

Updated Distribution of the European Pond Turtle, *Emys orbicularis* (L., 1758) (Emydidae) on the Extreme Northern Border of its European Range in Latvia

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Abstract: We registered 98 old and new findings of *Emys orbicularis* with different degrees of reliability in Latvia in 1984–2017. Nineteen findings of *E. orbicularis*, proven by the authors or with photographic documentation, are confirmed; ten findings by other biologists are highly probably. We registered both adult males and females, one young juvenile and three semi-adult *E. orbicularis* in Latvia. Based on our research, we suppose that fragmented populations of *E. orbicularis* exist in Latvia. Additional genetic research is necessary for identifying if the current *E. orbicularis* individuals in Latvia are autochthonous. Probably the Latvian populations of *E. orbicularis* found near the borders with Lithuania, Belarus, and Russia extend in these countries, which demands additional and trans-border research.

Key words: zoogeography, northern populations, Emydidae, Baltic countries, nature conservation

Introduction

Latvia is located on the extreme northern border of the European Pond Turtle *Emys orbicularis* (Linnaeus, 1758) (Testudines: Emydidae: Emydinae) distribution in Europe (BERDNIKOV 1999, FRITZ 2003). Northern populations of *E. orbicularis* in Europe are small and fragmented because of the limiting influence of cold climate (SCHNEEWEISS 2004) and other negative factors (DROBENKOV 1991). This impedes its location in the wild by researchers. Therefore, in spite of the first published *E. orbicularis* findings in Latvia which are known since 1827 (SILINS & LAMSTERS 1934), for a long time opinions about the existence of *E. orbicularis* populations in Latvia were contradictory. Thus, ZIRNIS (1980) examined data of the Ministry of Environment and concluded that a lot of these data were not precise because some individuals of *E. orbicularis* could be escapees or released from pet owners. In the Red Data Book of Latvia, *E. orbicularis* is listed in the Zero Category (extinct species) (BERZINS 2003) in spite of one finding (in Apgulde) being listed in the

same publication as an extant population. Therefore, the research on the distribution of *E. orbicularis* in Latvia, independent from previous data (SILINS & LAMSTERS 1934, ZIRNIS 1980, BERDNIKOV 1999), is topical. Since the publication of the first materials (MEESKE et al. 2006, PUPINS & PUPINA 2008a, 2008b, 2013), we made new findings of *E. orbicularis* in Latvia and obtained additional information about some of the published findings. This warrants a necessity to register the new findings of *E. orbicularis* in Latvia, to verify the previously registered findings, their coordinates and plausibility as well as to generalize the updated information about all the findings.

Materials and Methods

We started registering findings of *E. orbicularis* since 1984. The research covered all the territory of Latvia and was conducted with the permission of the Nature Conservation Agency of Latvia.

Due to the extreme rarity and paucity of *E. orbicularis* in Latvia, we chose the interview method, especially of residents connected to nature: biologists, hunters, fishermen, Latgales Zoo visitors, students in biology and landowners as a primary means of obtaining information. Interviewing was conducted face-to-face or by phone; we also asked about finding of *E. orbicularis* using TV and other mass media. The total number of interviewees in 2010–2015 exceeded 30,000 people. Apart from a question about findings of turtles in the wild, in case of a positive answer, we asked questions of ecological and ethological nature (described in detail in PUPINS & PUPINA 2008a, 2008b), and we showed interviewees photos of *E. orbicularis* and exotic turtles previously found in Latvia (PUPINS 2007, PUPINS & PUPINA 2011, PUPINA & PUPINS 2016). If an interviewee indicated an approximate interval in years for an old finding of turtle, the middle of this interval was considered as the year of finding. If the interviewee's indication of place of finding was approximate, the centre of the area of finding in this habitat (e.g. pond, swamp, lake shore) was considered as the point of finding. While verifying previously registered findings, we conducted repeated interviews; unverified and questionable findings were excluded from the register.

We conducted field expeditions to the sites of turtle findings indicated by residents, identified species of found turtles, estimated their habitats and further interviewed local residents.

