121
Emys orbicularis	MG10	25.980141	41.592178
Emys orbicularis	MG11	25.97872	41.682236
Emys orbicularis	MG12	25.977293	41.772292
Emys orbicularis	MG13	25.975859	41.862348
Emys orbicularis	MG22	26.097596	41.7733
Emys orbicularis	MG30	26.220083	41.594056
Emys orbicularis	MG32	26.217905	41.774182
Emys orbicularis	MG35	26.2146	42.044361
Emys orbicularis	MG42	26.338219	41.774938
Emys orbicularis	MG45	26.335422	42.045125
Emys orbicularis	MG57	26.454706	42.225882
Emys orbicularis	MG74	26.698337	41.956586
Emys orbicularis	MH25	26.080687	42.943945
Emys orbicularis	MH54	26.449192	42.85626
Emys orbicularis	MH60	26.574058	42.496569
Emys orbicularis	MH86	26.815858	43.03754
Emys orbicularis	MH87	26.815588	43.127589
Emys orbicularis	MH99	26.938348	43.307816
Emys orbicularis	MJ15	25.942591	43.843191
Emys orbicularis	MJ25	26.066975	43.844274
Emys orbicularis	MJ33	26.193786	43.665162
Emys orbicularis	MJ42	26.318827	43.575935
Emys orbicularis	MJ43	26.31781	43.66597
Emys orbicularis	MJ57	26.438469	44.026776
Emys orbicularis	MJ73	26.689905	43.667585
Emys orbicularis	MJ82	26.81422	43.577813
Emys orbicularis	MJ88	26.812535	44.118036
Emys orbicularis	MJ92	26.938073	43.577948
Emys orbicularis	NG39	27.425333	42.406512
Emys orbicularis	NG44	27.542985	41.955698
Emys orbicularis	NG49	27.546852	42.405997
Emys orbicularis	NG55	27.664578	42.045125
Emys orbicularis	NG58	27.667413	42.315298
Emys orbicularis	NG59	27.668367	42.405353
Emys orbicularis	NG65	27.7854	42.044361
Emys orbicularis	NG67	27.787629	42.224474
Emys orbicularis	NG68	27.788751	42.314527
Emys orbicularis	NG75	27.906218	42.043471
Emys orbicularis	NG76	27.9075	42.133525
Emys orbicularis	NG84	28.025582	41.952401
Emys orbicularis	NG85	28.027029	42.042453

Emys orbicularis	NH06	27.061381	43.037672
Emys orbicularis	NH18	27.184684	43.217637
Emys orbicularis	NH20	27.304247	42.496957
Emys orbicularis	NH30	27.425943	42.496569
Emys orbicularis	NH48	27.554039	43.216444
Emys orbicularis	NH51	27.670288	42.585458
Emys orbicularis	NH52	27.671255	42.675509
Emys orbicularis	NH58	27.677151	43.215782
Emys orbicularis	NH73	27.916646	42.763862
Emys orbicularis	NH76	27.920656	43.033985
Emys orbicularis	NH78	27.923361	43.214059
Emys orbicularis	NH79	27.924722	43.304095
Emys orbicularis	NH88	28.046456	43.213
Emys orbicularis	NH89	28.047999	43.303031
Emys orbicularis	NJ08	27.062489	44.118172
Emys orbicularis	NJ17	27.187181	44.028002
Emys orbicularis	NJ28	27.31244	44.117762
Emys orbicularis	NJ80	28.04955	43.393062
Emys orbicularis	NJ90	28.173002	43.391862
Emys orbicularis	PJ00	28.296446	43.390529
Emys orbicularis	PJ10	28.419882	43.389063
Emys orbicularis	PJ22	28.547897	43.567485
Emys orbicularis	PJ23	28.550208	43.657493
Mauremys rivulata	FL88	23.212925	41.395267
Mauremys rivulata	FL89	23.215986	41.485275
Mauremys rivulata	FL98	23.33245	41.392905
Mauremys rivulata	FL99	23.335676	41.482906
Mauremys rivulata	FM80	23.219062	41.575282
Mauremys rivulata	LG74	25.491927	41.947077
Mauremys rivulata	MF08	25.863333	41.410937
Mauremys rivulata	MF18	25.982963	41.412057
Mauremys rivulata	MF28	26.1026	41.413053
Mauremys rivulata	MF29	26.101357	41.503117
Mauremys rivulata	MF39	26.221165	41.50399
Mauremys rivulata	MG04	25.853784	41.95126
Mauremys rivulata	MG11	25.97872	41.682236
Mauremys rivulata	MG12	25.977293	41.772292
Mauremys rivulata	MG22	26.097596	41.7733
Mauremys rivulata	MG30	26.220083	41.594056
Mauremys rivulata	MG32	26.217905	41.774182
Mauremys rivulata	MG35	26.2146	42.044361
Mauremys rivulata	MG42	26.338219	41.774938
Mauremys rivulata	MG53	26.457778	41.865634
Mauremys rivulata	MG57	26.454706	42.225882
Mauremys rivulata	MG64	26.577675	41.956205
Mauremys rivulata	NG08	27.060676	42.317224
Mauremys rivulata	NG68	27.788751	42.314527
Mauremys rivulata	NG75	27.906218	42.043471
Mauremys rivulata	NG76	27.9075	42.133525
Mauremys rivulata	NG84	28.025582	41.952401
Mauremys rivulata	NG85	28.027029	42.042453

Appendix 3. Previously unpublished distribution data for *Emys orbicularis* and *Mauremys rivulata*, based on the 1×1 km MGRS grid (Military Grid Reference System, UTM zone 35N, datum WGS 1984). Cell names and the X, Y coordinates of the centroids are provided.

Cite: Kornilev Y., Popgeorgiev G., Naumov B., Stoyanov A. & Tzankov N. 2017. Updated distribution and ecological requirements of the native freshwater turtles in Bulgaria. Acta Zoologica Bulgarica Supplement 10: 65-76 + i-xvii.