Reliability of sighting of *E. orbicularis* and other turtles was evaluated on a scale from 4 to 1, where the highest, 4 – Confirmed findings (highest plausibility) – are our personal findings or high-quality photos with known location; 3 – Highly probable sighting (high plausibility) – are findings made by other biologists; 2 – Probable sighting (medium plausibility) – are findings by non-biologists; and 1 – Potential sighting (low plausibility) – are findings for which interviewees heard about from other people. We registered as reliable only those findings of *E. orbicularis* with degrees of reliability 4 and 3. The findings of degrees 2 and 1 were included in the register as possible findings of some turtle species and will be subject to further verification.

The three sites of *E. orbicularis* releases in the wild in 2014 in Daugavpils district (PUPINS & PUPINA 2014) were not considered during data processing.

We divided all findings into old (before 2000) and new (after 2000). Findings with different degrees of reliability were mapped on separate maps.

Table 1. Coordinates of confirmed findings of *Emys orbicularis* in Latvia (1972–2017)

Year of finding	Latitude (N)	Longitude (E)	Registration individual number
1972	56.620365°	23.776374°	023
1984	55.876639°	26.510269°	001
1988	56.530814°	23.228458°	085
1995	55.689090°	26.752271°	002
1997	56.531681°	23.230221°	011
1998	57.707969°	22.378722°	025
2003	56.936578°	25.880594°	013
2005	55.903936°	26.529520°	016
2005	56.062270°	27.491256°	024
2007	57.492222°	22.061289°	047
2009	56.667302°	24.253861°	060
2010	56.667303°	22.494701°	061
2010	56.154224°	21.029118°	062
2010	55.820646°	26.675631°	063
2010	56.655820°	23.700788°	064
2010	56.966475°	22.006120°	065
2011	56.576797°	26.357883°	066
2015	57.191874°	27.578599°	096
2017	56.771526°	24.110631°	097

Table 2. Coordinates of highly probable sightings of *Emys orbicularis* in Latvia (1965–2017)

Year of sightings	Latitude (N)	Longitude (E)	Registration number
1965	55.706213°	26.758254°	030
1968	55.889374°	26.560661°	029
1985	57.653283°	22.260326°	073
1987	57.651681°	22.257793°	074
1988	57.141954°	22.550009°	020
1989	57.701425°	22.382943°	021
1996	56.530639°	23.228291°	010
2003	57.677669°	22.574299°	022
2004	57.151462°	25.000410°	048
2007	57.276252°	25.504084°	059

Results and Discussion

Independently from earlier researches (SILINS & LAMSTERS 1934, ZIRNIS 1980, BERDNIKOV 1999), we registered 98 localities, both previously published by us (MEESKE et al. 2006, PUPINS & PUPINA 2008a, 2008b, 2013) and including four new findings of *E. orbicularis* with different degrees of reliability in Latvia in 1984–2017. Overall, nineteen findings of *E. orbicularis* were proven by us personally or with high-quality photographs (Table 1); ten sightings were highly probable (Table 2). Forty findings were probable and other findings were potential.

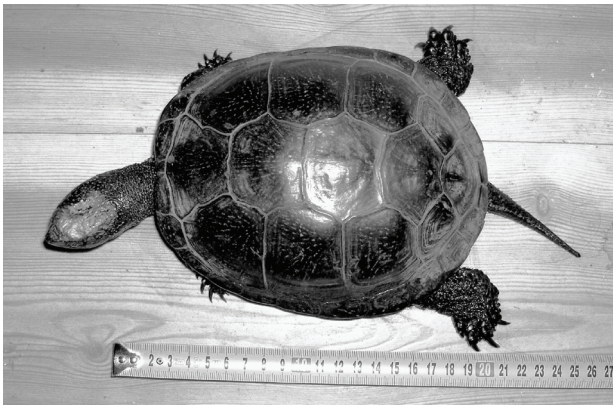


Fig. 1. Adult female *Emys orbicularis* (registration number 047): carapace (Photographed by Mihails Pupins)

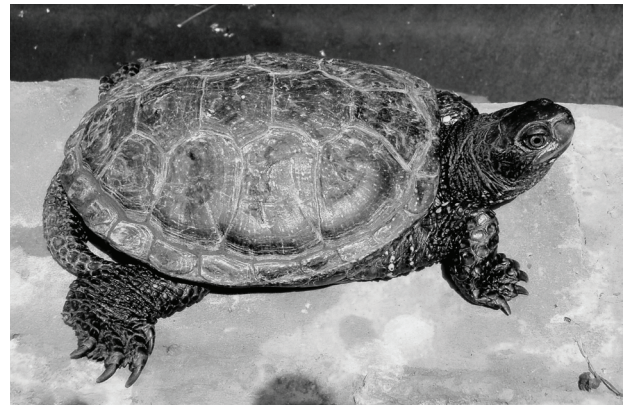


Fig. 3. Subadult male *Emys orbicularis* (registration number 060) (Photographed by Agnese Pupina)



Fig. 2. Adult female *Emys orbicularis* (registration number 047) plastron (Photographed by Aija Pupina)

The locations of confirmed (Fig. 4A), highly probable (Fig. 4B) and probable (Fig. 4C) findings show they predominantly occur in the western and south-eastern parts of Latvia. Potential findings are also concentrated in these parts (Fig. 4D). Such locations of findings can be caused both by particularities of the climate or the distribution of suitable habitats, along with the higher number of residents in these regions and their vicinity, and, therefore, more frequent observations of *E. orbicularis*.

The locations of confirmed findings of *E. orbicularis* in Latvia close to the borders with neighbouring countries (0.9 km to the border with Belarus, 9.8 km to Lithuania, 12.6 km to Russia; Fig. 4) suggest that the distribution of these populations or metapopulations may extend into these countries. In addition, BANNIKOV et al. (1977) noted a finding of *E. orbicularis* in present-day Estonia's territory. We assume the continued existence of at least separate individuals or small *E. orbicularis* populations in southern Estonia, because we registered by photograph an adult male in Latvia (registration number 096) in 2015, within a distance of

only 38 km from the border with Estonia. All these observations need to be investigated further and could serve for future joint trans-border conservation efforts.

Four previously published sightings with the lowest (1) and medium degrees (2) of reliability (two in Daugavpils district, one in Riga, and one in Gauja) after additional interviewing of respondents were removed from the register as doubtful.

The findings made in 2015, 2016, and in 2017 in Daugavpils District in the sites of release of *E. orbicularis* in the wild in 2014 (PUPINS & PUPINA 2014) are not included in the results presented here. We observed the turtles in the same habitats after over-wintering, which proves the potential for their successful survival under Latvia's natural conditions and suggests the possible persistence of these individuals in the future.

We personally found both adult males and females (Figs. 1, 2) in Latvia.

We have collected a number of data proving that *E. orbicularis* successfully reproduces in Latvia. In three confirmed cases, *E. orbicularis* females captured on land by local people laid between 5 and 12 eggs within the next two days. We also personally found three subadult *E. orbicularis* (Fig. 3) and registered with photograph one juvenile *E. orbicularis* with straight carapace length of 4.4 cm. Multiple observations (Apgulde District: 12 observations, Talsi District: 6 observations, Daugavpils District: 14 observations and Kuldiga District: 4 observations) and observation of more than one individual at the same time (registration number 056) as well as confirmed findings of a juvenile and subadults strongly support the existence of reproducing *E. orbicularis* populations in Latvia.

More than half (58.6%) of the confirmed and highly probable findings were made after the year