Species	Square	X (centroid)	Y (centroid)
Emys orbicularis	MH7495	26.749054	42.861812
Emys orbicularis	LH7988	25.501332	43.329529
Emys orbicularis	MG9743	26.933366	42.213649
Emys orbicularis	MG9736	26.921217	42.24066
Emys orbicularis	MG9744	26.933356	42.222655
Emys orbicularis	MH7640	26.687165	42.996738
Emys orbicularis	LH7987	25.501553	43.320528
Emys orbicularis	KH9657	24.489781	43.032663
Emys orbicularis	MH7186	26.737914	42.600627
Emys orbicularis	MH7196	26.750104	42.600655
Emys orbicularis	MH7184	26.73799	42.582616
Emys orbicularis	MG9666	26.957638	42.150616
Emys orbicularis	KH8978	24.379778	43.309326
Emys orbicularis	NG6699	27.841494	42.174556
Emys orbicularis	NG7617	27.865462	42.156366
Emys orbicularis	NG7635	27.889415	42.13817
Emys orbicularis	NG7645	27.901515	42.138075
Emys orbicularis	NG7643	27.901259	42.120065
Emys orbicularis	NG7633	27.889163	42.120159
Emys orbicularis	NG7661	27.925189	42.101861
Emys orbicularis	NG7596	27.960787	42.056537
Emys orbicularis	NG7576	27.936619	42.056737
Emys orbicularis	NG8532	28.008551	42.020101
Emys orbicularis	NG6680	27.828331	42.093595
Emys orbicularis	NG4439	27.525219	41.996311
Emys orbicularis	NG5790	27.720528	42.184386
Emys orbicularis	MG4352	26.343545	41.842521
Emys orbicularis	MG3526	26.184222	42.057659
Emys orbicularis	MG6648	26.570216	42.167831
Emys orbicularis	MG6698	26.630748	42.168042
Emys orbicularis	KG8631	24.382811	42.075737
Emys orbicularis	FL9849	23.327921	41.433527
Emys orbicularis	NG3989	27.468166	42.446872
Emys orbicularis	NG7597	27.960923	42.065542
Emys orbicularis	NG7587	27.948837	42.065643
Emys orbicularis	NG7577	27.936752	42.065742
Emys orbicularis	FL9876	23.362818	41.405795
Emys orbicularis	FL9828	23.303683	41.425008
Emys orbicularis	FL8995	23.270006	41.488725
Emys orbicularis	FL8994	23.269692	41.479724
Emys orbicularis	FL8991	23.26875	41.452723
Emys orbicularis	FL9839	23.315961	41.433768
Emys orbicularis	FL7854	23.099219	41.392895
Emys orbicularis	FL7845	23.087553	41.402114
Emys orbicularis	FL6873	23.003309	41.385599
Emys orbicularis	FL7831	23.074453	41.366324
Emys orbicularis	LG6421	25.341995	41.913487
Emys orbicularis	LG6403	25.317415	41.931142
Emys orbicularis	LG5483	25.293302	41.930786
Emys orbicularis	LG6485	25.413424	41.950522
Emys orbicularis	LG6328	25.342693	41.886478
Emys orbicularis	LG7315	25.451784	41.860981
Emys orbicularis	LG7325	25.463828	41.861143
Emys orbicularis	LG7305	25.43974	41.860818
Emys orbicularis	LG7335	25.475873	41.861303
Emys orbicularis	LG7365	25.512006	41.861777
Emys orbicularis	LG7355	25.499961	41.86162
Emys orbicularis	LG7394	25.548344	41.853236
Emys orbicularis	LG8304	25.560387	41.853387
Emys orbicularis	LG8303	25.560589	41.844383
Emys orbicularis	LG8313	25.572631	41.844534
Emys orbicularis	LG8312	25.572831	41.835529
Emys orbicularis	MG0460	25.872592	41.910917
Emys orbicularis	MG0470	25.884648	41.911034
Emys orbicularis	MG0347	25.848967	41.883662
Emys orbicularis	MG0337	25.836916	41.883541
Emys orbicularis	MG1306	25.921421	41.875359
Emys orbicularis	MG1325	25.945668	41.866578
Emys orbicularis	MG0396	25.909372	41.875245
Emys orbicularis	MG0397	25.909219	41.884251
Emys orbicularis	MG0398	25.909066	41.893256
Emys orbicularis	MG0377	25.885118	41.884019
Emys orbicularis	LG7092	25.554813	41.5651
Emys orbicularis	MG3239	26.199354	41.814586
Emys orbicularis	MG3331	26.199129	41.832598

Emys orbicularis	MG3347	26.210507	41.886717
Emys orbicularis	MG3355	26.222778	41.868787
Emys orbicularis	MG3369	26.234396	41.904892
Emys orbicularis	MG3466	26.233642	41.967934
Emys orbicularis	LH0218	24.577131	42.683363
Emys orbicularis	LH0292	24.67671	42.631397
Emys orbicularis	LH2111	24.826395	42.535279
Emys orbicularis	LG2729	24.848427	42.24752
Emys orbicularis	LG2812	24.83539	42.274292
Emys orbicularis	LG2736	24.861453	42.220747
Emys orbicularis	LG2756	24.885669	42.221196
Emys orbicularis	LG2746	24.873561	42.220972
Emys orbicularis	LG5768	25.260601	42.245508
Emys orbicularis	LG5824	25.210611	42.298774
Emys orbicularis	LG5825	25.210356	42.307776
Emys orbicularis	LG5837	25.221977	42.325968
Emys orbicularis	LG5848	25.233856	42.335158
Emys orbicularis	LG5849	25.233604	42.344159
Emys orbicularis	KG8861	24.411711	42.256502
Emys orbicularis	KG8819	24.348138	42.327092
Emys orbicularis	KG8809	24.336014	42.32681
Emys orbicularis	KG8900	24.335634	42.335807
Emys orbicularis	KG7991	24.323127	42.34452
Emys orbicularis	LG0923	24.601411	42.368694
Emys orbicularis	LG0932	24.613886	42.359949
Emys orbicularis	LG0942	24.626019	42.360201
Emys orbicularis	LG0941	24.626358	42.351203
Emys orbicularis	LG0924	24.601069	42.377692
Emys orbicularis	KG8921	24.359509	42.345365
Emys orbicularis	KG8920	24.359886	42.336368
Emys orbicularis	KG8829	24.360262	42.327371
Emys orbicularis	KG7745	24.268719	42.199152
Emys orbicularis	KG7755	24.280818	42.19944
Emys orbicularis	KG7754	24.281204	42.190444
Emys orbicularis	KG7764	24.293301	42.19073
Emys orbicularis	KG7774	24.305399	42.191015
Emys orbicularis	KG7735	24.25662	42.198863
Emys orbicularis	KG7707	24.219536	42.21598
Emys orbicularis	KG5880	24.073084	42.23935
Emys orbicularis	KG5789	24.0735	42.230355
Emys orbicularis	KG6810	24.109398	42.240271
Emys orbicularis	KG6739	24.134016	42.231884
Emys orbicularis	KG9679	24.549123	42.151457
Emys orbicularis	KG9669	24.537031	42.151198
Emys orbicularis	KG9659	24.524939	42.150937
Emys orbicularis	KG9658	24.525289	42.141939
Emys orbicularis	KG9689	24.561216	42.151715
Emys orbicularis	KG9698	24.573652	42.142973
Emys orbicularis	KG8678	24.428572	42.139811
Emys orbicularis	KG9618	24.476929	42.140885
Emys orbicularis	KG8649	24.391936	42.147989
Emys orbicularis	LG0668	24.658293	42.144732
Emys orbicularis	LG2679	24.911962	42.158638
Emys orbicularis	LG2689	24.924059	42.158857
Emys orbicularis	LG2699	24.936156	42.159076
Emys orbicularis	LG4720	25.093158	42.170799
Emys orbicularis	LG4740	25.11736	42.171199
Emys orbicularis	LG4667	25.142351	42.144589
Emys orbicularis	LG4677	25.154447	42.144784
Emys orbicularis	LG4678	25.154186	42.153786
Emys orbicularis	LG7558	25.495095	42.068704
Emys orbicularis	LG7549	25.482797	42.077548
Emys orbicularis	LG7539	25.470712	42.077387
Emys orbicularis	LG7559	25.494882	42.077707
Emys orbicularis	LG7568	25.507178	42.068861
Emys orbicularis	LG8517	25.5678	42.060628
Emys orbicularis	LG6652	25.373344	42.103067
Emys orbicularis	LG6662	25.385434	42.103238
Emys orbicularis	LG6633	25.348932	42.111724
Emys orbicularis	LG9533	25.713523	42.026329
Emys orbicularis	LG9552	25.737854	42.017592
Emys orbicularis	LG9523	25.701446	42.026193
Emys orbicularis	LG9524	25.701263	42.035197
Emys orbicularis	LG9580	25.774426	41.999976
Emys orbicularis	LG9590	25.786498	42.000104
Emys orbicularis	MG0563	25.870526	42.027981
Emys orbicularis	MG0562	25.870685	42.018976
Emys orbicularis	MG0571	25.882919	42.01009
Emys orbicularis	MG1348	25.969329	41.893812
Emys orbicularis	MG2344	26.090371	41.858808
Emys orbicularis	MG2343	26.090498	41.849802
Emys orbicularis	MG2342	26.090626	41.840797
Emys orbicularis	MG2351	26.102795	41.831886
Emys orbicularis	MG2335	26.078195	41.867718
Emys orbicularis	MG2325	26.066146	41.867621
Emys orbicularis	MG2316	26.053966	41.876528
Emys orbicularis	MG3232	26.200138	41.751543
Emys orbicularis	MG3251	26.2243	41.742701
Emys orbicularis	MG2370	26.127	41.823065
Emys orbicularis	LH0698	24.661143	43.045299
Emys orbicularis	LH3821	24.939412	43.167709
Emys orbicularis	LH2889	24.887753	43.238802

Emys orbicularis	LH3802	24.914517	43.176263
Emys orbicularis	LH4771	25.12659	43.080883
Emys orbicularis	LH2527	24.82413	42.949465
Emys orbicularis	LH2517	24.81188	42.949231
Emys orbicularis	LH6567	25.36325	42.958447
Emys orbicularis	LH5592	25.278719	42.912182
Emys orbicularis	LH5565	25.241214	42.938626
Emys orbicularis	LH5554	25.229221	42.929436
Emys orbicularis	LH7670	25.497408	42.987301
Emys orbicularis	MH1768	25.972989	43.154645
Emys orbicularis	MH1758	25.960692	43.154534
Emys orbicularis	MH1759	25.960539	43.163537
Emys orbicularis	MH1749	25.94824	43.163425
Emys orbicularis	MH1767	25.97314	43.145642
Emys orbicularis	MH1722	25.924746	43.100173
Emys orbicularis	MH1712	25.91246	43.100057
Emys orbicularis	MH1711	25.912619	43.091054
Emys orbicularis	MH0696	25.888864	43.045801
Emys orbicularis	MH3528	26.172186	42.976161
Emys orbicularis	MH3519	26.159801	42.985076
Emys orbicularis	LH8755	25.592421	43.123582
Emys orbicularis	LH8745	25.580132	43.12343
Emys orbicularis	NG2669	27.320872	42.177194
Emys orbicularis	NG2647	27.296571	42.159247
Emys orbicularis	NG4456	27.549134	41.969179
Emys orbicularis	FP3684	22.725181	43.920594
Emys orbicularis	FP3674	22.71273	43.920781
Emys orbicularis	FP2623	22.525726	43.914428
Emys orbicularis	FP3871	22.717138	44.073772
Emys orbicularis	FM5905	22.828634	42.397217
Emys orbicularis	FM6904	22.949793	42.386215
Emys orbicularis	LJ3167	24.977866	43.492548
Emys orbicularis	LJ3177	24.990226	43.492766
Emys orbicularis	LJ3157	24.965506	43.492329
Emys orbicularis	LJ3147	24.953146	43.492108
Emys orbicularis	LH5929	25.180505	43.333878
Emys orbicularis	LH5919	25.168176	43.333682
Emys orbicularis	LH5908	25.156119	43.324483
Emys orbicularis	LH5909	25.155846	43.333483
Emys orbicularis	LJ5020	25.180236	43.342878
Emys orbicularis	LJ5010	25.167905	43.342681
Emys orbicularis	KH8892	24.41052	43.16596
Emys orbicularis	KH8888	24.395936	43.219654
Emys orbicularis	LJ0274	24.617003	43.548621
Emys orbicularis	LJ0284	24.629372	43.548878
Emys orbicularis	LJ0275	24.616649	43.557617
Emys orbicularis	LJ0262	24.605347	43.530369
Emys orbicularis	LJ0252	24.592983	43.53011
Emys orbicularis	LJ0242	24.580618	43.529848