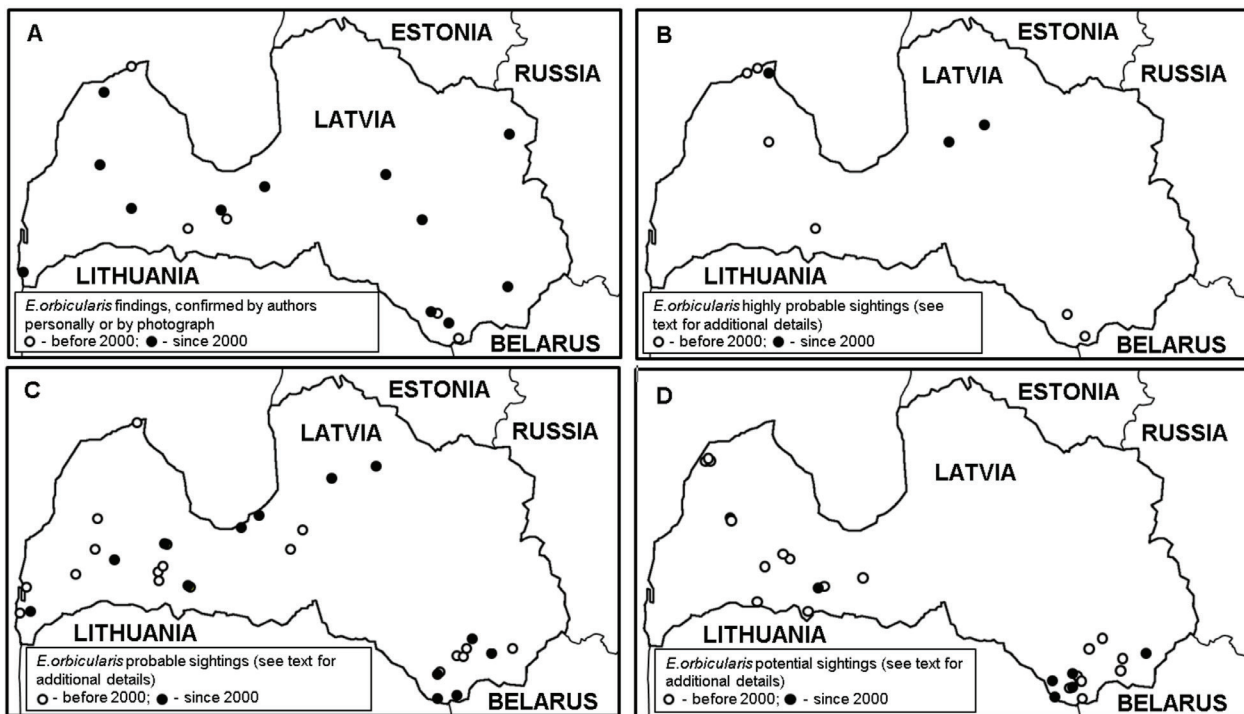


Fig. 4. Location maps of findings of *Emys orbicularis* in Latvia until 2017: A – confirmed findings found by authors personally or confirmed by photograph, B – highly probable sightings, C – probable sightings, D – potential sightings

2000. A smaller number of recent probable findings was noted. However, these data cannot prove an increase in the number of *E. orbicularis* because our knowledge on the occurrence of *E. orbicularis* is influenced not only by its numbers but also by other factors such as their availability for observation, the spread of mobile phones and e-mails as tools for reporting findings, etc.

We researched only the distribution of *E. orbicularis* in Latvia. The question of autochthony was not the goal of this investigation but genetic research is ongoing. However, we are confident that the majority of these findings are not intentional releases by local hobbyists; we know the significant terrarium hobbyists in Latvia and they do not have *E. orbicularis* in their collections. Keeping *E. orbicularis* as a pet or its transportation, selling, exchange, donation and release in the wild are strictly prohibited and regulated by legislation in Latvia (PUPINS & PUPINA 2007, SAEIMA 2015); however, we cannot estimate the level of enforcement of these restrictions.

Warming of climate, probably, will contribute to the survival and extended distribution of *E. orbicularis* on the northern border of its European range in Latvia, especially to the successful incubation of eggs and the overwintering of hatchlings in the nest. However, such warming will also have

complex influences on the characteristics of the water and terrestrial habitats of the species since thermophilic invasive species, possible drying out and overgrowth with vegetation will pose challenges (PUPINS & PUPINA 2007) for the persistence of *E. orbicularis*.

Conclusions

Based on our research, we are highly confident that viable populations of *E. orbicularis* exist in Latvia. However, these populations are small, fragmented, and difficult to find. Additional genetic research is necessary to identify if the found *E. orbicularis* are autochthonous. It is possible that Latvian populations of *E. orbicularis* found near the borders with Lithuania, Belarus, Russia and Estonia extend to these neighbouring countries, demanding additional research and trans-border cooperation.

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