Emys orbicularis	LJ0251	24.593341	43.521113
Emys orbicularis	LJ1343	24.700506	43.631366
Emys orbicularis	LJ1353	24.712892	43.631614
Emys orbicularis	LJ1354	24.712551	43.640611
Emys orbicularis	LJ1364	24.724939	43.640859
Emys orbicularis	LJ1355	24.712209	43.649608
Emys orbicularis	MJ1398	26.001038	43.695154
Emys orbicularis	MJ1386	25.988933	43.67704
Emys orbicularis	MJ1388	25.988631	43.695045
Emys orbicularis	MJ1236	25.928516	43.586449
Emys orbicularis	MJ1246	25.940901	43.586565
Emys orbicularis	MJ2343	26.063777	43.650665
Emys orbicularis	MJ2310	26.027017	43.623346
Emys orbicularis	MJ2344	26.063637	43.659668
Emys orbicularis	MJ2334	26.051237	43.659566
Emys orbicularis	MJ3224	26.164092	43.570406
Emys orbicularis	NG7642	27.901132	42.111059
Emys orbicularis	NG8448	28.020053	41.983973
Emys orbicularis	NG5689	27.708319	42.175456
Emys orbicularis	NG6685	27.828917	42.138623
Emys orbicularis	NG6696	27.841136	42.14754
Emys orbicularis	MG4371	26.367722	41.833649
Emys orbicularis	MG4340	26.331688	41.824439
Emys orbicularis	MG4372	26.367634	41.842656
Emys orbicularis	MG5385	26.499914	41.870329
Emys orbicularis	MG2348	26.08986	41.894831
Emys orbicularis	MG2347	26.089987	41.885825
Emys orbicularis	MG2358	26.101913	41.894926
Emys orbicularis	FM8025	23.189248	41.580357
Emys orbicularis	FL8969	23.235334	41.52543
Emys orbicularis	GL0926	23.425938	41.494546
Emys orbicularis	MF0886	25.904976	41.424852
Emys orbicularis	MF1805	25.929055	41.416072
Emys orbicularis	MF0895	25.917091	41.41596
Emys orbicularis	MF0885	25.905127	41.415846
Emys orbicularis	MF0867	25.880891	41.433628
Emys orbicularis	MF0877	25.892858	41.433744
Emys orbicularis	FN9857	23.40689	43.214971
Emys orbicularis	MJ6450	26.571719	43.716725
Emys orbicularis	MJ7348	26.683537	43.699081
Emys orbicularis	MJ7347	26.683585	43.690077
Emys orbicularis	MJ8536	26.794675	43.861404
Emys orbicularis	NJ6549	27.802959	43.885779

Emys orbicularis	NJ4582	27.603153	43.823982
Emys orbicularis	NJ4581	27.603062	43.814979
Emys orbicularis	NJ5459	27.689889	43.79648
Emys orbicularis	NJ5458	27.689785	43.787477
Emys orbicularis	NJ4489	27.602881	43.796972
Emys orbicularis	NJ4443	27.552664	43.743203
Emys orbicularis	NJ4453	27.565082	43.743142
Emys orbicularis	FP5356	22.9287	43.665237
Emys orbicularis	FP5357	22.928988	43.674236
Emys orbicularis	FP6470	23.078688	43.698622
Emys orbicularis	FP5562	22.945755	43.809007
Emys orbicularis	FP5542	22.920903	43.809428
Emys orbicularis	FP6580	23.094226	43.788375
Emys orbicularis	FP6419	23.006978	43.780937
Emys orbicularis	FP6590	23.106646	43.788147
Emys orbicularis	FP6591	23.106963	43.797144
Emys orbicularis	FP6581	23.09454	43.797373
Emys orbicularis	FP4569	22.823408	43.87405
Emys orbicularis	KH9068	24.523296	42.502111
Emys orbicularis	KH9078	24.535455	42.502373
Emys orbicularis	KH9079	24.535102	42.51137
Emys orbicularis	KH8067	24.402082	42.49042
Emys orbicularis	KH9089	24.547263	42.511632
Emys orbicularis	KH8039	24.364858	42.50758
Emys orbicularis	MG6819	26.532503	42.356815
Emys orbicularis	MG6818	26.53257	42.347809
Emys orbicularis	MG6828	26.54471	42.347858
Emys orbicularis	MG6827	26.544775	42.338852
Emys orbicularis	MG6826	26.54484	42.329846
Emys orbicularis	MG6730	26.557985	42.185798
Emys orbicularis	MG6405	26.523344	41.960496
Emys orbicularis	MG6404	26.523411	41.951489
Emys orbicularis	MG7557	26.703848	42.069183
Emys orbicularis	MG6910	26.532436	42.36582
Emys orbicularis	MG6901	26.520223	42.374776
Emys orbicularis	MG7994	26.750892	42.402527
Emys orbicularis	MG7995	26.750856	42.411533
Emys orbicularis	MG6439	26.559296	41.996666
Emys orbicularis	MG6428	26.547286	41.987613
Emys orbicularis	MG7521	26.667867	42.015045
Emys orbicularis	FP3267	22.690875	43.587969
Emys orbicularis	FN6506	22.967317	42.944236
Emys orbicularis	FN5595	22.954782	42.935446
Emys orbicularis	KH6814	24.065631	43.175637
Emys orbicularis	FM5685	22.917583	42.125591
Emys orbicularis	LF9959	25.747179	41.540336
Emys orbicularis	MF1820	25.953705	41.371261
Emys orbicularis	MF0871	25.893775	41.379708
Emys orbicularis	LG6085	25.422276	41.590378
Emys orbicularis	LG3486	25.051377	41.953952
Emys orbicularis	LG2634	24.865089	42.112745
Emys orbicularis	LG6538	25.350099	42.06671
Emys orbicularis	LG6548	25.362182	42.066883
Emys orbicularis	LG3498	25.06289	41.97216
Emys orbicularis	LG4500	25.074411	41.990366
Emys orbicularis	LG6651	25.373575	42.094064
Emys orbicularis	LG8505	25.556126	42.042469
Emys orbicularis	LG6650	25.373805	42.085061
Emys orbicularis	LG4598	25.180957	42.064153
Emys orbicularis	LG4577	25.157057	42.054766
Emys orbicularis	LG4566	25.14524	42.045569
Emys orbicularis	LG3519	24.963236	42.069501
Emys orbicularis	LG3610	24.962948	42.078501
Emys orbicularis	LG3620	24.97503	42.078715
Emys orbicularis	LG3631	24.986827	42.087929
Emys orbicularis	LG3651	25.010995	42.088351
Emys orbicularis	LG3662	25.0228	42.097561
Emys orbicularis	NH7532	27.900601	42.921581
Emys orbicularis	NG7598	27.961058	42.074547
Emys orbicularis	MH1224	25.932226	42.667996
Emys orbicularis	MH1214	25.920025	42.667881
Emys orbicularis	MH4162	26.348226	42.563051
Emys orbicularis	NH5525	27.643587	42.95033
Emys orbicularis	LH8112	25.556529	42.555812
Emys orbicularis	LH8142	25.593062	42.556266
Emys orbicularis	MH0119	25.798886	42.621648
Emys orbicularis	LH3265	25.004921	42.664601
Emys orbicularis	PJ2257	28.554665	43.589903
Emys orbicularis	MH3024	26.178628	42.489914
Emys orbicularis	MH2013	26.044929	42.479872
Emys orbicularis	MH2023	26.057094	42.479973
Emys orbicularis	MH5199	26.506097	42.62688
Emys orbicularis	MH5168	26.469589	42.617711
Emys orbicularis	MH8106	26.762294	42.600681
Emys orbicularis	MH7185	26.737952	42.591622
Emys orbicularis	MH8116	26.774484	42.600705
Emys orbicularis	MG1700	25.916233	42.18153
Emys orbicularis	LG8648	25.601873	42.160117
Emys orbicularis	LG8649	25.601674	42.16912
Emys orbicularis	LG8833	25.586762	42.295022
Emys orbicularis	MG0568	25.869728	42.073005
Emys orbicularis	MG0567	25.869888	42.064001

Emys orbicularis	LG7666	25.505487	42.140889
Emys orbicularis	MG3904	26.155504	42.399687
Emys orbicularis	MH2003	26.032764	42.47977
Emys orbicularis	MH1093	26.020599	42.479667
Emys orbicularis	MG3917	26.167297	42.426791
Emys orbicularis	LG7886	25.525496	42.321268
Emys orbicularis	MG0670	25.881498	42.091133
Emys orbicularis	LG7775	25.51569	42.222076
Emys orbicularis	LG7785	25.527803	42.222232
Emys orbicularis	LG8657	25.614171	42.15126
Emys orbicularis	LG8656	25.614367	42.142256
Emys orbicularis	LG8568	25.62802	42.07037
Emys orbicularis	LG7731	25.46811	42.185426
Emys orbicularis	MG0579	25.881656	42.082129
Emys orbicularis	MG1710	25.92834	42.181643
Emys orbicularis	MG1665	25.989593	42.137168
Emys orbicularis	MG2625	26.062187	42.137784
Emys orbicularis	LG8639	25.589571	42.168972
Emys orbicularis	LG7653	25.49403	42.113721
Emys orbicularis	MH3034	26.190795	42.490001
Emys orbicularis	MH0853	25.836866	43.198366
Emys orbicularis	LH7806	25.405514	43.22018
Emys orbicularis	LH7815	25.418054	43.211349
Emys orbicularis	LH7835	25.442667	43.211687
Emys orbicularis	LH7845	25.454974	43.211854
Emys orbicularis	LH8885	25.627276	43.214052
Emys orbicularis	LH8875	25.614968	43.213903
Emys orbicularis	LH9911	25.663019	43.268502
Emys orbicularis	LJ9142	25.695933	43.457974
Emys orbicularis	LJ9162	25.720649	43.458254
Emys orbicularis	MH0727	25.801006	43.143967
Emys orbicularis	MH0737	25.813301	43.144095
Emys orbicularis	MH0747	25.825596	43.144222
Emys orbicularis	LH8825	25.55343	43.213142
Emys orbicularis	LH8814	25.541337	43.203983
Emys orbicularis	LH8804	25.529031	43.203826
Emys orbicularis	LH8805	25.528815	43.212828
Emys orbicularis	LH8874	25.615171	43.204901
Emys orbicularis	LH9849	25.70036	43.250924
Emys orbicularis	LH9922	25.675143	43.277648
Emys orbicularis	LH9914	25.662428	43.295509
Emys orbicularis	LH9915	25.66223	43.304511
Emys orbicularis	LH9858	25.712865	43.242061
Emys orbicularis	LH9839	25.688044	43.250783
Emys orbicularis	LJ9222	25.669242	43.547709
Emys orbicularis	LJ9164	25.720269	43.476258

Emys orbicularis	MH7339	26.67589	42.807596
Emys orbicularis	MH6399	26.626968	42.807447
Emys orbicularis	MH3572	26.23417	42.922562
Emys orbicularis	MH3564	26.221691	42.940488
Emys orbicularis	MH3584	26.246203	42.940652
Emys orbicularis	MH3594	26.258459	42.940733
Emys orbicularis	MH7314	26.651681	42.762498
Emys orbicularis	MJ5079	26.474843	43.437192
Emys orbicularis	MH2839	26.057551	43.254425
Emys orbicularis	MH9812	26.895384	43.195226
Emys orbicularis	MH9802	26.883077	43.195214
Emys orbicularis	MH8779	26.846221	43.168156
Emys orbicularis	NH0731	27.043008	43.096212
Emys orbicularis	MH8769	26.833919	43.168139
Emys orbicularis	NH0722	27.030724	43.105221
Emys orbicularis	MH8757	26.821669	43.150111
Emys orbicularis	NH1405	27.128534	42.862015
Emys orbicularis	GP0200	23.480465	43.510531
Emys orbicularis	FP9232	23.394653	43.530369
Emys orbicularis	FP9242	23.407017	43.53011
Emys orbicularis	FP9251	23.419022	43.520852
Emys orbicularis	FP9109	23.356506	43.504151
Emys orbicularis	FP9356	23.424436	43.655794
Emys orbicularis	FP8227	23.260311	43.578125
Emys orbicularis	FP8350	23.298466	43.604375
Emys orbicularis	FP9482	23.463815	43.708973
Emys orbicularis	GP0513	23.505144	43.807113
Emys orbicularis	GP0504	23.493097	43.81638
Emys orbicularis	GP0514	23.50552	43.816108
Emys orbicularis	GP1394	23.720939	43.631109
Emys orbicularis	GP1395	23.721345	43.640103
Emys orbicularis	GP2305	23.733729	43.639807
Emys orbicularis	GP2316	23.746523	43.648504
Emys orbicularis	GP2346	23.783679	43.647605
Emys orbicularis	GP2357	23.796482	43.656296
Emys orbicularis	GP2494	23.849007	43.718022
Emys orbicularis	GP3405	23.861834	43.726705
Emys orbicularis	GP2483	23.836184	43.709338
Emys orbicularis	GP3307	23.858413	43.654762
Emys orbicularis	GP2275	23.816212	43.547768
Emys orbicularis	GP3306	23.857986	43.64577
Emys orbicularis	GP3305	23.857559	43.636777
Emys orbicularis	GP2383	23.83195	43.619407
Emys orbicularis	MJ2697	26.121296	43.95725
Emys orbicularis	MJ5763	26.457309	44.013361
Emys orbicularis	MJ5773	26.469784	44.01342

Emys orbicularis	MJ5784	26.482181	44.02248
Emys orbicularis	MJ5704	26.382366	44.021984
Emys orbicularis	MJ5735	26.419709	44.031183
Emys orbicularis	MJ5764	26.457227	44.022364
Emys orbicularis	MJ6764	26.581999	44.022889
Emys orbicularis	MJ9812	26.89381	44.095632
Emys orbicularis	MJ8830	26.79393	44.077488
Emys orbicularis	NJ0865	27.081241	44.122662
Emys orbicularis	NJ0845	27.056244	44.122677
Emys orbicularis	NJ0856	27.068753	44.131674
Emys orbicularis	NJ0844	27.056235	44.113674
Emys orbicularis	NJ1800	27.131136	44.077599
Emys orbicularis	MG9556	26.945612	42.060546
Emys orbicularis	MG9566	26.957698	42.060551
Emys orbicularis	NG1755	27.187841	42.231527
Emys orbicularis	NG7519	27.864482	42.084322
Emys orbicularis	NG8507	27.973008	42.06544
Emys orbicularis	NG7566	27.924535	42.056835
Emys orbicularis	NG1765	27.199959	42.231506
Emys orbicularis	NG8418	27.983843	41.984289
Emys orbicularis	NG8419	27.983982	41.993295
Emys orbicularis	NG8428	27.995913	41.984185
Emys orbicularis	NG8515	27.984815	42.047327
Emys orbicularis	NG3923	27.394868	42.393112
Emys orbicularis	NG3932	27.406959	42.384064
Emys orbicularis	NG2885	27.345874	42.321221
Emys orbicularis	NG2865	27.321603	42.321292
Emys orbicularis	NG2922	27.273333	42.38446
Emys orbicularis	NG2921	27.273294	42.375454
Emys orbicularis	KJ7161	24.238991	43.423063
Emys orbicularis	LJ7101	25.399614	43.445206
Emys orbicularis	LJ7100	25.399851	43.436205
Emys orbicularis	LJ0456	24.584343	43.746016
Emys orbicularis	LJ6085	25.376352	43.390853
Emys orbicularis	LJ7144	25.448338	43.47289
Emys orbicularis	LJ7155	25.460469	43.482059
Emys orbicularis	LJ7166	25.472604	43.491226
Emys orbicularis	LJ7167	25.472377	43.500227
Emys orbicularis	MG5520	26.426406	42.005086
Emys orbicularis	MG3457	26.221465	41.976859
Emys orbicularis	MG3458	26.221355	41.985865
Emys orbicularis	MG5412	26.41499	41.932975
Emys orbicularis	MG3208	26.163355	41.805322
Emys orbicularis	MG3450	26.222231	41.913817
Emys orbicularis	MG0157	25.864201	41.703678
Emys orbicularis	MG0175	25.888545	41.685902
Emys orbicularis	MG3276	26.247825	41.787892
Emys orbicularis	LG9186	25.780256	41.693811
Emys orbicularis	MG0149	25.851864	41.721569
Emys orbicularis	MG1016	25.937932	41.605306
Emys orbicularis	KJ6423	24.05225	43.706512
Emys orbicularis	GL0828	23.423255	41.422551
Emys orbicularis	GL2983	23.735958	41.460566
Emys orbicularis	NH5223	27.640606	42.662176
Emys orbicularis	NH5105	27.615494	42.590268
Emys orbicularis	NH5106	27.615582	42.599274
Emys orbicularis	NG5954	27.674394	42.400814
Emys orbicularis	NG5944	27.662244	42.400885
Emys orbicularis	NG5945	27.662339	42.409891
Emys orbicularis	NG5897	27.722273	42.337481
Emys orbicularis	NG6805	27.734202	42.319393
Emys orbicularis	NG6744	27.781515	42.220012
Emys orbicularis	NG6734	27.7694	42.220094
Emys orbicularis	NG6811	27.745911	42.283293
Emys orbicularis	NH7323	27.885902	42.750596
Emys orbicularis	NH7304	27.861591	42.759787
Emys orbicularis	NH2065	27.322524	42.50141
Emys orbicularis	NH2075	27.334695	42.501375
Emys orbicularis	NH2076	27.334743	42.51038
Emys orbicularis	NH2085	27.346865	42.501339
Emys orbicularis	NG3979	27.456006	42.446921
Emys orbicularis	NG3953	27.431316	42.392981
Emys orbicularis	NG2977	27.334311	42.429328
Emys orbicularis	NH3167	27.444996	42.609069
Emys orbicularis	NH3196	27.4815	42.599915
Emys orbicularis	LJ5346	25.195269	43.667263
Emys orbicularis	KH7340	24.247125	42.693912
Emys orbicularis	FM3799	22.691175	42.255236
Emys orbicularis	FN6505	22.96703	42.935236
Emys orbicularis	KG8848	24.384884	42.318931
Emys orbicularis	LG9505	25.67692	42.043925
Emys orbicularis	MJ8863	26.83132	44.10456
Emys orbicularis	NG2864	27.321557	42.312286
Emys orbicularis	KJ7079	24.252145	43.405372
Emys orbicularis	LG9879	25.755487	42.351013
Emys orbicularis	FN9913	23.359769	43.269978
Emys orbicularis	FM5758	22.884781	42.243211
Emys orbicularis	GN0172	23.526791	42.537037
Emys orbicularis	GN0162	23.514626	42.537305
Emys orbicularis	GN0152	23.50246	42.537571
Emys orbicularis	GN0006	23.439525	42.484898
Emys orbicularis	KH7391	24.307709	42.704358

Emys orbicularis	KH8301	24.319906	42.704644
Emys orbicularis	MG5590	26.510932	42.005477
Emys orbicularis	NG1659	27.187681	42.177489
Emys orbicularis	NG1608	27.127121	42.168566
Emys orbicularis	NG1609	27.127139	42.177572
Emys orbicularis	NG0627	27.030263	42.159626
Emys orbicularis	MG9684	26.98185	42.132609
Emys orbicularis	LG6307	25.318833	41.877124
Emys orbicularis	LG6335	25.355434	41.859641
Emys orbicularis	LG5428	25.219714	41.974699
Emys orbicularis	LG5467	25.268215	41.966435
Emys orbicularis	LG5466	25.268459	41.957433
Emys orbicularis	LG3470	25.040971	41.899738
Emys orbicularis	KG8641	24.394887	42.076012
Emys orbicularis	KG8633	24.38207	42.093731
Emys orbicularis	MF2873	26.132689	41.399772
Emys orbicularis	MF2864	26.120606	41.408688
Emys orbicularis	FL7800	23.038324	41.357963
Emys orbicularis	LG6316	25.331114	41.868297
Emys orbicularis	MF1881	26.025306	41.380898
Emys orbicularis	MF2892	26.156729	41.390943
Emys orbicularis	LF9786	25.787001	41.333595
Emys orbicularis	MF0851	25.869861	41.379476
Emys orbicularis	LH8430	25.575134	42.808195
Emys orbicularis	MG1482	26.016988	41.930257
Emys orbicularis	MG1493	26.028911	41.939365
Emys orbicularis	MG1494	26.028774	41.948371
Emys orbicularis	MG2357	26.102039	41.88592
Emys orbicularis	MG2356	26.102165	41.876914
Emys orbicularis	MG2359	26.101787	41.903932
Emys orbicularis	MG2349	26.089732	41.903837
Emys orbicularis	MG2462	26.113468	41.931043
Emys orbicularis	MG2499	26.14881	41.994356
Emys orbicularis	MG4681	26.377139	42.103901
Emys orbicularis	MG5451	26.463312	41.924204
Emys orbicularis	MG5452	26.463237	41.93321
Emys orbicularis	LG7345	25.487917	41.861462
Emys orbicularis	LG7374	25.524258	41.852929
Emys orbicularis	LG8333	25.596714	41.84483
Emys orbicularis	LG8374	25.644692	41.854413
Emys orbicularis	LG8385	25.656548	41.863559
Emys orbicularis	LG8386	25.656359	41.872564
Emys orbicularis	LG8396	25.668407	41.872704
Emys orbicularis	MG6749	26.569544	42.266898
Emys orbicularis	MH6557	26.576941	42.969368
Emys orbicularis	MH5081	26.49521	42.464728
Emys orbicularis	NH5556	27.68046	42.959122
Emys orbicularis	NG5955	27.674491	42.40982
Emys orbicularis	MG8610	26.77628	42.096367
Emys orbicularis	MG8504	26.764387	42.042303
Emys orbicularis	MG6524	26.546903	42.041651
Emys orbicularis	MG7439	26.680035	41.997066
Emys orbicularis	FL9848	23.327599	41.424527
Emys orbicularis	MG3407	26.161119	41.976434
Emys orbicularis	MG9674	26.96975	42.132607
Emys orbicularis	NG0699	27.11503	42.177585
Emys orbicularis	NG1742	27.175647	42.204527
Emys orbicularis	GN2654	23.766499	42.999738
Emys orbicularis	NG4927	27.516657	42.428652
Emys orbicularis	NH3070	27.456072	42.455927
Emys orbicularis	KH8051	24.392168	42.436164
Emys orbicularis	LJ2362	24.849474	43.625263
Emys orbicularis	GP2325	23.758497	43.639212
Emys orbicularis	NG6803	27.733993	42.301382
Emys orbicularis	NG6804	27.734097	42.310387
Emys orbicularis	NG5883	27.70973	42.301534
Emys orbicularis	NG5896	27.72217	42.328475
Emys orbicularis	NG5970	27.698296	42.364647
Emys orbicularis	NG4799	27.600205	42.266135
Emys orbicularis	NG4789	27.588081	42.266198
Emys orbicularis	NG6708	27.73347	42.256354
Emys orbicularis	NG6718	27.745593	42.256276
Emys orbicularis	NG5779	27.697202	42.265587
Emys orbicularis	NG4897	27.60089	42.338181
Emys orbicularis	NG4896	27.600804	42.329175
Emys orbicularis	NG5805	27.612854	42.320105
Emys orbicularis	NG5804	27.612766	42.3111
Emys orbicularis	NG5814	27.6249	42.311034
Emys orbicularis	NG5824	27.637033	42.310967
Emys orbicularis	NG6835	27.770605	42.319154
Emys orbicularis	NG6826	27.758579	42.32824
Emys orbicularis	NH4009	27.493193	42.536826
Emys orbicularis	NH4104	27.493548	42.581853
Emys orbicularis	NH4103	27.493477	42.572847
Emys orbicularis	MG6834	26.557104	42.311882
Emys orbicularis	MH3574	26.233947	42.940571
Emys orbicularis	NJ1719	27.143603	44.06858
Emys orbicularis	NJ1709	27.131116	44.068595
Emys orbicularis	NJ1788	27.230978	44.059434
Emys orbicularis	NJ0853	27.068722	44.104664
Emys orbicularis	MJ8861	26.831371	44.086553
Emys orbicularis	MJ8862	26.831346	44.095556

Emys orbicularis	MJ8870	26.843886	44.077567
Emys orbicularis	LJ7370	25.481806	43.617405
Emys orbicularis	LJ7360	25.469417	43.61724
Emys orbicularis	LJ7351	25.456798	43.626074
Emys orbicularis	NH7623	27.889776	43.020722
Emys orbicularis	NH7613	27.877505	43.020816
Emys orbicularis	NH6663	27.816147	43.02127
Emys orbicularis	NH5662	27.693326	43.013075
Emys orbicularis	NH5673	27.7057	43.022005
Emys orbicularis	NH5664	27.693529	43.031084
Emys orbicularis	NH5654	27.681255	43.031158
Emys orbicularis	NH6673	27.828419	43.021182
Emys orbicularis	NH5652	27.681056	43.013149
Emys orbicularis	NH7620	27.889386	42.99371
Emys orbicularis	MG6907	26.519812	42.42881
Emys orbicularis	MG6843	26.569299	42.302922
Emys orbicularis	MH3553	26.209551	42.9314
Emys orbicularis	NG4861	27.563992	42.284332
Emys orbicularis	NG5850	27.673049	42.274737
Emys orbicularis	NG5841	27.661017	42.283813
Emys orbicularis	NJ1798	27.243464	44.059408
Emys orbicularis	NJ1726	27.15602	44.041554
Emys orbicularis	NJ0863	27.081216	44.104655
Emys orbicularis	NG5882	27.709629	42.292529
Emys orbicularis	NG5873	27.697599	42.301609
Emys orbicularis	NG5851	27.673144	42.283743
Emys orbicularis	NG5861	27.685272	42.283671
Emys orbicularis	NG5823	27.636942	42.301962
Emys orbicularis	NG6815	27.746336	42.319314
Emys orbicularis	NH4114	27.505733	42.5818
Emys orbicularis	MG5997	26.507655	42.428759
Emys orbicularis	MJ8871	26.843862	44.086571
Emys orbicularis	LJ7350	25.457028	43.617073
Emys orbicularis	NH6653	27.803875	43.021357
Emys orbicularis	MH2512	26.038142	42.921083
Emys orbicularis	MG5534	26.438164	42.04117
Emys orbicularis	NG1750	27.187707	42.186495
Emys orbicularis	GN2132	23.721422	42.532577
Emys orbicularis	GN0157	23.504259	42.582557
Emys orbicularis	GN0107	23.443383	42.583872
Emys orbicularis	LG6304	25.319541	41.850115
Emys orbicularis	MG0105	25.804452	41.685058
Emys orbicularis	NH8969	28.067199	43.343374
Emys orbicularis	NG7608	27.85348	42.165462
Emys orbicularis	NH4102	27.493406	42.563842
Emys orbicularis	GP0211	23.493195	43.519258
Emys orbicularis	GP1217	23.61914	43.570463
Emys orbicularis	MG0140	25.853304	41.640521
Emys orbicularis	FL9951	23.340527	41.451284
Emys orbicularis	FM3851	22.64317	42.273945
Emys orbicularis	FM6569	23.012604	42.069927
Emys orbicularis	KJ7069	24.239809	43.405075
Emys orbicularis	FP4324	22.767009	43.649844
Emys orbicularis	FP4238	22.777811	43.595653
Emys orbicularis	MG6326	26.54805	41.879535
Emys orbicularis	MG4233	26.320314	41.761323
Emys orbicularis	KH6094	24.196659	42.458561
Emys orbicularis	NG5888	27.710237	42.346562
Emys orbicularis	FN8295	23.312104	42.658639
Emys orbicularis	FM3780	22.676912	42.174392
Emys orbicularis	FN5584	22.94225	42.926655
Emys orbicularis	FN8211	23.213291	42.624571
Emys orbicularis	GN0314	23.461588	42.736566
Emys orbicularis	GN0331	23.48492	42.709048
Emys orbicularis	KH8728	24.326069	43.128
Emys orbicularis	KJ6050	24.107978	43.320779
Emys orbicularis	LH9904	25.650103	43.295364
Emys orbicularis	MG6316	26.535998	41.879487
Emys orbicularis	MH7192	26.750248	42.564632
Emys orbicularis	MH9319	26.896039	42.808008
Emys orbicularis	NG5980	27.710439	42.364573
Emys orbicularis	NH2504	27.251275	42.942859
Emys orbicularis	NJ4572	27.590717	43.824047
Mauremys rivulata	NG7596	27.960787	42.056537
Mauremys rivulata	NG7597	27.960923	42.065542
Mauremys rivulata	NG7587	27.948837	42.065643
Mauremys rivulata	NG7577	27.936752	42.065742
Mauremys rivulata	NG7576	27.936619	42.056737
Mauremys rivulata	FL8995	23.270006	41.488725
Mauremys rivulata	FL7854	23.099219	41.392895
Mauremys rivulata	FL8983	23.257411	41.470959
Mauremys rivulata	FL7831	23.074453	41.366324
Mauremys rivulata	MG4315	26.295072	41.869254
Mauremys rivulata	NG8507	27.973008	42.06544
Mauremys rivulata	MG4371	26.367722	41.833649
Mauremys rivulata	MG4340	26.331688	41.824439
Mauremys rivulata	MG4372	26.367634	41.842656
Mauremys rivulata	MG5385	26.499914	41.870329
Mauremys rivulata	MG5393	26.5121	41.852367
Mauremys rivulata	MF1805	25.929055	41.416072
Mauremys rivulata	MG6419	26.535149	41.996571
Mauremys rivulata	MF1820	25.953705	41.371261

Mauremys rivulata	MF1709	25.929942	41.362035
Mauremys rivulata	MF0871	25.893775	41.379708
Mauremys rivulata	NG7661	27.925189	42.101861
Mauremys rivulata	NG7671	27.937282	42.101763
Mauremys rivulata	NG7556	27.912451	42.056931
Mauremys rivulata	NG7566	27.924535	42.056835
Mauremys rivulata	NG7519	27.864482	42.084322
Mauremys rivulata	NG8437	28.007841	41.975075
Mauremys rivulata	NG8419	27.983982	41.993295
Mauremys rivulata	NG8409	27.97191	41.993398
Mauremys rivulata	NG8418	27.983843	41.984289
Mauremys rivulata	MG9726	26.909096	42.240651
Mauremys rivulata	MG3450	26.222231	41.913817
Mauremys rivulata	MF2945	26.095304	41.507573
Mauremys rivulata	MF2954	26.107409	41.49866
Mauremys rivulata	MF2864	26.120606	41.408688
Mauremys rivulata	MF2769	26.121213	41.363655
Mauremys rivulata	MF1881	26.025306	41.380898
Mauremys rivulata	MF1871	26.013349	41.380796
Mauremys rivulata	MF1870	26.013485	41.371789
Mauremys rivulata	MF2893	26.156613	41.39995
Mauremys rivulata	MF1887	26.024498	41.434935
Mauremys rivulata	MG4672	26.364955	42.11284
Mauremys rivulata	MG4692	26.389146	42.112972
Mauremys rivulata	MG5452	26.463237	41.93321
Mauremys rivulata	MG6524	26.546903	42.041651
Mauremys rivulata	MG6515	26.534755	42.050609
Mauremys rivulata	FL9848	23.327599	41.424527
Mauremys rivulata	MG4207	26.283826	41.797129
Mauremys rivulata	MG4217	26.295862	41.797204
Mauremys rivulata	MG5532	26.438323	42.023158
Mauremys rivulata	MG9674	26.96975	42.132607
Mauremys rivulata	NG0699	27.11503	42.177585
Mauremys rivulata	MG4683	26.376962	42.121913
Mauremys rivulata	FL8991	23.26875	41.452723
Mauremys rivulata	FL8982	23.257099	41.461959
Mauremys rivulata	FL8990	23.268436	41.443722
Mauremys rivulata	GL0920	23.423925	41.44055
Mauremys rivulata	MF1912	25.939993	41.479224
Mauremys rivulata	FM8108	23.169195	41.697821